HERITAGE IMPACT ASSESSMENT: PROPOSED GRID CONNECTION AND SWITCHING STATION FOR THE DE AAR 2 SOUTH WIND ENERGY FACILITY, DE AAR, NORTHERN CAPE

(Assessment conducted under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999) as part of Basic Assessment)

Prepared for

Arcus Consultancy Services South Africa (Pty) Ltd

On behalf of

Mulilo De Aar 2 South (Pty) Ltd

2 December 2020

Version 1.6

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by

John Gribble (MA)

Gail Euston-Brown (BA)

ACO Associates

8 Jacobs Ladder, St James, Cape Town, 7945

Phone (021) 706 4104

Fax (086) 603 7195

Email: john.gribble@aco-associates.com

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Preface pages and Appendix D
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 4
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 3: Terms of Reference
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5: Methodology
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8: Impact Assessment
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5.3: Archaeological Field Assessment
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5: Methodology
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7: Heritage Resources
(g) an identification of any areas to be avoided, including buffers;	Section 9: Proposed Mitigation Measures
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figures 6, 8 & 9
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5.4: Restrictions and Assumptions
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 8: Impact Assessment
(k) any mitigation measures for inclusion in the EMPr;	Section 9: Proposed

	Mitigation Measures
(l) any conditions for inclusion in the environmental authorisation;	Section 9: Proposed Mitigation Measures
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9: Proposed Mitigation Measures
(n) a reasoned opinion— i. as to whether the proposed activity, activites or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 10: Conclusion
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(p) any other information requested by the competent authority	N/A
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

DETAILS OF THE SPECIALIST

This study has been undertaken by John Gribble BA Hons, MA (ASAPA) and Gail Euston-Brown BA of ACO Associates CC, archaeologists and heritage consultants.

Unit D17, Prime Park, Mocke Road, Diep River, Cape Town, 7800

Email: john.gribble@aco-associates.com

Phone: 021 706 4104

Fax: 086 6037195

CONSULTANT DECLARATION OF INDEPENDENCE

I, John Gribble, declare that – general declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of company (if applicable): ACO Associates CC

Date: 2 December 2020

EXECUTIVE SUMMARY

ACO Associates CC was appointed by Arcus Consultancy Services South Africa (Pty) Ltd, on behalf of Mulilo De Aar 2 South (Pty) Ltd to carry out a heritage impact assessment of the proposed grid connection routes and switching station for the De Aar 2 South wind energy facility, east of De Aar in the Northern Cape.

The assessment comprised an archaeological walkover survey and impact assessment of the proposed development site, a desktop palaeontological impact assessment, and the production of this integrated heritage impact assessment which addresses the impacts of the project on heritage resources.

The grid connection alignments were surveyed by ACO Associates between 11-13 February 2020. The area surveyed and assessed for this report is undeveloped agricultural land which contains some existing electricity supply infrastructure.

Findings: The palaeontological impact assessment indicates that the grid connection crosses a range of geological rock and sediment types, of which the Ecca and Beaufort shales are the most likely to preserve fossils. In both cases, however, previous research, including fieldwork carried out for previous developments, has shown that fossils are rare in the area. There is thus a very small chance of fossils being encountered during the installation of the grid connection.

To mitigate any potential impacts, the palaeontological impact assessment proposed the implementation of a Fossil Chance Find Protocol at the commencement, and for the life of the grid connection construction which would ensure the conservation and reporting of any finds of fossil material.

The ACO walkover survey of the site, and previous archaeological surveys of the farms Vetlaagte, Badenhorst Dam and Du Plessis Dam, identified a large number of archaeological occurrences which include Middle and Late Stone Age archaeological material, possible historic period stone structures, Khoikhoi stone kraal complexes, some rock engravings and and scattered occurences of historical period archaeological material.

The volume of and apparently ubiquitous nature of the Middle Stone Age artefacts scattered across the landscape, and the fact that much of this material was found to be in secondary, or disturbed context, means that the combined overall impact of activities associated with this project on Middle Stone Age material will be relatively low.

By contrast, the context of much of the Late Stone Age artefacts noted during the survey appears to be better preserved than the Middle Stone Age material, and is thus of greater archaeological significance. More occurences that could be called sites were noted with the Late Stone Age material, and the assessment found that if these sites were to be lost or damaged as a result of the construction of the grid connection, the impact would be medium, although this could be reduced to low through the application of measures to mitigate potential loss or damage.

The possible Khoi kraals and other stone structures noted during the survey represent a little known aspect of the history and archaeology of this area and their damage or destruction would result in a loss of heritage. The application of measures to mitigate potential loss or damage, would significantly reduce the impact.

The archaeological assessment recommended that three archaeological sites require mitigation prior to the commencement of construction of the grid connections. These are:

- JG050-JG052 / GEB013-GEB014;
- JG067–JG072 / GEB025; and
- JG077.

It is recommended that the mitigation take the form of the mapping, recording and collection by the archaeologist of exposed artefactual material prior to the commencement of any activities related to the installation of the grid connections.

Other sites on or close to the grid connection routes require mitigation by avoidance. These sites, each with the buffer described below, must be considered no-go areas during construction activities and those nearest the route alignments must be clearly marked as out of bounds:

- The possible Khoi kraals and shepherds' huts (JG040; JG064; JG066; JG081-JG090) - 40 m buffer centered on JG088;
- The possible "wolwehok" (JG036) - 20 m buffer; and
- The rock engraving (JG044) - 20 m buffer.

Lastly, the archaeologist must review the positions of the individual pylons once these have been determined, to ensure that they will not impact on any recorded heritage resources. The micro-siting of pylon positions may be required, which should also be done in consultation with the archaeologist.

Should any human remains be encountered at any stage during the construction or earthworks associated with the project, or any other archaeological or palaeontological material be encoutered, work in the vicinity must cease, the remains must be left *in situ* but made secure and the project archaeologist and SAHRA must be notified immediately so that mitigatory action can be determined and be implemented.

Conclusion: Provided that the mitigation measures set out above are implemented, the overall impact of the proposed installation of the De Aar 2 South WEF grid connection is tolerable and generally of low heritage significance and the proposed activity is considered acceptable.

ACKNOWLEDGEMENTS AND THANKS

ACO Associates wishes to acknowledge the help and support of the following farmers and landowners along the proposed grid connection route, who graciously allowed us access to their land for the survey:

- Henk Weydeman, Eskom (Hydra Substaiton);
- Barend van der Merwe (Wag ‘n Bietjie);
- ‘Duppie’ Pienaar (Carolus Poort / Vetlaagte);
- Diederik Albertyn (Carolus Poort / Rusoord);
- Geit and Fia van der Merwe (Slingershoek); and
- The Emthanjeni Municipality.

GLOSSARY

Archaeology: 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.

Cultural landscape: The combined works of people and natural processes as manifested in the form of a landscape

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

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

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

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

Hornfels: A type of indurated shale used in the production of stone tools in the Karoo.

Late Stone Age: The archaeology of the last 20 000 years associated with fully modern people.

Lithology: The description of the physical characteristics of a rock unit, visible at outcrop, in hand or in core samples.

Lockshoek: A non-microlithic tool industry named by Sampson which is present in the Karoo and dates from the late Pleistocene/early Holocene, c. 10 000 years ago. The Lockshoek is contemporary with the Oakhurst/Albany Industries and.is charactised by large sidescrapers, frontal scrapers, endscrapers, thick backed adzes and a wide variety of ground stone implements.

Midden: A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.

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

Miocene: A geological time period (of 23 million - 5 million years ago).

National Estate: The collective heritage assets of the Nation

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.

Pleistocene: A geological time period (of 3 million – 10 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

SAHRA: South African Heritage Resources Agency – the compliance authority which protects

national heritage.

Smithfield: This term was coined in 1929 for a number of interior stone tools assemblages, made on indurated shale, and dating to the last 2000 years of the Later Stone Age. Various variants have been identified in different parts of the country but the term has not been clearly defined.

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

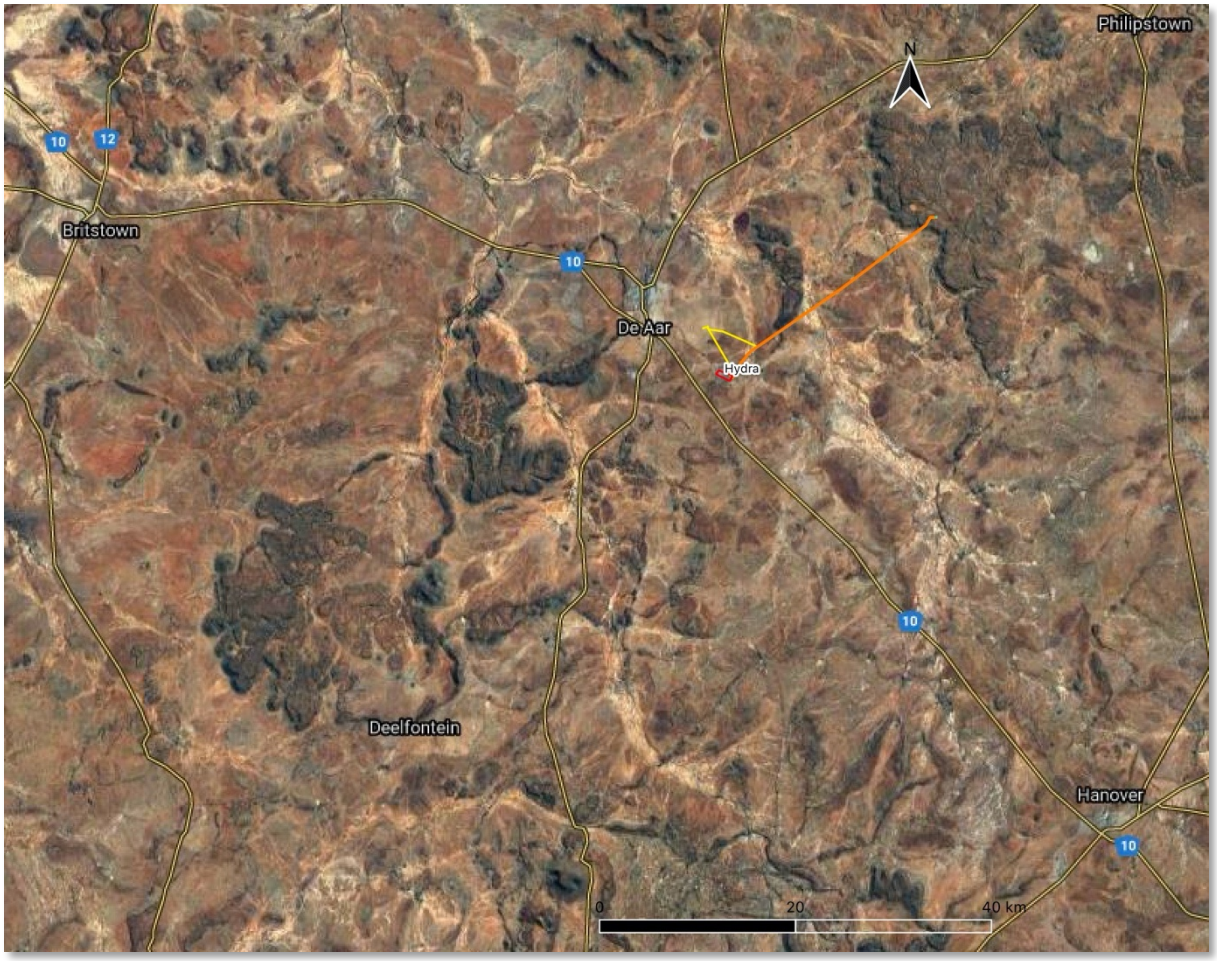
Wilton: A Late Stone Age microlithic industry dating to between 6000 and 4000 years ago.

ACRONYMS

DEFF	Department of Environment, Forestry and Fisheries
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
MSA	Middle Stone Age
Mya	Million years ago
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency
WEF	Wind Energy Facility

1 INTRODUCTION

ACO Associates CC (ACO) was appointed by Arcus Consultancy Services South Africa (Pty) Ltd (Arcus), on behalf of Mulilo De Aar 2 South (Pty) Ltd (Mulilo) to carry out a heritage impact assessment (HIA) of the proposed grid connection routes for the authorised De Aar 2 South wind energy facility (DA2S WEF), east of De Aar in the Northern Cape (Figure 1



).

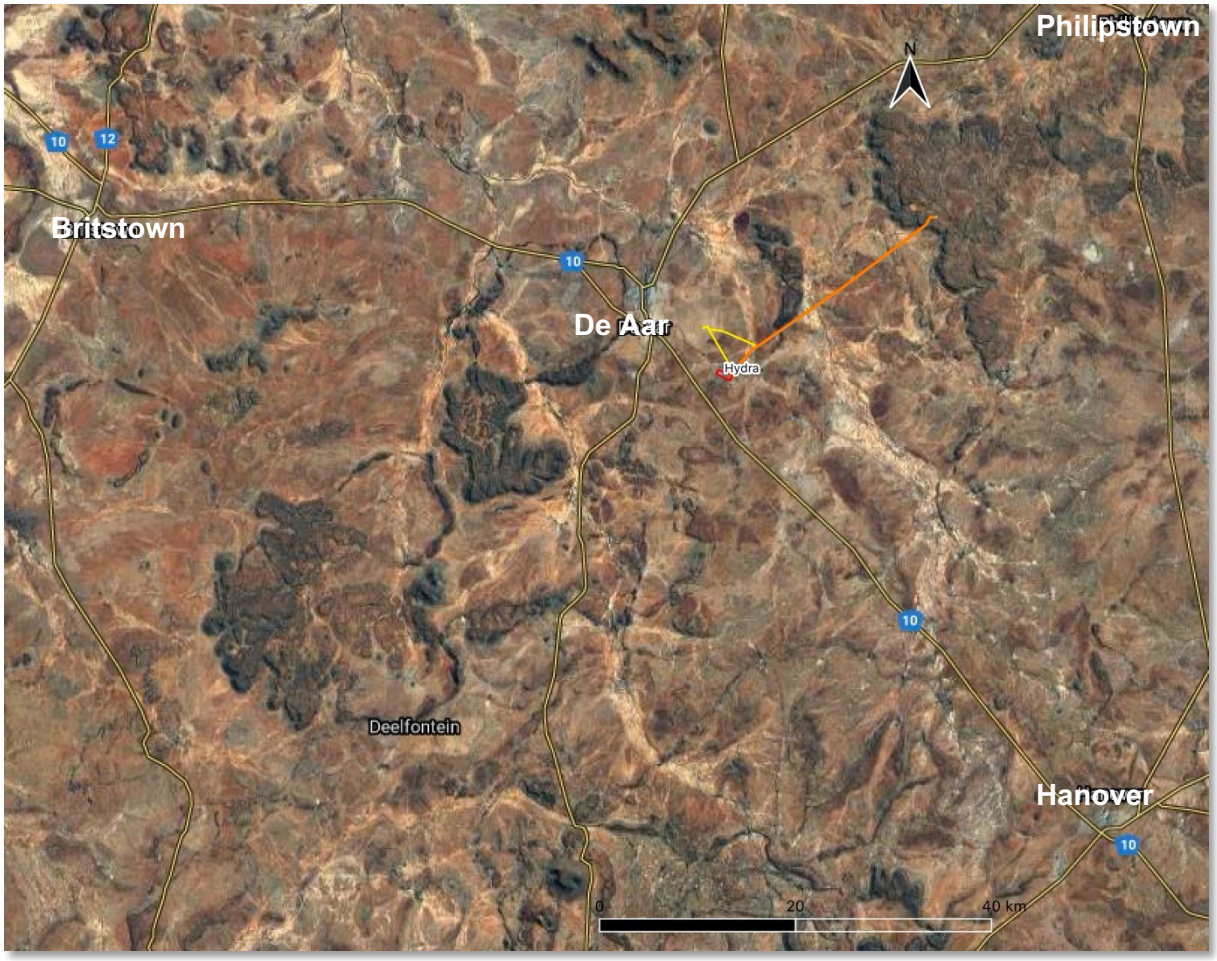


Figure 1: Proposed grid connection routes (yellow) between the Hydra Substation (red polygon) and the authorised De Aar 2 South WEF (orange dots). De Aar lies immediately west of the proposed routes. Philipstown is in the top right of the image and Hanover is off the image, bottom right.

2 DEVELOPMENT PROPOSALS

Mulilo are proposing the following two grid connection route alignment options, both to connect the authorised DA2S WEF to the Eskom Hydra Substation, south of De Aar:

- Route 1 is approximately 23 km in length and runs directly between the Hydra Substation and the DA2S WEF. For approximately 12 km from the Hydra Substation, the proposed line follows the approved grid connection transmission line route for the operational Longyuan Mulilo De Aar 2 North WEF. Thereafter, the proposed new line follows a direct path north east for a further 11 km up onto the plateau to the site of the DA2S WEF (see Figure 2). The entire proposed route alignment follows and is adjacent to the existing HYD-RA 220 kV transmission line; and
- Route 2 takes a dogleg north west from the Hydra Substation to an approved solar substation, before turning south to join Route 1 approximately 3.3 km north of the Hydra Substation. Thereafter Route 2 follows the same alignment as Route 1 onto the plateau to the site of the DA2S WEF (see Figure 2).

The proposed transmission line will consist of either steel monopole or lattice tower structures with maximum heights of 30 m, including foundations and insulators. The grid connection will have a capacity of up to 400 kV.

Existing access roads and jeep tracks will be utilised wherever possible but new line and servitude clearances will meet the statutory requirements.

The project will also include the construction of a 400 kV switching station (100 m x 100 m) within the authorised DA2S WEF site.

3 TERMS OF REFERENCE

ACO Associates was commissioned to produce a HIA as part of the Environmental Impact Assessment (EIA) process for this project, as required by the National Environmental Management Act (No. 107 of 1998), as amended.

The HIA aims to identify heritage resources which may be impacted during the *construction*, *operation* and *decommissioning* phases of the project, assess their significance and provide recommendations for mitigation.

This document therefore includes the following:

- A desk-top level literature review to assess the potential for archaeological, cultural and historic sites in the proposed development area;
- Archaeological field work to identify and document (collect GPS coordinates and photograph) heritage resources, that may be affected by the project, on the ground; and
- A desk-top palaeontological impact assessment (PIA) to assess whether palaeontological features will be affected by the project.

The results of the studies listed above are integrated in this HIA report along with an assessment of the sensitivity and significance of any heritage resources, an evaluation of the potential impacts on them of the construction, operation and decommissioning of the project, and recommendations for measures to mitigate any negative impacts of the project on them.

The HIA must be submitted for comment to the South African Heritage Resources Agency (SAHRA) and the Northern Cape Provincial Heritage Reources Authority (Ngwao-Boswa Jwa Kapa Bokone), the relevant statutory commenting bodies under the National Environmental Management Act.

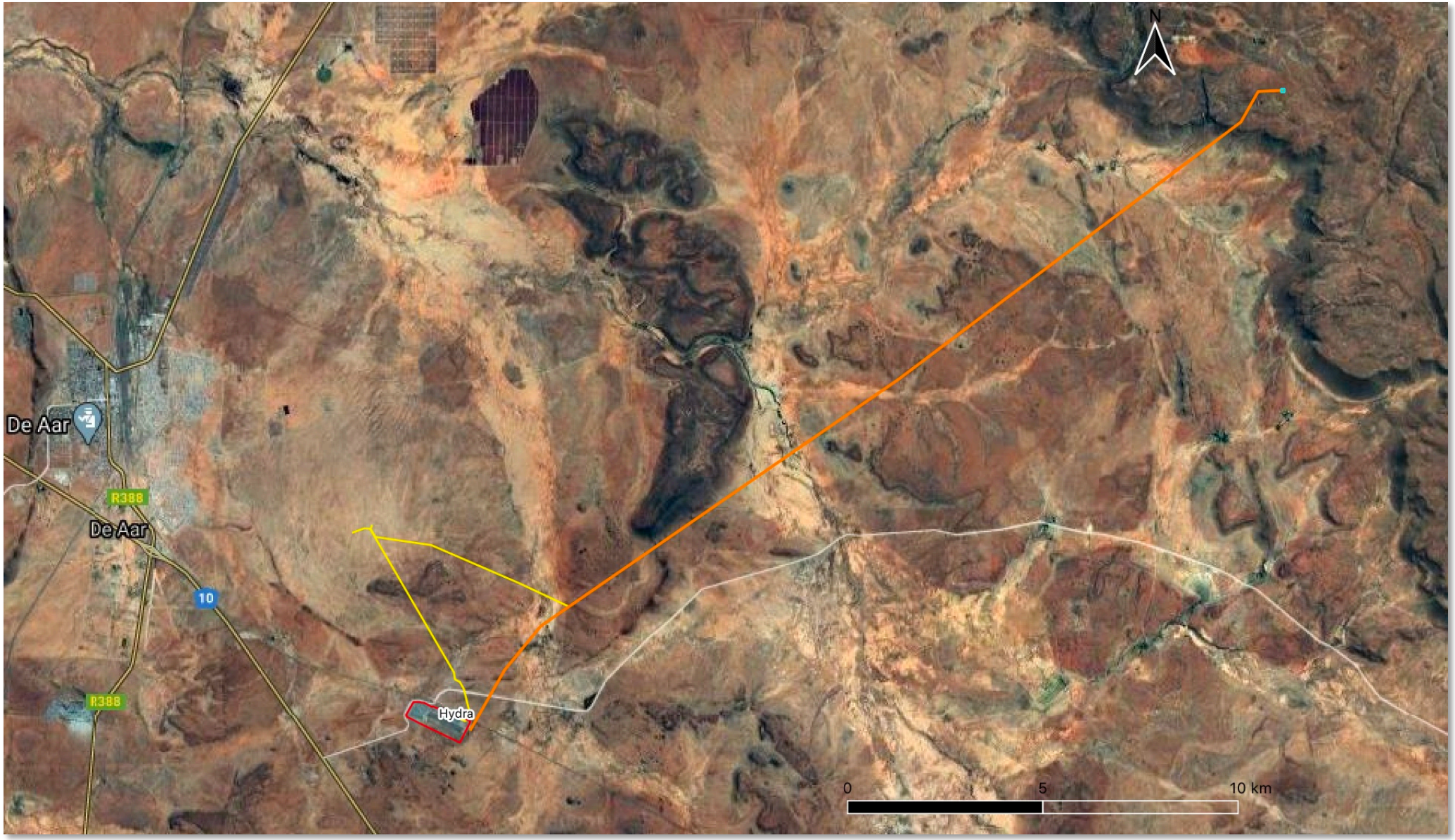


Figure 2: Proposed grid connection route options. Route 1 is shown in orange and Route 2 includes the dogleg shown in yellow

4 RELEVANT LEGISLATION

4.1 National Heritage Resources Act (No 25 of 1999)

The National Heritage Resources Act (NHRA) came into force in 2000 with the establishment of the SAHRA, replacing the National Monuments Act (No. 28 of 1969 as amended) and the National Monuments Council as the national agency responsible for the management of South Africa's cultural heritage resources.

The NHRA reflects the tripartite (national/provincial/local) nature of public administration under the South African Constitution and makes provision for the devolution of cultural heritage management to the appropriate, competent level of government. In the Northern Cape this is the Northern Cape Provincial Heritage Reources Authority, Ngwao-Boswa Jwa Kapa Bokone. At present, however, archaeological and palaeontological heritage management in the Northern Cape is being managed on an agency basis by SAHRA.

The NHRA gives legal definition to the range and extent of what are considered to be South Africa's heritage resources. According to Section 2(xvi) of the Act a heritage resource is "any place or object of cultural significance". This means that the object or place has aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

In terms of the definitions provided in Section 2 of the NHRA, heritage resources potentially relevant to this assessment are:

- Material remains of human activity which are in a state of disuse and are in or on land [which includes land under water] and which are older than 100 years, including artefacts, human and hominid remains and artificial features and;
- 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;
- 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;
- Any movable property of cultural significance which may be protected in terms of any provisions of the NHRA, including any archaeological artefact or palaeontological specimen; and
- Intangible heritage such as traditional activities, oral histories and places where significant events happened.

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA (currently) is required to destroy, damage, excavate, alter, deface or otherwise disturb any such site or material.

It is also important to be aware that in terms of Section 35(2) of the NHRA, all archaeological objects and palaeontological material is the property of the State and must, where recovered from a site, be lodged with an appropriate museum or other public institution.

Section 38 of the NHRA requires a Heritage Impact Assessments (HIA) for certain kinds of development. In relation to this project, the relevant development activity is the construction

of a road, wall, powerline, pipeline, canal or other simiar form of linear development or barrier exceeding 300 m in length (Section 38(1)(a)).

4.1.1 Grading of Heritage Resources

The South African heritage resources management system is based on grading, which provides for assigning the appropriate level of management responsibility to a heritage resource. Heritage resources were assessed according to criteria specified in the NHRA.

Grading, according to Winter & Oberholzer (2014) is "generally based on the intactness, rarity and representivity of the resource, as well as its role in the larger landscape or cultural context".

Section 3 of the NHRA suggests the following criteria for assigning heritage significance:.

- Importance in the community or pattern in South Africa's history;
- Possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- Importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- Importance in demonstrating a high degree of creative or technical achievement during a particular period;
- Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- Strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- Significance in relating to the history of slavery in South Africa.

The generally accepted heritage resource grades are shown in Table 1 below.

Table 1: Grading of heritage resources (Source: Baumann & Winter 2005: Box 5).

Grade	Level of significance	Description
1	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources.
2	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
3A	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3A heritage resources.
3B	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources.
3C	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources.

4.2 National Environmental Management Act (Act No 107 of 1998)

The National Environmental Management Act (NEMA) provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals that are likely to have a negative effect

on the environment.

Regulations governing the environmental authorisation process have been promulgated in terms of NEMA and include the EIA Regulations, 2014 as amended (GNR R326/2017) and Listing Notices 1 – 3 (GNR 324, 325 and 327/2017). These regulations were amended in April 2017 by Government Notices 324, 325, 326 and 327.

The development proposed for this project triggers a number of activities in the Listing Notices and, in terms of GNR 325 therefore, the project will be subject to a an Environmental Impact Assessment process and Mulilo will be required to obtain a positive Environmental Authorisation from the Department of Environmental Affairs prior to commencement of the proposed activities.

5 METHODOLOGY

This study was commissioned as a heritage impact assessment and attempts to assess the impacts of the proposed grid connection routes on the heritage resources of the area.

5.1 Archaeological Desktop Review

A number of previous published archaeological reports and unpublished archaeological, heritage and palaeontological impact assessments have been conducted for projects in the vicinty of De Aar and around the proposed grid connection routes (see Figure 3). The following reports, available on the SAHRIS online platform (https://sahris.sahra.org.za/) or in ACO's project archive, were therefore reviewed and have contributed to this assessment:

- Archaeological Scoping Study: Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa (ArchaeoMaps Heritage Consultancy, 2008);
- Archaeological Impact Assessment: Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa (ArchaeoMaps Heritage Consultancy, 2009);
- Archaeological impact assessment proposed Photovoltaic Power Generation Facility in De Aar, Northern Cape (Agency for Cultural Resource Management, 2010);
- Archaeological impact assessment of a proposed wind energy facility near De Aar, Northern Cape (Agency for Cultural Resource Management, 2010);
- Heritage scoping assessment for the proposed establishment of the ACED De Aar Solar Energy Facility, Northern Cape Province (J van Schalkwyk, 2011);
- Proposed De Aar Wind Energy Facility on the North and South Plateau, Northern Cape Province (Archaeology Contracts Office, 2011);
- Heritage Scoping Report for the proposed establishment of the Inca Energy PV Power Plant, De Aar, Northern Cape Province (Van Schalkwyk, 2011);
- Archaeological impact Assessment: proposed establishment of the Inca Solar Energy Facility, De Aar, Northern Cape (Heritage Contracts and Archaeological Consulting, 2011);
- Concentrated Solar Power EIA, De Aar: Heritage Impact Assessment (PGS, 2011 & 2012);
- Heritage Impact Assessment Scoping Report for De Aar Solar One Photovoltaic Power Plant, Nothern Cape (Bekker, 2012a);

- Phase 2 Heritage Impact Assessment De Aar Solar One Photovoltaic Power Project (Bekker, 2012b);
- Proposed establishment of a solar energy facility near De Aar, Northern Cape Province: Phase 1 Archaeological Impact Assessment Report (Kruger, 2012);
- Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern Cape Province: Palaeontological specialist study - combined desktop and field-based assessments (Almond, 2012);
- Two wind energy facilities on the Eastern Plateau near De Aar, Northern Cape Province proposed by Mulilo Renewable Energy (Pty) Ltd: palaeontological specialist study - combined desktop and field-based assessments (Almond, 2012b);
- Proposed Mulilo Renewable Energy PV2, PV3 and PV4 photovoltaic energy facilities on Farms Paarde Valley, Badenhorst Dam and Annex Du Plessis Dam near De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments (Almond, 2012a);
- Heritage Impact Assessment for three solar energy facilities at De Aar, Western Cape (sic) (Orton 2012);
- Proposed Photovoltaic (solar) energy facilities on du Plessis Dam Farm near De Aar: Palaeontological specialist study - combined desktop and field-based assessments, (Almond, 2013);
- Heritage Impact Assessment for multiple proposed solar energy facilities on De Aar 180/1 (Badenhorst Dam farm), De Aar, Northern Cape (Orton and Webley 2013a);
- Heritage Impact Assessment for multiple proposed solar energy facilities on Du Plessis Dam 179, De Aar, Northern Cape (Orton and Webley 2013b);
- Proposed construction of a 132 kV transmission line from the Longyuan Mulilo De Aar 2 North Wind Energy Facility on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape (PGS, 2014);
- Archaeological impact assessment for the proposed Casle Wind Energy Facility, De Aar, Northern Cape (Heritage Contracts and Archaeological Consulting, 2014);
- Heritage Impact Assessment: Walkdown of final layout of the Longyuan Mulilo De Aar 2 North Wind Energy Facility, Northern Cape Province (ACO Associates, 2014);
- Addendum: Proposed Wind Energy Facility situated on the Eastern Plateau (South) near De Aar, Northern Cape Province (ACO Associates, 2015);
- Archaeological Impact Assessment: proposed photovoltaic power generation facility in De Aar, Northern Cape (Archer, no date); and
- A Palaeontological Desktop Study of the area to be affected by the proposed Photovoltaic Power Project on Portion 3 of farm Hartebeestplaats 135 (Brink, no date).

The grid connection routes also lie less than 35 km west of the study area of the Zeekoei Valley Archaeological Survey (ZVAS), a major archaeological survey undertaken by a team led by Garth Sampson in the late 1970s and early 1980s (see Figure 4). The project surveyed 5 000 square kilometres of the catchment of the Zeekoei River (from the Sneeuberg Mountains to the Gariep River Valley) and recorded some 10 000 archaeological sites representing a history of human occupation covering at least 250 000 years. Sampson identified seven industries or phases of human history within his study area, each of which are legible on the landscape today, and each of which represent a pre-colonial layer of the human history of the Karoo (Sampson, 1985).

5.2 Desktop Palaeontological Assessment

According to the SAHRIS palaeosensitivity map the grid connection routes traverse an area with a range of palaeontological sensitivities. To address this, a desktop palaeontological impact assessment (PIA) was commissioned from Dr Marion Bamford of the University of the Witwatersrand. The results of this PIA are presented in this report, and the PIA is attached in full as Appendix A.

5.3 Archaeological Field Assessment

A physical archaeological survey of the project area was undertaken by John Gribble and Gail Euston-Brown of ACO Associates between 11-13 February 2020.

The route alignments and other relevant data were loaded onto hand-held GPS receivers (on the WGS84 datum) carried by each member of the field team. Travelled tracks were logged (Figure 5) and waypoints were entered into the GPS at the location of any identified heritage resources (Figure 6). Assessment focussed on a corridor of 100 m on either side of the proposed grid lines.

Although the veld was lush following recent rain in the area this did not influence the outcome of the study as ground visibility was generally good.

All heritage resources located were recorded, photographs were taken of most finds and the resource was graded according to the Baumann and Winter (2005) system set out in the guidelines for involving heritage practitioners in EIAs and referred to above (Table 1).

No trial holes were dug and all observations were based on visible surface material. No archaeological material was removed from the project area, but recorded and photographed *in situ*.

Appendix B contains the detail of the observations made in the field.

The analysis of heritage resources, which were almost exclusively pre-colonial archaeological material, is based upon the experience of the team members who are familiar with the standard classification systems for artefactual material in use to the degree that they can roughly date and characterise an archaeological site based on its visible content and artefacts.

5.4 Restrictions and Assumptions

5.4.1 Palaeontology

Based on the geology of the project area and the palaeontological record of the Karoo as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands in the area are typical and that some do contain fossil plant, wood, invertebrate traces and vertebrate material. This is borne out by previous site visit PIAs which identified occasional traces fossils and fragments of silicified wood occur in the Tierberg Formation (Ecca Group) and silicified wood, trace fossils and bone fragments in the Aldelaide Subgroup rocks (see for example Almond 2012a).

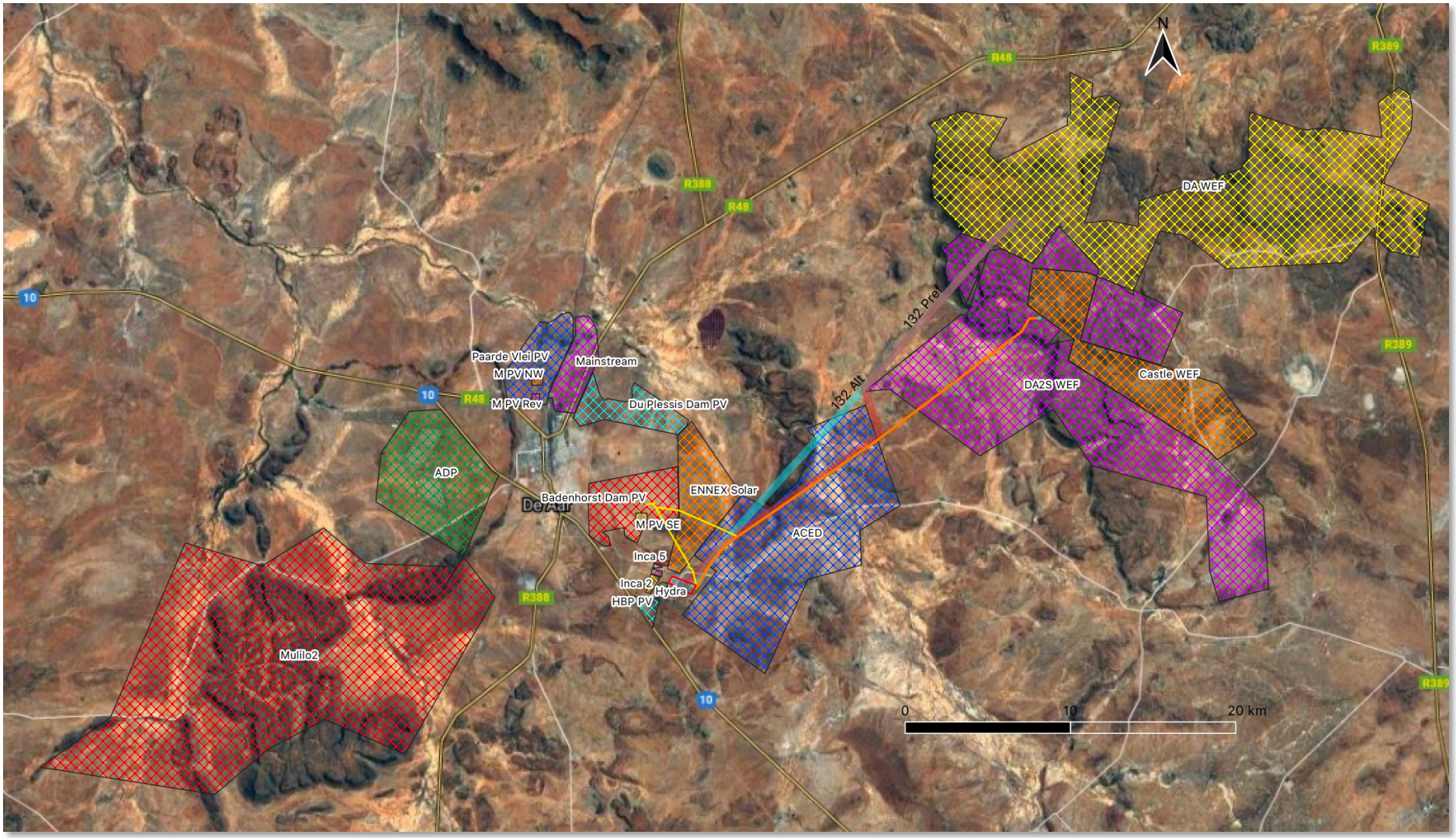


Figure 3: Previous heritage assessments carried out in the vicinity of the proposed grid connection routes (Source: Google Earth).

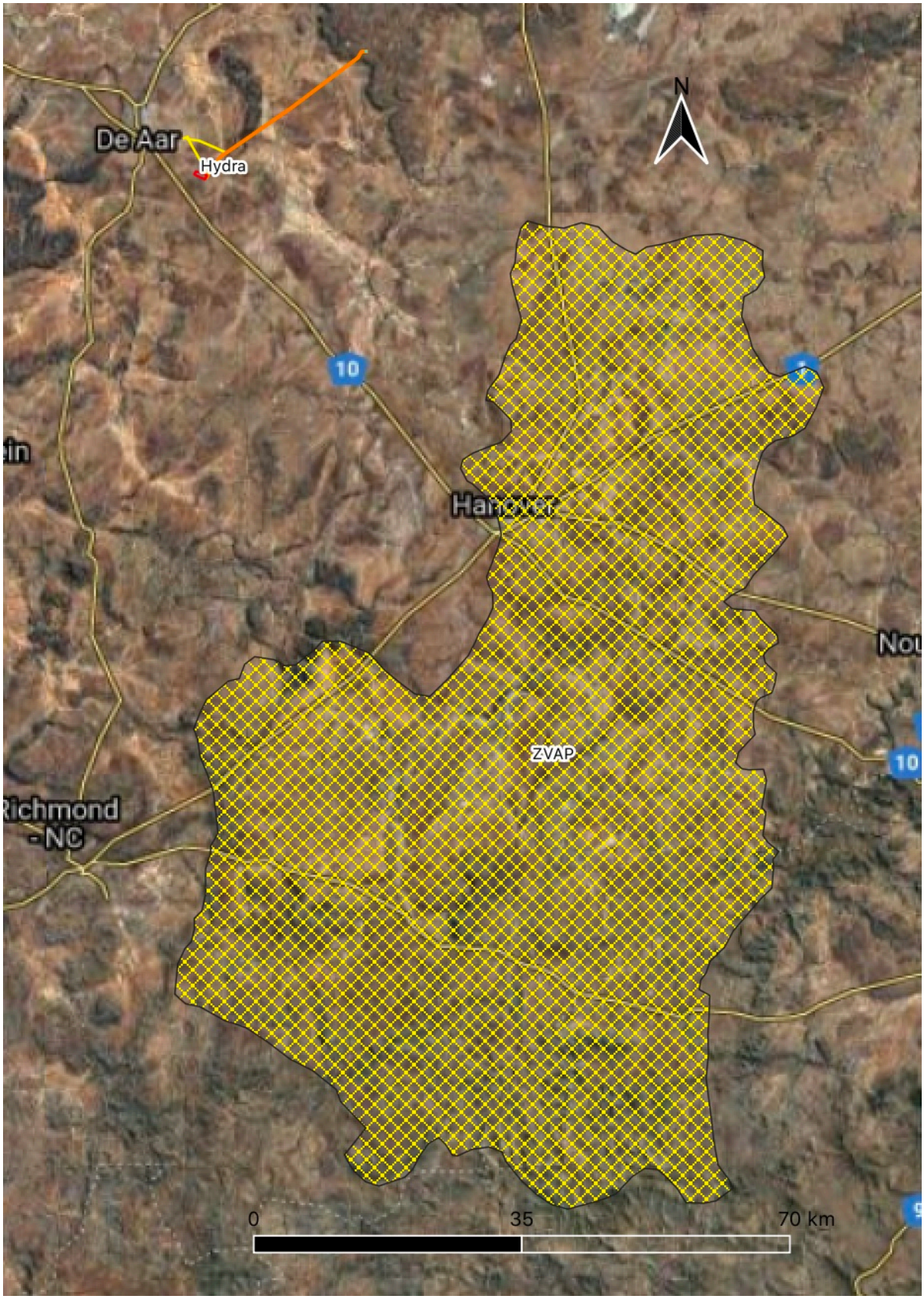


Figure 4: Proximity of the proposed grid connection routes to the Zeekoei Valley Archaeological Survey study area (After Sampson 1985)

5.4.2 Archaeology

Arrangements made by ACO with Eskom to provide accompanied direct access along the existing grid connection servitudes were changed at the last minute (a consequence of load shedding demands on Eskom staff at the Hydra substation). This meant that access to the proposed grid connection routes had to be on a farm by farm basis, which reduced the survey time on the route alignments.

The farm Badenhorst Dam (1/180) was not visited as landowner permission was not granted and time constraints, coupled with difficulty on the ground in physically accessing Vetlaagte (Re 4) meant that some portions of Route 2 could not be surveyed (Figure 5).

In respect of these farms, however, archaeological surveys have been conducted on both farms in the past for proposed solar energy facilities. Kruger (2012) surveyed much of Vetlaagte in 2012, and in 2011 and 2013 ACO Associates conducted field assessments on Badenhorst Dam (Orton, 2012; Orton and Webley 2013a) (Figure 7).

The receiving environment on both farms is very similar to that encountered elsewhere on the grid connection route by ACO in 2020, and the archaeological material reported by Kruger (2012), Orton (2012) and Orton and Webley (2013a) – MSA and LSA lithic scatters, a number of Khoi kraals and circular stone structures associates with rocky ridges and outcrops, and some historical remains - is what would have been expected, based on the results of the recent ACO survey of the rest of the grid connection routes and the other assessments in the area.

A handful of archaeological occurences were identified by these studies close to the proposed Route 2 option grid connection alignment, and these are considered in the archaeological assessment below.

Lack of access to Badenhorst Dam and Vetlaagte is thus not considered a serious limitation as the results of the remainder of the survey, together with Kruger's (2012), Orton's (2012) and Orton and Webley's (2013a; 2013b) results from Vetlaagte, Badenhorst Dam and Du Plessis Dam provide a good indication of the heritage resources that can be anticipated in the portions of Route 2 that were not accessed.

6 RECEIVING ENVIRONMENT

This part of the Northern Cape is characterised by wide plains interspersed with koppies and mountains formed by ingenous intrusions. The grid connection lines cross a variety of terrains. At their eastern terminus they are located on a large flat mountain plateau which rises at least 100 m above the surrounding plains. The plateau is generally flat rocky outcrops and is covered in typical Karoo scrub and grasses (Plate 1). There are more dense clusters of trees in some of the deeply incised valleys. There are a number of dry stream beds which flow periodically after summer rains.

Below the plateau, the grid connection routes traverse a series of flat valley bottoms divided by intrusive dolerite koppies (Plate 2). These flat valley bottoms are almost without exception seasonal river and stream drainages, the largest of which is the Brak River on Carolus Poort

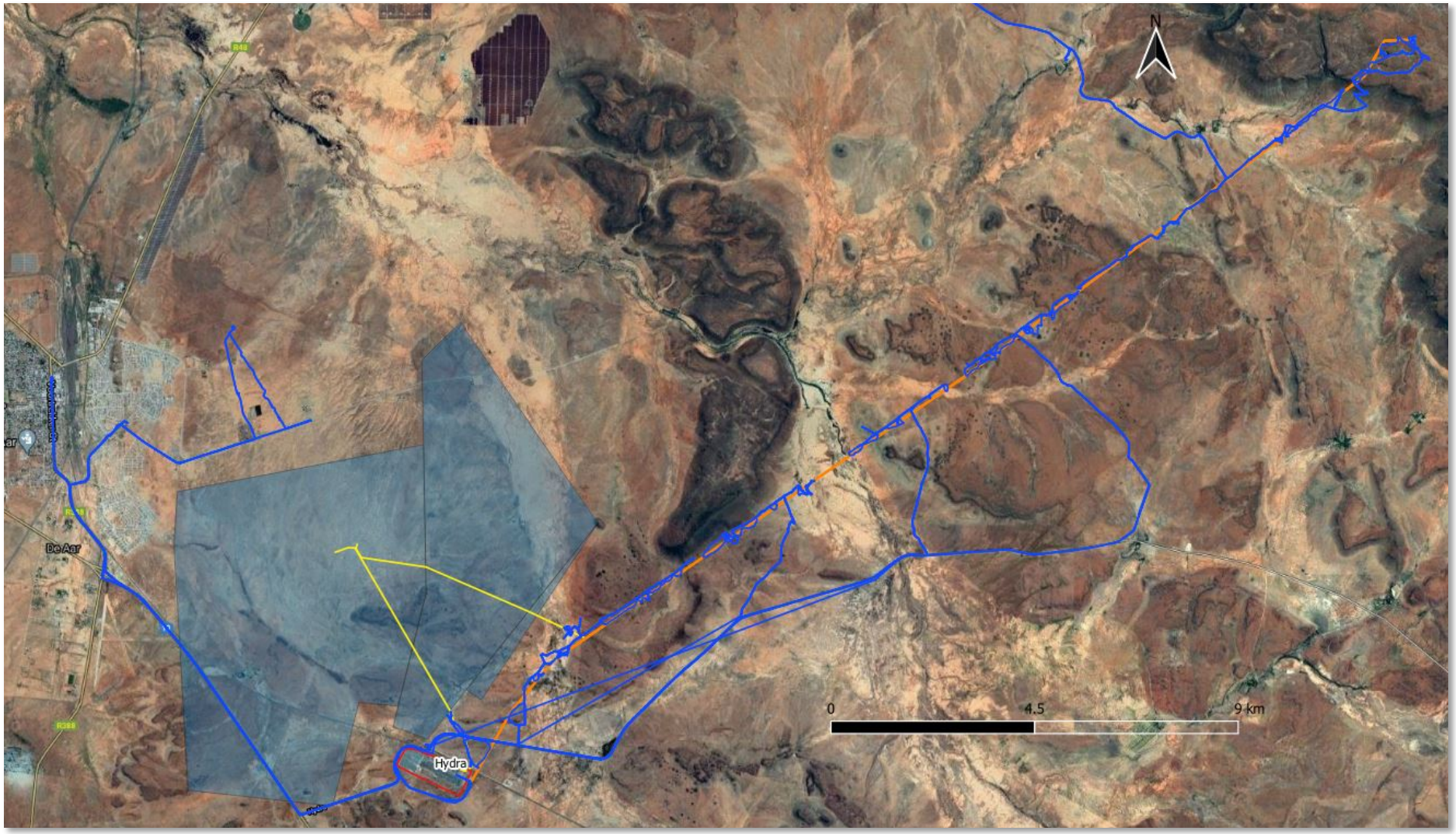


Figure 5: ACO Associates survey tracks (blue) overlaid on proposed grid connection routes (red and orange). Note that issues of physical accesibility and landowner attitude meant that it was not possible to survey the farm portions highlighted in blue.

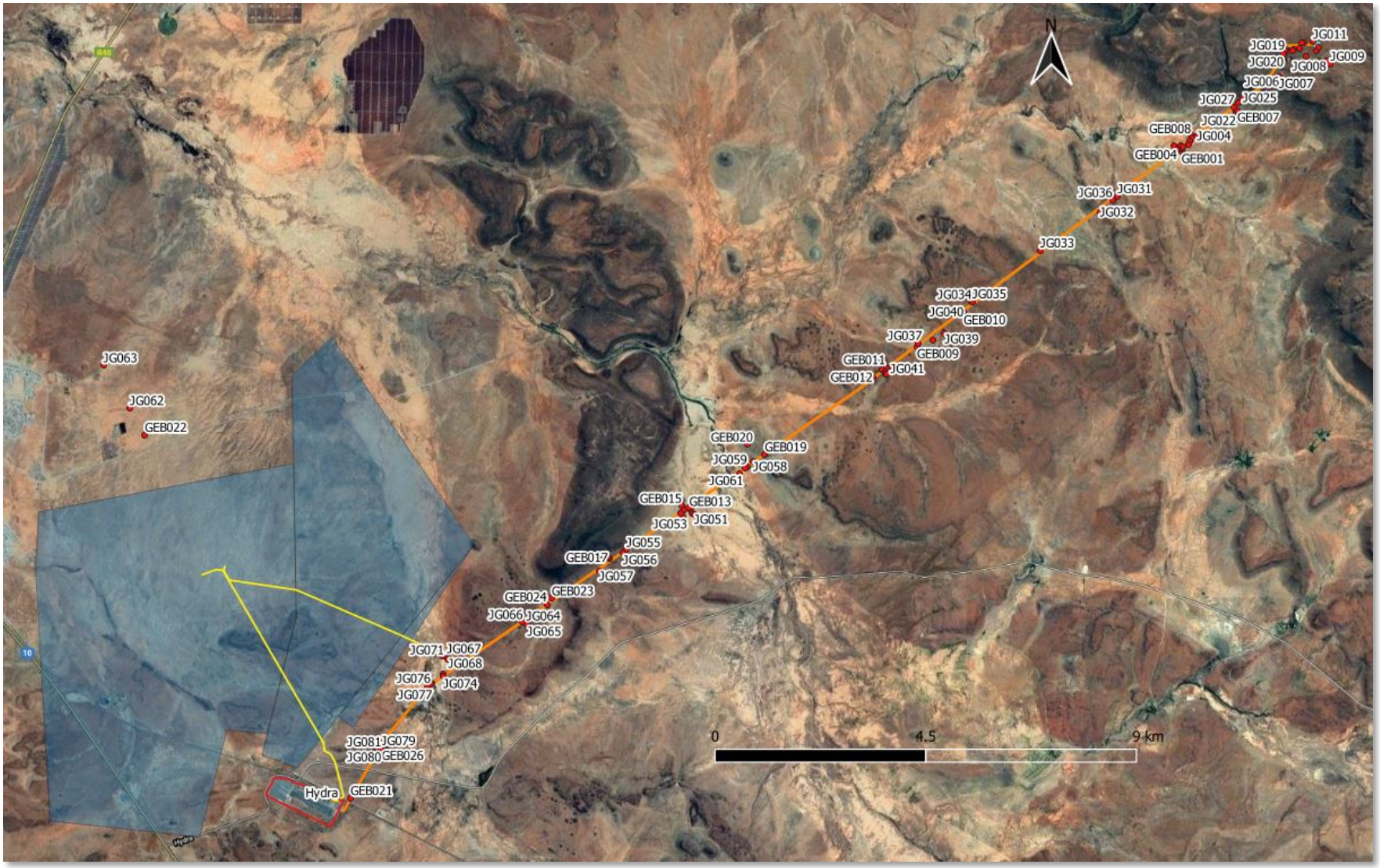


Figure 6: Waypoints denoting archaeological occurences recorded during the ACO survey of the proposed grid connection routes.

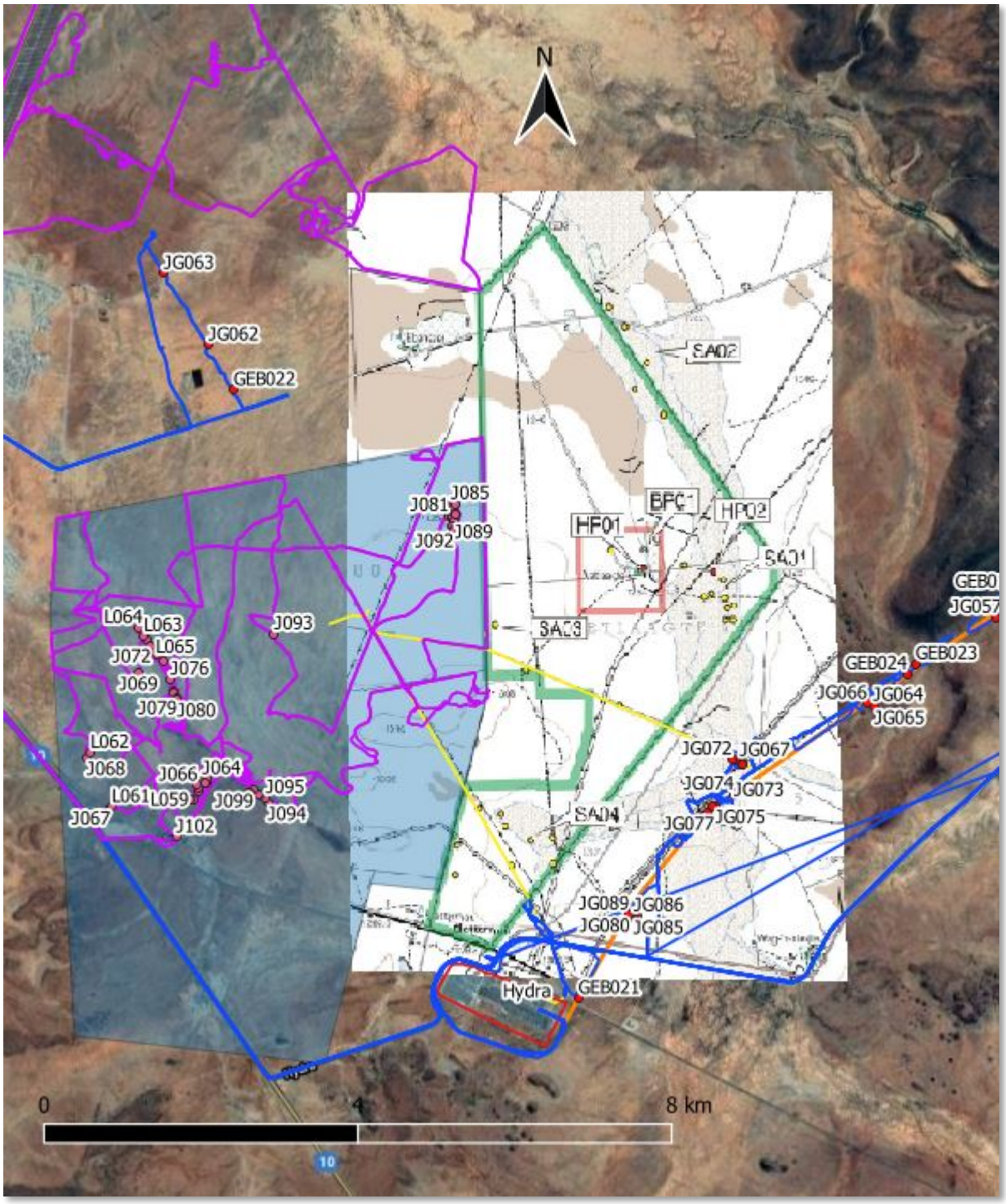


Figure 7: Overlay of Kruger (2012) (inserted map) and Orton and Webley (2013a) survey results on the farms Vetlaagte and Badenhorst Dam with proposed Route 2 grid connection option (yellow and orange lines). The purple lines and numbered points represent the 2013 ACO survey tracks and find spots. The dark blue lines and numbered points on theright of the image are 2020 ACO survey result.

Plate 1:View across upland plateau.

Plate 2:View from the plateau across the proposed alignment of grid connection Route 1. De Aar and the Hydra substation are located below the hills on the horizon. Note the open erosive areas in the foreground which are typical of the valley bottoms traversed by the route. The yellow line shows the approximate route of the new grid connection. The existing power line is visible to the right of the proposed route.

Plate 3: View to the east across the Brak River valley along the proposed Route 1 alignment. The proposed new grid connection line will run to the right of the pylons in the photograph. Note the erosive surface in the forground and the Brak River in the distance.

Plate 4: Example of an area of erosion and deflation with exposed archaeological material (JG077 – see Appendix B) on the farm Wag 'n Bietjie (Re 5). Grid connection Route 1 runs directly across this site.

3/3 and here the land is low-lying and following the rains prior to the fieldwork was swampy with thick silty Quaternary sediments (Plate 3). In many of these areas vegetation is more sparse and there are large open eroded and deflated surfaces where archaeological material is often exposed (Plate 4).

Sampson's (2015:4-5) description of the geography of the Zeekoe Valley is remarkably similar to the physical environment encountered in the area surveyed for the proposed grid connections: valley floors bifurcated by dolerite dykes and sills which form clusters of low hills and ridges and in many places the underlying Beaufort shales indurated or baked by the intrusive dolerites to form a metamorphic rock known as hornfels.

6.1 Palaeontological Context

The Karoo is a vast palaeontological landscape consisting of multiple layers of sediments that contain an array of fossils, ranging from fish, early vertebrates, plant remains to trace fossils. It is considered to be one of the most complete fossil repositories on the planet.

The geology and paleontology of the region has been a subject of research since the early 20th century. The flat plains of the modern Karoo are underlain by a series of shale and mudstone strata which represent some 400 million years of depositional history (Visser et al 1977).

The basal rocks of the Karoo sequence are known as the Dwyka formation and are a glacial deposit laid down during the Permo-Carboniferous glaciation (c. 300 million years ago (Mya)).

This was followed by the deposition of the Ecca formation, sediments deposited in a shallow sea that covered much of what is now the interior of South Africa. Ecca shales form the base of many of the large flat plains of the Upper Karoo (Truswell 1977; Tankard et al 1982; Visser 1977).

The best known depositional event of the Karoo sequence is the laying down of the Beaufort shales about 230 Mya. These shales are a rich, stratified sequence of fish, reptilian and amphibian remains that are fossilized in Permian and Triassic period swamp deposits (Truswell 1977; Visser 1977; Oelofsen and Loock 1987).

At the end of the Triassic period (c. 252-201 Mya) a series of geological upheavals took place as the Pangaea super continent fragmented. Triassic period vulcanism led to dolerite intrusions through the shales of the Karoo which formed vertical dykes and horizontal sills following the bedding planes of the shales. These geological structures give rise to a very characteristic topography of the Karoo with its mesas, hillocks and sharp ridges (Visser 1986).

De Aar is in the north central part of the Karoo Basin and the predominant rocks are those of the Beaufort shales of middle to late Permian in age (c. 276-252 Mya). The Beaufort shales are overlain by Ecca Group sediments, in the De Aar area the Tierberg Formation of the Ecca Group, which represent the gradual filling up of the shallow palaeo sea within the Karoo Basin, that was terminated by the Triassic Drakensberg volcanics.

Intruding through the shales are large expanses of late Triassic / early Jurassic dolerite which, being more weathering-resistant, tends to form the relief in the area, with the mountains to the north and northeast of De Aar being formed by a huge exposure of dolerite. Smaller dykes appear as long lines or circular exposures of dark weathered boulders and rocks.

In the water courses of the area much younger sands and alluvium of the Quaternary Kalahari Sands have been deposited. These sediments were transported from farther north in the past when there was likely much more rainfall in the system, and more recently with flash flooding. Their composition and origin can be very mixed (Bamford 2020).

6.2 Archaeological Context

Our understanding of the pre-colonial archaeology of the Upper Karoo is derived in large part from the exhaustive archaeological survey of the Zeekoe River Valley by Prof Garth Sampson (1985, 1992, 2015) of Southern Methodist University in the United States referred to earlier.

This large-scale and detailed survey produced a comprehensive and unparalleled body of archaeological information which can be extrapolated to this HIA to inform our understanding of the pre-colonial heritage of the area to be affected by the proposed grid connections.

The ZVAS identified a long sequence of archaeological material in the Upper Karoo indicating the occupation of the region by our forebears since the Early Stone Age (ESA) Acheulian (after 1 million years ago), through multiple Middle Stone Age (MSA) phases, four Later Stone Age (LSA) phases to herder sites, many with low stone-walled kraals and Khoekhoe-like, thin-walled ceramics, dating to within the last 2000 years (Sampson 1985, 2015:3).

The Acheulian sites in the Zeekoe Valley are reported by Sampson (1985) as clustering close to sources of tool-making stone raw material, rather than being close to sources of water and tend to be found on the flats rather than on ridges and hills.

The many Middle Stone Age artefact occurences reported by Sampson (1985) are almost exclusively “open sites”, a factor probably of the lack of rock shelters and overhangs in the Karoo geology. He describes the open sites as occurring in erosion features along stream banks, but makes it clear that MSA artefacts are widely distributed across the landscape, in the form of “ancient litter” and are frequently found on the edges of pans, streams and at the base of small hills or koppies.

Sampson (1985) recorded thousands of Later Stone Age sites in the Zeekoe River Valley, which are attributed to the ancestors of the San peoples and, after 2000 years ago, to Khoekhoen pastoralists. As with the MSA sites, the LSA material is generally found in the open due to the scarcity of rock shelters and comprise large scatters of stone tools. Other traces of the San presence in the Karoo can be found as rock engravings on dolerite boulders (Webley and Orton 2011:14).

The earlier phase of the LSA dates to around 10 000 years ago and is described by Sampson (1985) as the Lockshoek. This industry is contemporary with the Oakhurst/Albany Industries and is charactised by large sidescrapers, frontal scrapers, endscrapers, thick backed adzes and a wide variety of ground stone implements. These sites are overwhelmingly found near water points (Webley and Orton 2011:14).

The Lockshoek is followed by the ‘Interior Wilton’ (IW) which Sampson describes as including small convex scrapers, adzes, drills, reamers as well as ceramics in the final phase of the IW. Unlike the Lockshoek, IW sites are found on hills and ridges with commanding views of rivers and valleys (Webley and Orton 2011:14).

The Interior Wilton is followed by the Smithfield which is characterised by abundant

endscrapers made on elongated flakes, often with extensive trimming down the margins. Sampson's Smithfield is generally associated with ceramics (Webley and Orton 2011:14).

The introduction of pastoralism (sheep, goats and, later, cattle) roughly 2000 years along with the arrival of the Khoekhoen may have resulted in changes in land use. It is suggested the Khoekhoen followed a transhumant lifestyle, and are likely to have utilized the grazing opportunities of the Karoo on a seasonal basis (Webley and Orton 2011:14).

By the early 18th century the San appear to have retreated to the Great Karoo ahead of the expansion north and east from the Dutch settlement around the Cape of mobile colonial stock farmers or trekboers. Here they managed to eke out an existence which includes hunting, gathering and raiding the livestock of the trekboers, resulting in the "Bushman War". Eventually kommandos dispatched from regional centres such as Graaff Reinet prevailed and the "wild bushman" of the Karoo were rendered extinct by the early 19th century (Webley and Orton 2011:14).

The most recent archaeological layer in the Karoo landscape relates to the historical occupation of the area by stock farmers of European descent from the late 18th century, but is a layer which is not well-documented. These European pastoralists, were highly mobile – hence the name trekboers – moving between winter and summer grazing on and off the Great Escarpment. Land ownership was informal and only became regulated after the implementation of the quitrent system of the 19th century used by the Government to control the lives and activities of the farmers. However, judging by the kinds of artefacts and structures found on the landscape, many of the farms in the Upper Karoo are likely to have been used before land was formally granted or loaned in the early 19th century (Sampson and Sampson, 1994).

The town of De Aar was established on the farm of that name at the site of an important railway junction created by the Cape Government Railways in the last two decades of the 19th century on the line between the Kimberley diamond fields and Cape Town. In 1899 the Friedlander brothers, who ran a trading store and hotel at the junction, purchased the farm and after the end of the South African War surveyed the land for the establishment of a town. The municipality was created a year later (https://en.wikipedia.org/wiki/De_Aar).

7 HERITAGE RESOURCES

The archaeological survey of the grid connection routes documented a large number of pre-colonial archaeological sites and lithic scatters, but only a handful of occurences of colonial period archaeological material or structures were noted.

The archaeological finds are too extensive to describe individually in this report and are thus presented in Appendix B. They include Middle and Late Stone Age archaeological material, possible historic period stone structures, Khoikhoi stone kraal complexes and a single occurence of late 19th / early 20th century historical material.

7.1 Palaeontology

According to the palaeontological dektop study by Bamford (2020) (see Appendix A), the area traversed by the grid connection routes crosses a range of geological rock and sediment types (Figure 8) and almost the full range of palaeontological sensitivities described on the SAHRIS

palaeomap (Figure 9).

The dolerite contains no fossils because they do not occur in intrusive, volcanic rock. Furthermore, when igneous dykes intrude through the overlying sediments they tend to physically destroy any fossils in their paths and the heat they generate can destroy or alter fossils in the vicinity. The dolerites have a zero palaeontological sensitivity.

The Quaternary sands in the water courses are young enough to preserve fossils but having been washed down slopes and streams into rivers, any fossils would have been transported from thier sites of origin and their context and associations with other fossil material in the assemblage will have been lost. These sediments are indicated as moderately sensitive by SAHRIS.

In contrast, the Ecca and Beaufort shales are much more likely to preserve fossils and many years of research by geologists and palaeontologists in the Karoo (for example, Rubidge, 1995, 2005; Johnson et al., 2006; Rubidge et al., 2016) has produced a detailed lithology and described the terrestrial flora and vertebrate fauna of these rocks. From this and other parts of the Karoo the Tierberg Formation has produced a number of trace fossils of worm burrows, root casts and invertebrate trackways (van Dijk et al., 2002; Almond, 2013). Fossil plants are rare in this part of the Karoo basin but there are records of fragments of silicified wood from east of De Aar (Almond, 2013).

The Adelaide Subgroup, undifferentiated in this area, can be divided into the Abrahamskraal or Koonap Formations and the Teekloof or Middleton and Balfour Formations. Expected vertebrate fossils are a variety of dinocephaleans, gorgons and therocephaleans and some fish but according to Almond's site surveys (Almond 2012a, 2012b, 2012c), vertebrate fossils are rare as there is little exposure.

Potential fossil plants are typical Permian impressions of *Glossopteris* leaves, lycopods, sphenophytes and ferns, and silicified wood (Anderson and Anderson, 1085). Only fossil wood has been seen in the Adelaide Subgroup in this area (Almond, 2012a). The samples have not been collected or identified.

7.2 Pre-colonial Archaeology

7.2.1 Early Stone Age

No ESA material was identified in the 2020 ACO survey, or by the surveys by Kruger (2012), Orton (2012) and Orton and Webley (2013a) in the area traversed by the Route 2 grid connection option.

7.2.2 Middle Stone Age

MSA material was encountered across much of the area surveyed. The MSA artefacts encountered were made on a now very heavily patinated and weathered hornfels. Although black when broken or flaked, hornfels acquires a reddish-brown protective skin or patination with exposure to the elements and the MSA material recorded during the survey was both

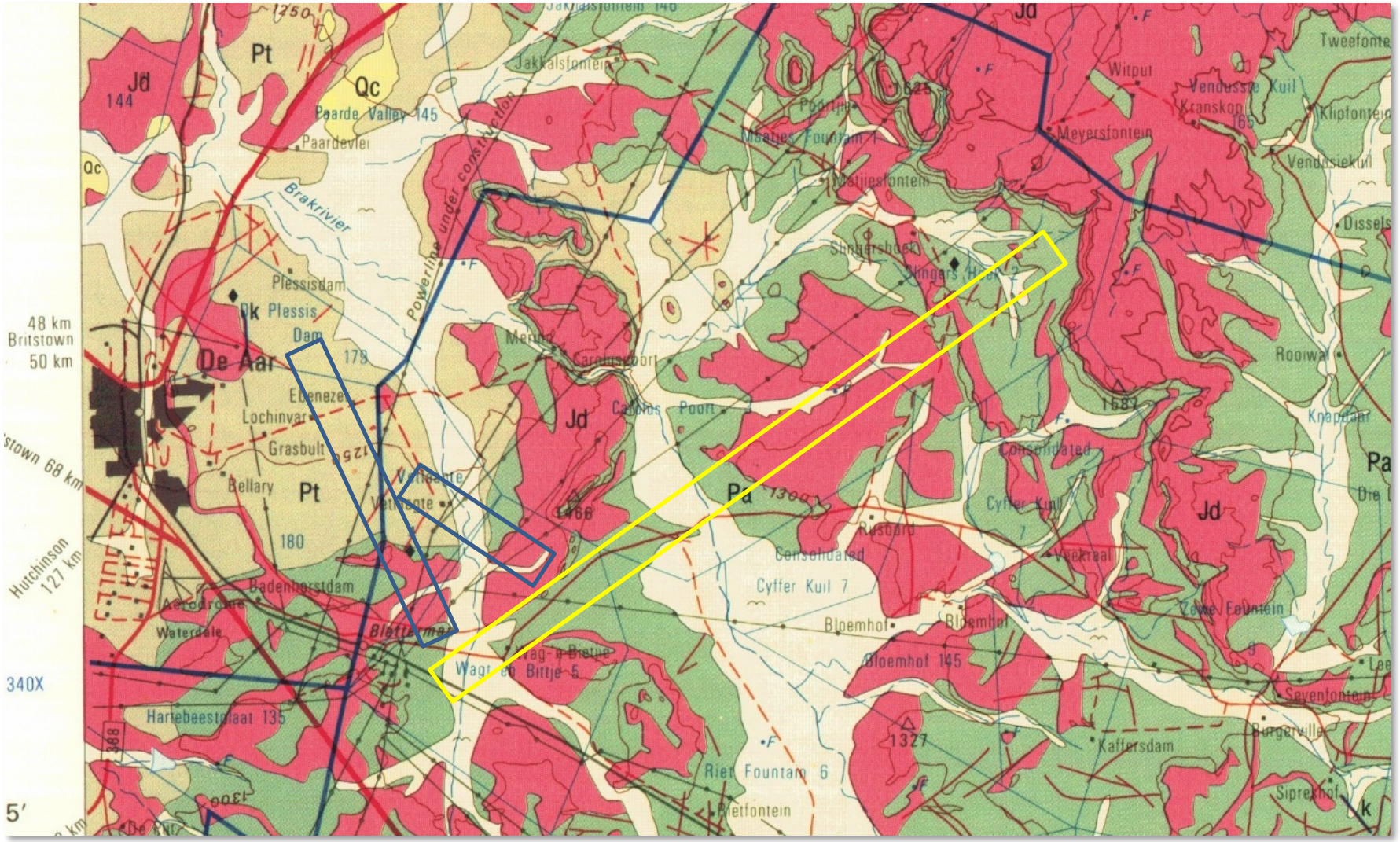


Figure 8: Geological map of the De Aar area. The blue and yellow polygons shows the approximate alignments of the proposed grid connection routes. The key rock or sediment types on the routes are: red = Jurassic dolerite dykes, green = Adelaide Subgroup shales, khaki = Tierberg Formation shales and mudstones, white = Quaternary Kalahari sands (Map enlarged from the Geological Survey 1: 250 000 map 3024 Colesburg)

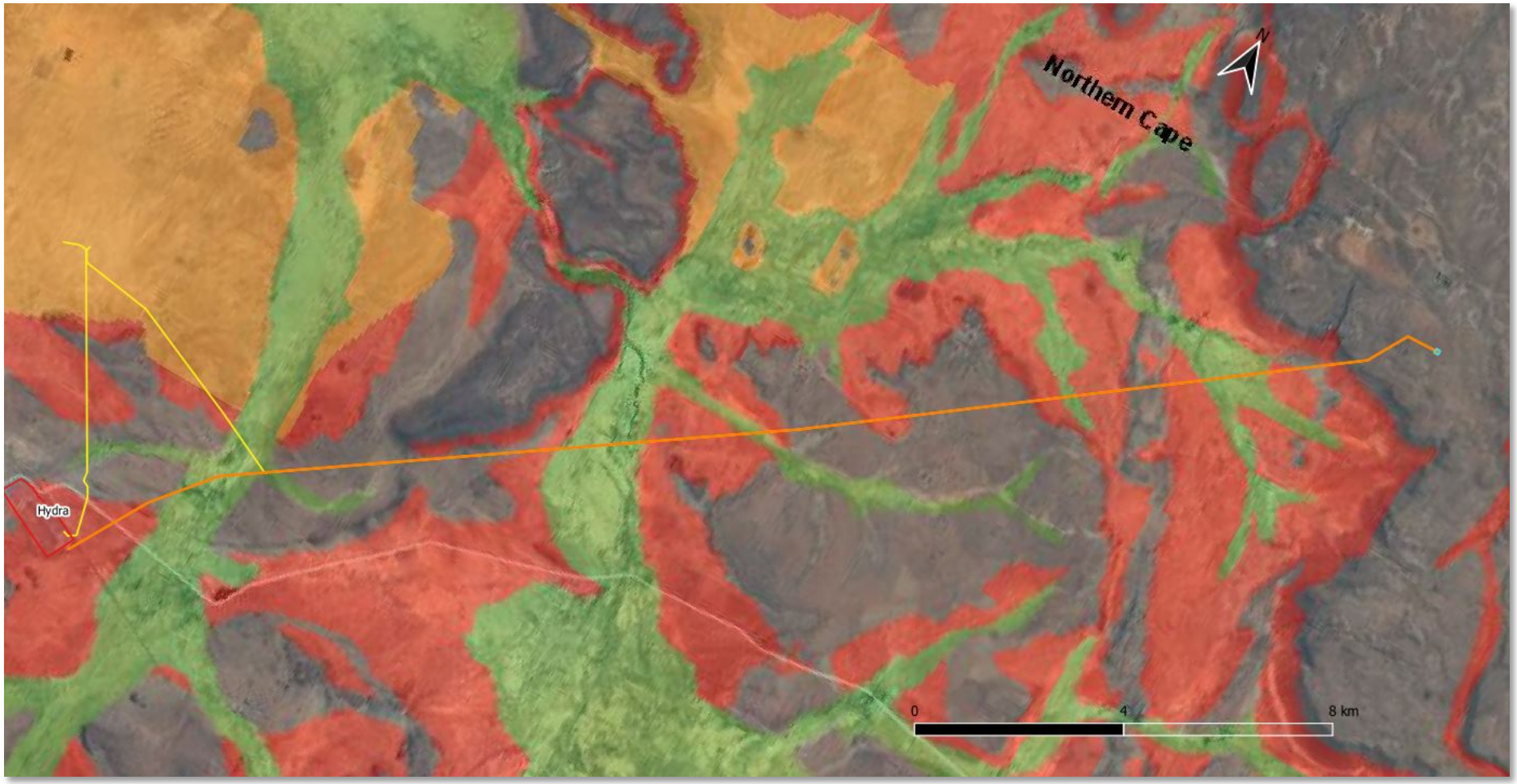


Figure 9: Overlay of the SAHRIS palaeosensitivity map on the proposed grid connection routes. The background colours indicate the following degrees of sensitivity: red = very high; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

heavily patinated and edge-worn (Plate 5). The artefacts include cores, flakes, blades and snapped blades. There were few diagnostic MSA elements, apart from occasional triangular flakes with dorsal ridges removed or long blades with parallel dorsal scars. Some flakes and blades have signs of utilisation damage. No bifacially worked points (Stillbay) or artefacts typical of the Howieson's Poort were seen. No other associated archaeological material (bone, ostrich eggshell, etc.) was found with the MSA lthics.

Similar to what has been described by Sampson (1985) in the nearby Zeekoe Valley and by Kruger (2012), Orton (2012) and Webley and Orton (2011, 2013a; 2013b) for a number of other projects in the area, much of the MSA material was found lying on harder, gravelly substrate in areas of where the orange sand that mantles the landscape has been eroded by water or deflated by wind (Plate 6).

Discrete, clearly definable MSA sites were difficult to identify because material is generally visible only in areas where the overlying orange sand has been stripped away and because the landscape is liberally spread with material, a type of "ancient litter" (Webley and Orton 2011).

Plate 5: Examples of weathered and patinated MSA stone artefacts found widely distributed across the survey area.

Plate 6: MSA lithics being exposed by erosion (JG012). Most of the stone visible in this image is MSA material.

A few dense scatters were identified and recorded as archaeological sites – JG046, JG058-9 – and what may be a MSA quarry on the plateau where the wind energy facility is to be constructed and the grid connection terminates. The potential quary, JG008 is a dense concentration of MSA litihcs noted across a wide area (at least 100 m in all directions) on and in the orange sand surrounding a dolerite koppie. Excavated material from an antbear hole contained hornfels chunks and cobbles from ±30 cm below the surface and this weathered hornfels lag deposit may be a source of raw material being exploited by MSA people. LSA flakes and “freshly” retouched MSA flakes were noted in places on this site.

7.2.3 Late Stone Age

The LSA artefact assemblages encountered are all made on hornfels, with occasional isolated pieces of other raw materials such as agate, a yellow mudstone, and a banded, indurated shale noted on a few sites.

Most of the LSA artefacts have a pale grey patina or are black and sharp, suggesting that they were relatively recently flaked. Smithfield industry artefact scatters, with no evidence of associated pottery and characterised by endscrapers (or duckbill scrapers) made on long flakes were noted in places (JG061, for example) as were sites containing early Holocene, Lockshoek lithics, dating to c.10 000 years ago (JG050 and JG068) (Plate 7). Both industries are typical of what is expected in this part of the Karoo according to Sampson (1985).

Plate 7: Smithfield lithics from site JG061 (left) and possible Lockshoek material from JG050 (right).

A single piece of grass-tempered pottery (Plate 8) was found associated with an LSA hornfels stone tool scatter (JG079) and a series of possible Khoi kraals (JG082, JG084, JG088) (see following section).

Plate 8: Site JG079 (left) with grass-tempered pottery sherd (right).

7.2.4 Stone Features and Kraals

Circular packed stone features were noted at places within the survey area.

Some of these features are almost certainly from the colonial era and are probably shepherds' huts. Four such features were noted (GEB020, JG065, JG083 andJG090). They are roughly 1.5-1.8 m across internally with a narrow opening on one side – usually the east. Surviving walls are generally 50-60 cm high (Plate 9). Two of these features (JG083 and JG090) are constructed within what appear to be earlier, Khoi kraals (JG082 and JG082).

Complexes of circular Khoi kraals are a feature of the region and large numbers were recorded by Sampson in the Zeekoe Valley. These features tend to form clusters of curcular or sub-circular packed stone walls, and are often located in the lee of koppies or rocky outcrops.

A number of possible Khoi kraals were identified along the grid connection, although only one

(the complex including JG082 and JG084 described above) appears unequivocably to be a Khoi kraal complex.

This complex is visible on Google Earth photography, and may extend well beyond the three clear stone circles identified during the survey (Figure 10).

Other possible kraals were noted at JG039, JG040, JG064 and JG066. Orton and Webley (2013a) recorded Khoi kraals on the farm Badenhorst Dam traversed by the Route 2 grid connection option.

Plate 9: Possible shepherds' huts (GEB020 and JG090).

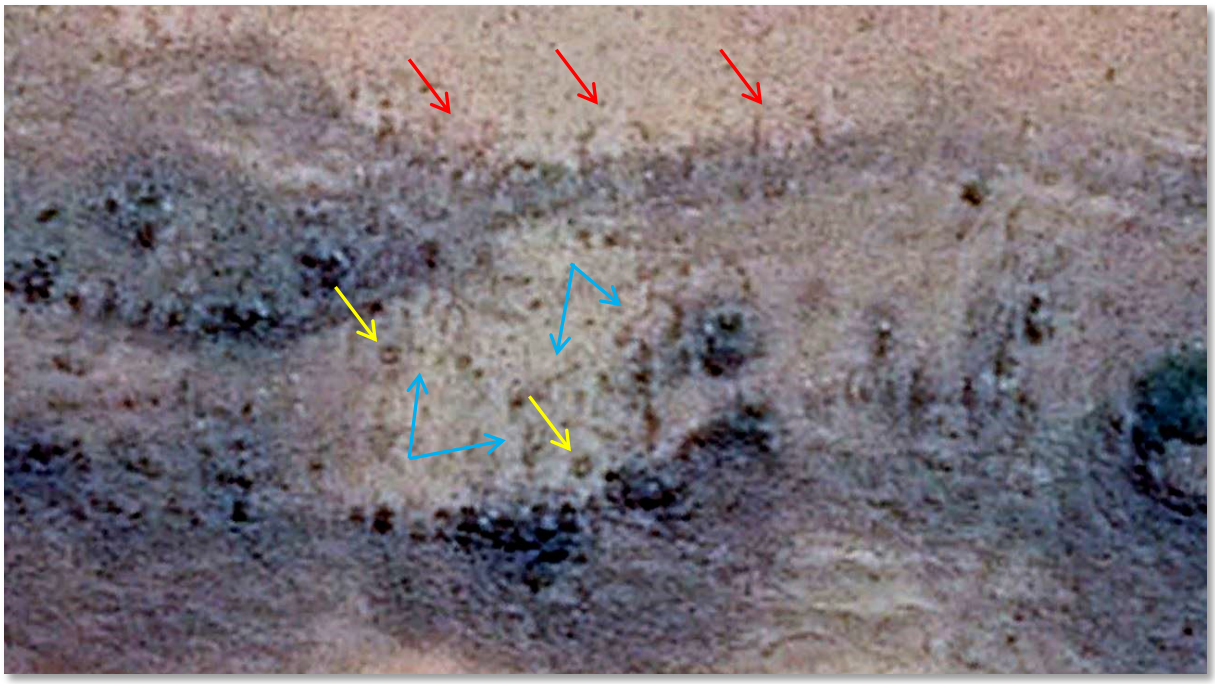


Figure 10: Googe Earth image of possible Khoi kraal complex. Shepherds' huts JG083 and JG090 are marked by the yellow arrows. Both are located within wider Khoi stone kraal circles (blue arrows), with other conjoining walls visible in the hollow between the surrounding koppies and also possibly against the northern (top of image) slope of the hill (red arrows) (Source: Google Earth).

7.2.5 Engravings and Rock Art

Webley and Orton (2011) reported rock engravings on dolerite boulders on a koppie behind the main farmhouse at Slingers Hoek and a rock gong with an associated fine-line engraving that looks to be of an animal were recorded on the farm Badenhorst Dam (Orton and Webley (2013a). During the 2020 ACO field assessment, Duppie Pienaar of Carolus Poort talked of San rock paintings in a valley overlooking the Brak River. None of these sites are close to the proposed grid connection lines and none will be impacted by the proposals.

The only rock engraving encountered during this survey was what appears to be a modern engraving on a dolerite boulder on a koppie on the farm Carolus Poort 2 (JG044) (Plate 10). The engraving is located on the north side of the koppie and consists of two long thin parallel lines with seven"bars" scratched between them. It is about 10 m from the LSA stone scatter JG043.

Plate 10: Rock engraving (JG044) on Carolus Poort 2. The position of the engraving is marked by the arrow on the image on the right.

7.3 Historical Archaeology

A small number of historical artefacts were noted at only one place along the route: on and below the koppie on which the Khoi kraal complex discussed earlier was located.

The thin scatter of ceramics, glass and metal are of late 19th / early 20th century date. A shovel head with an embossed broad arrow, denoting British government property suggests occupation may have dated to around the South African War (Plate 11). The proximity of the material to the shepherds' huts at this site suggests they may be associated.

The 2011 and 2013 surveys of Badenhorst Dam identified similarly thin and ephemeral scatters of historical material at a number of places on the farm, none of which, however, will be affected by the Route 2 grid connection option (Orton 2012; Orton and Webley 2013a).

Plate 11: Shovel head with embossed broad arrow denoting British government property.

7.4 Graves, Cairns and Stone Features

No graves or cairns were encountered during the survey, although Duppie Pienaar of Carolus Poort indicated that four South African War graves of Boer fighters are located near his farmhouse. These are a substantial distance from the proposed grid connection lines and will not be impacted by the proposals.

It should be noted that pre-colonial graves are often completely unmarked and can be located anywhere where the soil is suitable for digging a grave.

A small ruined stone structure was recorded next to the road on a dolerite platform on the farm Slingershoek (JG036). The surviving packed stone walls are roughly 1.5 x 1 m in length and stand approximately 20-30 cm. The structure has been interpreted as a colonial period “wolwehok” or vermin trap (Plate 12 and Plate 13).

Plate 12: Ruins of a possible colonial era “wolwehok” or vermin trap on the farm Slingershoek (JG036).

Plate 13: Example of a intact stone built wolwehokke. Left, example encountered near Noupoort, and right, an example recorded by James Walton at Herenlogement (Sources: ACO Associates; https://www.vassa.org.za/walton-old-cape-farmsteads/wolwehok-herenlogement/)

7.5 Built Environment

No historical building were recorded anywhere within the proposed grid connection corridor, and the closest farm werf to the routes is Slingershoek, which is a little less than one kilometre distant, on the far side of an existing powerline.

7.6 Cultural Landscape

The landscape traversed by the grid connection routes is a cultural landscape, of clear significance to a succesion of pre-colonial and, to a lesser degree, colonial people, as demonstrated by the presence of the widespread archaeological sites and materials described above.

This cultural landscape is essentially a series of layers of occupation and use by our ancestors that have become superimposed on the land surface. And the land surface, while not cultural, is nevertheless of heritage value as a vast palaoentological respository.

Early, Middle and Later Stone age people left at least half a million years of human debris on the land surface – stone tool scatters, engravings, kraals, etc. More recently the landscape received the imprint of the European colonisation of the region as it was used and settled by colonial Trekboers who imposed their structure on the land in the form of farm buildings, dams and fence alignments. Most recently there has been the introduction into landscape of modern industrial elements such as railways tracks and electrical infrastructure.

8 IMPACT ASSESSMENT

This impact assessment makes use of the method developed by Hacking (2001), with a minor change to the terminology related to the duration of impacts, to better suit its application to heritage resources. Because of the non-renewable nature of heritage resources, the duration of the effect of impacts which result in changes to the resource will always be permanent and this is reflected in the tables which follow.

8.1 Nature of Impacts

Heritage resources are highly context sensitive and the main cause of impacts to such sites is physical disturbance of the material itself and its context.

The installation of the De Aar 2 South WEF grid connection can have a number of direct and indirect impacts on the heritage resources and qualities of an area. In the case of De Aar, there is also the cumulative impact of the numerous powerlines that converge on the Hydra substation to consider.

During the construction of the grid connection lines the following physical impacts to the landscape and any heritage resources that lie in or on it can be expected:

- Excavations to construct the foundations for each pylon;
- Leveling of the ground for pylons located on hillsides;
- Construction of roads or track s to service both the installation of the powerline and its longer term maintenance;
- Creation of working and lay-down areas for the installation of the pylons; and
- Introduction of vehicles, machinery and people into environment.

Lastly, the introduction of a substantial industrial feature can have an impact on the cultural landscape.

Mitigating factors in the list above are the fact that pylon foundations are relatviely small and shallow. An existing service road follows the powerline adjacent to the proposed grid connection line and it is assumed that this will be used for to some exent to access the line during construction. That said, the stringing and pulling of the cables between pylons will likely require vehicular access down the new route and this will impact sites in its path.

The best method for managing impacts to heritage resources is avoidance or exclusion of the site from activities associated with the project. If this is not possible, then some form of mitigation will be required to manage the impacts. This is generally considered a second best approach as *in situ* preservation, wherever possible is always the preferred option.

8.2 Extent of impacts

The fieldwork undertaken to inform this assessment identified MSA, LSA lithic material and Khoi and colonial era stone structures of a generally relatively low, local archaeological significance, widely distributed across the landscape.

The impacts to archaeological material in the area of the construction of the grid connection will be relatively small and localised, although where individual sites or structures are affected the impact will be high.

8.3 Significance of Impacts

Based on the information that has been collected, indications are that impacts on heritage resources arising from the installation of the grid connections will be as follows:

- **Palaeontological resources**: Given the nature of the proposed project, activities may impact upon fossils if they are present close to the ground surface in the development footprint. The geological mapping indicates that the Route 2 option will cross an area where the bedrock is the correct age to contain fossils, particularly trace fossils and silicified wood fragments within the Tierberg Formation although site visits and solar facility PIAs conducted for the two farms in the area, (De Aar 1/180 and Vetlaagte) (Almond, 2012b) and a palaeontological site survey for the De Aar South 2 WEF

(Almond 2012c) found very few fossils.
If existing service roads and access points are used during the construction of the grid connection powerlines this will reduce the potential for impacts on fossil resources and the very small footprint of pylon foundations means that the impact on the fossil heritage resources from the instalation of the grid connections is assessed to be very low. Taking all of the above into account, the significance of potential impacts to fossil heritage resources is extremely low.

- **MSA**: The volume of and apparently ubiquitous nature of the MSA artefacts scattered across the landscape, and the fact that much of this material is in secondary, or disturbed context, means that the combined overall impact significance of activities associated with this project on MSA material will be relatively low;
- **LSA**: The context of much of the LSA material noted during the survey appears to be better preserved than the MSA material, and is thus of greater archaeological significance. More occurences that could be called sites were noted with the LSA material, and the possible association of OES with some of the early Holocene material eroding out the banks of the Brak River, for example, makes some of these sites of particular interest and importance. Were these sites, highlighted in Appendix B and described in Section 7.4 above, to be lost or damaged as a result of the construction of the grid connection, the impact significance would be medium. The application of measures to mitigate potential loss or damage, however, would reduce the impact significance to low;
- **Kraals and Stone Structures**: The possible Khoi kraals and other stone structures noted during the survey, parlicularly the complex described in detail earlier, represent a little known aspect of the history and archaeology of this area. Their damage or destruction would result in a loss of heritage, and the impact significance would be medium. The application of measures to mitigate potential loss or damage, however, would reduce the impact significance to low;
- **Graves, cairns and stone features**: No graves or cairns were encountered during the survey. Damage to or the destruction of the possible ruined “wolwehok” would have a moderate impact significance. The application of measures to mitigate potential loss or damage, however, would reduce the impact significance to low;

No impacts are expected to engravings and rock art, historical archaeological sites and materials or the built environment.

The likely impacts of the grid connections on identified heritage resources are assessed as follows:

Table 2: Pre-colonial and Colonial Archaeological Impact Assessment

Impact Phase: Grid Connection Construction		
Possible impacts to archaeological sites and materials		
	Without Mitigation	**With Mitigation**
Extent	Local (Low)	Local (Low)
Duration	Permanent (High)	Permanent (High)
Intensity / Severity	Low	Low
Consequence of Impact	Medium	Medium
Probability	High	Low
Confidence	High	High
Status	Negative	Neutral/Positive

Significance	Medium	Low
Can the impact be reversed?	**No** – impacts to archaeological resources cannot be reversed, but can be mitigated.	
Will impact cause irreplaceable loss or resources?	**No** - the archaeological occurrences recorded are well represented in other areas and provided the recommended mitigation measures are implemented, there should be no irreplaceable loss of resources.	
Can impact be avoided, managed or mitigated?	**Yes** – impacts can be avoided or mitigated through the implementation of the mitigation measures listed below.	

Mitigation measures:	**General:**
	• Do not disturb any old stone kraals or ruins and do not remove stone from walls, or artefacts from the earth.
	• Report any chance discoveries of human remains to an archaeologist or a heritage authority.
	
	Specific:
	• Three archaeological sites require mitigation, in the form of artefact mapping, recording and collection by the archaeologist prior to the commencement of construction of the grid connections. These are:
	  • JG050-JG052 / GEB013-GEB014;
	  • JG067–JG072 / GEB025; and
	  • JG077.
	• The following sites, each with the buffer described below, must be considered no-go areas during construction activities and those nearest the route alignments must be clearly marked as out of bounds:
	  • The possible Khoi kraals and shepherds' huts (JG040; JG064; JG066; JG081-JG090) – 40 m buffer centered on JG088;
	  • The possible "wolwehok" (JG036) – 20 m buffer; and
	  • The rock engraving (JG044) - 20 m buffer.	

Can any residual risk be monitored/managed?	**Yes** – the continued avoidance of identified heritage resources during the lifetime of the grid connection will ensure that residual risk can be managed and is of low significance.	
Will this impact contribute to any cumulative impacts?	**Yes** – but the implementation of measures to mitigate projet level impacts can to much to reduce cumulative impacts.	

Table 3: Palaeontological Impact Assessment

Impact Phase: Grid Connection Construction		
Possibility of encountering fossils during groundworks		
	Without Mitigation	**With Mitigation**
Extent	Local (Low)	Local (Low)
Duration	Permanent (High)	Permanent (High)
Intensity / Severity	Low	Low
Consequence of Impact	Medium	Medium
Probability	Low	Low
Confidence	High	High
Status	Negative	Neutral/Positive
Significance	Low	Low
Can the impact be reversed?	**No** – palaeontological heritage resources are non-renewable and key contextual data for fossils (sedimentology, taphonomy) is difficult to reconstruct following disturbance.	
Will impact cause	**Possible but Unlikely** – well-preserved, scientifically valuable fossils are	

irreplaceable loss or resources?	scarce within the project area and those that do occur probably occur widely across the region.
Can impact be avoided, managed or mitigated?	**Yes** – it can be managed and mitigated through the effective implementation of a Chance Fossil Find Protocol by the ECO and a professional palaeontologist.
Mitigation measures:	• Implementation of a Chance Fossil Find Protocol (see Appendix C) • Reporting by the ECO of any chance fossil finds to SAHRA and their conservation (preferably *in situ*). • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy) within the final footprint; and • Curation of any recovered fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.
Can any residual risk be monitored/managed?	**Yes** - through ongoing application of the Chance Fossil Find Protocol by the ECO.
Will this impact contribute to any cumulative impacts?	**Yes** - cumulative impacts, although at an extremely low level, on local fossil heritage resources are anticipated. The cumulative impact is of very low significance.

8.4 Cumulative Impacts

Cumulative impacts or effects, can be described as "changes to the environment that are caused by an action in combination with other past, present and future human actions". They are the result of multiple activities whose individual direct impacts may be relatively minor but which, in combination with others result are significant environmental effects (DEAT 2004:5)

In respect of potential cumulative impacts on palaeontological resources of the installation of the De Aar 2 South grid connections, the mixed nature of the geology of the area and the low level of surface and near surface exposure of fossil-bearing rocks where they do occur in the area suggests that the cumulative impact will be low.

Archaeological material and historical sites are potentially far more at risk from the cumulative impacts, given their widespread occurrence and exposure across the area. Multiple human activities in the landscape, of which the installation of the grid connection is the latest, can erode the integrity of these resources through their physical damage or destruction.

At an individual project level these impacts may not appear to be significant, but the cumulative effects of multiple developments on archaeological and historical heritage resources can be high. The implementation of measures at individual project level can, however, do much to mitigate and reduce cumulative impacts.

For the cultural landscape, the presence of a good deal of existing infrastructure in the area - the railway system, the N9 and the electrical and linear infrastructure related to the Hydra substation and the various wind and solar energy facilities surrounding De Aar – suggests that the presence of the additional grid connection lines are unlikely to be out of place in the local environment, although they will add to the cumulative effect of modern development on the cultural landsape.

8.5 The No-Go Alternative

Not implementing the proposal will result in no impacts to heritage resources**.**

9 PROPOSED MITIGATION MEASURES

With regard to palaeontological resources, the Fossil Chance Find Protocol attached to this report as Appendix C must be implemented at the commencement, and for the life of the grid connection construction. The responsible person/environmental officer must look out for fossils and the Protocol must be implemented should fossils be encountered.

The field survey, identified a substantial number of archaeological occurrences and sites, although in most cases the material noted was difficult to define as discrete sites and can be viewed as part of a widespread archaeological litter across the landscape which becomes visible in areas where erosion or deflation of the overlying soils occurs.

There are three archaeological sites which require mitigation prior to the commencement of construction of the grid connections. These are:

- JG050-JG052 / GEB013-GEB014 – dense early Holocene LSA stone scatter with ostrich eggshell eroding out of the bank of a stream in the Brak River Valley;
- JG067–JG072 / GEB025 – deflation hollow with possibly early Holocene LSA lithics, with OES, eroding out of white riverine covers sands; and
- JG077 - Dense scatter of large, fresh hornfels artefacts in a sandy materix which appear to still be in the process of eroding.

The active erosive nature of these sites suggests that they retain contextual archaeological value and it is recommended that the mitigation take the form of the mapping, recording and collection by the archaeologist of exposed artefactual material prior to the commencement of any activities related to the installation of the grid connections.

Other sites on or close to the grid connection routes require mitigation by avoidance. Although not directly on the proposed cable alignment, some of these sites are close enough to potentially be impacted or suffer damage as a direct, or indirect result of the installation of the powerline.

These sites, each with the buffer described below, must be considered no-go areas during construction activities and those nearest the route alignments must be clearly marked as out of bounds:

- The possible Khoi kraals and shepherds' huts (JG040; JG064; JG066; JG081-JG090) - 40 m buffer centered on JG088;
- The possible "wolwehok" (JG036) - 20 m buffer; and
- The rock engraving (JG044) - 20 m buffer.

The archaeologist must review the positions of the individual pylons once these have been determined, to ensure that they will not impact on any recorded heritage resources. The micro-siting of pylon positions may be required, which should also be done in consultation with the archaeologist.

In the event of anything unusual being encountered, SAHRA must be consulted immediately

so that mitigatory action can be determined and be implemented if necessary. Such mitigation is at the cost of the developer, while time delays and diversion of machinery/plant may be necessary until mitigation in the form of conservation or archaeological sampling is completed.

Should any human remains be encountered at any stage during the construction or earthworks associated with the project, work in the vicinity must cease, the remains must be left *in situ* but made secure and the project archaeologist and SAHRA must be notified immediately so that mitigatory action can be determined and be implemented.

10 CONCLUSION

Provided that the mitigation measures set out above are implemented, the overall impact of the proposed installation of the De Aar 2 South WEF grid connection is tolerable and generally of low heritage significance and the proposed activity is considered acceptable.

11 REFERENCES

Almond, J. 2012a. *Proposed Mulilo Renewable Energy PV2, PV3 and PV4 photovoltaic energy facilities on Farms Paarde Valley, Badenhorst Dam and Annex Du Plessis Dam near De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments*. Unpublished report prepared for Aurecon Environmental Services. Natura Viva.

Almond, J.E. 2012b. *Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments*, 33 pp. Natura Viva cc, Cape Town.

Almond, J. 2012c. *Palaeontological Specialist Study - Combined Desktop and Field-based Assessments: Two wind energy facilities on the Eastern Plateau near De Aar, Northern Cape Province proposed by Mulilo Renewable Energy (Pty) Ltd*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. Natura Viva cc.

Almond, J. 2013. *Proposed Photovoltaic (solar) energy facilities on du Plessis Dam Farm near De Aar: Palaeontological specialist study - combined desktop and field-based assessments*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. Natura Viva.

Anderson, J.M., Anderson, H.M., 1985. *Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous*. A.A. Balkema, Rotterdam. 423 pp.

Archer, W. No Date. *Archaeological Impact Assessment: proposed photovoltaic power generation facility in De Aar, Northern Cape*. Unpublished report prepared for DJ Environmental Consultants. W Archer.

Bamford, M. 2020*. Palaeontological Impact Assessment for the proposed Mulilo De Aar grid connection and battery storage project, Northern Cape Province*. Unpublished report prepared for Arcus Consultancy Services South Africa. M Bamford.

Baumann, N. & Winter, S. 2005. *Guideline for involving heritage specialists in EIA process. Edition 1. CSIR report No ENV-S-C 2005 053E*. Provincial Government of the Western Cape: Department of Environmental Affairs and Developmental Planning.

Bekker, E. 2012a. *Heritage Impact Assessment Scoping Report for De Aar Solar One Photovoltaic Power Plant, Nothern Cape*. Unpublished report prepared for CCA Environmental. Elise Bekker.

Bekker, E. 2012b. *Phase 2 Heritage Impact Assessment De Aar Solar One Photovoltaic Power Project*. Unpublished report prepared for CCA Environmental. Elise Bekker.

Brink, J.S. No Date. *A Palaeontological Desktop Study of the area to be affected by the proposed Photovoltaic Power Project on Portion 3 of farm Hartebeestplaats 135*. Unpublished report.

DEAT. 2004. *Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7.* Department of Environmental Affairs and Tourism. Pretoria.

Fourie, W. 2012. *Concentrated Solar Power EIA, De Aar: Heritage Impact Assessment*. Unpublished report prepared for SiVEST Environmental Division. PGS.

Fourie, W. 2014. *Proposed construction of a 132 kV transmission line from the Longyuan Mulilo De Aar 2 North Wind Energy Facility on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape*. Unpublished report prepared for Aurecon Environmental Services. PGS.

Hacking, T. 2001. *An innovative approach to structuring environmental impact assessment reports; Part 2: Ranking the significance of environmental aspects and impacts*. 19. 56-59.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Kaplan, J. 2010a. *Archaeological impact assessment proposed Photovoltaic Power Generation Facility in De Aar, Northern Cape*. Unpublished report prepared for DJ Environmental Consultants. Agency for Cultural Resource Management.

Kaplan, J. 2010b. *Archaeological impact assessment of a proposed wind energy facility near De Aar, Northern Cape*. Unpublished report prepared for DJ Environmental Consultants. Agency for Cultural Resource Management.

Kruger, N. 2012. *Proposed establishment of a solar energy facility near De Aar, Northern Cape Province: Phase 1 Archaeological Impact Assessment Report*. Unpublished report prepared for Ennex Development. N Kruger.

Oelofsen, B.W. , Loock, J.C. 1987. Paleontology. In Cowling, R.M. & Roux, P.W. (eds). *The Karoo biome: apreliminary synthesis - vegetation and history*. South African National Scientific Programmes Report No 142: 102-116. Pretoria: CSIR.

Orton, J. 2012. *Heritage Impact Assessment for three solar energy facilities at De Aar, Western Cape* (sic). Unpublished report prepared for Aurecon South Africa (Pty) Ltd. ACO Associates.

Orton, J. and Webley, L. 2013a. *Heritage Impact Assessment for multiple proposed solar energy facilities on De Aar 180/1 (Badenhorst Dam farm), De Aar, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. ACO Associates.

Orton, J. and Webley, L. 2013b. *Heritage Impact Assessment for multiple proposed solar energy facilities on Du Plessis Dam 179, De Aar, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. ACO Associates.

Rubidge, B.S. (Ed.) 1995. *Biostratigraphy of the Beaufort Group (Karoo Supergroup)*. South African Committee for Biostratigraphy, Biostratigraphic Series No. 1., 46 pp. Council for Geoscience, Pretoria.

Rubidge, B.S. 2005. Re-uniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust. 27th Du Toit Memorial Lecture. *South African Journal of Geology* 108, 135-172.

Rubidge B.S., Day, M.O., Barbolini, N., Hancox, P.J., Choiniere, J.N., Bamford, M.K., Viglietti, P.A., McPhee, B.W., Jirah, S., 2016. Advances in Karoo biostratigraphy in the Permo-Triassic non-marine realm: significance for understanding basin development. In: Linol, B. and de Wit,

M., (Eds), *Origin and Evolution of the Cape Mountains and Karoo Basin. Regional Geology Reviews*, pp. 141-149. , DOI 10.1007/978-3-319-40859-0_14

Sampson, C.G. 1985. *Atlas of stone age settlements in the central and upper Seacow Valley*. Memoirs of the National Museum Bloemfontein No. 20.

Sampson, C.G., 1992. *Stylistic boundaries among mobile hunter-gatherers in the Zeekoe Valley, Eastern Cape*. Washington, Smithsonian Institution Press.

Sampson, CG., Samspon, BE & Neville, D. 1994. An early Dutch Settlement pattern on the north east frontier of the Cape Colony. *Southern African Field Archaeology* 3: 74-81.

Sampson, C.G., Moore, V., Bousman, C.B., Stafford, B., Giordano, A. and Willis, M.2015. A GIS analysis of the Zeekoe valley Stone Age archaeological record in South Africa. Journal of African Archaeology 13:2. 167-185.

Tankard, J.A., Jackson, M.P.A., Eriksson, K.A., Hobday, D.K., Hunter, D.R., Minter, W.E.L. 1982. *Crustal evolution of South Africa*. New York: Springer-Verlag.

Truswell, J.F. 1977. *The geological evolution of South Africa*. Cape Town: Purnell.

Van der Walt, J. 2011. *Archaeological impact Assessment: proposed establishment of the Inca Solar Energy Facility, De Aar, Northern Cape*. Unpublished report prepared for SAVANNAH Environmental (Pty). Heritage Contracts and Archaeological Consulting.

Van der Walt, J. 2014. *Archaeological impact assessment for the proposed Casle Wind Energy Facility, De Aar, Northern Cape*. Unpublished report prepared for SAVANNAH Environmental (Pty). Heritage Contracts and Archaeological Consulting.

Van Dijk, D.E., Channing, A., van den Heever, J.A. 2002. Permian trace fossils attributed to tetrapods (Tierberg Formation, Karoo Basin, South Africa). *Palaeontologia africana* 38: 49-56.

Van Ryneveld, K. 2008. *Archaeological Scoping Study: Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa*. Unpublished report prepared for BKS engineering and Management. ArchaeoMaps Heritage Consultancy.

Van Ryneveld, K. 2009. *Archaeological Impact Assessment: Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa*. Unpublished report prepared for BKS engineering and Management. ArchaeoMaps Heritage Consultancy.

Van Schalkwyk, J. 2011a. *Heritage scoping assessment for the proposed establishment of the ACED De Aar Solar Energy Facility, Northern Cape Province*. Unpublished report prepared for SAVANNAH Environmental (Pty). J van Schalkwyk Heritage Consultant Ltd.

Van Schalkwyk, J. 2011b. *Heritage Scoping Report for the proposed establishment of the Inca Energy PV Power Plant, De Aar, Northern Cape Province*. Unpublished report prepared for SAVANNAH Environmental (Pty). J van Schalkwyk Heritage Consultant Ltd.

Visser, J.N.J., Loock, J.C., Van Der Merwe, J., Joubert, C.W., Potgieter, C.D., Mclaren, C.H., Potgieter, G.J.A., Van Der Westhuizen, W.A., Nel, L. & Lemer, W.M. 1977. The Dwyka Formation and Ecca Group, Karoo Sequence, in the northern Karoo Basin, Kimberley-Britstown area. *Annals of the Geological Survey of South Africa* 12, 143-176

Webley, L. and Halkett, D. 2014. *Heritage Impact Assessment: Walkdown of final layout of the Longyuan Mulilo De Aar 2 North Wind Energy Facility, Northern Cape Province*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. ACO Associates.

Webley, L. and Halkett, D. 2015. *Addendum: Proposed Wind Energy Facility situated on the Eastern Plateau (South) near De Aar, Northern Cape Province*. Unpublished report prepared for Holland and Associates Environmental Consultants. ACO Associates.

Webley, L. and Orton, J. 2011. *Proposed De Aar Wind Energy Facility on the North and South Plateau, Northern Cape Province*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. Archaeology Contracts Office.

11.1 Online Sources

De Aar, https://en.wikipedia.org/wiki/De_Aar (Accessed on 2 March 2020)

Wolwehok, Herenlogement, https://www.vassa.org.za/walton-old-cape-farmsteads/wolwehok-herenlogement/ (Accessed on 2 March 2020)

Palaeontological Impact Assessment for the proposed Mulilo De Aar grid connection and switching station, Northern Cape Province

Desktop Study (Phase 1)

For

ACO Associates

23 February 2020

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 3years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by ACO Associates, Cape Town, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the proposed Mulilo – De Aar grid connection and switching station, between the De Aar 2 South Wind Energy Facility and Hydra Substation, east of De Aar, Northern Cape Province. This is part of a large project to generate clean electricity in the Northern Cape.

To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

The proposed routes lie on Permian Karoo sediments, Jurassic dolerites and Quaternary sands and alluvium. The dolerite is non-fossiliferous so the proposed DAS2 WEF facility will not impact on the fossil heritage. Parts of Route 2 DA2S Line option 2 part 2 (and Route 1) lie on Quaternary sands with very low impact, and Adelaide Subgroup rocks. The latter is potentially fossiliferous (vertebrates and silicified wood). The DA2S Line option 2 part 1 route and connection to Mulilo De Aar PV (separate process) are on rocks of the Tierberg Formation (trace fossils and wood fragments). For both strata, the fossils are sporadic and rare and the 132 kV steel monopole or lattice tower structures with maximum heights of 30 m, including foundations and insulators (pole) footprint is so small that the impact would be very small. Since there is a small chance of finding fossils once excavations have commenced, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless the responsible person on site finds fossils and then a palaeontologist should be called to assess and collect if required.

Table of Contents

Background

Mulilo De Aar 2 South (Pty) Ltd ("Mulilo") are seeking approval for a grid connection route and switching station in the Northern Cape Province.

Grid Connection

Two routes must be assessed for authorisation,. Mulilo are proposing to construct a **Route 1**: new grid connection transmission power line, approximately 23 km in length, to connect the authorised De Aar 2 South Wind Energy Facility (DA2S WEF) to the Eskom Hydra Substation near De Aar, Northern Cape Province. For approximately 12km from the Eskom Hydra Substation, the proposed line follows approved grid-connection transmission line route for the operational Longyuan Mulilo De Aar 2 North WEF. Thereafter, the proposed new line follows a direct path northeast for a further 11 km up onto the plateau. The entire proposed route for the new line follows and is adjacent to the existing HYD-RO 220kV transmission line; or **Route 2**, which takes a dogleg north west from the Hydra Substation to an approved solar substation before turning south to join Route 1 approximately 3.3 km north of the Hydra Substation. Thereafter Route 2 follows the same alignment as Route 1 onto the plateau to the site of the DA2S WEF The grid connection is for up to 400 kV. The corridor to be assessed is 200m (i.e. 100m either side of all grid lines in the KMZ).

The proposed project will include an up to 400 kV switching station (100m x 100m in extent). The proposed transmission line would consist of the following infrastructures:

- Steel monopole or lattice tower structures with maximum heights of 30 m, including foundations and insulators;
- Existing access roads and jeep tracks; and
- Line and servitude clearances to meet the statutory requirements.

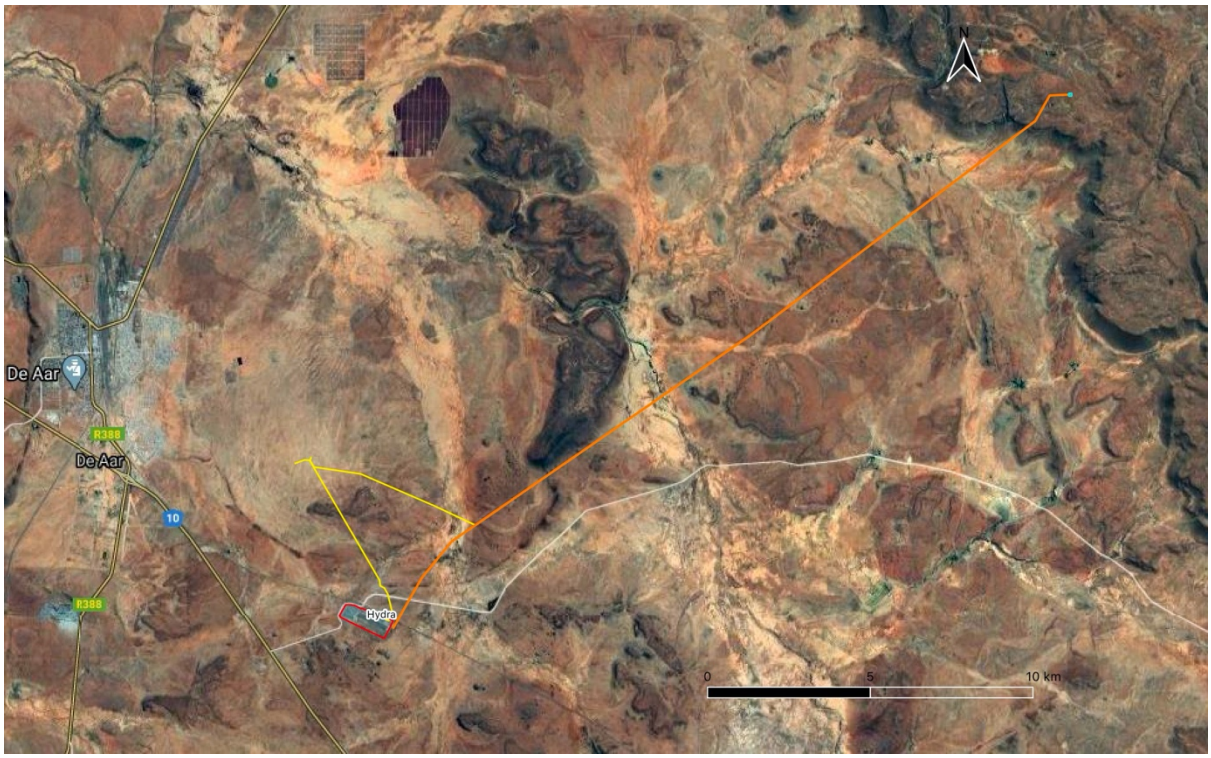


Figure 1: Google Earth map of the proposed routes for the Mulilo De Aar grid connection project.

A Palaeontological Impact Assessment was requested for the project. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is presented herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 0
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 0
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 0
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 0
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A

o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	As no specific assessment protocol has been prescribed, the required level of assessment is based on the findings of the Initial Site Sensitivity Verification complies with Appendix 6 of the Environmental Impact Assessment Regulations promulgated under sections 24(5) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (The Act), where a specialist assessment is required.

Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;

2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

Geology and Palaeontology

Project location and geological context

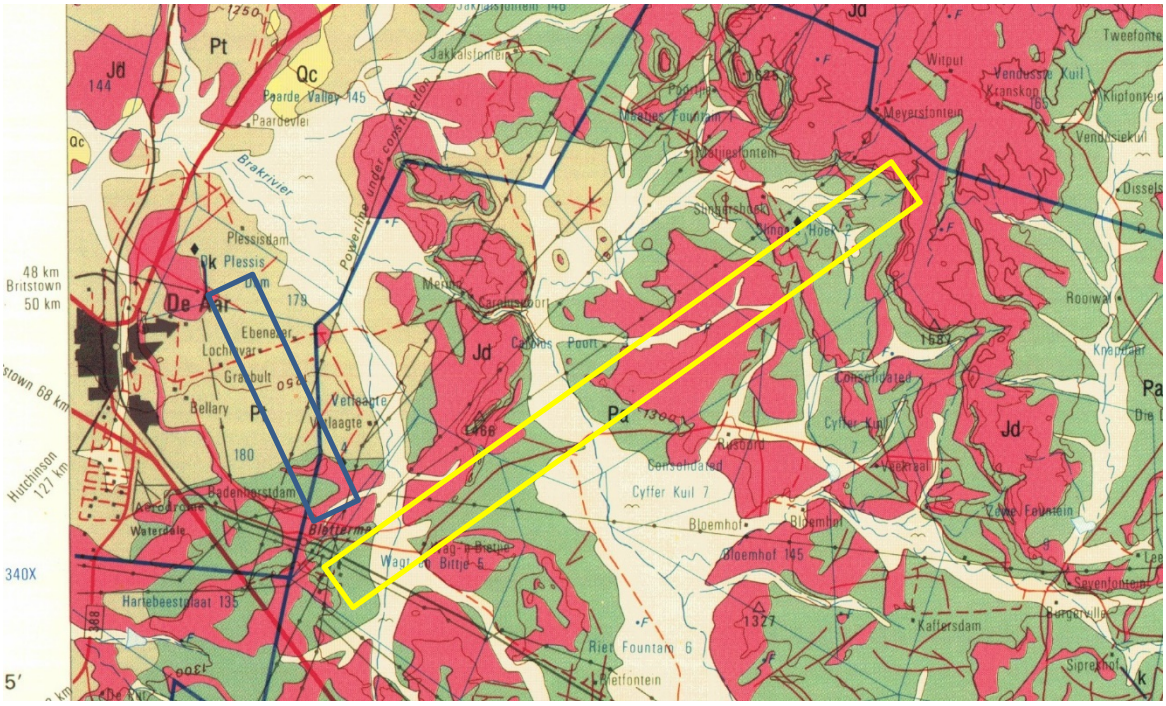


Figure 2: Geological map of the whole are of the proposed Mulilo De Aar project. Within the yellow rectangle, the southwestern end includes the red line from Figure 2 and the northeastern end includes the red line from Figure 3. The blue rectangle includes the existing powerline from De Aar to Hydra. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 3024 Colesburg.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary Kalahari sands	Alluvium, sand, calcrete	Neogene, ca 25 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 183 Ma
Pa	Adelaide Subgroup, Beaufort Group, Karoo Supergroup	Blue-grey silty mudstones, sandstones	"middle" Permian, Lower Beaufort Group.
Pt	Tierberg Formation, Ecca Group, Karoo SG	Blue-grey to black mudstones, concretions;	"early" Permian, Ecca Group

Symbol	Group/Formation	Lithology	Approximate Age
		siltstones sandstones near the top	

De Aar is in the north central part of the Karoo Basin and the predominant rocks are those of the Beaufort, middle to late Permian in age. There are large expanses of Jurassic aged dolerite that intruded through the Karoo sediments at the time when Africa was separating from South America and the Drakensberg volcanics erupted. Generally to the south and east are the younger Adelaide Subgroup rocks. This subgroup has been divided into a number of formations based on lithology and fossil content but in this area the formations are not recognisable. The mudrocks are massive and weather to form blocky material (Johnson et al., 2006)

To the north and west are the slightly older Tierberg Formation (Ecca Group) sediments that are similar to the overlying Adelaide subgroup shales and mudstones. This succession of rocks represents the gradual filling up of the Karoo Basin that was then terminated by the Drakensberg volcanics.

The more weathering-resistant dolerite dykes tend to form the relief in the area, with the mountains to the north and northeast being formed by a huge exposure of dolerite. Smaller dykes show as long lines or circular exposures of dark weathered boulders and rocks

Along some of the water courses much younger sands and alluvium of the Quaternary Kalahari Sands have been deposited (white in the geological map, Figure 2). These sediments have been transported from farther north in the past when there was likely much more rainfall in the system, and more recently with flash flooding. Their composition and origin can be very mixed.

Palaeontological context

The Palaeontological Assessment is presented from the location point of view, not the proposed routes and options, because there is a large degree of overlap.

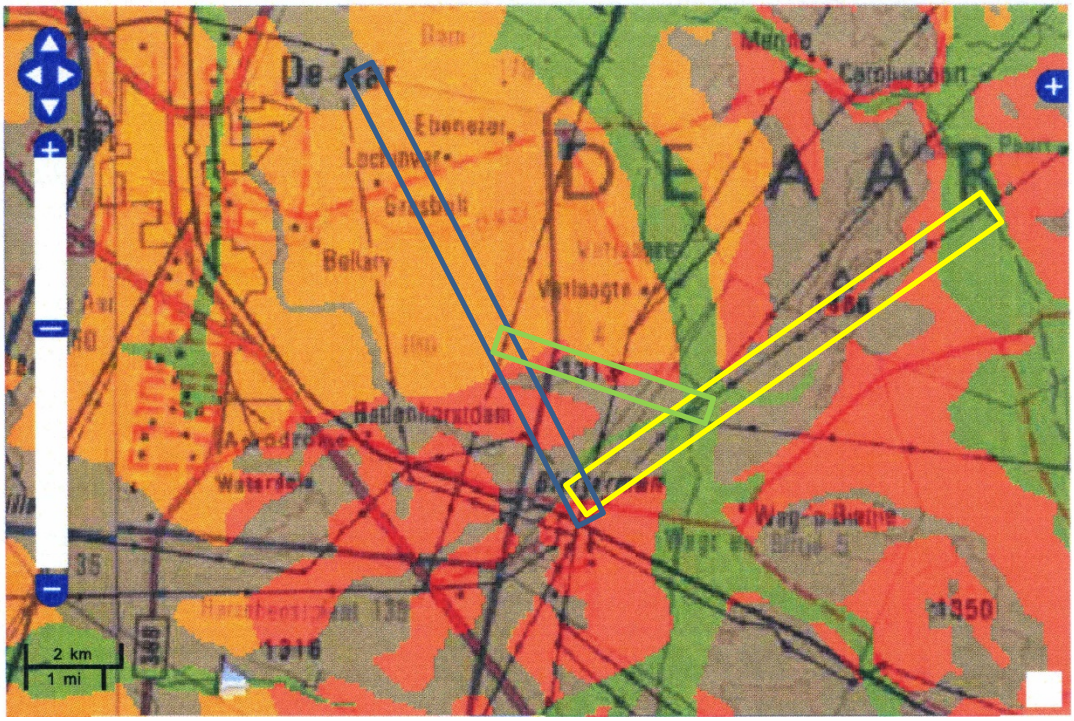


Figure 3: SAHRIS palaeosensitivity map for the site for the proposed Mulilo De Aar project. Route 1 and Route 2 part 2 are shown within the yellow rectangle. Route 2 part 1 within the blue rectangle and existing link/line within the green rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

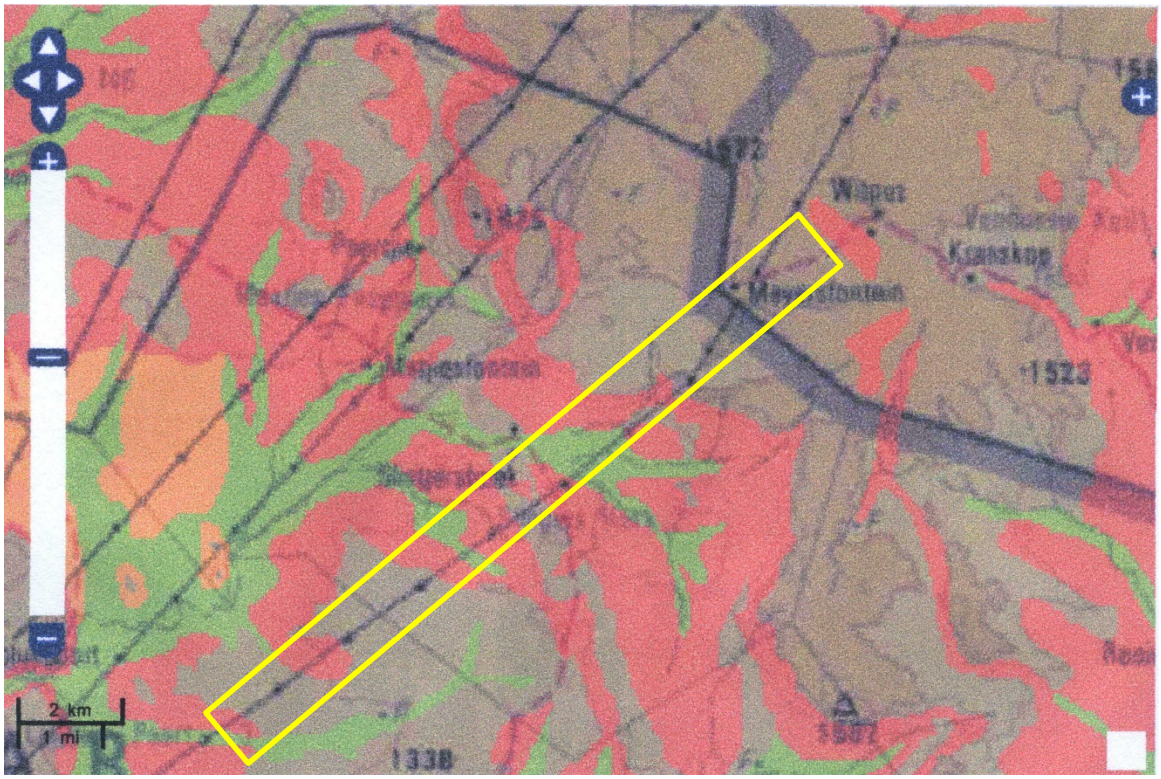


Figure 4: Northeastern section of the De Aar – WEF line with Route 1 and Route 2 part 2 within the yellow rectangle. De Aar is off the map to the southwest. See Figure 5 for SAHRIS colour coding.

From the SAHRIS maps above the area is indicated as having the whole range of sensitivities along the various proposed routes. The dolerite has no fossils (grey) because they do not occur in volcanic rocks. As the dykes intrude through the overlying sediments they tend to physically destroy any fossils that might have been in their paths, and the heat can destroy or alter fossils in the near vicinity.

The Quaternary sands (Figure 2) along the water courses are young enough to preserve fossils but by their nature, washed down slopes and streams into rivers, any fossils would have been transported from its site of origin into the river system. The context of the fossils and associated fossils in the assemblage will have been lost. Only robust fossil fragments can survive the journey but their scientific value is greatly reduced because they lack original context. These sediments are indicated as moderately sensitive on the maps (green; Figures 3 and 4).

In contrast, the Ecca and Beaufort rocks are much more likely to preserve fossils. Their distribution, however, is unpredictable but they can be easier to locate on hillsides and slopes. Based on many years of research by geologists and palaeontologists in the Karoo (Rubidge, 1995, 2005; Johnson et al., 2006; Rubidge et al., 2016 and many other references) the lithology and terrestrial flora and vertebrate fauna have been closely correlated, and the fauna used as a biostratigraphic framework. From this and other parts of the Karoo the Tierberg Formation has produced a number of trace fossils of worm burrows, root casts and invertebrate trackways (van Dijk et al., 2002; Almond, 2013). Fossil plants are rare in this part of the Karoo basin but there are records of fragments of silicified wood from east of De Aar (Almond, 2013).

The Adelaide Subgroup, undifferentiated in this area, can be divided into the Abrahamskraal or Koonap Formations and the Teekloof or Middleton and Balfour Formations. Without fossils it is not possible to distinguish the strata based only on lithology. The relevant assemblage zones are, from the base upwards, the *Eodicynodon, Tapinocephalus, Pristerognathus, Tropidostoma* and *Cistecephalus* zones. Expected vertebrate fossils are a variety of dinocephaleans, gorgons and therocephaleans and some fish. According to Almond's site surveys (Almond 2012a, 2012b, 2012c), vertebrate fossils are rare as there is little exposure.

Potential fossil plants are typical Permian impressions of *Glossopteris* leaves, lycopods, sphenophytes and ferns, and silicified wood (Anderson and Anderson, 1085). Only fossil wood has been seen in the Adelaide Subgroup in this area (Almond, 2012a). The samples have not been collected or identified.

Dr John Almond (Natura Viva) has carried out a number of site visits around De Aar for other aspects of the project (Almond, 2012a, b, c, 2013). He found very few fossils because the area has a large amount of non-fossiliferous dolerite, and the Permian sediments are covered by sand and soil to a large extent.

Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

Table 3a: Criteria for assessing impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 3b: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	**H**	-
	M	-
	L	-
	L+	The Tierberg Fm sediments might preserve trace fossils of fossil woo fragments; The Adelaide Subgroups rocks might preserve fossil bones; it is less likely to preserve fossil plant impressions. The impact would be low.
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since only the possible fossils within the area would be trace fossils and wood fragments from the *Glossopteris* flora in the Tierberg Fm shales and rare vertebrate bones and wood in the Adelaide Subgroup, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is unlikely that any fossils would be found in the loose Quaternary sand; trace fossils and wood fragments might occur in the Tierberg Fm and vertebrate bones and wood in the Adelaide Subgroup rocks. Therefore, a Fossil Chance Find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age to contain fossils, in particular trace fossils and silicified wood fragments in the Tierberg Formation, in the DAS2 line option 1, part 1. Site visits and PIAs have already been done for the two farms in the area, namely 1/180 and Vetlaagte (Almond, 2012b). Site surveys have also been done for the DAS2 WEF area when the proposed PV facilities on the mountain top were being researched (Almond 2012c). Since roads and access have already been developed along all the routes, and the new poles have a very small footprint, the impact on the fossil heritage is very low. Therefore, a Fossil Chance Find Protocol has been added to this report. Once excavations have commenced for the pole foundations, the responsible person/environmental officer should look out for fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and some do contain fossil plant, wood, invertebrate traces and vertebrate material. The sands of the Quaternary period would not preserve fossils in context. From previous site visit PIAs we know that rare traces fossils and fragments of silicified wood occur in the Tierberg Formation (Ecca Group) and silicified wood, trace fossils and bone fragments occur in the Aldelaide Subgroup rocks. Non- fossiliferous dolerite and sand are widespread.

Recommendation

Based on experience and the findings from previous palaeontological site visits to the area, it is very unlikely that any fossils would be impacted upon by the foundations for some poles (steel monopole or lattice tower structures with maximum heights of 30 m including foundations and insulators) because the fossils are sporadic and of common forms. The proposed site for a switching station at DAS2 WEF is on non-fossiliferous dolerite so would not impact upon the fossil heritage at all. The route between Hydra and this facility (Routes 1 and 2) has several potentially fossiliferous patches but prior field surveys by John Almond show that fossils are rare. The same applies to the DAS2 line option 2 Part 1 – fossils may be present but the footprint is so small that an impact is unlikely on the fossils. Since there is a small chance that fossils may occur in the Tierberg Formation and Adelaide Subgroup mudstones and shales, a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample, with a SAHRA permit.

References

Almond, J.E. 2012a. Proposed Mulilo Renewable Energy PV2, PV3 and PV4 photovoltaic energy facilities on Farms Paarde Valley, Badenhorst Dam and Annex Du Plessis Dam near De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments, 45 pp. Natura Viva cc, Cape Town.

Almond, J.E. 2012b. Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments, 33 pp. Natura Viva cc, Cape Town.

Almond, J.E. 2012c. Two wind energy facilities on the Eastern Plateau near De Aar, Northern Cape Province proposed by Mulilo Renewable Energy (Pty) Ltd. Palaeontological specialist study: combined desktop and field-based assessments, 55 pp. Natura Viva cc, Cape Town.

Almond, J.E., 2013. Palaeontological specialist study: Combined desktop and field-based assessments, proposed Photovoltaic (solar) energy facilities on du Plessis Dam Farm near De Aar, Northern Cape. 20pp. Natura Viva cc, Cape Town.

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Bamford, M.K. 2016. Fossil woods from the Upper Carboniferous to Lower Jurassic Karoo Basin and the environmental interpretation. In: Linol, B. and de Wit, M., (Eds), Origin and Evolution of the Cape Mountains and Karoo Basin. Regional Geology Reviews. pp. 158-167. DOI 10.1007/978-3-319-40859-0_16.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

McCarthy, T.S., 2006. The Witwatersrand Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 155-186.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Rubidge, B.S. (Ed.) 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup). South African Committee for Biostratigraphy, Biostratigraphic Series No. 1., 46 pp. Council for Geoscience, Pretoria.

Rubidge, B.S. 2005. Re-uniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust. 27th Du Toit Memorial Lecture. South African Journal of Geology 108, 135-172.

Rubidge B.S., Day, M.O., Barbolini, N., Hancox, P.J., Choiniere, J.N., Bamford, M.K., Viglietti, P.A., McPhee, B.W., Jirah, S., 2016. Advances in Karoo biostratigraphy in the Permo-Triassic non-marine realm: significance for understanding basin development. In: Linol, B. and de Wit, M., (Eds), Origin and Evolution of the Cape Mountains and Karoo Basin. Regional Geology Reviews, pp. 141-149. , DOI 10.1007/978-3-319-40859-0_14

Van Dijk, D.E., Channing, A., van den Heever, J.A. 2002. Permian trace fossils attributed to

tetrapods (Tierberg Formation, Karoo Basin, South Africa). Palaeontologia africana 38: 49-56.

Chance Fossil Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations and associated activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, trace fossils) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 1.5). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossils from the Permian Karoo.

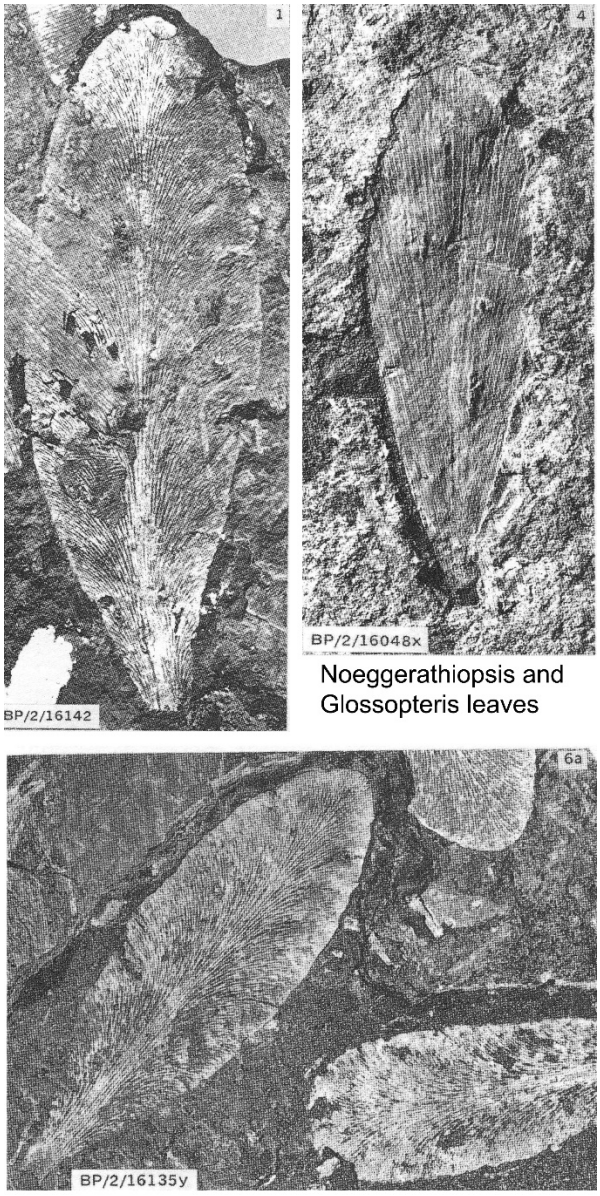


Figure 5: examples of Permian *Glossopteris* leaf impressions.

Figure 6: Vertebrate bones embedded in the mudstone.

Figure 7: A common trace fossil of worm burrows.

Figure 8: piece of silicified wood. Note the knots for branches.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2020

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations
Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees
All at Wits University

Degree	Graduated/completed	Current
Honours	7	0
Masters	10	4
PhD	12	5
Postdoctoral fellows	10	3

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 –
Journal of African Earth Sciences: 2020 -
Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex

- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h-index = 27; Google scholar h-index = 32; -i10-index = 80
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

13 APPENDIX B: 2020 FIELD-BASED ARCHAEOLOGICAL OBSERVATIONS

Green highlights = mitigation required. Please note that certain archaeological sites have more than one co-ordinate.

Waypoint	Latitude	Longitude	Description	Grade	Photograph
JG001	-30.606480°	24.253572°	MSA stone scatter on and around existing Hydra line and service road. Very large and extends to east as far as berm modern farm. Tools noted on berm. See also GEB001-007 which defines the visible extent of one lithic scatter. Lithics exposed on eroded / deflated area of shallow river valley bottom. Density 20 + pieces/m2. Hornfels. Heavily patinated but with some, possibly later unpatinated pieces noted. Flakes, blades, cores and chips. Some retouch and possibly prepared platforms. Very edgeworn.	3C	
JG002	-30.606459°	24.254711°			
JG003	-30.606649°	24.255231°			
JG004	-30.604886°	24.257939°	Eroded / deflated scatter of edgeworn, patinated MSA lithics. Less dense but otherwise similar to JG001-003 / GEB001-007. One of two less patinated pieces noted one with retouch along edge - possible Lockshoek LSA sidescraper. Shaley flake - grey with light patina. Also khaki/mustard flake of what looks like mudstone.	3C	
JG006	-30.595005°	24.273707°	Large weathered MSA flake (HF) in roadway.	NCW	

JG007	-30.595000°	24.273710°	Further similar MSA lithics from vicinity of JG006	NCW	
JG008	-30.592464°	24.282744°	Worn and patinated MSA lithics in high density across very wide area (at least 100 m in all directions). Lying on and in orange sand on and around a low dolerite koppie. Possible quarry site for hornfels lag deposit. Antbear burrow kicked up hornfels chunks from ± 20-30 cm down and flaked material. Suggests good flakeable material below sand. Evidence of material being washed together in recent rainwater runnels. Some possible LSA flakes noted and later retouch on earlier MSA flakes.	3C	 
JG009	-30.592936°	24.283568°	Part of same site as JG008	3C	

JG010	-30.590711°	24.280878°	Walked from road to BESS - litter of patinated and worn MSA everywhere. In orange sand.	NCW	 
JG011	-30.589299°	24.280219°	Endscraper in / near BESS. Nearby lithics in eroded channels/rivulets	NCW	

JG012	-30.590268°	24.281356°	MSA scatter in rainwater runnel	NCW	
JG013	-30.589434°	24.278496°	Scatter of LSA HF lithics in sandy, sloping hollow between rocky outcrops. Some possibly on earlier MSA flakes of which there are examples present. Smithfield? - large sidescraper type flake. Also broken blade with endscraper retouch (crossmend). Site overlooks river gully. All material in orange sand. Exposed by erosion.	3C	 

JG014	-30.589408°	24.278082°	Dense MSA slope wash on side of river gully below JG013. Very waterworn. In dolerite cobbles and scree.	3C	
JG015	-30.590345°	24.277628°	Further MSA lithics and later, possibly Smithfield (including endscrapers) in erosion wash and runnels.	3C	
JG016	-30.590532°	24.276526°	LSA, with some possible MSA, lithic scatter on dolerite outcrop. Eroded.	3C	 

JG017	-30.590717°	24.276331°	Lithics eroding out of deposit on opposite side of outcrop to JG016. Mix of MSA with some early Holocene LSA material - large sidescraper. Single piece of flaked agate. View to BESS from dogleg.	3C	 
JG018	-30.590532°	24.274909°	Dense MSA waterworn lithics in erosion gully. Very rolled.	3C	
JG019	-30.590824°	24.274807°	Same as JG018. Appears to be long, continuous scatter. Quarrying?	3C	
JG020	-30.591415°	24.274568°	Same as JG018/JG019.	3C	
JG021	-30.592031°	24.274437°	Same as JG018/JG019/JG020.	3C	
JG022	-30.601148°	24.265414°	MSA on slope wash. Mostly very rolled and patinated. ± 10 pieces/m2.	3C	
JG023	-30.600768°	24.265531°	Same as JG022.	3C	

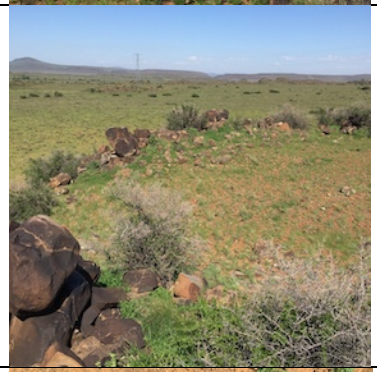
JG024	-30.600680°	24.265576°	Large MSA hornfels flake with "fresh" retouch.	NCW	
JG025	-30.598577°	24.266719°	Approximate upper limit on slope of stone tools. Gets shaley above.	Not Graded	
JG026	-30.599426°	24.265971°	Stone scatter - general and of varying density down slope above and below this mark.	NCW	
JG027	-30.600102°	24.265106°	Rough hornfels core/flaked cobble - LSA?	NCW	
JG028	-30.605219°	24.256954°	Patinated (black/grey) hornfels lithics in erosion fan. Extension/part of general scatter on either side?	NCW	

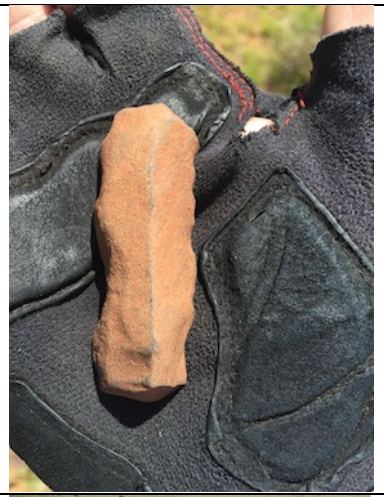
JG029	-30.605770°	24.256471°	Hornfels lithic scatter on eroded flat. Patinated and worn (black/grey).	NCW	
JG030	-30.606202°	24.256341°	Same as JG029 above.	NCW	
JG031	-30.614816°	24.242742°	Exposed hornfels carpet. Some worn and patinated MSA.	NCW	 
JG032	-30.617445°	24.239304°	Boulder outcrop on ridge. Stopped to check for engraving (nothing). But ubiquitous lithics scatter. Possible mix of MSA and LSA. Hornfels (worn & patinated) but also flake on banded ironstone.	3C	

					
JG033	-30.623782°	24.227876°	Low level MSA scatter - patinated and worn hornfels.	NCW	

					
JG034	-30.632295°	24.214686°	Isolated hornfels flakes. Heavily patinated MSA. In red sand with dolerite cobbles. Adjacent to Carolus Poort 2 / Slingerhoek fence.	NCW	
JG035	-30.632187°	24.214838°	Small LSA agate flake.	NCW	

JG036	-30.615468°	24.241709°	Packed stone ruin - possibly old wolvehok.	3C	
JG037	-30.639067°	24.204355°	Area of patinated black dolerite boulders next to watercourse (approximately 30 x 100 m). Heavily patinated hornfels flakes and chunks noted - probably MSA. Low density visible on surface. Half circle of boulder may be portion of kraal.	3C	
JG038	-30.638589°	24.207245°	Isolated MSA lithics (4-5) in open area of wash.	NCW	

JG039	-30.637487°	24.209534°	Possible Khoi kraal. Dolerite boulders in rough circle in lee of two small rocky outcrops. Approximately 10 x 7 m across.	3C	
JG040	-30.633936°	24.213173°	Cleared raised area between three rocky outcrops. Possible kraal. ± 30 x 50 m. Small hand-size cobbles cover the surface, mixed with shale. Larger dolerite rocks and boulders in line around outside. 1 x LSA hornfels flake and some patinated MSA lithics (flakes and chunks) noted on surface. (Same as GEB010).	3C	
JG041	-30.643307°	24.199117°	MSA lithics eroding out of shallow slope. Very worn and heavily patinated. Mostly flakes. Hornfels.	NCW	

JG042	-30.643273°	24.198368°	Isolated MSA denticulated piece. Worn and heavily patinated hornfels. Upslope of JG041 on slopes of koppie.	NCW	
JG043	-30.643418°	24.197404°	Dense scatter of unpatinated LSA hornfels on western edge of koppie top. Lies against line of boulders on edge. 30-40 pieces/m2. Concentrated in approximately 3m2. Chips, chunks, flakes, cores, blades. Single piece with retouch noted. Some MSA present too - some red patination.	3C	

					
JG044	-30.643353°	24.197522°	(Modern) graffiti on boulder. On same koppie as JG043. North side about 10m from stone scatter. Two long thin parallel lines with seven"bars" scratched between them.	3C	
JG045	-30.643845°	24.198110°	Hornfels lithics in bare patches on eastern slope of koppie. Some larger and worn and patinated. Most still "fresh" black. Couple of pieces, including an endscraper middle-patinated (grey) Mostly flakes and chips. Large, fresh chunky core found about 10 m SE.	3C	

JG046	-30.644182°	24.198144°	Heavily patinated hornfels MSA eroding down hillside. Dense. Some reuse of MSA - fresh flakes and chips.	3C	
JG047	-30.644174°	24.198304°			
JG049	-30.666640°	24.159428°	Barren, vegetation free areas have with lithics. Not dense - item every few metres. LSA, including duckbilled scraper. Not patinated. Hornfels	3C	

					
JG050	-30.667187°	24.161105°	Very dense LSA exposure on erosion slope. Material being exposed as bank along river channel erodes back. Suggest buried until recently. Very fresh and unpatinated hornfels. One small piece of flaked white agate. Possibly retouched piece of brown mudstone/ironstone. Formal/retouched pieces. Endscrapers (slugs?). Orangean sidescraper. Edge scraper. OES pieces noted. Possibly associated if material buried until recently? Some dolerite cobbles with flake scars. Seems to be ± 40-50 cm below modern ground level.	3A	 
JG051	-30.667280°	24.161474°	Eastern edge of JG050 at this location.	3A	

JG052	-30.666300°	24.160471°	Same as JG050 and JG051 above. On eroding slope. OES present in quantities.	3A	
JG053	-30.667739°	24.159290°	Odd collection of broken cobbles. Rough hornfels or dolerite. On pan surface. Completely isolated.	NCW	
JG054	-30.667240°	24.158969°	Same as JG054 above.	NCW	

JG055	-30.673205°	24.148478°	Isolated edge-flaked cobble. Dolerite. Large. On edge of streambed. Period unknown	NCW	
JG056	-30.673672°	24.147800°	Odd looking boulder field - shaped? In soil below is the same patinated/worn MSA hornfels assemblage seen elsewhere but in higher concentration here than lower down slope. Boulders are on a level platform on slope.	3C	
JG057	-30.676632°	24.143262°	Eroded wash on slope. Worn MSA lying in sheet wash. Wide area.	NCW	
JG058	-30.658561°	24.172766°	Scattered, patinated hornfels MSA lithics on slope between koppie and river. Visible where there is erosion of the surface sand - in runnels.	NCW	
JG059	-30.659533°	24.171604°	Random point in same sort of wash as JG058 - more extensive on this lower slope. Same general occurrence of rolled, patinated MSA stone. Extensive erosion runnels across landscape going down to river.	NCW	

JG060	-30.659719°	24.171280°	Smithfield(?) lithics on hornfels on eroded surface. Also patinated, earlier lithics present. ± 10/m2. Cores, flakes, chunks, blades. Retouch on number of pieces. Endscrapers too (ph). Appears to be visible in ± 5m radius around waypoint - odd pieces further away. Suggest it may be more widely present under covering sand.	3C	 
JG061	-30.660573°	24.170073°	Scatter of hornfels lithics - fairly thin (± 3/m2) - on eroding sandy mound in erosion wash. Lithics actively eroding, not on sheet wash. Hornfels, unpatinated - flakes, blades. Of the 17 lithics randomly picked up in area of 5 m2, 6 had retouch. 5 = endscraper type and 1 x side/end scraper.	3C	

					
JG062	-30.649812°	24.053184°	Open areas of low level presence of hornfels (patinated/worn) wherever soil denuded and exposed - right along line.	NCW	
JG063	-30.642762°	24.048078°	As above.	NCW	
JG064	-30.685039°	24.129275°	Possible Khoi kraal? - not hugely convincing but there seems to be packed stone along with naturally occurring boulders of dolerite outcrop (ph). Isolated flaked stone in vicinity.	3C	
JG065	-30.685468°	24.129430°	Small stone structure. Circular - (actually more oval) - opening to east. Packed cobbles/rocks from dolerite outcrop it nestles against. On S side of outcrop = 3-4 courses of stone. Walls stand 50-70 cm high. No artefacts seen associated. There is a low level presence of the patinated/worn hornfels lithics, as well as a scatter around outcrop of more freshly flaked hornfels. Internal dimensions of structure approximately 1m wide x 1.5m long. External = 2m wide x 2.5m long.	3C	

JG066	-30.685123°	24.128588°	Possible kraal. Rocky outcrop with cleared centre approximately 14m x 10m. No obvious standing/packed walls, but there does seem to be a clear rocky circle.	3C	
JG067	-30.690737°	24.114019°	Stone tools on erosion slope down in wash - MSA blade with later retouch. Extension / same as GEB025 to the west.	3A	
JG068	-30.691042°	24.114248°	Further exposure like JG067 and GEB025. Shale background with hornfels lithics. Calcrete like nodules present. Below ± 40-50 cm orange sand.	3A	 

JG069	-30.691134°	24.114276°	Same as JG068 above.	3A	
JG070	-30.691206°	24.114263°	Same as JG068 and JG069 above.	3A	
JG071	-30.690651°	24.113478°	Opposite side of wash hollow. Same eroding slope with lithics. As on other side, mainly fresh hornfels (whole range), but some older, grey patinated pieces too.	3A	
JG072	-30.690631°	24.113098°	Similar exposure to JG067-071. Less dense artifactually. But mix of old and new.	3A	
JG073	-30.693613°	24.113338°	Large hornfels sidescraper, isolated in eroded area (same surface as JG067-072) but in larger river eroded system.	NCW	

JG074	-30.694075°	24.113321°	Concentration of hornfels (probably LSA) lithics on eroded surface.	3C	
JG075	-30.695239°	24.111199°	Lithics in erosion gully. Grey patinated hornfels flakes.	3C	
JG076	-30.695336°	24.110892°	Lithics (hornfels, fresh) on calcrety eroded surface. Below bottom of orange sand.	NCW	
JG077	-30.695918°	24.110349°	Dense (± 20/m2) scatter of large, fresh HF lithics. In sand. Still eroding out. Area approximately 10 x 20 m. 1 x flaked agate pebble. Some banded ironstone. Mainly large flakes and cores. No retouched pieces noted.	3A	

JG078	-30.705940°	24.101496°	Hornfels scatter in neck between koppies. Fresh. Associated with piece of grass-tempered pottery. Has views to north and south. Protected in hollow. Scatter covers large part of hollow.	3C	
JG079	-30.705935°	24.101464°			
JG080	-30.706201°	24.101419°			
JG081	-30.706136°	24.101435°	Modern stone circle (?) with glass and burned plastic. Old spade head with broad arrow. "R Steelface".	3C	
JG082	-30.706104°	24.101675°	Centre stone kraal - circular with JG083 (stone bothy) in kraal.	3C	
JG083	-30.706149°	24.101740°	Stone bothy in kraal. Approximately 1.5 x 1.5 cm. Entrance to East.	3C	
JG084	-30.706069°	24.101819°	Kraal 2?	3C	
JG085	-30.706136°	24.101832°	Line of kraal 2 wall. Not fully enclosed/circular	3C	
JG086	-30.706028°	24.101865°	Line of kraal 2 wall. Not fully enclosed/circular	3C	
JG087	-30.706021°	24.101766°	Line of kraal 2 wall. Not fully enclosed/circular	3C	

JG088	-30.705949°	24.101484°	Possible kraal 3 on far side of hollow. Walls not complete.	3C	
JG089	-30.705877°	24.101336°			
JG090	-30.705959°	24.101346°	Bothy 2. Circular ± 1.8 x 1.8 m. Door to East.	3C	

Waypoint	Latitude	Longitude	Description	Grade	Photo (Y/N)
GEB001	-30.607424°	24.255003°	Same site as JG014	3C	
GEB002	-30.607083°	24.254997°	Same site as JG014	3C	
GEB003	-30.606883°	24.254721°	Same site as JG014	3C	
GEB004	-30.606765°	24.254087°	Same site as JG014	3C	
GEB005	-30.591628°	24.278963°	Scatter of biggish worn, patinated MSA flakes in deflation hollows. Area ± 10 x 10 m	3C	
GEB006	-30.592196°	24.274613°	Scatter of lithics in hollow between small hills, in front of tree'd area. Worn, patinated MSA, including an endscraper, and a couple of small unpatinated LSA flakes. All lithics are hornfels. Area ± 15 x 15 m.	NCW	Y
GEB007	-30.600890°	24.265697°	Worn, patinated MSA flakes scattered all alongside the fence. Gets denser about half-way up towards the mountain.	NCW	N
GEB008	-30.604612°	24.256805°	Just a few lithics on flat area, near pylon. Includes one side scraper.	NCW	Y

GEB009	-30.639628°	24.204219°	One patinated hornfels MSA flake amongst area of dolerite boulders. On outskirts of JG037.	NCW	
GEB010	-30.634055°	24.213184°	Just a handful of MSA flakes in hollow on top of hill which is surrounded by boulders. Possible kraal - the centre of hill has been cleared of boulders (Same as JG040).	3C	
GEB011	-30.643086°	24.198144°	Scatter of lithics around foot of small hill (top of hill recorded by John - JG043). Fresh, unpatinated hornfels and ? Flakes. A flake every metre or so. They appear to run all around the base of the hill.	3C	
GEB012	-30.644727°	24.195703°	Light scatter of patinated hornfels flakes in a slight hollow surrounded by boulder outcrops.	NCW	
GEB013	-30.666459°	24.160531°	Same as JG050 next to river channel. Quite a few pieces of OES, particularly in the runnels.	3A	

GEB014	-30.666493°	24.160731°	On the other side of little hill to GEB013, so it is a continuation of this site.	3A	
GEB015	-30.665938°	24.159066°	A scatter of unpatinated hornfels flakes across an area of ± 20 x 20 m. A number of cores and some OES.	3C	
GEB016	-30.674615°	24.145283°	Initially thought to be a kraal, but closer inspection suggested it is probably the result of clearing for an electricity pylon.	Not Graded	

GEB017	-30.674490°	24.144903°	Initially thought to be a kraal, but closer inspection suggested it is probably the result of clearing for an electricity pylon.	Not Graded	
GEB018	-30.674170°	24.144871°	Initially thought to be a kraal, but closer inspection suggested it is probably the result of clearing for an electricity pylon.	Not Graded	
GEB019	-30.657462°	24.175029°	A single patinated hornfels MSA blade on plateau before going down to river valley. Area between pylon and hill with stone structure (GEB020).	NCW	
GEB020	-30.655841°	24.171715°	Small stone structure on the side and top of a flattened koppie, which is on escarpment above the river bed. It is round, and the highest point (opposite the entrance way) consists of about 8 courses of stone. This side appears pretty intact still. The diameter is ± 2 m. Found an upper grind stone inside the structure. On the slope about 8 m down from the structure, were a handful of very nice tools: an upper grind stone, a core and two scrapers. There were a few pieces of modern metal lying around, so maybe structure has been reused.	3C	
GEB021	-30.714167°	24.095526°	A handful of worn hornfels MSA flakes, on open, flat area.	NCW	
GEB022	-30.654228°	24.056064°	A scatter of very worn, patinated MSA flakes on the farm Lochinvaar. Wherever there's a deflated area, they are visible.	NCW	
GEB023	-30.681224°	24.134149°	A general scatter of worn, patinated hornfels MSA flakes.	NCW	

GEB024	-30.682218°	24.133163°	Mass of patinated hornfels, but no obvious flakes.	NCW	
GEB025	-30.690479°	24.113964°	Big area of lithics eroding out of a bank. Joins up with JG067(?). MSA hornfels flakes (incl a large side scraper) as well as smaller, unpatinated LSA lithics (incl side scrapers).	3A	
GEB026	-30.705946°	24.101517°	Piece of grass-tempered pottery at site JG092.	3C	
GEB027	-30.706092°	24.102212°	Stone with striations found in shoulder between two koppies, before hill slopes down. Below sites JG082 - JG090.	NCW	

14 APPENDIX C: FOSSIL CHANCE FIND PROTOCOL

Monitoring Programme for Palaeontology – to commence once pylon excavations and associated activities begin.

- The following procedure is only required if fossils are seen on the surface and when excavations commence.
- When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, trace fossils) must be put aside in a suitably protected place. This way the project activities will not be interrupted.
- Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures.
- Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
- If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
- Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
- If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
- If no fossils are found and the excavations have finished then no further monitoring is required.

15 APPENDIX D: HIA SPECIALIST CURRICULUM VITAE

Name:	John Gribble
Profession:	Archaeologist
Date of Birth:	15 November 1965
Parent Firm:	ACO Associates cc
Position in Firm:	Senior Archaeologist
Years with Firm:	1
Years of experience:	28
Nationality:	South African
HDI Status:	n/a

Education:

1979-1983	Wynberg Boys' High School (1979-1983)
1986	BA (Archaeology), University of Cape Town
1987	BA (Hons) (Archaeology), University of Cape Town
1990	Master of Arts, (Archaeology) University of Cape Town

Employment:

- ACO Associates, Senior Archaeologist and Consultant, September 2017 – present
- South African Heritage Resources Agency, Manager: Maritime and Underwater Cultural Heritage Unit, 2014 – 2017 / Acting Manager: Archaeology, Palaeontology and Meteorites Unit, 2016-2017
- Sea Change Heritage Consultants Limited, Director, 2012 – present
- TUV SUD PMSS (Romsey, United Kingdom), Principal Consultant: Maritime Archaeology, 2011-2012
- EMU Limited (Southampton, United Kingdom), Principal Consultant: Maritime Archaeology, 2009-2011
- Wessex Archaeology (Salisbury, United Kingdom), Project Manager: Coastal and Marine , 2005-2009
- National Monuments Council / South African Heritage Resources Agency, Maritime Archaeologist, 1996-2005
- National Monuments Council, Professional Officer: Boland and West Coast, Western Cape Office, 1994-1996

Professional Qualifications and Accreditation:

- Member: Association of Southern African Professional Archaeologists (No. 043)
- Principal Investigator: Maritime and Colonial Archaeology, ASAPA CRM Section
- Field Director: Stone Age Archaeology, ASAPA CRM Section
- Member: Chartered Institute for Archaeologists (CIfA), United Kingdom
- Class III Diver (Surface Supply), Department of Labour (South Africa) / UK (HSE III)

Experience:

I have nearly 30 years of combined archaeological and heritage management experience. After completing my postgraduate studies, which were focussed on the vernacular architecture of the West Coast, and a period of freelance archaeological work in South Africa and aboard, I joined the National Monuments Council (NMC) (now the South African Heritage Resources Agency (SAHRA)) in 1994. As the Heritage Officer: the Boland I was involved in day to day historical building control and heritage resources management across the region. In 1996 I become the NMC's first full-time maritime archaeologist in which role was responsible for the management and protection of underwater cultural heritage in South Africa under the National Monuments Act, and subsequently under the National Heritage Resources Act.

In 2005 I moved to the UK to join Wessex Archaeology, one of the UK's biggest archaeological consultancies, as a project manager in its Coastal and Marine Section. In 2009 I joined Fugro EMU Limited, a marine geosurvey company based in Southampton to set up their maritime archaeological section. I then spent a year at TUV SUD PMSS, an international renewable energy consultancy based in Romsey, where I again provided maritime archaeological consultancy services to principally the offshore renewable and marine aggregate industries.

In August 2012 I set up Sea Change Heritage Consultants Limited, a maritime archaeological consultancy. Sea Change provides archaeological services to a range of UK maritime sectors, including marine aggregates and offshore renewable energy. It also actively pursues opportunities to raise public awareness and understanding of underwater cultural heritage through educational and research projects and programmes, including some projects being developed in South Africa.

Projects include specialist archaeological consultancy for more than 15 offshore renewable energy projects and more than a dozen offshore aggregate extraction licence areas.

In addition to managing numerous UK development-driven archaeological projects, I have also been involved in important strategic work which developed guidance and best practice for the offshore industry with respect to the marine historic environment. This has included the principal authorship of two historic environment guidance documents for COWRIE and the UK renewable energy sector, and the development of the archaeological elements of the first Regional Environmental Assessments for the UK marine aggregates industry. In 2013-14 I was lead author and project co-ordinator on the Impact Review for the United Kingdom of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. In 2016 I was co-author of a Historic England / Crown Estate / British Marine Aggregate Producers Association funded review of marine historic environment best practice guidance for the UK offshore aggregate industry (.

I returned to South African in mid-2014 where I was re-appointed to my earlier post at SAHRA: Manager of the Maritime and Underwater Cultural Heritage Unit. In July 2016 I was also appointed Acting Manager of SAHRA's Archaeology, Palaeontology and Meteorites Unit.

I left SAHRA in September 2017 to join ACO Associates as Senior Archaeologist and Consultant.

I have been a member of the ICOMOS International Committee for Underwater Cultural Heritage since 2000 and have served as a member of its Bureau since 2009. I am currently the secretary of the Committee.

I have been a member of the Association of Southern African Professional Archaeologists for more than twenty years and am accredited by ASAPA's CRM section. I have been a member of the UK's Chartered Institute for Archaeologist's (CIfA) since 2005, and served on the committee of its Maritime Affairs Group between 2008 and 2010. Since 2010 I have been a member of the UK's Joint Nautical Archaeology Policy Committee.

I am currently a member of the Advisory Board of the George Washington University / Iziko Museums of South Africa / South African Heritage Resources Agency / Smithsonian Institution 'Southern African Slave Wrecks Project' and serve on the Heritage Western Cape Archaeology, Palaeontology and Meteorites Committee.

Books and Publications:

Gribble, J. and Scott, G., 2017, *We Die Like Brothers: The sinking of the SS Mendi*, Historic England, Swindon

Lloyd Jones, D., Langman, R., Reach, I., Gribble, J., and Griffiths, N., 2016, Using Multibeam and Sidescan Sonar to Monitor Aggregate Dredging, in C.W. Finkl and C. Makowski (eds) *Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments, Coastal Research Library 13*, Springer International Publishing, Switzerland, pp 245-259.

Athiros, G. and Gribble, J., 2015, *Wrecked at the Cape Part 2*, The Cape Odyssey 105, Historical Media, Cape Town.

Gribble, J. and Sharfman, J., 2015, The wreck of SS Mendi (1917) as an example of the potential trans-national significance of World War I underwater cultural heritage, *Proceedings of the UNESCO Scientific Conference on the Underwater Cultural Heritage from World War I*, Bruges, 26-28 June 2014.

Gribble, J., 2015, Underwater Cultural Heritage and International Law. Cambridge by Sarah Dromgoole, in *South African Archaeological Bulletin*, 70, 202, pp 226-227.

Athiros, G. and Gribble, J., 2014, *Wrecked at the Cape Part 1*, The Cape Odyssey 104, Historical Media, Cape Town.

Gribble, J., 2014, Learning the Hard Way: Two South African Examples of Issues Related to Port Construction and Archaeology, in Dredging and Port Construction: Interactions with Features of Archaeological or Heritage Interest*, PIANC Guidance Document 124*, pp 97-107.

UK UNESCO 2001 Convention Review Group, 2014, *The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001: An Impact Review for the United Kingdom*, ISBN 978-0-904608-03-8.

Sadr, K., Gribble, J. and Euston-Brown, G, 2013, Archaeological survey on the Vredenburg Peninsula, in Jerardino et al. (eds), *The Archaeology of the West Coast of South Africa*, BAR International Series 2526, pp 50-67

Gribble, J. and Sharfman, J, 2013, Maritime Legal Management in South Africa, *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Gribble, J., 2011, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001, *Journal of Maritime Archaeology* 6:1 77-86.

Gribble, J., 2011, The SS Mendi, the Foreign Labour Corps and the trans-national significance of shipwrecks, in J. Henderson (ed.): *Beyond Boundaries, Proceedings of IKUWA 3, The 3rd International Congress on Underwater Archaeology*, Römisch-Germanische Kommission (RGK), Frankfurt.

Gribble, J., 2011, Competence and Qualifications, in Guèrin, U., Egger, B. and Maarleveld, T. (eds) *UNESCO Manual for Activities directed at Underwater Cultural Heritage*, UNESCO - Secretariat of the 2001 Convention, Paris.

Gribble, J. and Leather, S. for EMU Ltd., 2010, *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector*. Commissioned by COWRIE Ltd (project reference GEOARCH-09).

Sadr, K and Gribble, J., 2010, The stone artefacts from the Vredenburg Peninsula archaeological survey, west coast of South Africa, *Southern African Humanities* 22: 19–88.

Gribble, J., 2009, HMS Birkenhead and the British warship wrecks in South African waters in *Proceedings of the Shared Heritage Seminar*, University of Wolverhampton, 8 July 2008

Gribble, J., Parham, D. and Scott-Ireton, D., 2009, Historic Wrecks: Risks or Resources? In *Conservation and Management of Archaeological Sites*, Vol. 11 No. 1, March, 2009, 16–28.

Gribble, J. and Athiros, G., 2008, *Tales of Shipwrecks at the Cape of Storms*, Historical Media, Cape Town.

Gribble, J., 2008, The shocking story of the ss Mendi, in *British Archaeology*, March/April 2008.

Gribble, J., 2007, The Protection of the Underwater Cultural Heritage: National Perspectives in light of the UNESCO Convention 2001 by Sarah Dromgoole, in *The International Journal of Nautical Archaeology*, 36, 1, pp 195-6.

Gribble, J., 2006, The Sad Case of the ss Maori, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 41-43, ICOMOS, Paris

Gribble, J., 2006, Pre-Colonial Fish Traps on the South Western Cape Coast, South Africa, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 29-31, ICOMOS, Paris.

Forrest, C.S.J., and Gribble, J., 2006, The illicit movement of underwater cultural heritage:

The case of the Dodington coins, in *Art and Cultural Heritage: Law, Policy and Practice*, (ed B.T. Hoffman), New York, Cambridge University Press.

Forrest, C.S.J., and Gribble, J., 2006, Perspectives from the Southern Hemisphere: Australia and South Africa, in *The UNESCO Convention for the Protection of the Underwater Heritage: Proceedings of the Burlington House Seminar*, October 2005, JNAPC / NAS.

Gribble, J., 2003, "Building with Mud" – Developing historical building skills in the Karoo, in ICOMOS South Africa, in *The Proceedings of Symposium on Understanding and using urban heritage in the Karoo*, Victoria West, South Africa, 3-5 March 2002.

Forrest, C.S.J., and Gribble, J., 2002, The illicit movement of underwater cultural heritage: The case of the Dodington coins, *International Journal of Cultural Property*, Vol II (2002) No 2, pp 267-293.

Gribble, J. 2002, The Past, Present and Future of Maritime Archaeology in South Africa, *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad), New York, Plenum Press.

Thackeray, F. and Gribble, J., 2001, Historical Note on an Attempt to Salvage Iron from a Shipwreck, *Looking Back*, Vol 40, November 2001, pp 5-7.

Gribble, J., 1998, Keeping Our Heads Above Water – the development of shipwreck management strategies in South Africa, *AIMA Bulletin*, Vol 22, pp 119-124.

Gribble, J. 1996, Conservation Practice for Historical Shipwrecks, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Gribble, J. 1996, National Databases on Monuments and Sites, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Sadr, K, Gribble, J, & Euston-Brown, G L, 1992 The Vredenburg Peninsula survey, 1991/1992 season, *Guide to Archaeological Sites in the South-western Cape, Papers compiled for the South African Association of Archaeologists Conference*, July 1992, by A.B. Smith & B. Mutti, pp 41-42.

Smith, AB, Sadr, K, Gribble, J, & Yates, R., 1992 Witklip and Posberg Reserve, *Guide to Archaeological Sites in the South-western Cape*, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 31-40.

Smith, AB, Sadr, K, Gribble, J & Yates, R., 1991, Excavations in the south-western Cape, South Africa, and the archaeological identity of prehistoric hunter-gatherers within the last 2000 years, *The South African Archaeological Bulletin* 46: 71-91.

SITE VERIFICATION REPORT: PROPOSED GRID CONNECTION AND SWITCHING STATION FOR THE DE AAR 2 SOUTH WIND ENERGY FACILITY, DE AAR, NORTHERN CAPE

Prepared for
Arcus Consultancy Services South Africa (Pty) Ltd

On behalf of
Mulilo De Aar 2 South (Pty) Ltd

December 2020

Version 1.1

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by
John Gribble (MA)

ACO Associates
8 Jacobs Ladder, St James, Cape Town, 7945
Phone (021) 706 4104
Fax (086) 603 7195
Email: john.gribble@aco-associates.com

Introduction

The Screening Tool Report generated for the proposed De Aar 2 South WEF Grid Connection route options, dated 23 October 2019, identifies the following heritage-related environmental sensitivities in relation to the project:

- a **high** sensitivity in respect of archaeology and cultural heritage, ascribed on the basis of the Grid Connection routes:
    - crossing an important wetland;
    - being located within 500 m of an important wetland; and
    - being located within 500 m of a heritage site.
    - Archaeology and cultural heritage are also ascribed a **medium** sensitivity on the basis of the Grid Connection routes being located, in places, on a mountain or ridge; and
- a **high** and **medium** sensitivity in respect of palaeontology, ascribed on the basis of the Grid Connection routes being associated with rock units with high and medium paleontological sensitivities.

Based on this identification of environmental sensitivities, the list of specialist assessments identified for inclusion in the Basic Assessment report for the Grid Connection included archaeology and cultural heritage and palaeontology.

Initial Site Sensitivity Verification Report Requirements

As required by the *General requirements for undertaking an Initial Site Sensitivity Verification where no specific assessment protocol has been Identified*, published in the Government Gazette (No. 45421) on 10 May 2019, an Initial Site Sensitivity Verification is required to confirm or dispute the potential environmental sensitivity of the site as identified by the environmental screening tool for the specific environmental theme being considered.

The Initial Site Sensitivity Verification must be undertaken through the use of:

- a desk top analysis, using satellite imagery; and
- a preliminary on-site inspection.

The results must be recorded in a report that:

- confirms or disputes the identified environmental sensitivity;
- contains a motivation and evidence of either the verified or different environmental sensitivity; and
- is submitted together with the relevant reports prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

Site Sensitivity Verification: Archaeology and Cultural Heritage

The proposed Grid Connection route options between the Hydra Substation and the De Aar 2 South (DA2S) WEF (Figure 1) cross a variety of environments: grassy flatlands, a number of seasonal river drainages and wetlands and dolerite ridges, before climbing onto a mountain plateau which rises at least 100 m above the surrounding plains. The upland plateau is generally flat with rocky outcrops and is covered in typical Karoo scrub and grasses.

Desk Top Analysis

Desk-based research for a large number of other proposed developments in the area of the proposed Grid Connection routes (see for example, Van Schalkwyk 2011; Webley and Orton 2011; Kruger 2012; Orton and Webley 2013; Fourie 2014; Van der Walt 2014; Webley and Halkett 2014, 2015) and detailed information about the archaeology of the Upper Karoo derived from the exhaustive archaeological survey of the Zeekoe River Valley by Sampson (1985, 1992, 2015) (Figure 2) can inform our understanding of the archaeology and cultural heritage of the area to be affected by the Grid Connection routes.

The Zeekoe Valley Archaeological Survey (ZVAS) and the other surveys in the area around De Aar have identified a long sequence of archaeological material in the Upper Karoo which indicates the occupation of the region by our forebears since the Early Stone Age (ESA) Acheulian (after 1 million years ago), through multiple Middle Stone Age (MSA) phases (c. 300 000 – 30 000 years ago), four Later Stone Age (LSA) phases to herder sites, many with low stone-walled kraals and Khoenkhoen-like, thin-walled ceramics, dating to within the last 2000 years (Sampson 1985, 2015:3).

Archaeological sites in the Upper Karoo are generally open sites due to the scarcity of rock shelters in the region and comprise scatters of stone tools, with bone and other non-lithic material sometimes preserved on the more recent, LSA sites.

Evidence suggests that ESA sites cluster close to sources of tool-making stone raw material, rather than close to sources of water, and tend to be found on the flats rather than on ridges, or mountaintops (Sampson 1985).

MSA sites and material are widely distributed across the landscape of the Upper Karoo in the form of “ancient litter” and are frequently found on the edges of pans, streams and at the base of small hills or koppies. The various surveys for development projects in the vicinity of the Grid Connection referred to above have recorded widespread occurrences of MSA lithics across the landscape in this area. This material tends to be exposed as a lag deposit on harder, gravelly substrate in areas where the orange sand that mantles the landscape has been eroded by water or deflated by wind.

Sampson (1985) recorded thousands of LSA sites in the Zeekoe River Valley and many more are reported in the previous heritage impact assessments in vicinity of the Grid Connection routes. These sites are attributed to the ancestors of the San peoples and, after 2000 years ago, to Khoekhoen pastoralists. Other traces of the San presence in the Karoo can be found as rock engravings on dolerite boulders (Webley and Orton 2011). LSA sites are found in a variety of loci but tend to be concentrated near water points or water sources, or on hills and ridges with commanding views of rivers and valleys (Webley and Orton 2011).

The most recent archaeological and heritage layer in the Karoo landscape relates to the historical occupation of the area by stock farmers of European descent from the late 18th century. These European pastoralists were highly mobile – hence the name trekboers – moving between winter and summer grazing on and off the Great Escarpment. Land ownership in the region was informal and only became regulated after the implementation

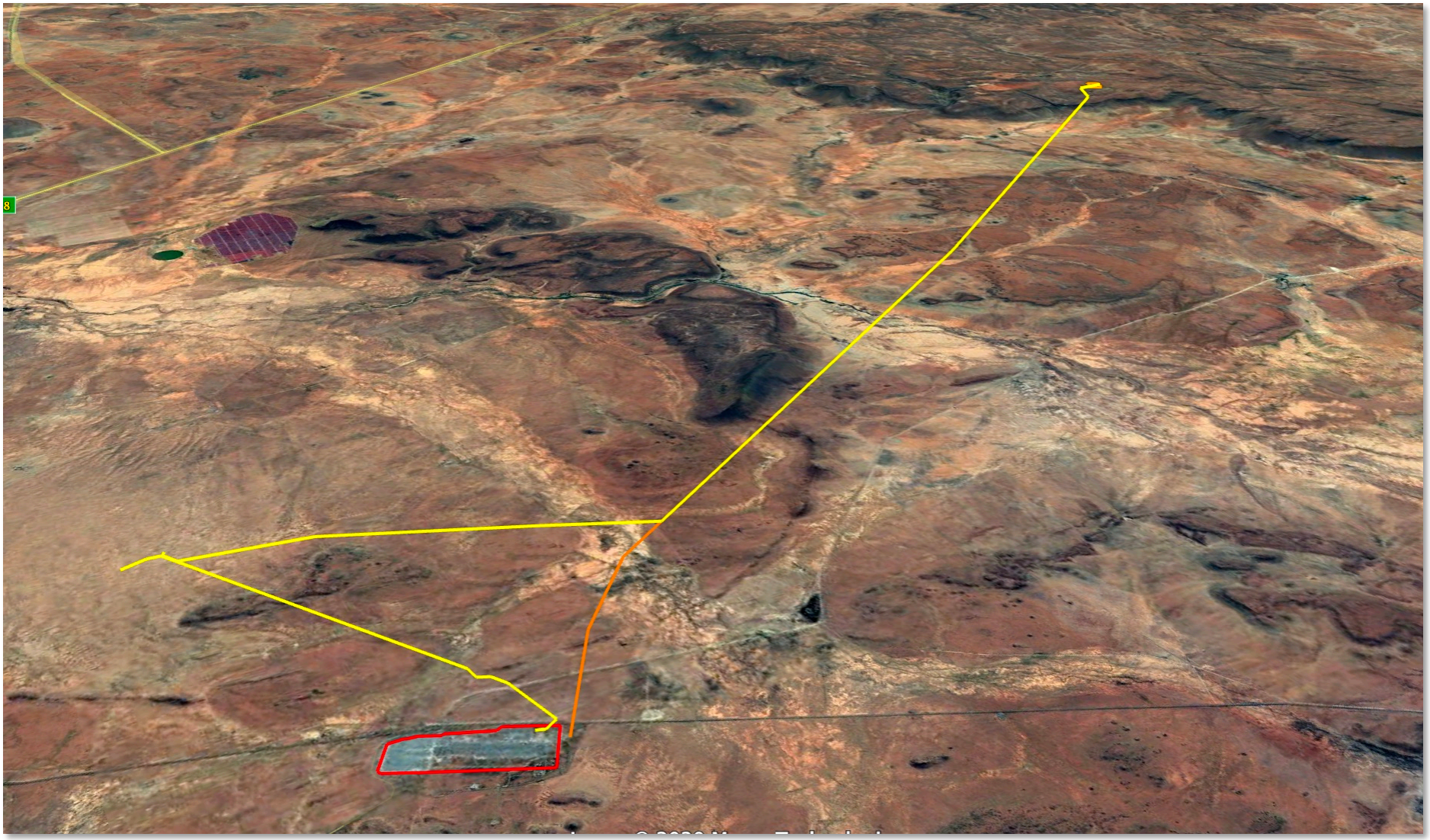


Figure 1: 3D view showing the proposed Grid Connection route options (yellow and orange lines) between the Hydra substation (red polygon) and the DA2S WEF site (orange rectangle) on mountain plateau above the surrounding plains (Source: Google Earth).

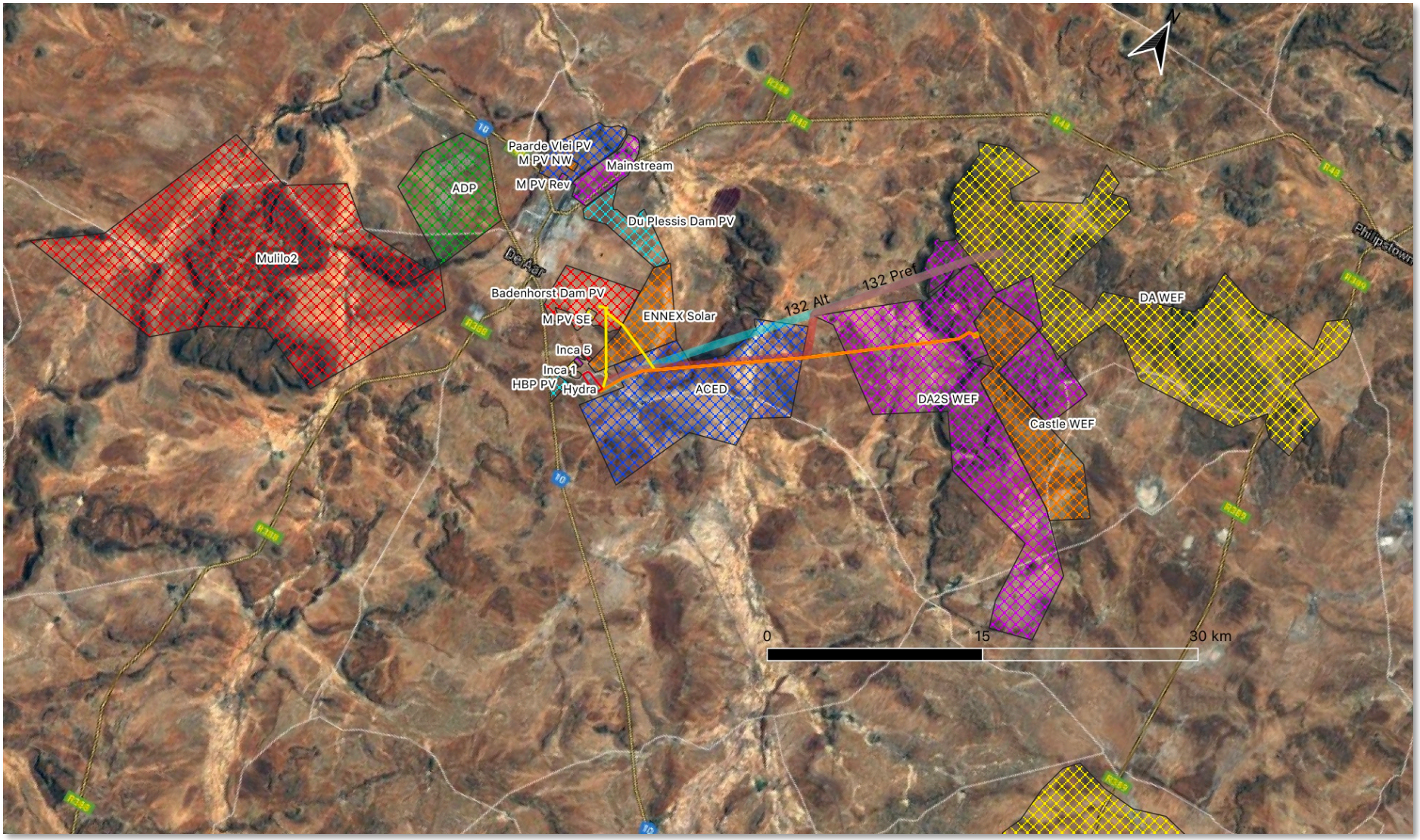


Figure 2: Previous heritage assessments carried out in the De Aar area with relevance to the assessment for the Grid Connection routes (orange and yellow lines). The northern portion of the ZVAS is the yellow polygon at the bottom right of the image (Source: Google Earth).

of the quitrent system of the 19th century, used by the Government to control the lives and activities of the farmers. Judging by the kinds of artefacts and structures associated with the historical occupation of the Upper Karoo and the area around the Grid Connection routes (stone-walled kraals, farm buildings, graveyards, etc.) found on the landscape, many of the farms in the Upper Karoo are likely to have been used before land was formally granted or loaned in the early 19th century (Sampson and Sampson, 1994).

The available desk-based evidence suggests that with the possible exception of ESA material, archaeological sites and material dating to all other periods can be expected along the Grid Connection routes.

On-Site Inspection

An archaeological survey of the Grid Connection routes (Figure 3) was undertaken by ACO Associates in February 2020. The survey was conducted to inform the Heritage Impact Assessment (HIA) required by the South African Heritage Resources Agency, as part of the Basic Assessment process.

MSA material was encountered across much of the area surveyed, although discrete, clearly definable MSA sites were difficult to identify because material is generally visible only in areas where the overlying orange sand has been stripped away wind or water and because the landscape is liberally spread with material, a type of “ancient litter”.

LSA artefact assemblages were also widely in evidence during the survey. Smithfield industry artefact scatters, dating to within the last 2 000 years, but with no evidence of associated pottery were noted in places, for as were a number of sites containing early Holocene, Lockshoek lithics, dating to c.10 000 years ago. Both lithic industries are typical of what is expected in this part of the Karoo (Sampson 1985). A single piece of grass-tempered pottery was found associated with an LSA stone tool scatter and a series of possible Khoekhoen kraals.

Circular packed stone features were noted at a number of places along the Grid Connection routes. Some of these features almost certainly date from the colonial era and are probably shepherds’ huts, but others may be Khoekhoen kraals. Only one such set of kraals - the site associated with the pottery referred to above – appears to be unequivocally a Khoekhoen complex.

A ruined packed stone structure encountered on the farm Slingershoek has been interpreted as a colonial period “wolwehok” or vermin trap and a single, possibly modern, rock engraving was recorded during this survey on a koppie on the farm Carolus Poort 2.

A small number of historical artefacts were noted at only one place along the Grid Connection routes: on and below the koppie on which the Khoekhoen kraal complex mentioned earlier was located. The thin scatter of ceramics, glass and metal are of late 19th / early 20th century date and suggest that occupation may have dated to around the South African War. No historical buildings were noted along either of the Grid Connection route options.

No graves or cairns were encountered during the survey, but It should be noted that pre-colonial graves are often completely unmarked and can be located anywhere where the soil is suitable for digging a grave.

Finding
Together, the information presented above **confirms** the identification of the Grid Connection routes by the Screening Tool as areas of archaeological and cultural heritage significance.

Site Sensitivity Verification: Palaeontology

Desk Top Analysis
Reference to the South African Heritage Resources Information System (SAHRIS) palaeo-sensitivity map (see https://sahris.sahra.org.za/map/palaeo) indicates that the Grid Connection routes cross a landscape with a range of palaeontological potential and sensitivity (Figure 4).

The dolerite koppies and dykes and the massif on which the Grid Connection routes terminate contain no fossils because they do not occur in intrusive, volcanic rock. Furthermore, where igneous dykes intrude through the overlying sediments they tend to physically destroy any fossils in their paths and the heat they generate can destroy or alter fossils in the vicinity. The areas of intrusive dolerite on the Grid Connection routes thus have a zero palaeontological sensitivity.

The Quaternary sands in the water courses crossed along the routes are young enough to preserve fossils but, having been washed down slopes and streams into rivers, any fossils would have been transported from their sites of origin and their context and associations with other fossil material in the assemblage will have been lost. These sediments are indicated as moderately sensitive on SAHRIS.

The Ecca and Beaufort shales are the most likely rock strata in the area to preserve fossils and many years of research by geologists and palaeontologists in the Karoo (for example, Rubidge, 1995, 2005; Johnson et al., 2006; Rubidge et al., 2016) have produced a detailed lithology and described the terrestrial flora and vertebrate fauna of these rocks. From this and other parts of the Karoo the Tierberg Formation has produced trace fossils of worm burrows, root casts and invertebrate trackways (van Dijk et al., 2002; Almond, 2013) and although fossil plants are rare in this part of the Karoo basin, there are records of fragments of silicified wood reported from east of De Aar (Almond 2012a, 2013). According to Almond's site surveys for a number of other projects in the area of the Grid Connection routes (Almond 2012a, 2012b, 2012c), the chances of encountering vertebrate and other fossils associated with these shales is unlikely in the area as there is little exposure at or near the surface of the rock strata that contain them.

Finding
The information presented above **confirms** the identification of the Grid Connection routes by the Screening Tool as areas of palaeontological significance.

Figure 3: ACO Associates 2020 survey tracks (dark blue and green) and archaeological sites located (red and pale blue dots) overlaid on the Grid Connection route options (yellow and orange lines) (Source: Google Earth).

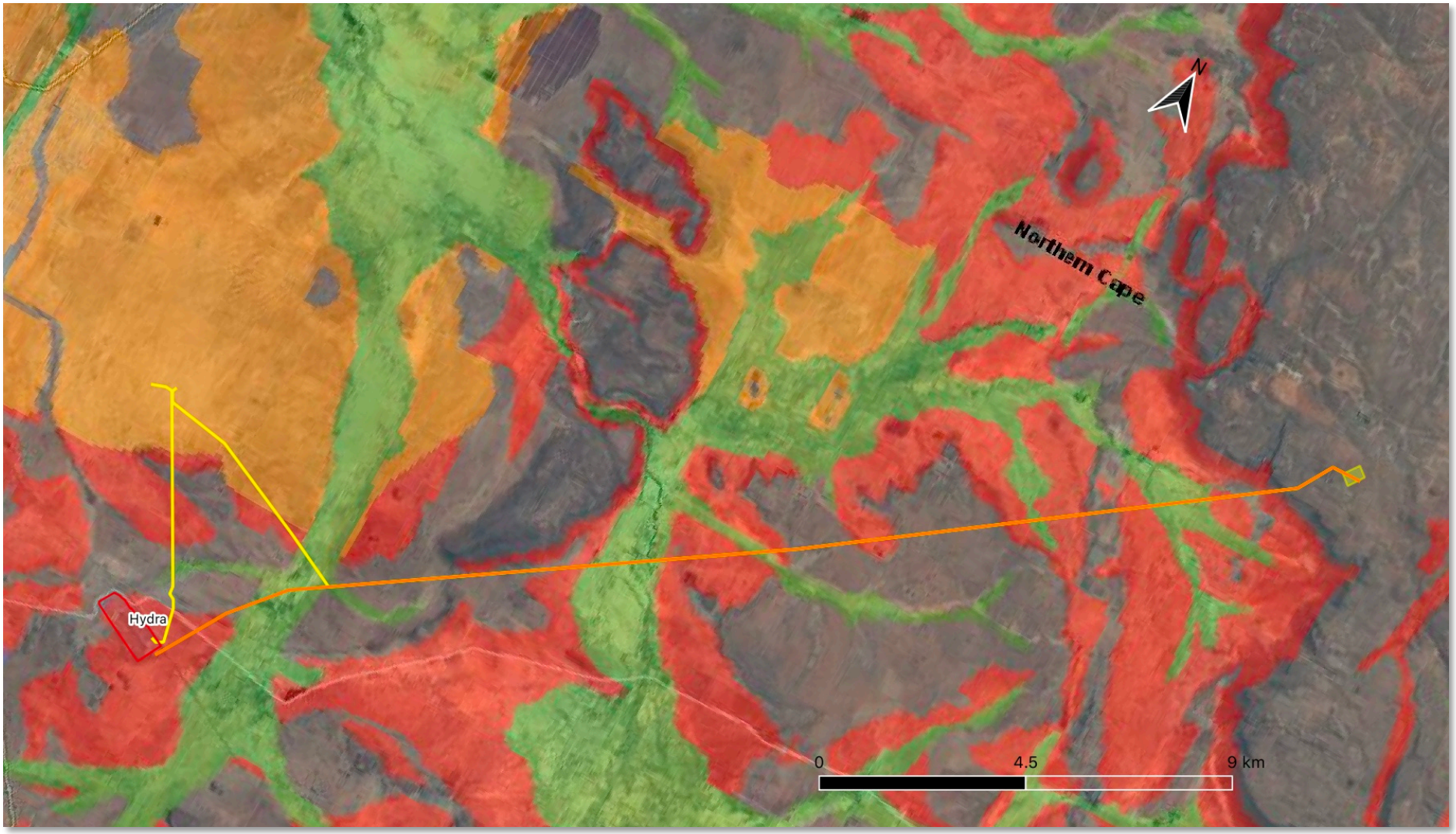


Figure 4: The Grid Connection routes superimposed on detail from SAHRA's palaeo-sensitivity map. The varied palaeontological sensitivity of the two proposed routes is clearly visible. Red = very high paleontological sensitivity, orange = high, green = moderate, and grey = zero/insignificant (Source: https://sahris.sahra.org.za/map/palaeo).

References

Almond, J. 2012a. *Proposed Mulilo Renewable Energy PV2, PV3 and PV4 photovoltaic energy facilities on Farms Paarde Valley, Badenhorst Dam and Annex Du Plessis Dam near De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments*. Unpublished report prepared for Aurecon Environmental Services. Natura Viva.

Almond, J.E. 2012b. *Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern Cape Province. Palaeontological specialist study: combined desktop and field-based assessments*, 33 pp. Natura Viva cc, Cape Town.

Almond, J. 2012c. *Palaeontological Specialist Study - Combined Desktop and Field-based Assessments: Two wind energy facilities on the Eastern Plateau near De Aar, Northern Cape Province proposed by Mulilo Renewable Energy (Pty) Ltd*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. Natura Viva cc.

Almond, J. 2013. *Proposed Photovoltaic (solar) energy facilities on du Plessis Dam Farm near De Aar: Palaeontological specialist study - combined desktop and field-based assessments*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. Natura Viva.

Fourie, W. 2014. *Proposed construction of a 132 kV transmission line from the Longyuan Mulilo De Aar 2 North Wind Energy Facility on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape*. Unpublished report prepared for Aurecon Environmental Services. PGS.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds*). The Geology of South Africa*. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Kruger, N. 2012. *Proposed establishment of a solar energy facility near De Aar, Northern Cape Province: Phase 1 Archaeological Impact Assessment Report*. Unpublished report prepared for Ennex Development. N Kruger.

Orton, J. and Webley, L. 2013. *Heritage Impact Assessment for multiple proposed solar energy facilities on De Aar 180/1 (Badenhorst Dam farm), De Aar, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. ACO Associates.

Rubidge, B.S. (Ed.) 1995. *Biostratigraphy of the Beaufort Group (Karoo Supergroup).* South African Committee for Biostratigraphy, Biostratigraphic Series No. 1., 46 pp. Council for Geoscience, Pretoria.

Rubidge, B.S. 2005. *Re-uniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust*. 27th Du Toit Memorial Lecture. South African Journal of Geology 108, 135-172.

Rubidge B.S., Day, M.O., Barbolini, N., Hancox, P.J., Choiniere, J.N., Bamford, M.K., Viglietti, P.A., McPhee, B.W., Jirah, S., 2016. Advances in Karoo biostratigraphy in the Permo-Triassic non-marine realm: significance for understanding basin development. In: Linol, B. and de Wit, M., (Eds), *Origin and Evolution of the Cape Mountains and Karoo Basin.* Regional Geology Reviews, pp. 141-149. , DOI 10.1007/978-3-319-40859-0_14

Sampson, C.G. 1985. *Atlas of stone age settlements in the central and upper Seacow Valley*. Memoirs of the National Museum Bloemfontein No. 20.

Sampson, C.G., 1992. *Stylistic boundaries among mobile hunter-gatherers in the Zeekoe Valley, Eastern Cape*. Washington, Smithsonian Institution Press.

Sampson, CG., Sampson, BE & Neville, D. 1994. An early Dutch Settlement pattern on the north east frontier of the Cape Colony. *Southern African Field Archaeology* 3: 74-81.

Sampson, C.G., Moore, V., Bousman, C.B., Stafford, B., Giordano, A. and Willis, M. 2015. A GIS analysis of the Zeekoe valley Stone Age archaeological record in South Africa. Journal of African Archaeology 13:2. 167-185.

Van der Walt, J. 2014. *Archaeological impact assessment for the proposed Casle Wind Energy Facility, De Aar, Northern Cape*. Unpublished report prepared for SAVANNAH Environmental (Pty). Heritage Contracts and Archaeological Consulting.

Van Dijk, D.E., Channing, A., van den Heever, J.A. 2002. Permian trace fossils attributed to tetrapods (Tierberg Formation, Karoo Basin, South Africa). *Palaeontologia africana* 38: 49-56.

Van Schalkwyk, J. 2011. *Heritage scoping assessment for the proposed establishment of the ACED De Aar Solar Energy Facility, Northern Cape Province*. Unpublished report prepared for SAVANNAH Environmental (Pty). J van Schalkwyk Heritage Consultant Ltd.

Webley, L. and Halkett, D. 2014. *Heritage Impact Assessment: Walkdown of final layout of the Longyuan Mulilo De Aar 2 North Wind Energy Facility, Northern Cape Province*. Unpublished report prepared for Mulilo Renewable Energy (Pty) Ltd. ACO Associates.

Webley, L. and Halkett, D. 2015. *Addendum: Proposed Wind Energy Facility situated on the Eastern Plateau (South) near De Aar, Northern Cape Province*. Unpublished report prepared for Holland and Associates Environmental Consultants. ACO Associates.

Webley, L. and Orton, J. 2011. *Proposed De Aar Wind Energy Facility on the North and South Plateau, Northern Cape Province*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. Archaeology Contracts Office.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Construction of the up to 400 kV De Aar 2 South Transmission Line and Switching Station, Northern Cape Province

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	ACO Associates cc			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	John Gribble			
Specialist Qualifications:	MA Archaeology			
Professional affiliation/registration:	Association of Southern African Professional Archaeologist (ASAPA) (Membership number 43)			
Physical address:	Unit D17, Prime Park, Mocke Road, Diep River			
Postal address:	Unit D17, Prime Park, Mocke Road, Diep River			
Postal code:	7800	Cell:	078 6162961	
Telephone:		Fax:		
E-mail:	john.gribble@aco-associates.com			

2. DECLARATION BY THE SPECIALIST

I, __John Gribble__, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

ACO Associates cc

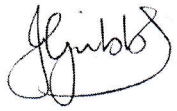
Name of Company:

25 February 2021

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, __John Gribble_, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.



Signature of the Specialist

ACO Associates cc

Name of Company

25 February 2021

Date

Signature of the Commissioner of Oaths

Rev. James Gribble
COMMISSIONER OF OATHS
MARRIAGE OFFICER (V3146) - REPUBLIC OF SOUTH AFRICA
"Windfall", 123 Woodgate Road, Plumstead 7800

25 Feb. 2021

Date