Basic Assessment for the Proposed Construction of Electrical Grid Infrastructure to support the juwi Skeerhok PV 1, 2 and 3 Solar Energy Facilities (SEF), Near Kenhardt, Northern Cape

DRAFT BASIC ASSESSMENT REPORT

APPENDIX E2:

Heritage

HERITAGE IMPACT ASSESSMENT:
BASIC ASSESSMENT REPORT FOR THE PROPOSED DEVELOPMENT OF A TRANSMISSION LINE AND ASSOCIATED ELECRICAL INFRASTRUCTURE TO SUPPORT THE PROPOSED SKEERHOK SOLAR ENERGY FACILITIES, KENHARDT, NORTHERN CAPE PROVINCE

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

CSIR – Environmental Management Services
P.O. Box 320, Stellenbosch, 7599
Tel: 021 8882432
Email: kstroebel@csir.co.za

On behalf of:

juwi Renewable Energies (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
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Email: jayson@asha-consulting.co.za

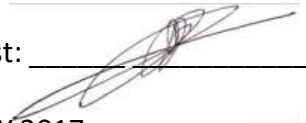
15 February 2018

Specialist declaration

I, Jayson Orton, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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.

Name of Specialist: ___JAYSON OTON_____

Signature of the specialist: 

Date: _____15 FEBRUARY 2017_____

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by juwi Renewable Energies (Pty) Ltd to assess the potential impacts to heritage resources that might occur through the proposed construction of a 132 kV transmission line, located some 26 to 43 km northeast of Kenhardt, Kenhardt Magisterial District, Northern Cape (S29° 05' 00" E21° 21' 00"). There are three alternative power line alignments being assessed. All three alternatives cross Smutshoek 395/0, Gemsbokbult 120/3, Gemsbokbult 120/5 and Gemsbokbult 120/9. In addition, Alternative 1 also passes over N'Rougas Zuid 121/1, Onder Rugzeer 168/3 and Boven Rugzeer 169/0. Corridors of 300 m width were provided for the assessment.

A survey of the area showed it to be flat with occasional gravel areas and generally light vegetation cover. Archaeological material was found to be very sparsely distributed across the study area but three sites/site complexes of high significance were located just outside of the proposed corridors. Impacts in the Alternative 2 and 3 corridors are expected to be of generally low significance before mitigation and very low significance after mitigation. For Alternative 1 there is the possibility of moderate significance impacts before mitigation but, again, mitigation wold reduce this to low significance. Palaeontological impacts are highly unlikely to occur and are of no concern. Impacts are expected to be of very low significance. Graves may be present but because of the very low likelihood of finding any the potential impact significance was rated as being very low. No other specific heritage resources were identified on site but the broader landscape carries a degree of heritage significance. Because of the already existing 'electrical layer' on this landscape and the fact that it has been identified for a hub of electrical development, the significance of impacts to this landscape are considered to be low both before and after mitigation. Cumulative impacts are likely to be of essentially the same significance as the construction impacts because of the very low density of significant heritage resources on the broader landscape.

Because the impacts to heritage resources will be either avoidable or easily managed, it is recommended that planning and construction of the proposed electrical infrastructure should be authorised for any of the three proposed alternatives but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- Fencing, where required, is to be visually permeable;
- The use of white paint on structures should be minimised with earthy tones favoured;
- A final archaeological walk down survey of the final chosen alignment must be carried out at least six months in advance of construction;
- Staff must be made aware of the small possibility of locating buried fossils and should this occur they must be left in place and immediately reported to the ECO and/or the heritage authorities; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency.

Contact site: An archaeological site that is essentially Stone Age in character but which includes historical materials obtained via trade or exchange with, or wages from, Europeans.

Diagnostic: Artefacts bearing features identifying them to a particular period of time.

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Hand-axe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Hominin: a smaller group consisting of modern humans, extinct species of humans and all their immediate ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BAR: Basic Assessment Report

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

DEA: Department of Environmental Affairs

ECO: Environmental Control Officer

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

MSA: Middle Stone Age

LSA: Later Stone Age

NBKB: Ngwao-Boswa Ya Kapa Bokoni

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

NID: Notification of Intent to Develop

PPP: Public Participation Process

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

SKA: Square Kilometre Array

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 (7 April 2017)	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4 Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii (Preliminary Section of this report)
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 4, 5, 6, 7 and 8.2
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 3
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 alternatives;	Section 1.1.1
g) an identification of any areas to be avoided, including buffers;	Section 10.2
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 10.2
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 9
l) any conditions for inclusion in the environmental authorisation;	Section 14
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 14
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 12
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q) any other information requested by the competent authority.	n/a
2. Where a government notice gazetted by the Minister provides for any protocol of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	n/a

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by juwi Renewable Energies (Pty) Ltd to assess the potential impacts to heritage resources that might occur through the proposed construction of a 132 kV transmission line, located some 26 to 43 km northeast of Kenhardt, Kenhardt Magisterial District, Northern Cape (S29° 05' 00" E21° 21' 00"). There are three alternative power line alignments being assessed. All three alternatives cross Smutshoek 395/0, Gemsbokbult 120/3, Gemsbokbult 120/5 and Gemsbokbult 120/9. In addition, Alternative 1 also passes over N'Rougas Zuid 121/1, Onder Rugzeer 168/3 and Boven Rugzeer 169/0. Corridors of 300 m width were provided for the assessment. The transmission line is proposed to connect three solar energy facilities (currently being assessed under separate environmental impact assessments) to the national electricity grid via the Eskom Nieuwehoop Substation.

1.1. Project description

1.1.1. Proposed infrastructure

The proposed transmission line and associated infrastructure will include the following:

- A 132 kV transmission line with concrete foundations and steel tower structures (i.e. pylons). The line will consist of either self-supporting suspension structures or guyed monopoles and will have a maximum height of 32 m. The span lengths are estimated to range between 200 m and 300 m. The servitude for the 132 kV power line will be 52 m wide. Associated electrical infrastructure at the Eskom Nieuwehoop Substation will be constructed in order to ensure that the substation is capable of receiving the additional electricity that is generated by the proposed Skeerhok PV facilities. This infrastructure includes, but is not limited to, feeders, Busbars, transformer bays and extension to the platform at the Eskom Nieuwehoop Substation.

- An on-site substation (with a capacity of 22/33 kV to 132 kV). The on-site substation building is expected to extend approximately 30 m in height, with a maximum footprint of 1 hectare. It is important to note that all high voltage infrastructure leading up to the Point of Connection (i.e. Skeerhok PV facilities' section of the proposed collector/on-site substation) have been considered within the three EIA Processes (i.e. for Skeerhok PV 1. PV 2 and PV 3). High voltage infrastructure extending from the Point of Connection (i.e. Eskom's section of the proposed collector/on-site substation) up to the line bay at the Eskom Nieuwehoop Substation may be handed over to Eskom and is assessed in this BA Process (i.e. Skeerhok Alternative 1, 2 and 3 – Transmission Lines).

- For powerline maintenance existing service and access roads will be utilised as much as possible. Where no existing access is present it will be provided in the form of jeep tracks, as opposed to formalised roads. Some sections may be accessed via the existing Transnet service road.

1.1.2. Alternatives

As part of this BA, three connectivity alternatives are considered, namely:

1. Skeerhok Alternative 1 – Transmission Line
2. Skeerhok Alternative 2 – Transmission Line
3. Skeerhok Alternative 3 – Transmission Line

A description of each alternative is summarised in Table 1 and shown in Figure 1 below.

Table 1: *The Skeerhok Alternatives – Transmission Line descriptions.*

	Skeerhok Alternative 1	**Skeerhok Alternative 2**	**Skeerhok Alternative 3**
Line length	30 km	18 km	19 km
Farm portions affected	• Portion 0 of Smutshoek Farm 395 • Portion 3 of Gemsbok Bult Farm 120 • Portion 5 of Gemsbok Bult Farm 120 • Portion 9 of Gemsbok Bult Farm 120 • Portion 1 of N'Rougas Zuid Farm 121 • Portion 3 of Onder Rugzeer Farm 168 • Portion 0 of Boven Rugzeer 169	• Portion 0 of Smutshoek Farm 395 • Portion 3 of Gemsbok Bult Farm 120 • Portion 5 of Gemsbok Bult Farm 120 • Portion 9 Gemsbok Bult Farm 120	• Portion 0 of Smutshoek Farm 395 • Portion 3 of Gemsbok Bult Farm 120 • Portion 5 of Gemsbok Bult Farm 120 • Portion 9 of Gemsbok Bult Farm 120
Foundation	Concrete	Concrete	Concrete
Pylon	Steel tower	Steel tower	Steel tower
Tower type	self-supporting suspension structures or guyed monopoles	self-supporting suspension structures or guyed monopoles	self-supporting suspension structures or guyed monopoles
Height	32 m	32 m	32 m
Span length	200 – 300 m	200 – 300 m	200 – 300 m
Servitude width	40 m	40 m	40 m

Alternative 2, which is shortest, is preferred. It is important to note that should the routing change subsequent to the issuing of an EA (should such authorisation be granted), any alternative layout or revisions to the layout occurring within the boundaries of the corridor would not be regarded as a change to the scope of work or the findings of the impact assessments undertaken during the BA Phase. This is based on the understanding that the specialists have assessed the larger corridor and have identified sensitivities, which have been avoided in the siting of the proposed infrastructure. The corridor is considered to be a "development envelope" in which the project components can be constructed at whichever location (within the boundary of the corridor) without requiring an additional assessment or change in impact significance. Any changes to the layout within the boundaries of the corridor following the issuing of the EA (should it be granted) will therefore be considered to be non-substantive.

1.1.3. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for foundations may impact on archaeological and/or palaeontological remains, while the above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

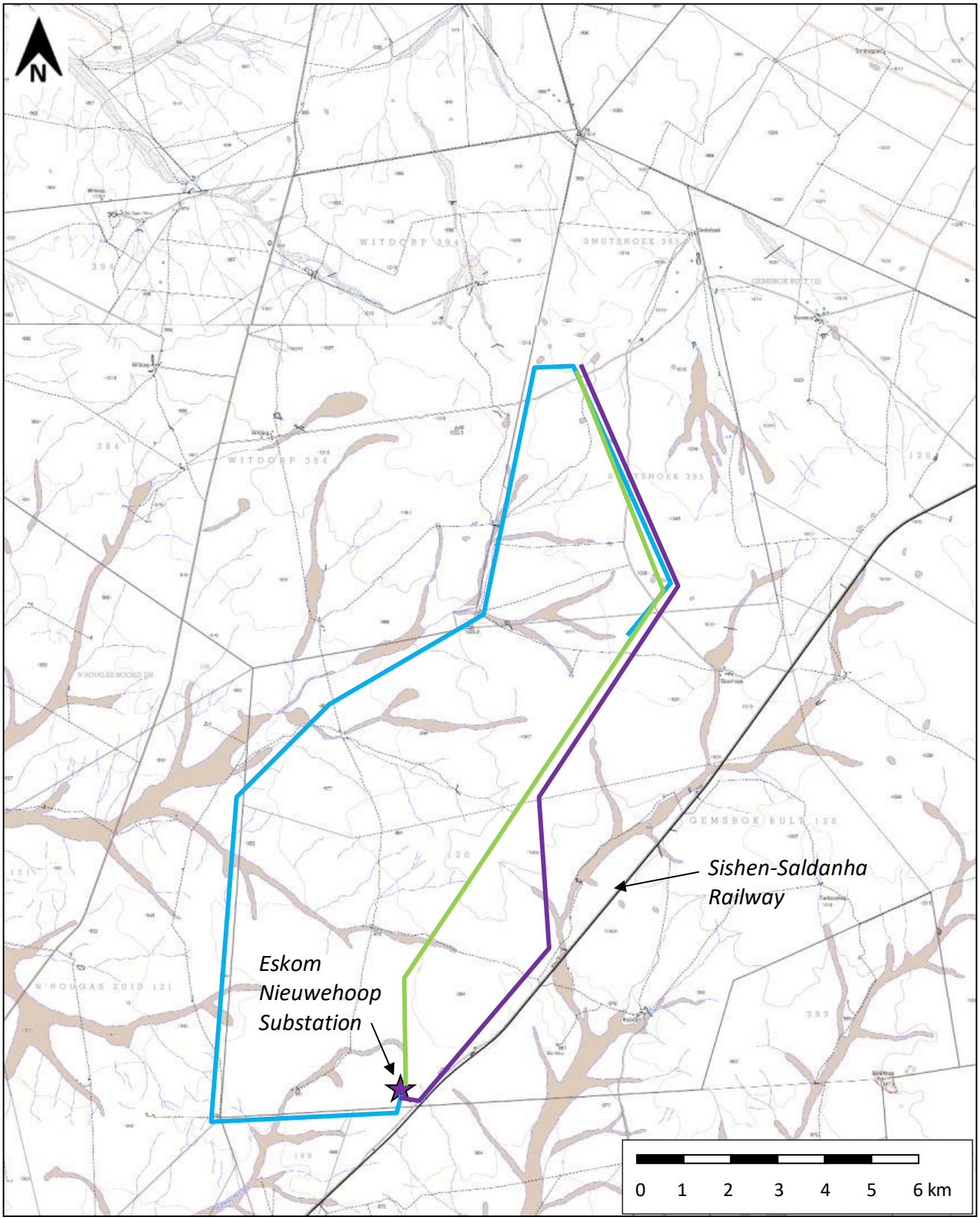


Figure 1: *Extract from 1:50 000 topographic maps 2821CD & 2921AB showing the location of the three alternatives (Alt. 1 = turquoise; Alt. 2 = green; Alt. 3 = purple). Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

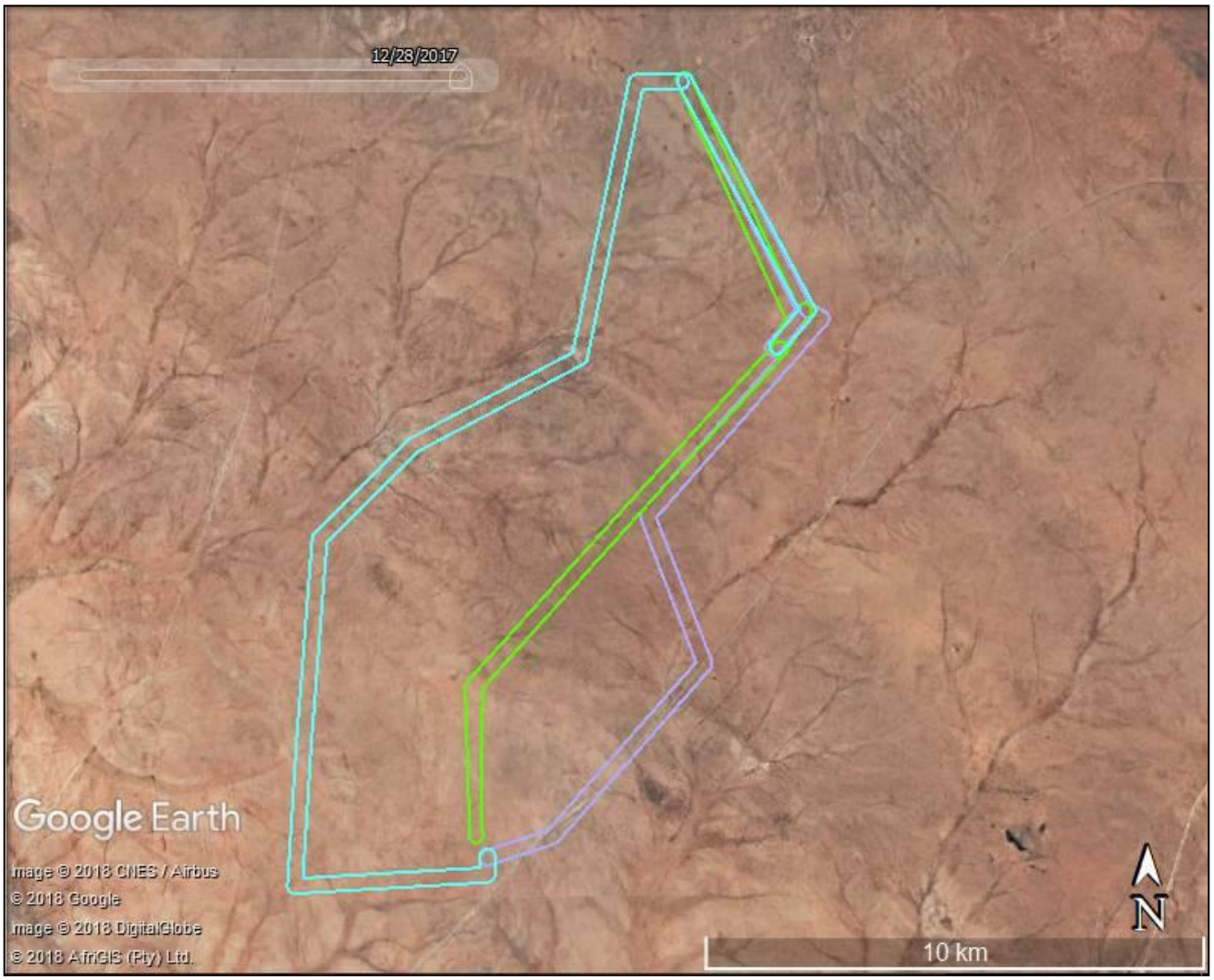


Figure 2: *Aerial view of the study area showing the three proposed alternative power line alignments (Alt. 1 = turquoise; Alt. 2 = green; Alt. 3 = purple).*

1.2. Terms of reference

ASHA Consulting was asked to compile a heritage impact assessment (HIA) that included all relevant aspects of heritage, but particularly including palaeontology, archaeology and the cultural landscape which were seen as likely to be the most significant aspects.

It should also be noted, however, that following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.3. Scope and purpose of the report

A heritage impact assessment (HIA) is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued for consideration by the National Department of Environmental Affairs (DEA) who will review the Basic Assessment Report (BAR) and grant or withhold authorisation. The

HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “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”;
- Palaeontological material: “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”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation”; and d) “features,

structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";
- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BAR. The present report provides the heritage component. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:50 000 map and historical aerial images were sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field survey

The site was subjected to a partial foot survey on 30 June, 1, 2 and 3 July 2017. In addition, parts of the Alternative 2 and 3 alignments were covered by the present author on other surveys in June 2014 and October 2015. The present survey was during mid-winter, although seasonality in this part of South Africa, where vegetation cover is minimal at all times of the year, had no material effect on the fieldwork. During the survey the positions of finds were recorded on a hand-held Global Positioning System (GPS) receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

3.3. Impact assessment

For consistency, the impact assessment was conducted through application of a scale supplied by the CSIR. The impact assessment methodology used for this HIA can be found in Section D of the Basic Assessment Report (BAR).

3.4. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. SAHRA (2007) has formulated its own system[1] for use in provinces where it has commenting authority. In this system sites of high local significance are given Grade IIIA (with the implication that the site should be preserved in its entirety) and Grade IIIB (with the implication that part of the site could be mitigated and part preserved as appropriate) while sites of lesser significance are referred to as having 'General Protection' and rated with an A (high/medium significance, requires mitigation), B (medium significance, requires recording) or C (low significance, requires no further action).

3.5. Assumptions and limitations

The study was carried out at the surface only and hence any completely buried archaeological sites or palaeontological occurrences will not be readily located. Similarly, it is not always possible to determine the depth of archaeological or palaeontological material visible at the surface. Due to the large areas involved in the three alignments (and others surveyed during the same project) it was impractical to cover the entire area in detail. This means that the results of the survey are indicative of the types of heritage resources likely to be present. It should be noted, however, that all obvious features such as pans and rocky hills were visited and covered in greater detail such that the chances of having missed important heritage resources are very small.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts within a 30 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of twelve other PV plants (Figure 3), the already constructed Eskom Nieuwehoop Substation (Figure 3) and various associated power lines. However, it is notable that the DEA has issued a statement that a maximum of six PV facilities in this area will be issued with preferred bidder status due to the potential negative impacts on the Square Kilometre Array (SKA).

[1] The system is intended for use on archaeological and palaeontological sites only.

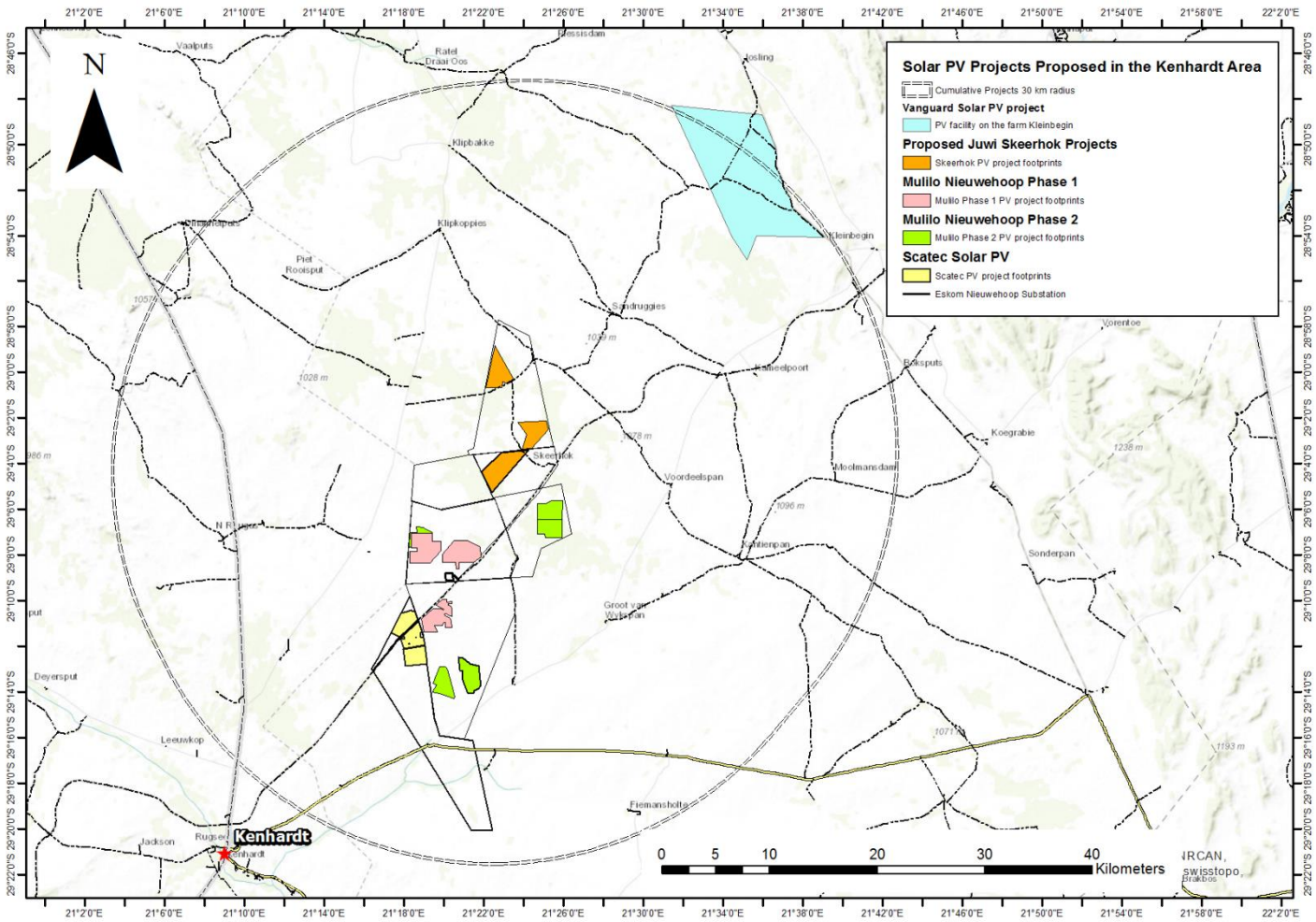


Figure 3: *Map of the broader area around the Nieuwehoop Substation (marked by a red arrow) showing the various solar energy facilities proposed.*

3.6. Consultation processes undertaken

The NHRA requires consultation as part of an HIA but, since the present study falls within the context of a BAR which includes a public participation process (PPP), no dedicated consultation was undertaken as part of the HIA. Interested and affected parties would have the opportunity to provide comment on the heritage aspects of the project during the PPP.

Although not formal consultation, it is noted that contact was made with a local resident who knew the locations of some rock art sites. These sites were visited with the resident as part of the general background study but, owing to their distance from the study area, they have no direct relevance on the present assessment.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site is located in a rural area, some 43 km northeast of Kenhardt. However, the Sishen-Saldanha railway line transporting iron ore, its gravel service road, the large, new Eskom Nieuwehoop Substation and some power lines do occur in the general vicinity. The land is otherwise used for grazing of both small stock and wild game.

4.2. Site description

Like much of the broader landscape in this area, the study is generally very flat (Figure 4), but a few low rocky hills do occur sporadically (Figure 5). Vegetation consists of grass and low bushes punctuated by occasional taller bushes, especially in ephemeral drainage lines and around pans (Figures 6). Rare quiver trees also occur in the vicinity. The surface is generally sandy, but gravel (calcrete and other rocks) does occur in places. A new gravel road had been graded along a new power line that was busy being installed at the time of the survey and which crosses through the study area along parts of Alternatives 1 and 2 (Figure 7).

Figure 4: *View towards the south along the western-most part of the Alternative 1 alignment.*

Figure 5: *View northwards from a rocky hill on the Alternative 1 alignment.*

Figure 6: *View towards the north at a small pan with taller vegetation in the eastern part of the study area and that falls within all three alternative alignments.*

Figure 7: *View northwards along the north-western margin of the study area showing a new power line currently under construction (during July 2017) parallel to part of Alternative 1.*

5. ARCHAEOLOGICAL AND HISTORICAL CONTEXT

This section of the report contains the desktop study and establishes what is already known about heritage resources in the vicinity of the study area. What was found during the field survey as presented below may then be compared with what is already known in order to gain an improved understanding of the significance of the newly reported resources.

5.1. Archaeological Aspects

Bushmanland is well known for the vast expanses of gravel that occur in places and which frequently contain stone artefacts in varying densities (Beaumont *et. al* 1995). Such material is often referred to as 'background scatter' and is generally of limited significance (Orton 2016i). At times, however, the scatter can become very dense and mitigation work is occasionally called for. The artefacts located in these contexts are largely Early Stone Age (ESA) and Middle Stone Age (MSA) and date to the middle to late Pleistocene. They are not associated with any other archaeological materials, since these would have long since decomposed and disappeared. Previous experience in the general vicinity suggests that such dense accumulations of background scatter artefacts are unlikely to occur in this part of Bushmanland.

Of potentially more significance, however, are Later Stone Age (LSA) sites which are commonly located along the margins of water features in Bushmanland. These features include both pans and ephemeral drainage lines. Such sites have been identified in the broader vicinity in association with pans but artefact scatters associated with drainage lines are rare (Orton 2014a, 2014b, 2014c, 2016b, 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2016j, 2016k, 2016l). These sites would typically contain mostly stone artefacts, but fragments of ostrich eggshell (from eggs used as water containers and also as a food source) and pottery are also found at times, while bone is rare and likely confined to sites that are very recent. While no sites have ever been sampled in the vicinity of the present study area, excavations to the northeast of Pofadder at sites adjacent to small water holes demonstrate this pattern well (Orton 2016a). Similar LSA sites can also be found in association with rocky outcrops. Because of their positions along water courses and adjacent to rocky areas, many of these sites get avoided by development proposals because of the need to avoid the relevant natural features. Despite the increased likelihood of locating archaeology along

streams, Morris (2009) noted that a search along the banks of the Hartebeest River close to Kenhardt, where he expected elevated frequencies of archaeological material, revealed virtually nothing. This is in contrast to a section of river bank some 11.5 km south of the Nieuwehoop Substation along which a dense concentration of LSA and historical sites (including contact sites) was found (Orton 2016d).

Another kind of archaeological site fairly commonly encountered in Bushmanland is small rock outcrops that have been quarried as a source of stone material for making stone tools. Several such occurrences – usually of quartz – have been seen in the general area but these are not significant sites.

A few rock engravings and paintings are known from the broader area (Louw Roux Bushmanland 2013). From the limited information available and from observations made along the Hartebees River by the present author, the engravings tend to be naturalistic images produced by the Bushmen, while the paintings are geometric images, produced by the Khoekhoen. The latter are not well known from the area (Orton 2013), although examples have been seen in the region (David Morris, pers. comm. 2015; Orton 2016g). Painted art is also very rare but again, examples are known, particularly on large granite boulders like that recorded by Orton (2016g) some 2.5 km away from the south-eastern part of the Alternative 3 corridor and 7 km east of the Nieuwehoop Substation (Figure 9).

Figure 9: *View of the context of the one painted site known from within the vicinity of the study area. It is evident from the photograph that such contexts are rare in this very flat landscape.*

5.2. Historical Aspects

The Anglo-Boer War was fought across much of the Northern Cape interior, but information on the role of Kenhardt appears difficult to locate. The town was occupied by the Boers in late February 1900 after they convinced the magistrate that they had a large gun and would fire on the town if it did not surrender. They later surrendered to the British who occupied the town on 31st March 1900. By mid-1900 there were perhaps 100 Cape Rebels detained in a camp outside of Kenhardt (Grobler 2004). The British raised a local force known as the Border Scouts in Upington in May 1900. Many were mixed-race individuals, some local farmers, others Kalahari hunters, but all disliked the Boers. The scouts were responsible for a large area of the north-western Cape Colony centred on Upington and Kenhardt. They eventually numbered 786 by January 1901 and were under the command of Major John Birbeck (AngloBoerWar.com 2015; Rodgers 2011). At the beginning of 1902 there were 150 Border Scouts stationed at Kenhardt. Two boers, H.L. Jacobs and A.C. Jooste, were accused of treason and executed in the town on 24 July 1901 (Grobler 2004). A memorial stands there to their

honour (Green Kalahari n.d.). Events around Kenhardt were likely not that important and this execution does not even feature in the Boer War timeline provided by Packenham (1993: 291-294). No major action appears to have taken place around Kenhardt, although the Boers are known to have attacked a patrol on 17th May 1901, while the British attacked a Boer position on 25th June 1901 (AngloBoerWar.com 2015).

From an archaeological point of view the only material remains possibly related to occupation around the time of the Boer War are the series of contact period river bank scatters mentioned above. On one of these was a rusted pen knife handle with the portrait and name of Paul Kruger on it. This may indicate that a Boer commando had camped there (Orton 2016d).

5.3. Built Environment

The built environment is sparsely represented in rural Bushmanland because the farms tend to be so large. The vast majority of structures appear to be quite recent in age (20th century) and are of very limited heritage significance. In any case, the development will not directly affect any buildings.

5.4. Graves

Graves are also very rare. Some older farm complexes have small graveyards located close to their farm buildings, while suspicious isolated rocks, perhaps planted upright, may mark historical graves of early mobile farmers (the so-called *trek boers*). An example has been seen some 6.5 km to the southwest of the south-western corner of the Alternative 1 corridor (Orton 2016j), while another was seen in the footprint of the proposed Skeerhok PV3 currently under assessment through a separate NEMA process DEA ref 14/12/16/3/3/2/1035 (Orton in prep.). Unmarked pre-colonial graves can, in theory, be located anywhere, although they are generally more common in sandy areas where excavation of graves was easier and in more productive areas where population densities would have been higher.

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. Table 1 provides a list of those resources recorded, identifying which are within the potential impact zone and which not. Figures 10 to 14 map these finds.

Table 1: *List of findings made during the field survey. Sites recorded during other surveys and located more than 200 m from all of the proposed corridors are not listed here. Note that sites located more than 30 m from all three of the proposed project corridors are highlighted in grey. In the 'Alt.' column parentheses denote a distance of greater than 30 m from between site and corridor when one alternative is closer than 30 m. All of these sites may still be vulnerable to indirect impacts.*

Waypoint	Alt.	GPS co-ordinates	Site name	Description	Significance (Mitigation)
001	Alt. 2	S29 08 42.7 E21 20 16.0	GBB2014/001	Minimally flaked quartz outcrop (Orton 2014b).	Very low
836	Alt. 1	S29 03 32.2	GBB2017/005	Light scatter of MSA and LSA artefacts	Medium-low

	Alt. 2 Alt. 3	E21 23 54.3		alongside a pan. Materials include quartzite, quartz, hornfels and CCS. The mid-section of a very thin, flat hornfels blade with unifacial flaking was seen. Variable weathering on the artefacts suggests variable age.	**(2 hours)**
845	Alt. 1	S29 03 41.6 E21 21 31.6	GBB2017/006	A small clearing in the rocks on a large rocky hill. It contains both historical and Stone Age materials. Brown glass (likely 20th century), three weathered ostrich eggshell fragments and some quartz flakes.	Low
846	Alt. 1	S29 03 34.3 E21 21 30.4	GBB2017/007	Quartz artefact scatter on the northern edge of the rocky hill.	Very low
868	Alt. 1	S29 06 01.7 E21 18 11.2	GBB2017/008	Quarried quartz outcrop. This outcrop lies about 5 m outside the Alt. 3 corridor.	Very low
869	Alt. 1	S29 06 49.1 E21 18 12.9	GBB2017/009	Quarried quartz outcrop.	Very low
870	Alt. 1	S29 07 15.5 E21 18 12.7	GBB2017/010	LSA artefact scatter alongside a pan. It is of quartz and there is quite a bit of ostrich eggshell too.	Medium-low **(4 hours)**
871	Alt. 1	S29 07 16.6 E21 18 12.5	GBB2017/011	LSA artefact scatter alongside a pan. It is of quartz and there is quite a bit of ostrich eggshell too.	Medium-low **(4 hours)**
872	Alt. 1	S29 07 17.1 E21 18 13.0	GBB2017/012	LSA artefact scatter alongside a pan. It is of quartz and there are a few pieces of ostrich eggshell too. Also a quartzite hammer stone.	Medium-low **(2 hours)**
873	Alt. 1	S29 07 16.9 E21 18 15.3	GBB2017/013	A scatter of quartz artefacts alongside a pan that seems to include both LSA and older material.	Low
874	Alt. 1	S29 07 16.2 E21 18 15.5	GBB2017/014	LSA artefact scatter alongside a pan. The artefacts are of quartz.	Low
875	Alt. 1	S29 07 12.9 E21 18 14.1	---	A widespread adiagnostic scatter of quartz artefacts a bit further away from the pan. It is likely of mixed age and attributable to background scatter.	Very low
876	Alt. 1	S29 06 43.1 E21 18 15.7	GBB2017/015	Quarried quartz outcrop.	Very low
894	Alt. 1 (Alt. 3)	S29 02 13.5 E21 23 56.5	---	Fragments of a saucer and a small metal 'cap' of some sort of container. This material is likely 20th century and probably not old enough to be archaeology. The scatter lies some 30 m outside of the Alt. 3 corridor and 70 m from Alt. 1.	Very low
906	Alt. 2 (Alt. 3)	S29 03 40.1 E21 23 53.9	---	An isolated lower grindstone on dolerite and found face up alongside a very small pan. The background scatter did not appear to be any different here to elsewhere.	Very low.
016	(Alt. 2)	S29 06 46.9 E21 20 25.6	---	Green bottle glass scatter. Single bottle. Base has "& CO" at the top and "14A" at the bottom. A partial digit before the "14A" is assumed to be a "0" (Orton 2014b).	Very low
Waypoints 887-892 represent a cluster of points at a single site located within a pan some 250 m outside of the proposed corridors in the northeast of the study area.					
887	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 22.8 E21 23 03.2	SHK2017/003	A pan that has been excavated out to create a 'dam'. The excavation appears to have penetrated a gravel deposit which has been laid on the sides of the hole to create berms around the 'dam'. Subsequent erosion has led to a lag deposit being present on the	High (AVOID)
888	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 23.1 E21 23 05.5			

889	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 23.6 E21 23 04.4		berms. This material is mostly gravel but there are many artefacts of mixed age in between. The artefacts include LSA, MSA and ESA, with the latter being the rarest inclusion represented by a few flakes and the distal portion of a hand-axe. Worthy of Grade IIIA, but excavation may yet reveal material worthy of a higher grading.	
890	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 24.6 E21 23 05.8			
891	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 28.3 E21 23 03.7			
892	(Alt. 1) (Alt. 2) (Alt. 3)	S29 00 24.8 E21 23 02.8			
Waypoints 847 to 867 & 877 to 880 were within an earlier alignment for Alternative 3 but, because of their significance, have now been avoided with a c. 250 m buffer. They are listed here for the record.					
847	(Alt. 1)	S29 04 53.4 E21 19 54.0	GBB2017/016	Calcrete wall of unknown function. Earth is built up against one side.	High **(AVOID)**
848	(Alt. 1)	S29 04 50.6 E21 19 48.1		Small stone foundation of 1x2 m.	
849	(Alt. 1)	S29 04 49.2 E21 19 44.9		Dam with stone-lined wall, square stone reservoir with (recent) plastered surfaces, various stone walls (one of which has been partly demolished to reuse the stones, some stone foundations, wind pump.	
850	(Alt. 1)	S29 04 48.1 E21 19 40.3		House foundation. Maximum dimensions are about 10x25 m but it looks like it was built in typical vernacular fashion with rooms added on at different times. Floor plan is very 'organic'. There are some smaller foundations just west of the main building. Also many artefacts lying about: green, blue, aqua and purple glass, stoneware, metal.	
851	(Alt. 1)	S29 04 48.0 E21 19 38.7		Massive ash dump that may be as much as 1 m high. It is about 20 m in diameter. There is lots of calcrete all over the dump, much of it is burnt. Also large numbers of glass and ceramic artefacts. A small turquoise glass bead is about 5.5 mm in diameter.	
852	(Alt. 1)	S29 04 45.9 E21 19 39.6		Calcrete-coated area with a historical artefact scatter over it. Includes glass, ceramics and metal.	
853	(Alt. 1)	S29 04 46.5 E21 19 40.6		a stone foundation of 6x4 m.	
854	(Alt. 1)	S29 04 47.4 E21 19 43.1		The north-eastern end of the dam wall.	
855	(Alt. 1)	S29 04 48.1 E21 19 35.5		Minimal structural remains (stones) suggesting a structure was present as well as some glass and ceramic fragments.	
856	(Alt. 1)	S29 04 56.4 E21 19 30.2		A large and very old kokerboom with three suspicious (presumably anthropogenic) holes in its branches.	
857	(Alt. 1)	S29 04 55.7 E21 19 33.6		A historical artefact scatter with glass, ceramics and metal.	
858	(Alt. 1)	S29 04 55.7 E21 19 40.5		A stone foundation of 3x4 m. Also widespread low density historical artefact scatter in this area.	
859	(Alt. 1)	S29 04 54.8 E21 19 42.9		A stone foundation of 1x1.5 m.	
860	(Alt. 1)	S29 04 53.4		A stone foundation of c. 2.5x2.5 m but hard	

		E21 19 43.6		to tell because it was partly covered with sand.	
861	(Alt. 1)	S29 04 54.0 E21 19 42.4		An ash dump of about 15x20 m and at least 0.5 m high. Also has much calcrete on it, mostly burnt. A circular metal item has "Pat April 23 1878" and "Made in the United States of America" on it.	
862	(Alt. 1)	S29 04 54.3 E21 19 42.3		A pile of stones on the edge of the ash heap.	
863	(Alt. 1)	S29 04 53.3 E21 19 42.3		A broken potjie and many fragments of another cast iron container (smooth surface).	
864	(Alt. 1)	S29 04 52.6 E21 19 42.1		A rectangular stone foundation of 3.5x6 m with red brick fragments lying around it.	
865	(Alt. 1)	S29 04 52.6 E21 19 43.0		House foundation of 9x12 m, again looking like it developed organically with rooms added at different times. It also shows evidence of a stoep along the northern side.	
866	(Alt. 1)	S29 04 50.9 E21 19 39.4		A pile of stones and brick fragments.	
867	(Alt. 1)	S29 04 45.4 E21 19 41.6		A small ash dump of about 10 cm high and 6 m diameter. It has very few artefacts on it. It also has burnt calcrete fragments all over it though.	
877	(Alt. 1)	S29 04 43.9 E21 19 46.2		A stone foundation of 8x8 m. Also two whole bottles here.	
878	(Alt. 1)	S29 04 43.0 E21 19 46.0		A small ash dump with a pile of rocks alongside it. The dump is about 20 cm high and it is about 6x8 m in size.	
879	(Alt. 1)	S29 04 41.3 E21 19 46.3		A small square stone foundation of 1x1 m.	
880	(Alt. 1)	S29 04 40.2 E21 19 45.7		A lower grindstone. Could be LSA or maybe historical.	
881	(Alt. 1)	S29 02 37.9 E21 21 40.9	SHK2017/010	A small rocky koppie with a clearing on its summit. There are quartz artefacts, ostrich eggshell fragments, bone fragments (mostly burnt), some glass and a bullet cartridge.	Low-medium **(2 hours)**
Waypoints 895 to 904 denote a site complex, the eastern edge of which is 180 m from the Alt. 2 corridor and more than 400 m from Alt. 1 and 3.					
895	(Alt. 2)	S29 02 59.1 E21 23 49.8	SHK2017/005	Very dense LSA artefact scatter along the edge of a pan. About 10 m by 30 m. Stone materials include quartz, quartzite, CCS, other. One possible adze seen. Many dolerite manuports present. Also minimal ostrich eggshell, glass and metal.	Medium **(3 days)**
896	(Alt. 2)	S29 02 57.1 E21 23 47.7	SHK2017/006	Many artefacts in burrow mounds at the base of the hill suggesting subsurface archaeology. Quartz, quartzite and CCS present.	Low
897	(Alt. 2)	S29 02 57.9 E21 23 47.5			
898	(Alt. 2)	S29 02 58.6 E21 23 48.8	SHK2017/007	Very dense LSA artefact scatter along the edge of the pan, directly across from 895. The scatter lies atop a low mound and includes quartz, quartzite and CCS. There are also many manuports.	Medium **(2 days)**
899	(Alt. 2)	S29 02 59.0 E21 23 49.2	---	Point marking pan.	---
900	(Alt. 2)	S29 02 59.3 E21 23 48.5	SHK2017/008	Small LSA artefact scatter as for 898	Medium-low **(2 hours)**
901	(Alt. 2)	S29 03 01.3	---	Light grinding groove on an angled boulder.	Low

		E21 23 45.6			
902	(Alt. 2)	S29 02 57.3 E21 23 45.2	SHK2017/009	Very dense LSA artefact scatter in a small 'clearing' on the top of the rocky hill to the northwest of the pan. Also a very light grinding patch on a flat boulder.	Medium **(1 day)**
903	(Alt. 2)	S29 02 56.5 E21 23 45.9	---	A gravel area with background scatter artefacts included.	Low
904	(Alt. 2)	S29 02 55.5 E21 23 46.1	---	Widespread, low density artefact scatter. No obvious concentration anywhere. Probably dense background scatter.	Low

6.1. Archaeology

Archaeological resources were found to be very sparsely distributed across the study area but with a few areas of significant concentration. There were, however, isolated background scatter artefacts found throughout the study area.

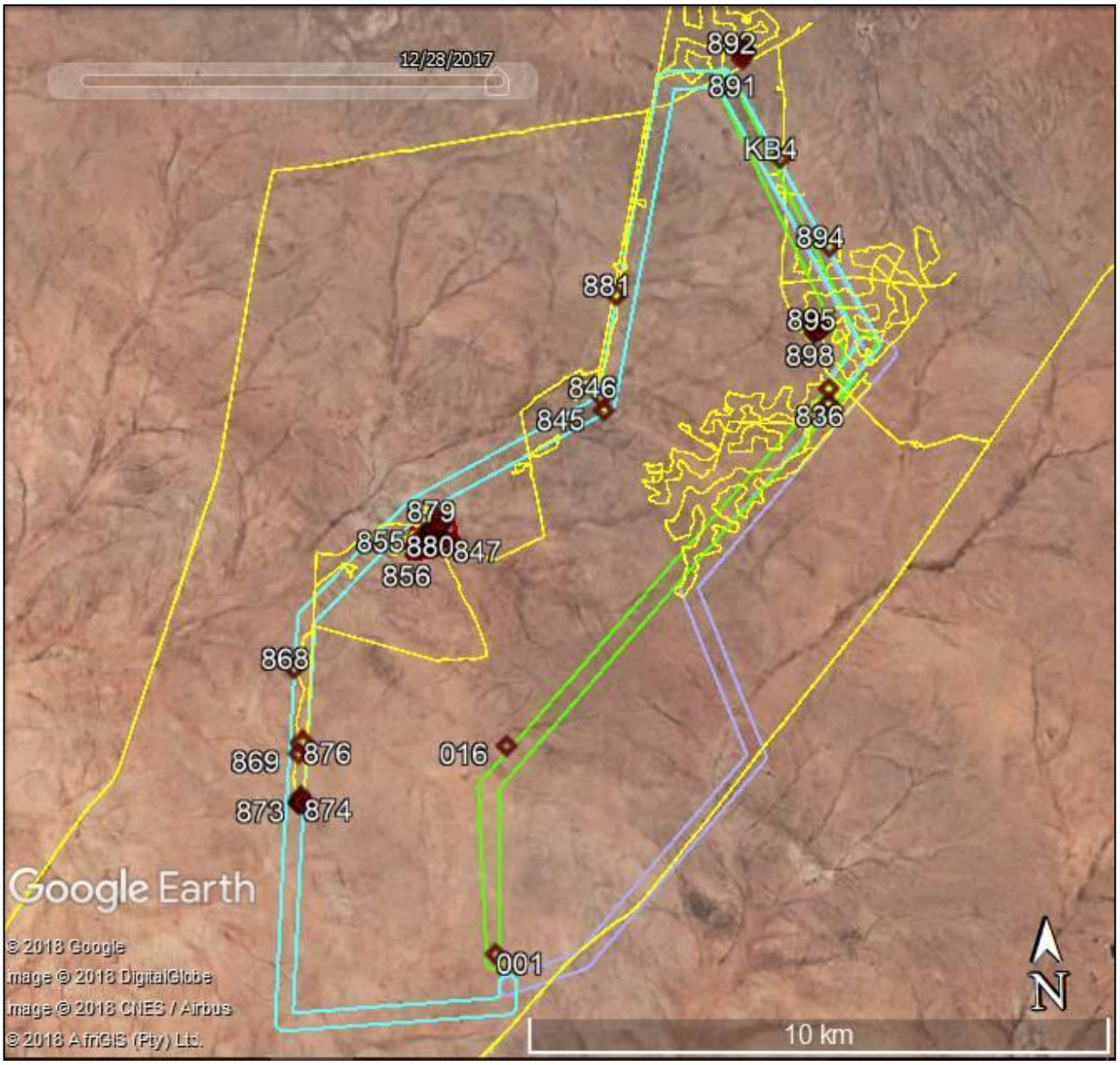


Figure 10: *Map showing the distribution of heritage resources (numbered symbols). The project alternative corridors are outlined in turquoise (Alt. 1), green (Alt. 2) and purple (Alt. 3). Yellow lines denote the survey tracks. See close-ups in Figures 11 to 13.*

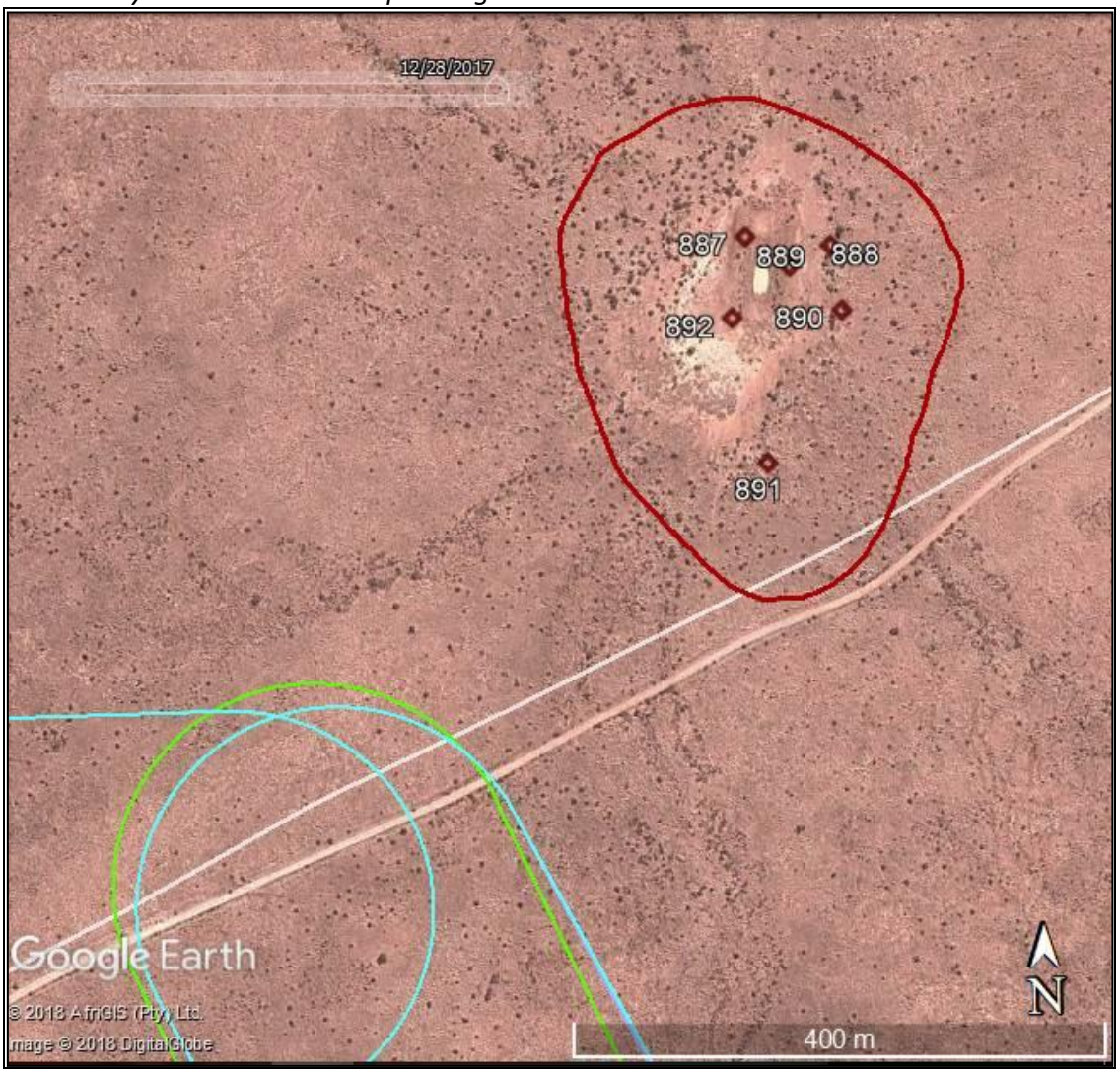


Figure 11: *Close-up aerial view of the south-western part of the study area. See Figure 10 for key.*

A variety of archaeological sites was located. These included a small cleared area on a rocky hill (Figure 5, waypoint 845) that contained both Stone Age and historical artefacts. It is likely that the site was reused in historical times after having originally been created by LSA people. Another type of site seen was quarry sites represented by small quartz outcrops from which flakes had been removed (examples were at waypoints 868, 869 and 876, all along the western part of Alternative 1). In the south-western part of the study area, along Alternative 1, a small pan had a few LSA artefact scatters around it (waypoints 870-874; Figures 15 & 16). Another pan, potentially affected by all three alternatives, lies at waypoint 836. Here there was a scatter of artefacts likely of mixed age and made from a variety of materials (Figure 17 & 18).

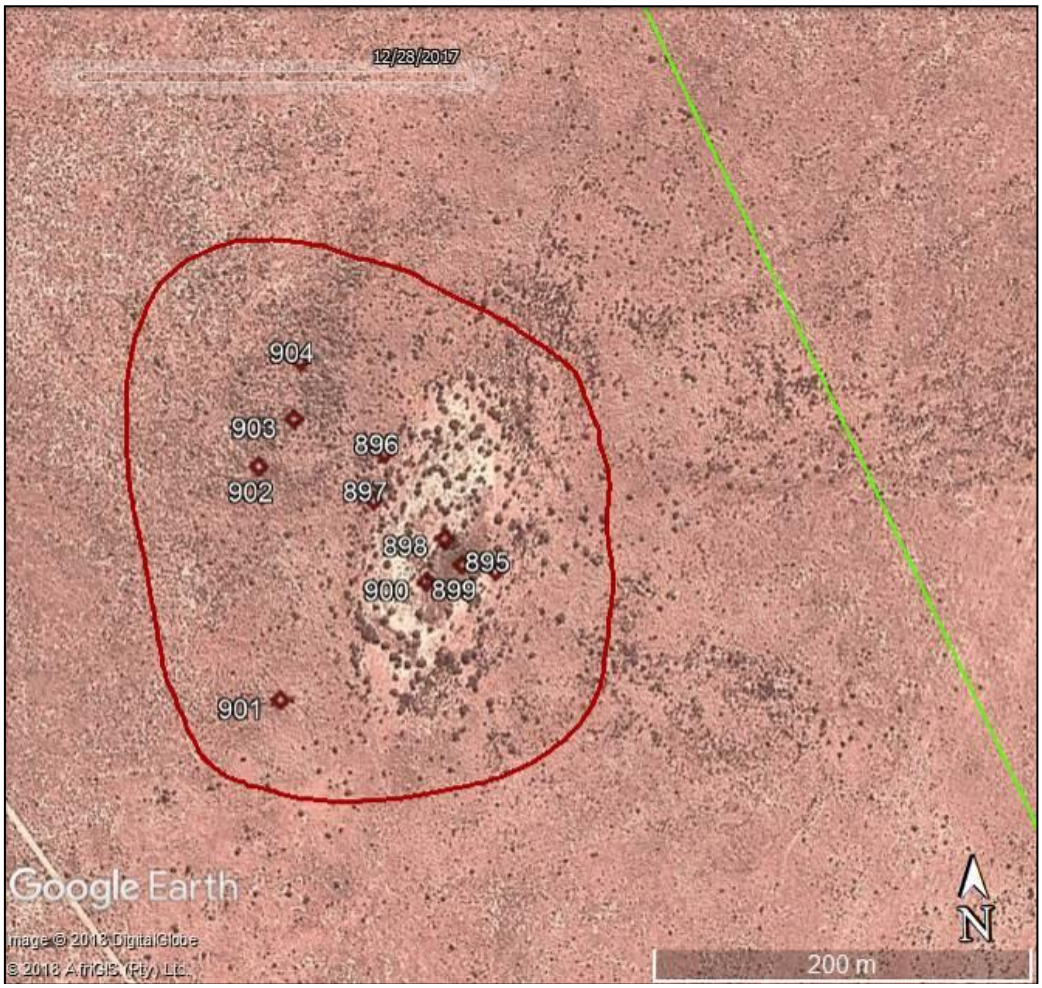


Figure 12: *Aerial view of the concentration of waypoints in the north-eastern part of the study area. The western edge of the Alt. 2 corridor is indicated by the green line.*

One significant set of LSA archaeological sites was discovered but it was located outside of all the corridors but within about 180 m of the western edge of the Alternative 2 corridor. The complex was reported as significant after the fieldwork and the proponent has revised the project layout to avoid the area. The complex is represented by waypoints 895-904 (Figure 12). It consists of an endorheic pan surrounded by artefact scatters and a low rocky hill with another site on top of it. Figure 19 shows an example of the context of the scatters around the pan and Figure 20 the surface appearance of these sites. The rocky hill alongside the pan had a small but dense artefact scatter on its crest contained within a small 'clearing' in the grass (Figures 21 & 22). Whether this area was cleared by people or naturally occurring is not known. It is possible that the site is fairly recent (last few hundred years) and that the grass cover has never recovered from the anthropogenic disturbance due to continued wind deflation of the cleared area. The potential exists for subsurface materials of greater age to be present, although none was seen at the surface.

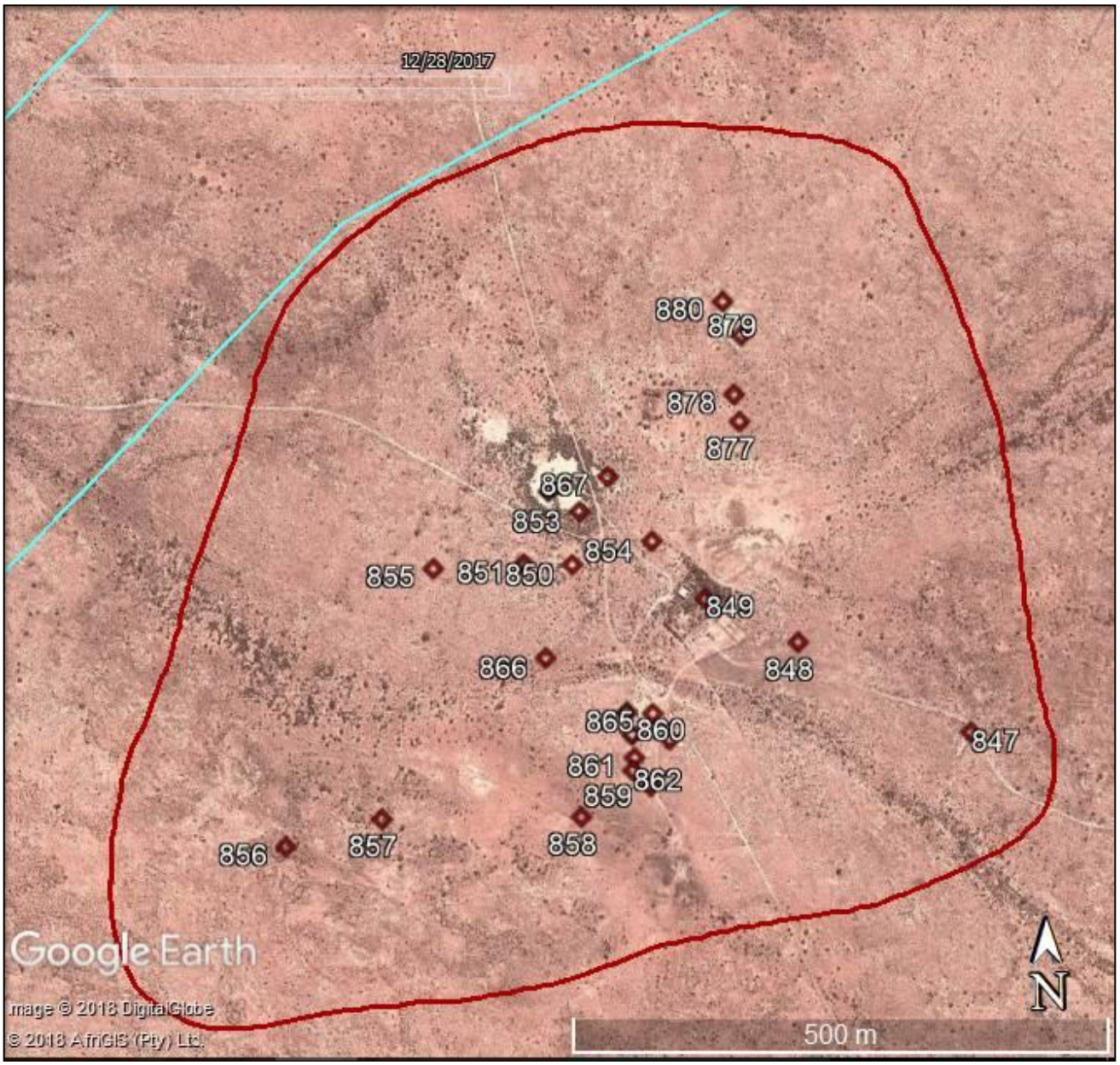


Figure 13: *Aerial view of the concentration of waypoints in the north-western part of the study area. Part of the Alt. 1 corridor is indicated by the turquoise lines.*

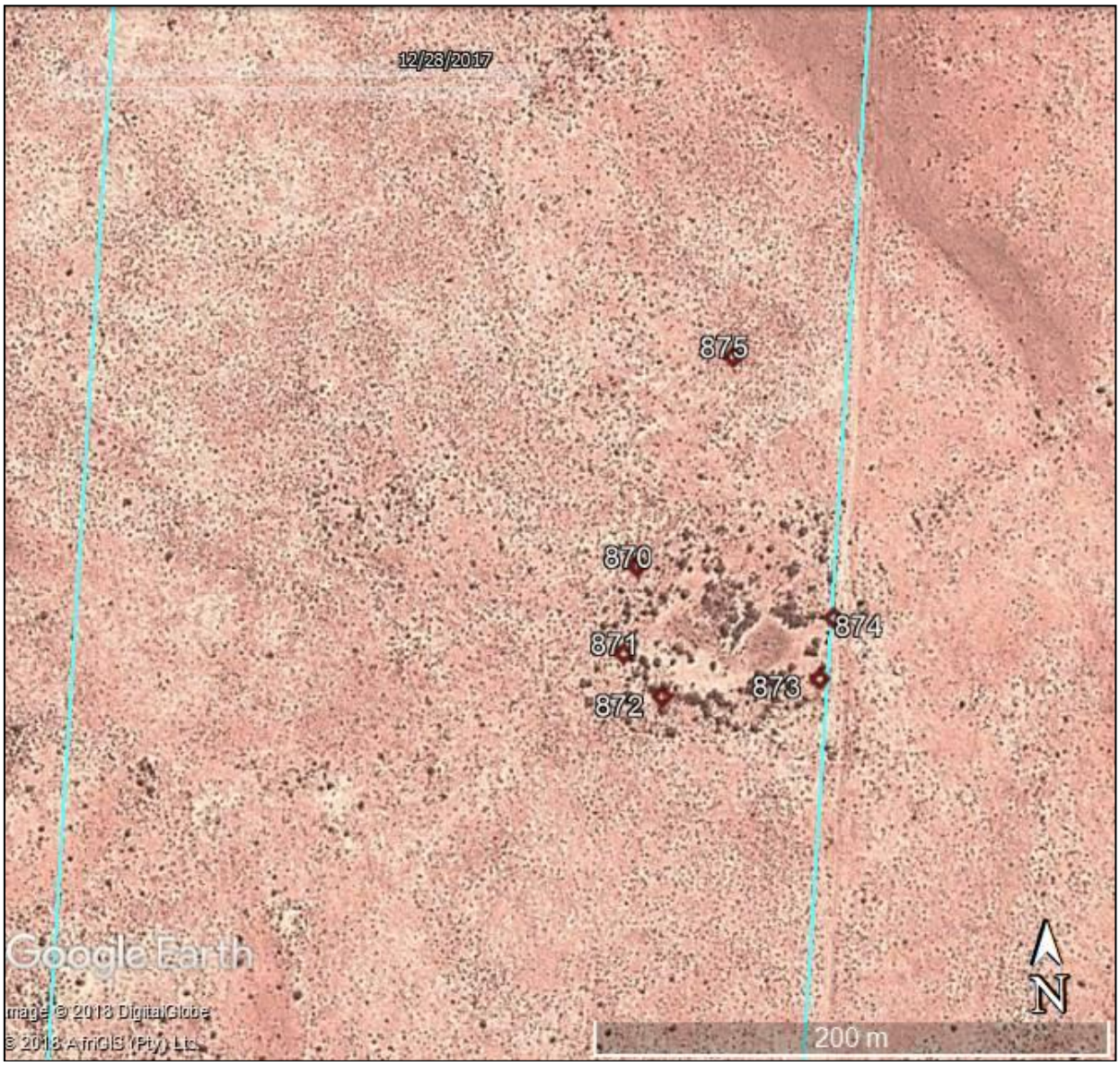


Figure 14: *Aerial view of the concentration of waypoints in the south-western part of the study area. Part of the Alt. 1 corridor is indicated by the turquoise lines.*

Figure 15: *The small pan at waypoints 870 to 874.*

Figure 16: *Surface view of the artefact and ostrich eggshell scatter at waypoint 870.*

Figure 17: *The location of the artefact scatter at waypoint 836. The pan lies to the left.*

Figure 18: *Examples of stone artefacts seen on the surface at waypoint 836. Scale in cm.*

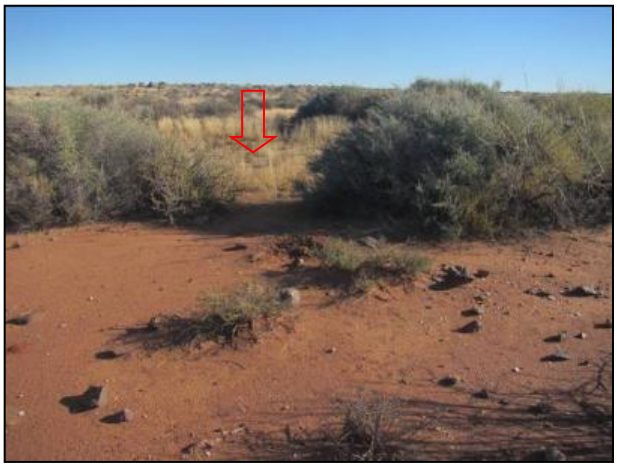


Figure 19: *View of the context of the artefact scatter at waypoint 895. The pan is arrowed.*

Figure 20: *View of the artefact and manuport scatter at waypoint 895.*

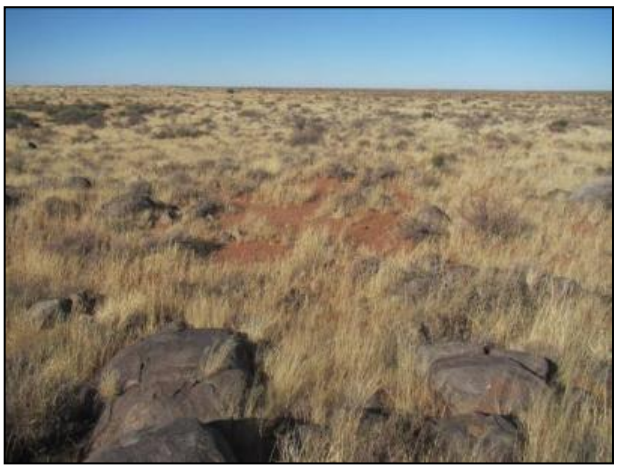


Figure 21: *View across the site at waypoint 902 on the crest of the rocky hill. The small 'clearing' housing the artefact scatter is visible in mid-picture.*

Figure 22: *Close-up view of the surface of the site at waypoint 902 showing stone artefacts.*

One very significant archaeological site was discovered but it was located just outside of the study area. It was represented by waypoints 897-892 (Figure 11). It consists of an endorheic pan that had been excavated deeper in its centre to create a better water catchment area for the livestock to drink from (Figure 23). The present owner did not know when the pan had been excavated out but 1944 aerial photography shows that it was still intact at that time. The excavation has created a long, narrow section that fills with water while the shape of the greater pan has slightly altered due to the water collecting in a different area (Figure 24). It is common to find archaeological sites associated with pans. The excavated material had been piled along the edges of the hollow with subsequent erosion have left them as gravel-coated 'berms' (Figure 25). This gravel contained many stone artefacts, now all in secondary context, but showing that all three Stone Ages were present. The vast majority of artefacts were likely from the MSA though (Figures 26 – 31).

Figure 23: *View towards the southwest across the pan. The yellow arrows show the excavated area, while the red arrows show the gravel 'berms' containing most of the artefacts.*

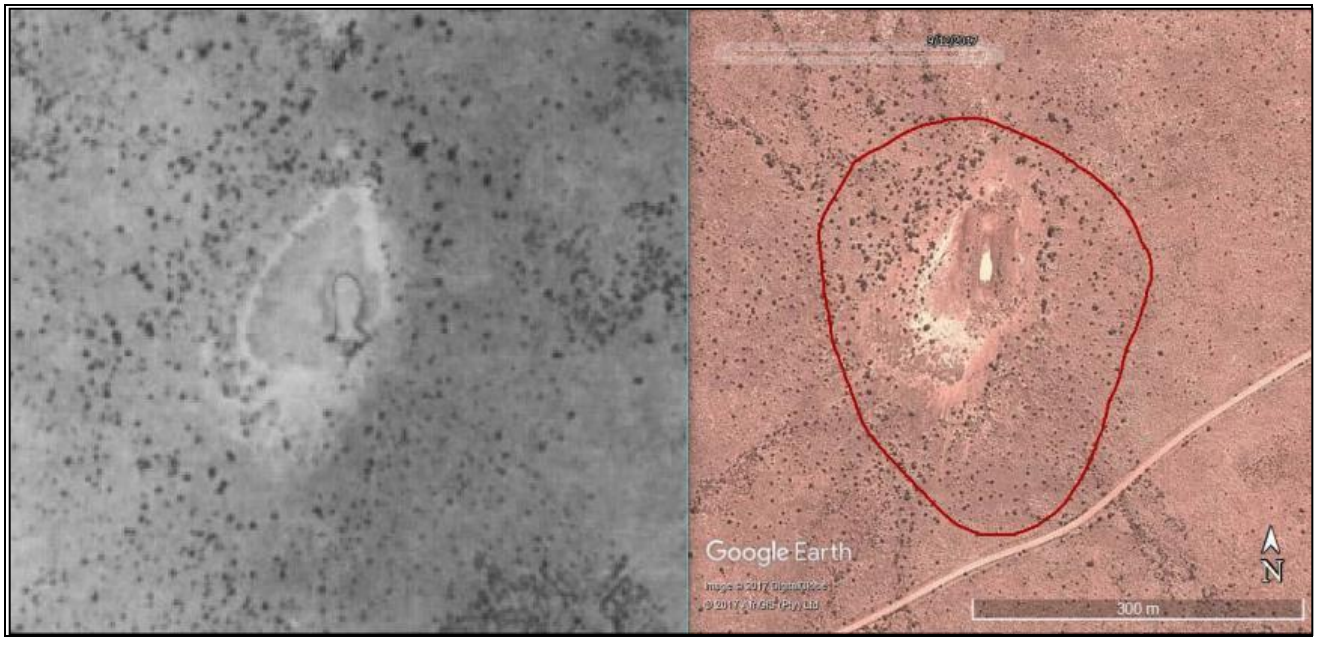


Figure 24: *1944 (Job 83, strip 001, photograph 02631) and modern (Google Earth) aerial photographs showing the pan to have had a natural appearance in 1944.*

Figure 25: *View of the gravel-coated 'berm' near waypoint 887.*

Figure 2: *Artefacts from the waypoint 887 area. Scale in cm.*

Figure 27: *Artefacts from the waypoint 887 area. Scale in cm.*

Figure 28: *Artefacts from the waypoint 887 area. Scale in cm.*

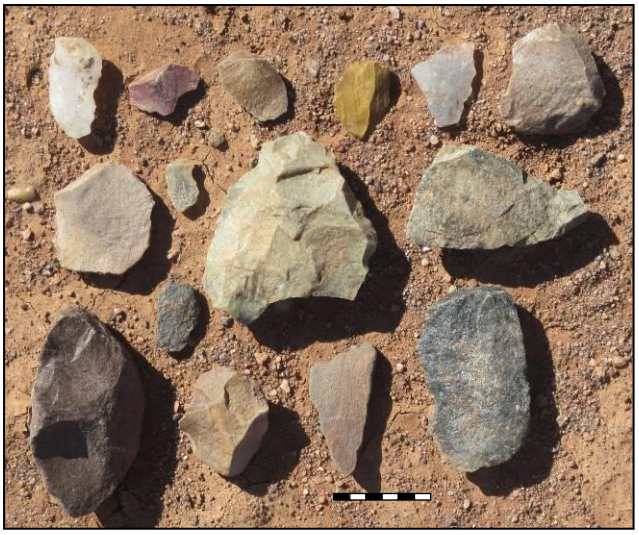


Figure 29: *Artefacts from the waypoint 887 area. Scale in cm.*

Figure 30: *The partial handaxe from the waypoint 887 area. Scale in cm.*

Figure 31: *Artefacts from the waypoint 887 area. Scale in cm.*

Another highly significant site is represented by waypoints 847 to 867 & 877 to 880 (Figure 13). It is the remains of a historic farm complex on Gemsbokbult 120/5. It was not possible to trace the name of this farm since the earliest topographic map series (Edition 1) dates to 1970 and no name was indicated (Figure 32). The most recent map also bears no name for the complex but does show it (Figure 33). None of the 1:250 000 maps show a farm complex in this location. Figure 34 shows a 1944 aerial photograph of the site. Although difficult to be certain, it appears as though no structures were still standing at that time.

The site consists of dams and kraals, a number of ruins (only foundations preserved) and some ash heaps. The latter include many thousands of artefacts of glass, ceramic and metal. The site is too extensive to provide a detailed description here but Table 1 and the set of photographs contained in Figures 35 to 45 provide some details.

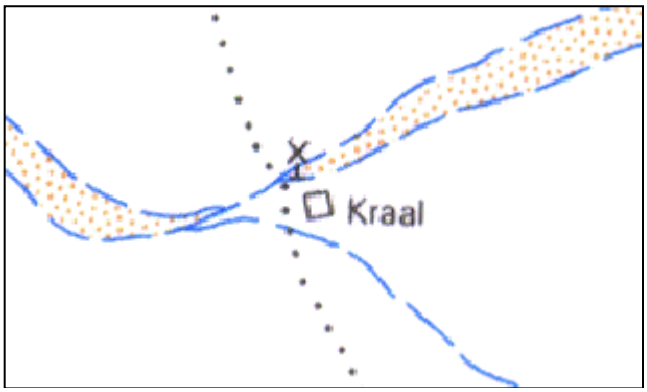


Figure 32: *Extract from the 1970 1st Edition 1:50 000 mapsheet 2921AB showing the farm complex on Gemsbokbult 120/5.*

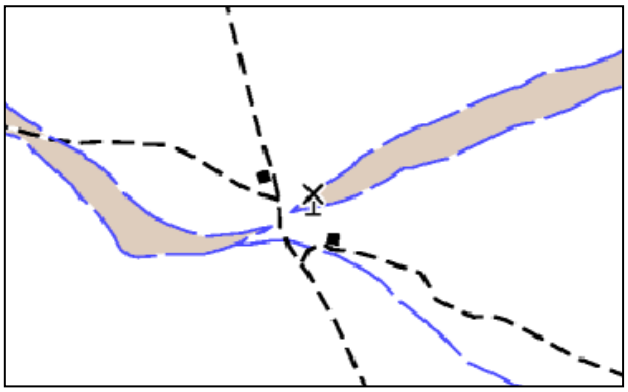


Figure 33: *Extract from the 2003 3rd Edition 1:50 000 mapsheet 2921AB showing the farm complex on Gemsbokbult 120/5.*

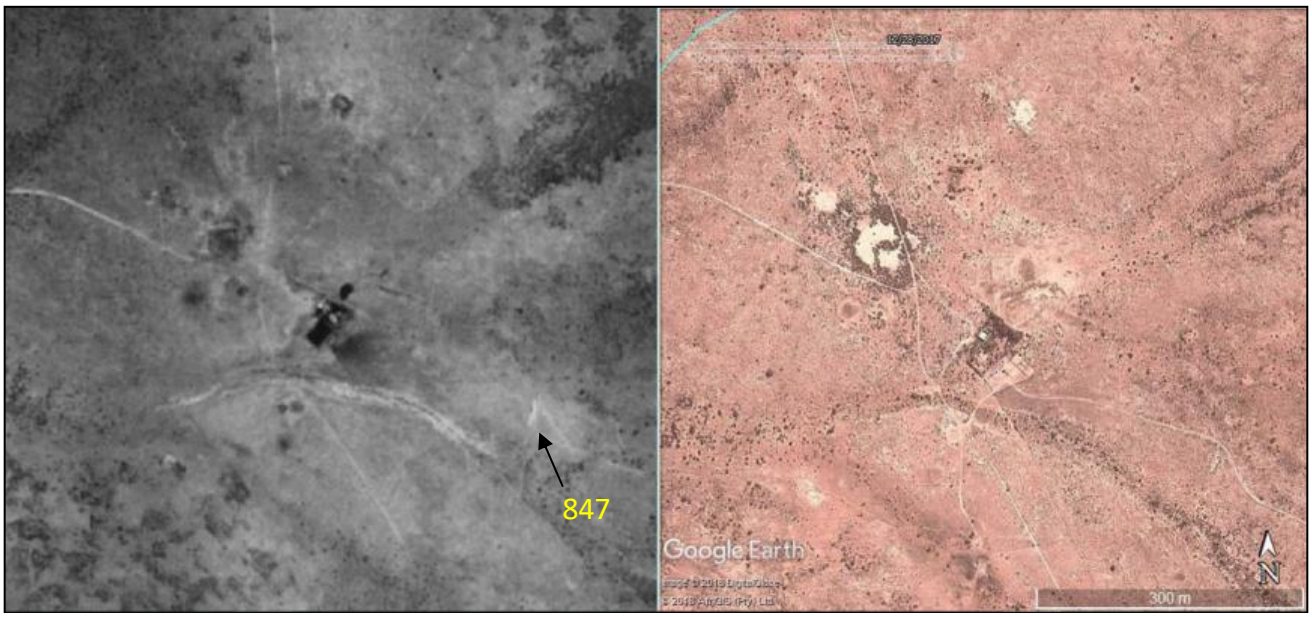


Figure 34: *Aerial views of the Gemsbokbult 120/5 farm complex from 1944 and 2013.*

Figure 35: *A calcrete wall that was likely part of a low dam (waypoint 847).*

Figure 36: *Small stone foundation (waypoint 848).*

Figure 37: *Stone reservoir with a recent cement lining, wind pump, drystone walling and two modern water tanks. The wind pump had been decommissioned (waypoint 849).*

Figure 38: *Stone foundations of one of the larger structures, presumably a farm house.*

Figure 39: *Ash heap containing many historical artefacts (waypoint 851).*

Figure 40: *Selection of ceramics from the ash midden at waypoint 851.*

Figure 41: *Selection of glass artefacts from the ash midden at waypoint 851.*

Figure 42: *Selection of metal artefacts from the ash midden at waypoint 851.*

Figure 43: *Ceramics from the ash dump at waypoint 878.*

Figure 44: *Ceramics from the ash dump at waypoint 878.*

Figure 45: *A lower grindstone from waypoint 880 that may be Stone Age or historical. It is about 34 cm long.*

6.2. Palaeontology

The SAHRIS Palaeosensitivity Map (Figure 46) shows the study area to be largely of moderate sensitivity, but with a large strip of zero sensitivity running from northwest to southeast through the general study area. Despite the moderate sensitivity, the nature of the area in terms of palaeontology is such that a full palaeontological study was not deemed necessary by the appointed specialist. Nevertheless, because SAHRA had requested an evaluation of the palaeontological impacts, a desktop study was compiled for the greater project and is briefly summarised here.

Figure 46: *Extract from the SAHRIS Palaeosensitivity map showing the study area to be of generally moderate (green shading) and zero palaeontological sensitivity (grey shading). Alternative 1 is in turquoise, Alternative 2 in green and Alternative 3 in purple.*

The broader area is underlain by metamorphic rocks that are entirely unfossiliferous. The overlying Late Cenozoic superficial sediments are generally of low palaeontological sensitivity, although small, isolated pockets of high sensitivity can be found when fossils are trapped within alluvium related to pans and river terraces along larger water courses (Almond 2017).

Almond (2017) has listed the possible fossils that might be found in the area, although he notes that none have been found there to date. Isolated bones and teeth (e.g. of mammals, fish, amphibians), ostrich eggshell fragments, freshwater molluscs, crabs, trace fossils (e.g. burrows), petrified wood, stromatolites, diatoms and pollen are all possible finds but deemed highly unlikely.

6.3. Graves

No graves were found within the study area, although this does not rule out the possibility that graves could occur due to the great difficulty in spotting them, or at least the stone 'features' thought to be graves.

6.4. Built environment

No built environment features were found within the study area. No structures were visible from the study area with the nearest house being 1.2 km to the southeast of part of the Alternative 3 corridor and 1.5 km from the Alternative 2 corridor. This is the landowner's residence. The structures are 20th century in age and are of low significance. Only one structure was present in 1945 (Figure 47). It was not visited during the field assessment. The farm complex would not be affected in any way, although one of the access road alternatives passes about 130 m north of the complex.

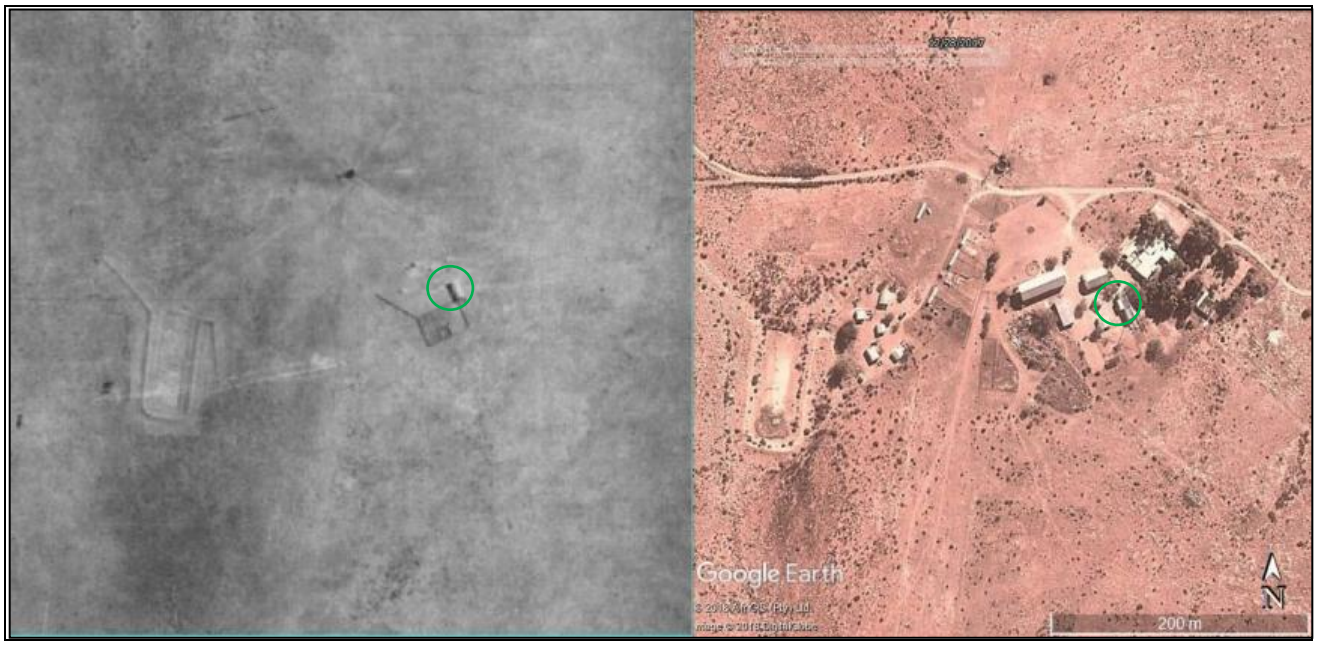


Figure 47: *Aerial views of the Skeerhok Farm Complex dating to 1945 (Job 083, strip 4, photograph 02372) and 2013 (Google Earth). The only structure present in 1945 is ringed in green in both images.*

6.5. Cultural landscape and visual concerns

The cultural and natural landscape is also of concern. However, the cultural landscape is very poorly developed in this area with fences, water troughs and wind pumps being the primary anthropogenic features. The primary sense of place is one of remoteness rather than of a farming landscape. This remoteness has already been impacted upon by the presence of the railway line, Nieuwehoop Substation and all associated power lines. The natural landscape lacks visually interesting and sensitive features. In addition, the proposed site is a long distance from any important roads (Alternative 1 comes within 13.5 km of the R27, while Alternatives 2 and 3 are closest to the R27 at the Nieuwehoop Substation which lies 17.2 km from the R27) and is highly unlikely to be visible to anyone other than local residents making use of the gravel road along the

railway line. Solar PV facilities are not very tall and, if an earthy coloured paint is used for the buildings where feasible, they can be almost invisible from as little as 1 km away.

A pan 2.2 km from the north-eastern edge of the study area was cultivated during the mid-20th century (Figure 48). This shows the low intensity, opportunistic subsistence agriculture practiced in a pan when sufficient rain had fallen. All other activities in the broader area relate to small stock grazing.

It is notable that the landscape in the vicinity of the study area already has an electrical layer comprised of a large substation and several power lines (Figure 49). It is because of the substation that the development location has been chosen.

Figure 48: *1944 (Job 83, strip 001, photograph 02633) and modern (Google Earth) aerial photographs showing the pan to have been under cultivation during the mid-20th century but excavated out to facilitate water catchment by the late 20th century.*

Figure 49: *Evening view of the large Eskom substation located some 16 km south of the proposed project.*

6.6. Summary of heritage indicators

The primary indicator of concern here is archaeological sites. Although no highly significant sites were located within any of the proposed development corridors (which was shifted to avoid sites after the fieldwork was completed), the chance still exists that such sites could occur there and be damaged or destroyed by the proposed development. The survey has ensured, however, that no large and potentially highly significant sites would be impacted. Graves could also occur, but again, the chances are small. The chances of impacting on significant palaeontological resources are considered minimal. The only other issue is visual impacts to the cultural landscape but this issue is unavoidable and of little heritage concern, especially given the other power lines and substation already in existence in the area.

6.7. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

The archaeological resources within the development footprint are deemed to have generally medium-low cultural significance for their scientific value (provisional grade: General Protection A), although it is noted that two sites of potentially very high significance (provisional grade: IIIA) lie just outside the proposed corridors.

Graves are deemed to have high cultural significance for their social value, but none have been located within any of the proposed corridors to date. Any graves present would be assigned a grading of IIIA.

The cultural landscape is of fairly low significance because it is extensive and quite monotonous. This makes it fairly well-suited to the proposed development because there are no strong cultural features to it that would be irreversibly harmed by it. Furthermore, there is an electrical layer already present with the potential for this to be expanded.

7. ISSUES, RISKS AND IMPACTS

7.1. Identification of potential impacts/risks

Based on both fieldwork and desktop research, the potential heritage-related impacts identified during the assessment are:

Construction Phase
- Potential direct impacts to archaeological resources
- Potential direct impact to palaeontological resources
- Potential direct impacts to graves
- Potential direct and visual impacts to the cultural landscape

Operational Phase
- Potential direct and visual impacts to the cultural landscape

Decommissioning Phase
- Potential direct and visual impacts to the cultural landscape

- Potential visual impacts to all visually sensitive heritage resources

Cumulative impacts
- Potential direct impacts to archaeological resources
- Potential direct impact to palaeontological resources
- Potential direct impacts to graves
- Potential direct and visual impacts to the cultural landscape

8. IMPACT ASSESSMENT

It should be noted that the potential construction phase impacts to archaeology are the same for Alternatives 2 and 3 but different for Alternative 1. All other impacts in all phases are expected to be the same for all Alternatives.

8.1. Direct Impacts

8.1.1. Construction Phase

Construction phase impacts are assessed in Table 2.

Potential impacts to archaeology

Archaeological resources are sparsely distributed on the landscape with important sites being rare – those found during the survey have been avoided. Nevertheless, direct impacts in the form of destruction of or damage to sites and materials may occur if mitigation of known sites is not carried out, if construction machinery operates outside of the demarcated areas, or if further as yet undiscovered archaeological sites are present. Because of the low likelihood of finding further significant archaeological resources in the proposed development corridors, the generally low density of sites in the wider landscape, and the generally low significance of those sites already on record in the Alternative 2 and 3 corridors, the overall impacts to archaeology for these alternatives are expected to be low before mitigation. Potential mitigation measures include conducting a final footprint survey and then excavating or sampling any important archaeological material found to occur within the footprint and that cannot be avoided. The chances of further such material being found, however, are considered to be very small. After mitigation, the overall impact significance would likely be very low. For Alternative 1, where a few more sites were located, the impact significance before mitigation is expected to be moderate. With mitigation as described above, this would also reduce to very low.

Potential impacts to palaeontology

The desktop study showed that the probability of finding and damaging or destroying significant palaeontological material during development is extremely unlikely. As such, the potential impacts to palaeontology are considered to be very low. The only measure that needs to be put in place is to ensure that the environmental control officer is alerted if any fossil material is found and that such material gets reported to SAHRA. A palaeontologist may need to inspect the find or conduct further research. The impact significance after mitigation remains very low.

Potential impacts to graves

The probability of uncovering graves during construction is extremely unlikely. Despite their importance, the significance of potential impacts to graves is thus assessed to be very low. Mitigation in the event that a grave was found would include following the appropriate exhumation process that should include a public consultation process if the grave is suspected to be historical. The impact significance after mitigation remains very low.

Potential impacts to the cultural landscape

Although impacts to the cultural landscape, in the form of the addition of features not considered generally compatible with a rural landscape, would definitely occur, the very limited heritage significance of this landscape and the current existence of a large substation and power lines means that the consequence is only seen as moderate. There is little that can be done by way of mitigation aside from minimising the disturbance footprint and using visually permeable fencing where required, since tall power line pylons cannot be hidden. The potential impact significance both before and after mitigation is thus low.

8.1.2. Operation Phase

Operation phase impacts are assessed in Table 3. Because no changes to the substrate are expected during operation, impacts relate solely to the presence of the electrical infrastructure in the landscape.

Potential impacts to the cultural landscape

Although impacts would definitely occur if the electrical infrastructure is constructed, because the cultural landscape is only weakly developed and of low heritage significance, the overall impact significance is rated as being low. The only reason it is not seen as very low is because of the long duration over which the impact would occur. After construction there is nothing that can be done by way of mitigation measures to further reduce impacts so no change to the significance assessment is required.

8.1.3. Decommissioning Phase

Decommissioning phase impacts are assessed in Table 4. Because no changes to undisturbed substrate are expected during decommissioning, impacts relate solely to the removal of the electrical infrastructure from the landscape and the subsequent rehabilitation period.

Potential impacts to the cultural landscape

The visual impact of the proposed electrical infrastructure would remain static until decommissioning. At this time, however, there would be an increased visual impact due to the equipment brought onto site to dismantle the power lines and substations and the rehabilitation work which would result in much dust. These impacts would, however, be temporary. After the decommissioning is complete, the landscape would then also be scarred but allowed to recover with time. The cleared but scarred landscape would result in less impacts than the actual dismantling of the plant so the assessment in Table 4 reflects the dismantling activities. While minimising the time taken to effect the decommissioning and employing dust suppression measures are appropriate mitigation measures,

they are unlikely to result in any change in significance to the impact ratings. The impacts are deemed to be of low significance.

8.1.4. Cumulative impacts

Cumulative phase impacts are assessed in Table 5. They are effectively all the same impacts as would be experienced during the construction phase of the proposed project.

Potential impacts to archaeology

Archaeological resources are sparsely distributed on the wider landscape with important sites being rare. Nevertheless, direct impacts in the form of destruction of or damage to sites and materials may occur at any of the proposed solar energy facilities in the area or along other power line alignments, especially if construction machinery operates outside of the demarcated areas or if further as yet undiscovered archaeological sites are present. Because of the low likelihood of finding further significant archaeological resources in the relevant areas proposed for development and the generally low density of sites in the wider landscape the overall impacts to archaeology are expected to be of generally low significance before mitigation. Potential mitigation measures include conducting final corridor surveys and then excavating or sampling any important archaeological material found to occur within the final alignments. The chances of further such material being found, however, are considered to be small, even across multiple development areas. After mitigation, the overall impact significance would likely be very low. It is considered unlikely that the cumulative impacts to archaeological resources would differ if six or fourteen solar energy facilities and their supporting electrical infrastructure were constructed in the area.

Potential impacts to palaeontology

The desktop study showed that the probability of finding and damaging or destroying significant palaeontological material during the construction of renewable energy facilities and their associated electrical infrastructure in this area is extremely unlikely. Areas in and along water courses tend to be of slightly higher sensitivity but such areas are routinely avoided anyway during the formulation of development proposals. As such, the potential impacts to palaeontology are considered to be very low. The only measure that generally needs to be put in place is to ensure that the environmental control officer is alerted if any fossil material is found and that such material gets reported to SAHRA. A palaeontologist may need to inspect the find or conduct further research. The impact significance after mitigation remains very low. It is considered unlikely that the cumulative impacts to palaeontological resources would differ if six or fourteen solar energy facilities and their supporting electrical infrastructure were constructed in the area.

Potential impacts to graves

The probability of uncovering graves during construction anywhere in the surrounding landscape is extremely unlikely. Despite their importance, the significance of potential impacts to graves is thus assessed to be very low. Mitigation in the event that a grave was found would include following the appropriate exhumation process that should include a public consultation process if the grave is suspected to be historical. The impact significance after mitigation remains very low. It is considered unlikely that the cumulative impacts to archaeological resources would differ much if six or fourteen solar energy facilities and their supporting electrical infrastructure were constructed in the area. Given

the difficulty in identifying graves, there is a small chance that a slightly greater impact could be experienced if fourteen facilities and their supporting electrical infrastructure are built.

Potential impacts to the cultural landscape

Although impacts to the cultural landscape, in the form of the addition of features not considered generally compatible with a rural landscape, would definitely occur, the very limited heritage significance of this landscape means that the consequence is only seen as moderate. There is no way of reducing impacts, aside from minimising the disturbance footprint, since such large structures cannot be hidden. The impacts are thus considered to be of low significance both before and after mitigation. It is considered unlikely that the cumulative impacts to the cultural landscape would differ much if six or fifteen solar energy facilities and their supporting electrical infrastructure were constructed in the area. This is mainly due to the quite isolated location of the Nieuwehoop Substation and the various projects proposed around it. Also, once the visual qualities of the area have been compromised through the installation of several power lines, it is better to construct more in the same, already visually cluttered area rather than placing them in pristine environments.

8.2. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many vantage points is undesirable. Because of the height of the pylon structures proposed here, it is likely that they would visually dominate the landscape, at least from close range. However, the subject landscape has already been compromised and it is deemed more acceptable to further change this landscape through adding new power lines than to change another pristine landscape elsewhere.

Table 2: Impact assessment summary table – Construction Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Clearing of site and excavation of foundations and construction of the facility	**ALT. 2 & 3 Loss of / damage to archaeological sites**	Negative	Site	Permanent	Severe	Very unlikely	Non-reversible	High	Final footprint survey, excavation if needed	Low	Very low	5	High
	Alt. 1 only Loss of / damage to archaeological sites	Negative	Site	Permanent	Substantial	Unlikely	Non-reversible	High	Final footprint survey, excavation if needed	Moderate	Very low	5	High
	Alt. 1-3 **Loss of / damage to palaeontological materials**	Negative	Site	Permanent	Severe	Extremely unlikely	Non-reversible	High	Chance finds procedure	Very low	Very low	5	High
	Alt. 1-3 **Loss of / damage to graves**	Negative	Site	Permanent	Extreme	Extremely unlikely	Non-reversible	High	Exhumation process	Very low	Very low	5	Medium
	Alt. 1-3 **Impacts to the cultural landscape**	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Use visually permeable fencing; Minimise disturbance footprint.	Low	Low	4	High

Table 3: Impact assessment summary table – Operation Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of the solar energy facility on the landscape and occasional access by maintenance vehicles	Alt. 1-3 **Impacts to the cultural landscape**	Negative	Local	Long term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	None	Low	Low	4	High

Table 4: Impact assessment summary table – Decommissioning Phase direct impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of the solar energy facility on the landscape, frequent access by construction vehicles, creation of dust and landscape scarring	Alt. 1-3 **Impacts to the cultural landscape**	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Minimise work time, Use dust suppression measures	Low	Low	4	High

Table 5: Impact assessment summary table – Cumulative impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Clearing of sites, excavation of foundations and construction of the facilities	Alt. 1-3 **Loss of / damage to archaeological sites**	Negative	Site	Permanent	Severe	Very unlikely	Non-reversible	High	Final footprint survey, excavation if needed	Low	Very low	5	High
	Alt. 1-3 **Loss of / damage to palaeontological materials**	Negative	Site	Permanent	Severe	Extremely unlikely	Non-reversible	High	Chance finds procedure	Very low	Very low	5	High
	Alt. 1-3 **Loss of / damage to graves**	Negative	Site	Permanent	Extreme	Extremely unlikely	Non-reversible	High	Exhumation process	Very low	Very low	5	Medium
	Alt. 1-3 **Impacts to the cultural landscape**	Negative	Local	Short term	Moderate	Very likely	High (rehabilitation after decommissioning)	High	Use visually permeable fencing; Minimise disturbance footprint.	Low	Low	4	High

9. LEGISLATIVE AND PERMIT REQUIREMENTS

Once Environmental Authorisation has been granted there are no further legal requirements that the developer has to meet so long as all conditions stipulated by the heritage authority have been complied with. If there is any archaeological mitigation work to be carried out then the appointed archaeologist would need to apply for and be granted a permit to allow them to carry out the work. This permit would be issued in the name of the archaeologist and it remains their responsibility to ensure that they have met the requirements that may be imposed on them as conditions on the permit. The permit application process allows the heritage authorities to ensure that a suitably qualified and experienced archaeologist undertakes the work and that the proposed excavation/sampling methodology is acceptable. The final comment issued by the heritage authority in response to the permit report would, however, still be needed by the developer to prove compliance with the heritage-related authorisation conditions.

In the event of any archaeological or palaeontological material or graves being exposed during construction it may be necessary for a specialist to apply for a permit as described above in order to effect rescue of the relevant material.

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The EMPr should include all mitigation and management actions suggested in this report as well as make provision for further actions that may become necessary after a final 'walkdown' survey of the various project component footprints. Monitoring would entail the ECO ensuring that any protected sites remain undisturbed throughout the duration of the construction period.

10.1. Mitigation requirements

At this point there are a few archaeological sites that fall within the proposed corridors and that would need to be excavated if they are not avoided (Figure 50). Because they are largely around pans, it is expected that they will be avoided. Because it was not practical to conduct a comprehensive survey of the entirety of all three alternative corridors, it is suggested that a pre-construction walk down survey be carried out along he final chosen alignment. The ECO will need to ensure that this survey is commissioned at least 6 months in advance of construction in order to allow for a mitigation process to be carried out in the unlikely event that this becomes necessary.

10.2. Monitoring requirements

The significant sites identified as requiring *in situ* conservation are all located at a reasonable distance from the proposed corridors. This is largely because the developer altered the alignments specifically to avoid two of them once their locations were known. A third site is located at least 250 m to the northeast of the corridors (Figure 50). The ECO should be aware of where these sites are and ensure that the areas remain out of bounds to construction crews. They are all sufficiently far enough away from the proposed corridors that they do not need to be cordoned off. Furthermore, whenever the ECO is on site they should be aware of any potential heritage material that may still be undiscovered. Graves are the main potential issue here. Any such material found would require immediate *in situ* preservation and reporting to SAHRA.

Although the chances of locating palaeontological material are extremely small, the ECO should make staff aware of this possibility and ensure that a reporting procedure is followed. The 'Chance Fossil Finds Procedure' include in the palaeontological specialist study (see Appendix 2) should be followed.

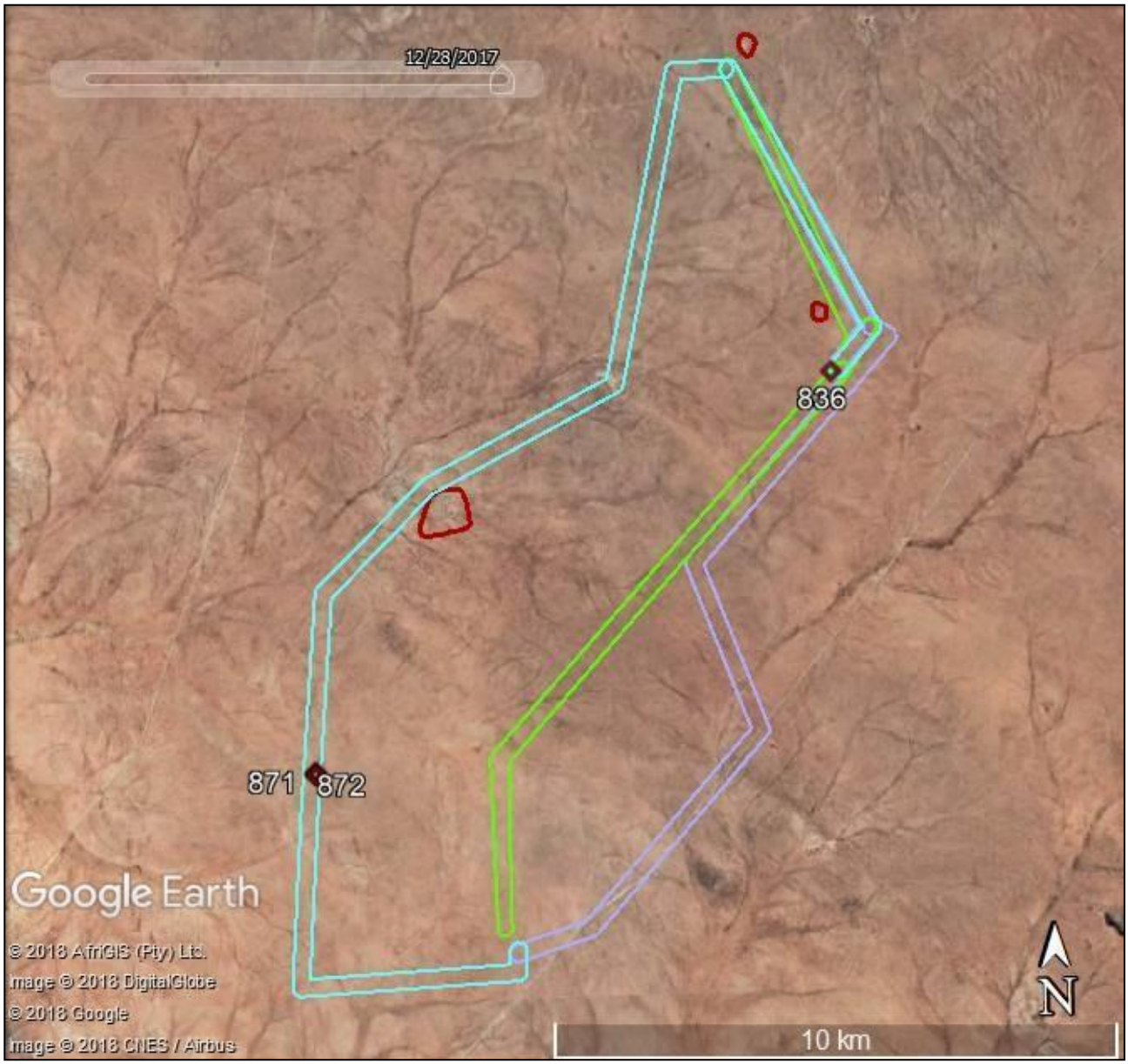


Figure 50: *Aerial view of the proposed development footprint (coloured outlines) showing the three important heritage sites located in close proximity (maroon outlines). These are sites GBB2017/016 (western outline), SHK2017/003 (northern outline) and SHK2017/005-009 (all within eastern outline). Also shown are the sites that would require mitigation if they were to be impacted (numbered symbols). These are GBB2017/005 (at waypoint 836) and GBB2017/010-012 (at waypoints 870-872, the former not displayed because of its close proximity to the others).*

11. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

The provision of electricity is important to South Africa in terms of both growing the economy to provide jobs and providing electricity to households. Because no highly significant heritage resources would be impacted by the proposed development it is considered that the social and economic benefits outweigh any minor impacts to heritage.

12. CONSULTATION WITH HERITAGE CONSERVATION BODIES

No formal consultation was carried out as part of this HIA because the report would be part of the legislated public participation process (PPP) that will be carried out as part of the BAR (see section 3.6 above).

13. CONCLUSIONS

Although a number of significant heritage resources have been identified in the vicinity of the proposed electrical infrastructure development, the most important ones have been avoided by all proposed development corridors and will be conserved *in situ*. A few smaller sites will probably be avoidable by the final chosen alignment but otherwise may need mitigation work. So long as a final walk down survey is carried out there are no reasons to prevent development proceeding in any of the proposed corridors. Because Alternative 1 has more sites associated with it and is generally longer, Alternatives 2 and 3 are seen as more favourable from a heritage point of view.

14. RECOMMENDATIONS

Because the impacts to heritage resources will be either avoidable or easily managed, it is recommended that planning and construction of the proposed electrical infrastructure should be authorised for any of the three proposed alternatives but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- Fencing, where required, is to be visually permeable;
- The use of white paint on structures should be minimised with earthy tones favoured;
- A final archaeological walk down survey of the final chosen alignment must be carried out at least six months in advance of construction;
- Staff must be made aware of the small possibility of locating buried fossils and should this occur they must be left in place and immediately reported to the ECO and/or the heritage authorities; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to

be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

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Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science) 1997	
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:

- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 archaeological test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 – Palaeontological study

PALAEONTOLOGICAL HERITAGE DESKTOP INPUT:

Kenhardt PV Solar Energy Facility, Farms Gemsbok Bult 120 and 120/9 near Kenhardt, Northern Cape and associated powerline to the existing Nieuwehoop Substation

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1. GEOLOGICAL CONTEXT

The study area for the proposed Kenhardt PV Solar Energy Facility on Gemsbok Bult Farm 120 and Farm 120/9, located some 40 km northeast of Kenhardt, is situated at an elevation of *c*. 1000 m amsl. in semi-arid, flat-lying terrain of the Bushmanland region of the Northern Cape (Northern Cape Pan Veld geomorphic region of Partridge *et al.* 2010). The region is drained by a dendritic network of shallow, southwesterly-flowing tributary streams of the Hartbeesrivier such as the Rugseersrivier and other unnamed drainage lines. The geology of the study area is shown on adjoining 1: 250 000 geology sheets 2920 Kenhardt and 2820 Upington (Council for Geoscience, Pretoria) (Figure 1). The entire area is underlain at depth by a variety of Precambrian basement rocks that are *c*. 2 billion years old and are assigned to the **Namaqua-Natal Province**. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the **Keimoes Suite** (granitoids) *plus* high grade metasediments of the **Jacobmynspan Group** (*e.g.* gneisses of the **Sandnoute Formation**) – are listed in the legend to Figure 1. The various basement rock units are described in the Kenhardt and Upington 1: 250 000 sheet explanations by Slabbert *et al.* (1999) and Moen (2007) respectively and are placed in the context of the Namaqua-Natal Province by Cornell *et al.* (2006). They generally crop out as scattered, low surface exposures rather than elevated *koppies*. The Precambrian crustal rocks are transected by the NW-SE trending Boven Rugzeer Shear Zone which trends NW-SE to the southwest of the core solar development study area and will be transected by the associated powerline connection to Nieuwehoop Substation (Figure 2). The shear zone is a band of large-scale tectonic deformation which separates two major crustal blocks in Bushmanland known as the Kakamas Terrane and Areachap Terrane (Cornell *et al.* 2006, their fig. 18).

A large proportion of the basement rock outcrop in the PV Solar Energy Facility project area is mantled by a range of superficial sediments of Late Caenozoic age, some of which are included within the **Kalahari Group**. These predominantly thin, unconsolidated deposits include small patches of calcretes (soil limestones), gravelly to sandy river alluvium, pan sediments along certain watercourses, surface gravels as well as – especially – Quaternary to Recent aeolian (wind-blown) sands of the **Gordonia Formation** (**Kalahari Group**). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw (1991), Haddon (2000) and Partridge *et al.* (2006). The thickness of the unconsolidated Kalahari sands in the Bushmanland area is variable and often uncertain. The Gordonia Formation dune sands were previously considered to range in age from the Late Pliocene/Early Pleistocene to Recent, dated in part from enclosed Middle to Late Stone Age stone artefacts (Dingle *et al*., 1983, p. 291). Following the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back

to 2.588 Ma the older Gordonia Formation sands are now dated to the Pleistocene Epoch. A number of older Kalahari formations underlie the young wind-blown surface sands in the main Kalahari depository to the north of the study area. However, at the latitude of the study area near Kenhardt (*c*. 29° S) Gordonia Formation sands less than 30 m thick are likely to be the main, or perhaps only, Kalahari sediments present (*cf* isopach map of the Kalahari Group, Figure 6 *in* Partridge *et al*., 2006). These unconsolidated sands will be locally underlain by thin subsurface gravels along the buried palaeosurface and also perhaps by calcretes of Pleistocene or younger age.

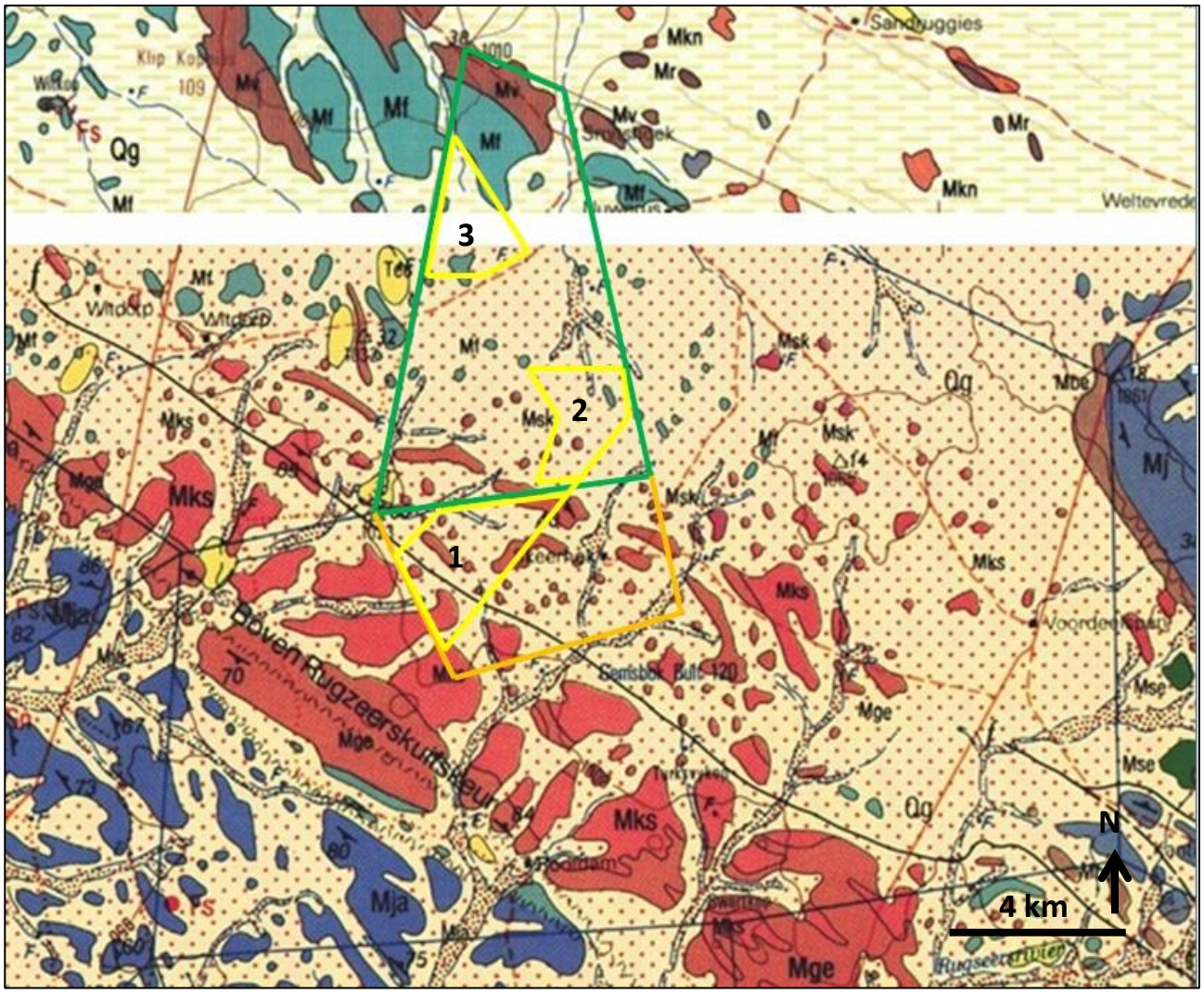

Figure 1. Extract from adjoining 1: 250 000 scale geological map sheets 2920 Kenhardt (below) and 2820 Upington (above) (Council for Geoscience, Pretoria) showing the geology of the Kenhardt PV Solar Energy Facility study area on Gemsbok Bult 120 (green polygon) and Gemsbok Bult 120/9 (orange polygon), situated *c*. 40 km to the NE of Kenhardt, Northern Cape. The three solar development areas under consideration (1, 2 and 3) are indicated by the small yellow polygons. The main geological units represented within the broader project area include:

PRECAMBRIAN BASEMENT ROCKS

KEIMOES SUITE

- **Brown (Mge) = Gemsbokbult Granite**

- **Dark brown (Mv) = Vaalputs Granite**
- **Red (Mks) = Klipkoppies Granite**
- **Red (Msk) = Skierhoek Granite**
- **Blue-grey (Mf) =Friersdale Charnockite**

JACOBMYNS PAN GROUP

- **Dark blue (Mja) = Jacobmyns Pan Group**

LATE CAENOZOIC SUPERFICIAL SEDIMENTS

- **Pale yellow with sparse red stipple or dashed ornament (Qg) = aeolian sands of the Gordonia Formation (Kalahari Group)**
- **Pale yellow with dense black stipple = alluvial and pan sediments**
- **Dark yellow (Tec) = calcrete**

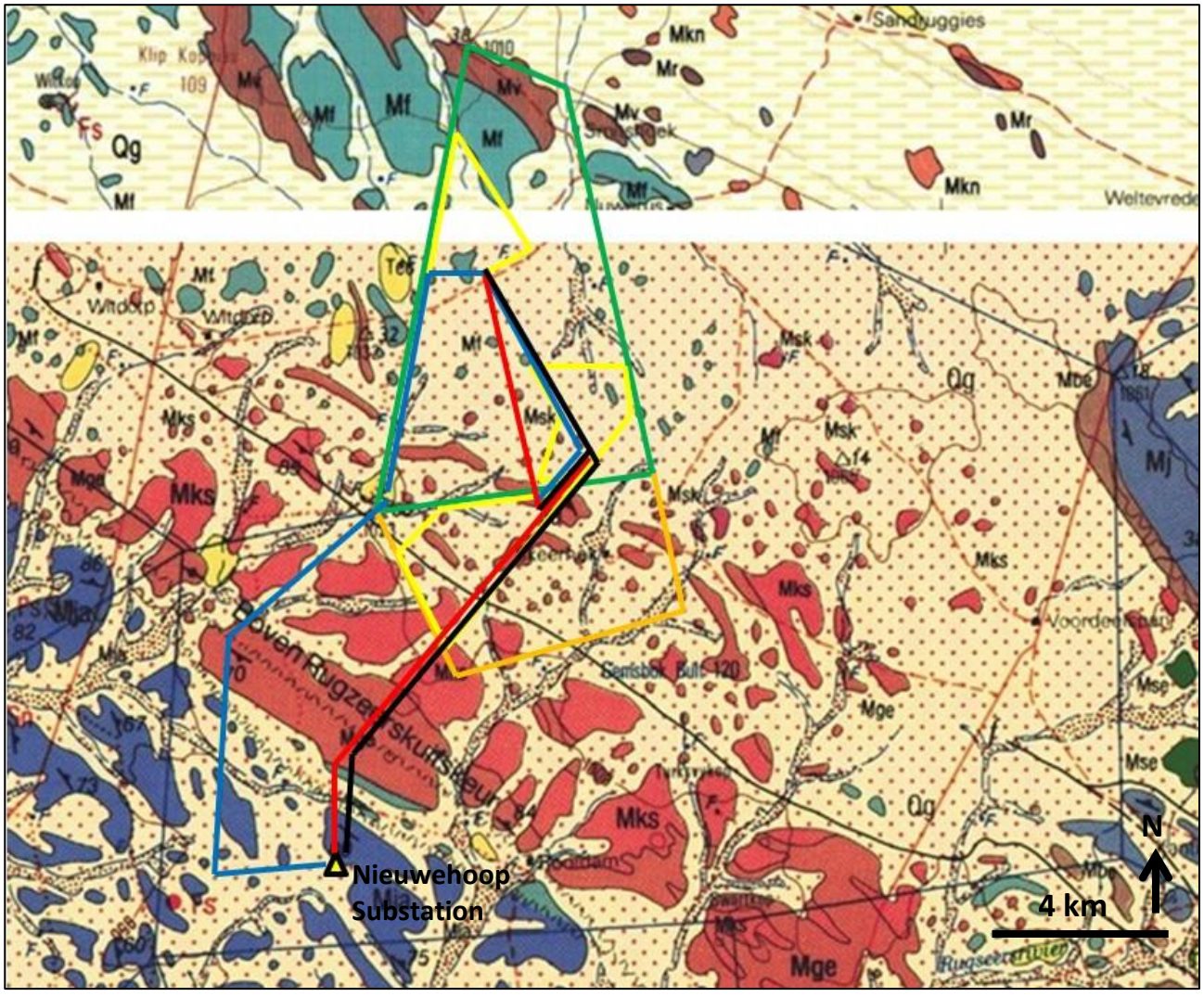

Figure 2. Extract from adjoining 1: 250 000 scale geological map sheets 2920 Kenhardt (below) and 2820 Upington (above) (Council for Geoscience, Pretoria) showing the geology of the study areas for the three power line route options (1- black; 2 – red; 3 – blue) between the Kenhardt PV solar development areas and the existing Nieuwehoop Substation. See legend to Figure 1 for a list of the relevant rock units.

2. PALAEONTOLOGICAL HERITAGE

The Precambrian basement rocks of the **Namaqua-Natal Province** represented within the study area are igneous and high grade metamorphic rocks that were last metamorphosed some 1 billion years ago and are entirely unfossiliferous.

The fossil record of the **Kalahari Group** as a whole is generally sparse and low in diversity; no fossils are recorded here in the Kenhardt and Upington geology sheet explanations by Slabbert *et al.* (1999) and Moen (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from underlying lime-rich bedrocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*), tortoise remains and shells of land snails (*e.g. Trigonephrus*) (Almond in Macey *et al.* 2011, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*), ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger (Pleistocene to Recent) fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain many, if any, substantial fossil or subfossil remains.

It is concluded that both the Precambrian bedrocks and the Late Caenozoic superficial sediments underlying the study area are generally of ZERO to LOW palaeontological sensitivity, although isolated, and largely unpredictable, pockets of high sensitivity (*e.g.* mammalian remains) may occur sporadically (Table 1). Note that, to the author's knowledge, there are no fossil records from the broader Kenhardt PV Solar Energy Facili**ty** project area itself and no palaeontological fieldwork has been undertaken here.

Table 1: Fossil heritage recorded from the major rock units that are represented within the PV Solar Energy Facility study area near Kenhardt

GEOLOGICAL UNIT	ROCK TYPES AND AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY
LATE CAENOZOIC SUPERFICIAL SEDIMENTS, **especially** **ALLUVIAL AND PAN SEDIMENTS**	**fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes (*e.g.* calcrete), colluvium (slope deposits such as scree), aeolian sands (Gordonia Formation, Kalahari Group)** **LATE TERTIARY, PLEISTOCENE TO RECENT**	**bones and teeth of wide range of mammals (*e.g.* mastodont proboscideans, rhinos, bovids, horses, micromammals), fish, reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.**	**GENERALLY LOW BUT LOCALLY HIGH** **(*e.g.* Tertiary alluvium associated with large old river courses)**
Basement granites and gneisses **NAMAQUA-NATAL PROVINCE**	**Highly-metamorphosed sediments, intrusive granites** **PRECAMBRIAN / MID-PROTEROZOIC (*c.*1- 2 billion years old)**	**None**	**ZERO**

3. CONCLUSIONS

- **Solar Development Areas**

Area 1: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Klipkoppies and Gemsbokbult Granites) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Area 2: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Skierhoek Granite, Friersdale Charnockite) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development

phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Area 3: The area is underlain at depth by unfossiliferous Precambrian basement rocks of the Namaqua-Natal Province (*e.g.* Friersdale Charnockite) as well as Late Caenozoic superficial sediments (Kalahari sands, alluvium, surface gravels) that are, at most, very sparsely fossiliferous (Fig. 1). The palaeontological sensitivity of the area is accordingly VERY LOW, as is the impact significance of the proposed small-scale PV solar development. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

- **Powerline route options**

All three powerline route options traverse broadly similar geological terrain comprising a range a Precambrian igneous and metamorphic rocks of the Namaqua-Natal Province that are extensively mantled by Late Caenozoic superficial sediments such as Kalahari sands, alluvium and surfacegravels. The palaeontological sensitivity of all the powerline route option corridors underconsideration is equally VERY LOW, as is the impact significance of the proposed small-scale powerline development. There is no preference on fossil heritage grounds for any particular route option. Pending the discovery of fossil material within the development footprint before or during the development phase (See appended Fossil Chance Finds Procedure), no further specialist palaeontological studies or mitigation are recommended for this project.

Cumulative impact significance

Several previous desktop palaeontological heritage studies submitted for alternative energy projects in the area northeast of Kenhardt have concluded that the impact significance of developments in this area is negligible to very low as far as fossil heritage is concerned (See reports by Almond under references). The potentially-fossiliferous Late Caenozoic sedimentary units represented here are generally of widespread occurrence in Bushmanland. It is concluded that the anticipated cumulative impact of the proposed new solar PV projects in the context of other alternative energy developments in the region is of LOW significance.

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QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Gauteng, KwaZulu-Natal, Mpumalanga, Northwest and Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has been a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
Natura ***Viva*** **cc**

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: Kenhardt PV Solar Energy Facility, Farms Gemsbok Bult 120 and 120/9 near Kenhardt, Northern Cape and associated powerline to the existing Nieuwehoop Substation</td></tr>
<tr><td>Province & region:</td><td colspan="2">NORTHERN CAPE, KENHARDT DISTRICT</td></tr>
<tr><td>Responsible Heritage Resources Authority</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Kalahari Group (esp. Gordonia Formation sands, alluvial and pan deposits, calcretes)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">bones and teeth of mammals, fish, reptiles, ostrich egg shells, fish, freshwater and terrestrial molluscs, crabs, trace fossils (e.g. calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.</td></tr>
<tr><td rowspan="4">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
Context – describe position of fossils within stratigraphy (rock layering), depth below surface
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
</table>

	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.