HERITAGE IMPACT ASSESSMENT:

Proposed Grid Connection Infrastructure (GCI) on Konkoonsies 91/2/rem, 91/5, 91/6 and Scuit Klip 92/1 near Pofadder, in the Khaî-Ma Local Municipality (Kenhardt Magisterial District, Northern Cape Province)

SAHRA Case No: 12583

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

Report for:

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EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by Gaea Enviro (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of the Paulputs Grid Connection Infrastructure (GCI) including two overhead 132 kV transmission powerlines that would run across the remainder of Portion 2, Portion 5 and Portion 6 of the farm Konkoonsies 91, and Portion 1 of the farm Scuit Klip 92 which are located 26 to 32 km northeast of Pofadder in the Kenhardt Magisterial District.

The study area is relatively flat, although a cluster of prominent rocky hills occurs in the far north. The surface tends to be of fine gravel and vegetation is quite sparse. Aside from the hills, rare bedrock outcrops occur but these tend to not be more than 30 cm above natural ground level. Occasional ephemeral water courses were noted in places.

A palaeontological desktop study found no significant impacts to fossils that might occur, although isolated fossils could be located if alluvial sediments were excavated during construction. Significant archaeological sites were seen in all three power corridor alternatives with one falling into each of the three alternative corridors. No graves were seen in the area and there are no structures within 700 m of any of the corridors. The cultural landscape is rather weakly developed due to the very remote location of the area and has also been compromised by the relatively recent addition of an electrical layer. The precolonial cultural landscape is strongly focused on rocky hills and is considered within the archaeological assessment.

The only significant impact to heritage identified relates to the damage to or destruction of archaeological sites. All sites may well be avoidable but, if not, they would be easy to mitigate via archaeological excavation should this be required. There are no fatal flaws for any of the three alternatives and it is concluded that development of any of the three is feasible. There is no preferred alternative from a heritage point of view. Provision should be made in the EMPr for the protection and reporting of any chance finds of fossils, archaeological materials or human burials.

Because the impacts to heritage resources would be of relatively low significance after mitigation and are easily manageable, it is recommended that the proposed power lines be authorised using any of the three alternatives proposed. However, the following recommendations that should be incorporated into the Environmental Authorisation:

- Archaeological sites KK2018/008 (Alt. 2 & 3) and KK2018/038 (Alt. 1) should be avoided if possible. If this is not possible then a professional archaeologist should be appointed to undertake mitigation prior to construction, and
- If any palaeontological or 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 appropriate professional. 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

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

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

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

CRM: Cultural Resources Management

DEA: National Department of Environmental Affairs

ECO: Environmental Control Officer

EIA: Environmental Impact Assessment

EMPr: Environmental Management Program

ESA: Early Stone Age

GPS: global positioning system

GP: General Protection

HIA: Heritage Impact Assessment

LSA: Later Stone Age

MSA: Middle 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

O&M: Operations & Maintenance

PPP: Public Participation Process

PV: Photo-Voltaic

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Gaea Enviro (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of the Paulputs Grid Connection Infrastructure (GCI) including two overhead 132 kV transmission power lines that would run across the remainder of Portion 2, Portion 5 and Portion 6 of the farm Konkoonsies 91, and Portion 1 of the farm Scuit Klip 92 which are located 26 to 32 km northeast of Pofadder in the Kenhardt Magisterial District (Figures 1 - 3). GPS co-ordinates for the end-points of the proposed power lines are as follows:

- Southwest end: S28° 55' 45" E19° 31' 35"; and
- Northeast end: S28° 52' 40" E19° 33' 55".

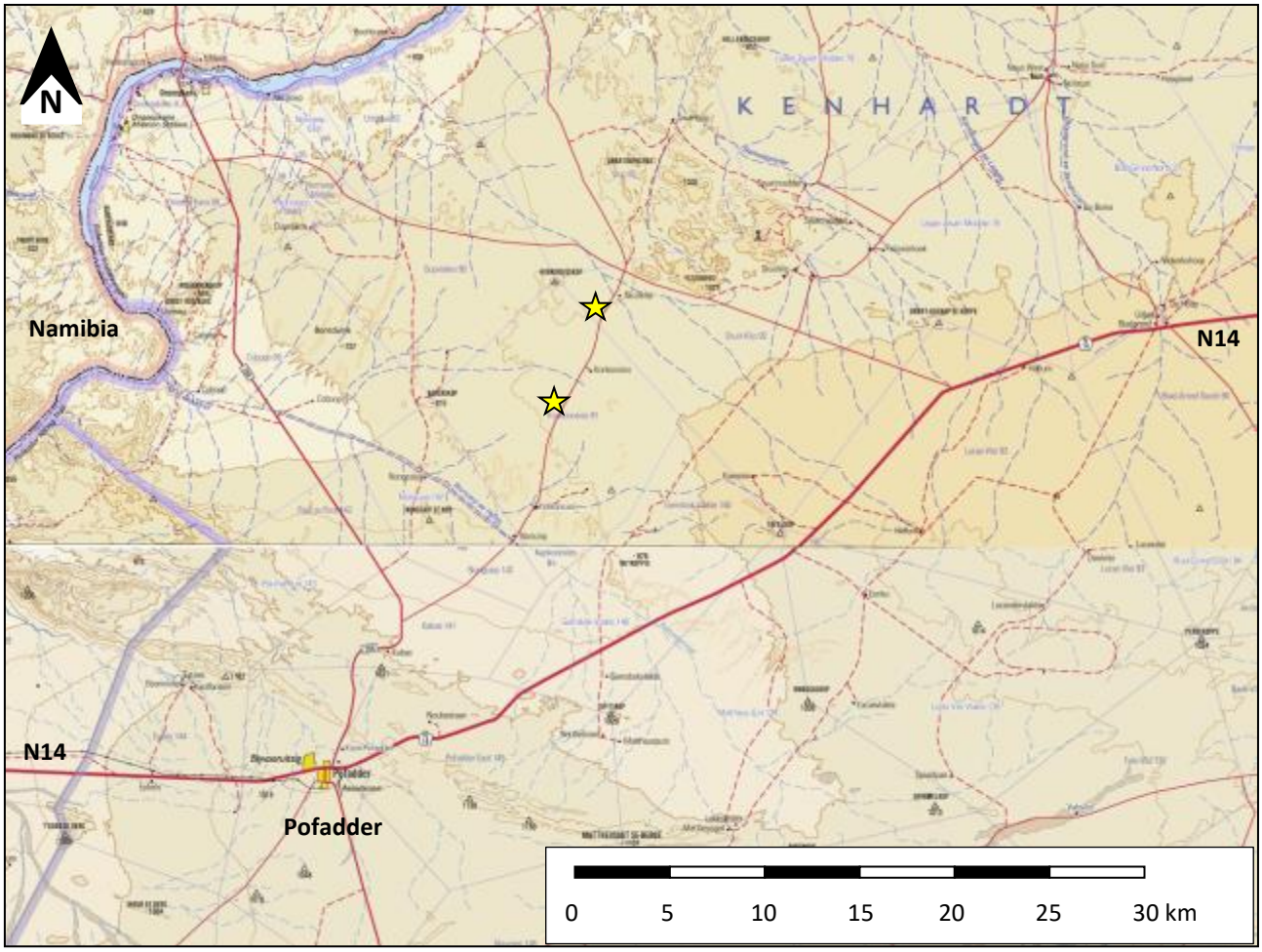


Figure 1: *Extract from 1:250 000 topographic maps 2818 & 2819 showing the location of the site. The yellow stars indicate the south-western and north-eastern ends of the proposed power line. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

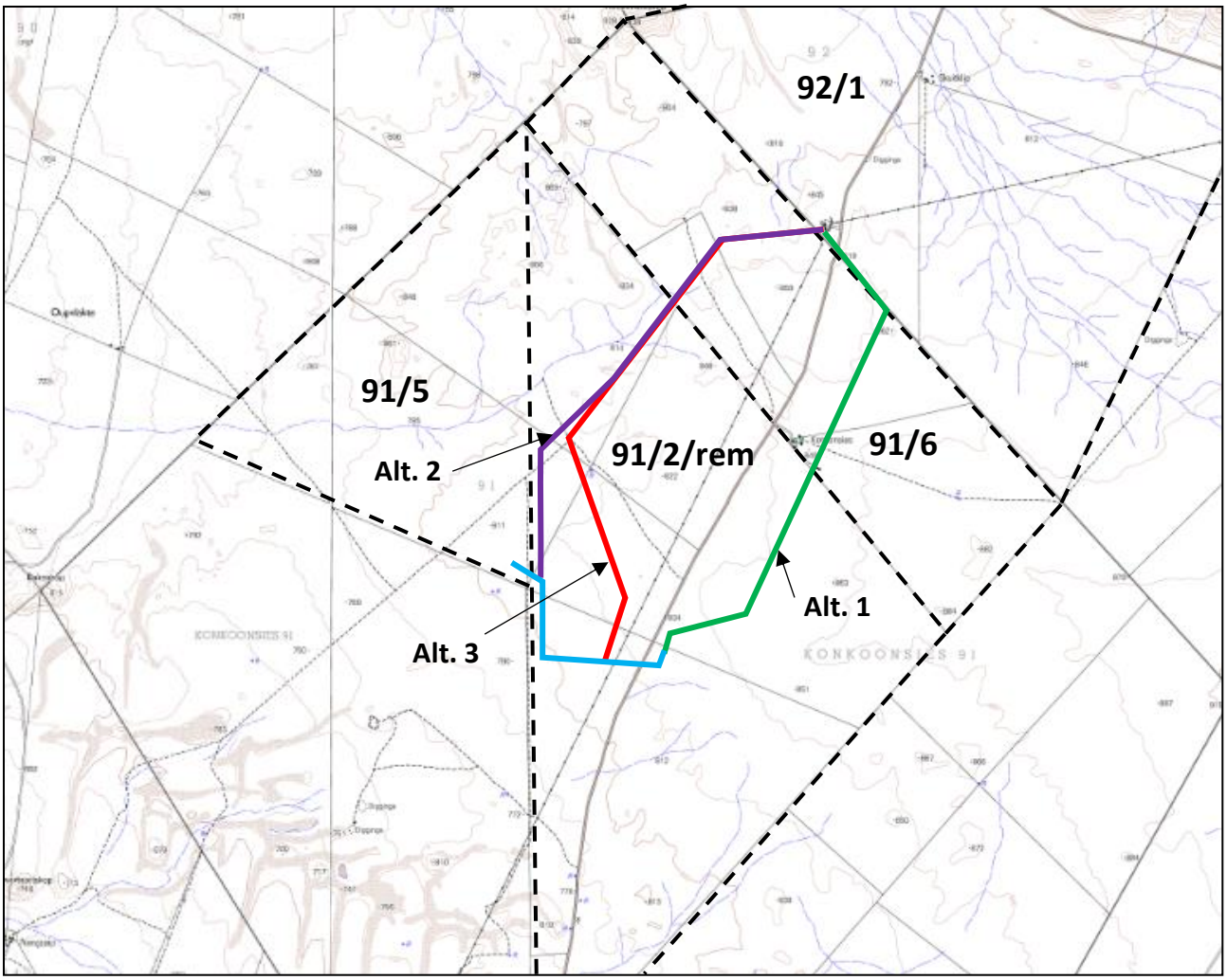


Figure 2: *Extract from a 1:50 000 topographic mapsheet 2819DC showing the farm portions (black dashed polygons) and proposed power corridor alternatives. The turquoise section is shared by all three alternatives.*

1.1. Project description

It is proposed to construct two overhead 132 kV transmission powerlines to connect the proposed Paulputs solar energy facility to the existing Eskom Paulputs Substation. The Paulputs GCI consists of two overhead 132 kV transmission powerlines, three switching substations and associated infrastructure (including jeep track, feeder bays, busbars, transformer and transformer bay at the Eskom substation). The total length of the two overhead 132 kV transmission powerlines would be approximately 10-11 km long and will cross Konkoonsies Remainder of 91/2, Konkoonsies 91/5, Konkoonsies 91/6 and Scuit-Klip 92/4. Three alternative power corridors, each with a width of 200 m, are proposed and assessed in this assessment as indicated in Figures 2 and 3.

1.1.1. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for pylon 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.

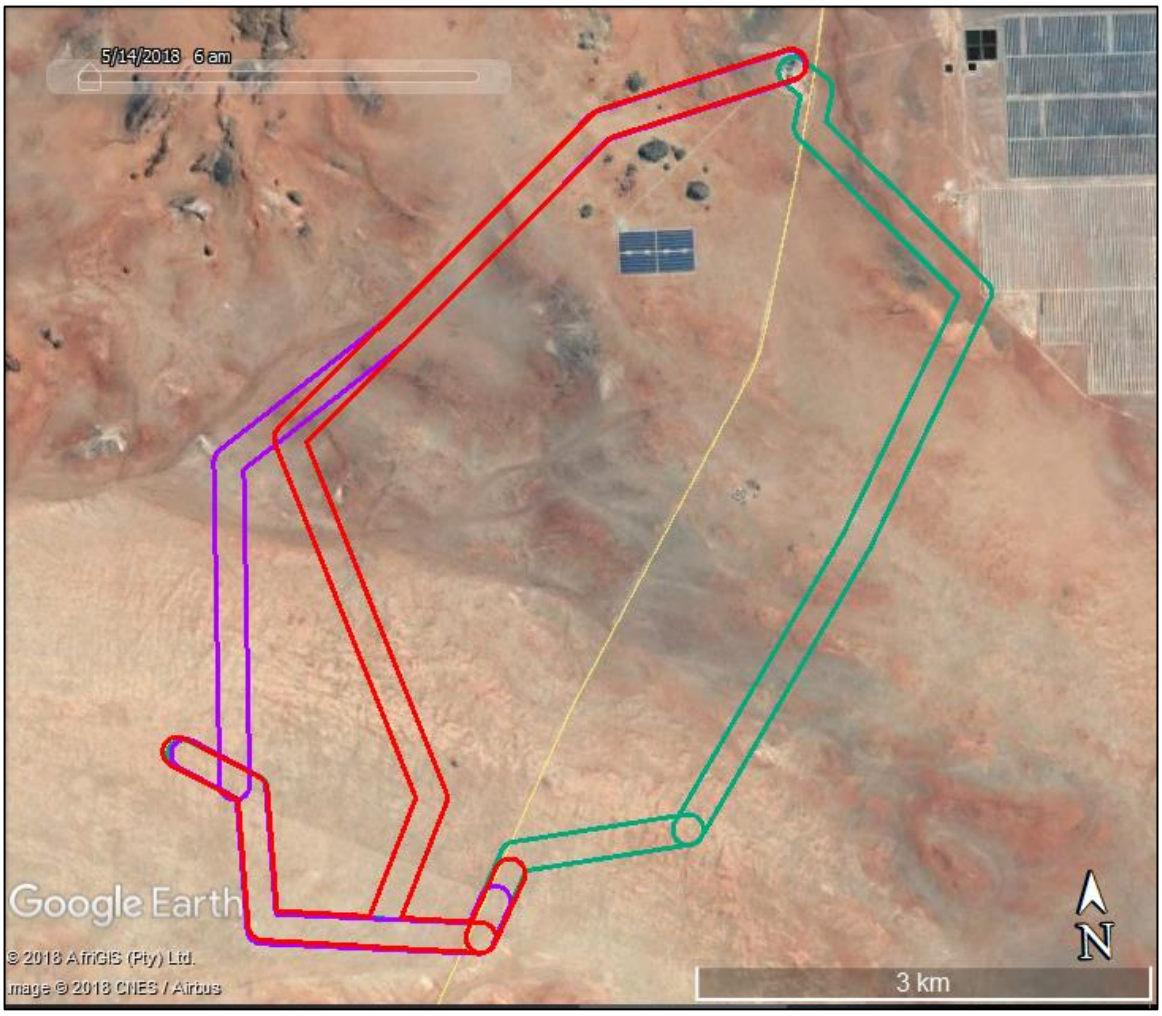


Figure 3: *Aerial view of Portions 2/rem, 5 and 6 of Konkoonsies 91 and Portion 1 of ScuitKlip 92 (black polygons) showing the proposed power corridor alternatives. Green = Alternative 1; Purple = Alternative 2; Red = Alternative 3 (note the area of overlap of all three alternatives in the south). Three existing solar energy facilities are visible to the north and northeast – a small one Farm 91/6 and two larger ones side by side on Farm 92/1.*

1.2. 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 refuse 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.

1.3. Terms of reference

ASHA Consulting was requested to compile an HIA that included assessments of archaeology, palaeontology and other relevant types of cultural heritage. The report was to be based on both desktop and field research. Three alternatives were provided for assessment.

On submission to the South African Heritage Resources Agency (SAHRA) of notification of the proposed development, they responded requesting that an impact assessment report be compiled. The report must include assessments of archaeology and palaeontology as well as any other relevant aspects of heritage.

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 as well as military remains more than 75 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. APPROACH AND METHODOLOGY

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 1:250 000 and 1:50 000 topographic maps were sourced from the Chief Directorate: National Geo-Spatial Information.

The palaeontological assessment was commissioned separately and the findings in this HIA are drawn directly from the palaeontological specialist study[1] by Almond (2018).

3.2. Field survey

The site was subjected to a survey on the 15th to the 17th May 2018. This was during early winter but in this dry part of South Africa seasonality makes little difference to the vegetation cover in terms of the visibility of heritage resources on the ground. 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 among specialist studies, the impact assessment was conducted through application of a scale supplied by Gaea Enviro.

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

[1] Note that the palaeontological desktop study covers all three solar PV projects as well as the power lines that is assessed separately. The same specialist study is thus incorporated into both HIA reports.

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[2] 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' (GP) and rated as GP A (high/medium significance, requires mitigation), GP B (medium significance, requires recording) or GP C (low significance, requires no further action).

3.5. Assumptions and limitations

The study is carried out at the surface only and hence any completely buried archaeological sites will not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface. Due to the width of the corridors provided for assessment it was not feasible to cover all the ground in detail. However, the survey aimed to locate potentially sensitive landscape features which, if found, were then examined more closely. This method generally produces good results in Bushmanland and the survey track density is thus not seen as a significant limitation. Alternatives 2 and 3 were realigned after the field survey which means that they were not surveyed as well as Alternative 1. Nevertheless, this is not regarded as a limitation due to the survey method just mentioned.

3.6. Consultation processes undertaken

The NHRA requires consultation as part of an HIA but, since the present study falls within the context of an EIA 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.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The site is in a rural context with minimal historical development. Farms are very large and lack infrastructure with houses being widely spaced. The main road through the study area is a gravel road. An existing powerline passes through the area between Alternatives 1 and 3, while another runs adjacent to Alternative 2.

In recent years, three solar energy facilities have been constructed to the northeast of the present study area. The two larger ones measure just over 300 ha each and the smaller one is about 15 ha in extent. In addition, another large facility was scheduled to start construction on 1st June 2018. This facility will be located between Alternatives 1 and 3, to the south of the existing facilities. These, the existing power lines and the Paulputs Substation located to the northeast, have resulted in a significant change to the character of the rural landscape with an electrical layer having been added to it.

4.2. Site description

The general area is relatively flat, although a series of rocky hills occurs in the far north just southwest of the Paulputs Substation. Vegetation cover tends to be very sparse, although with some rain a few weeks before the fieldwork there was a thin grass covering in places. Small bushes and rare small trees occur throughout the

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

study area but are never dense. The substrate is a coarse granitic sand with patches of fine gravel in places. There are occasional areas of quartz gravel and very rare granite/gneiss bedrock outcrops that are never more than about 30 cm above natural ground level. A few ephemeral water courses were noted in places. Figures 4 to 9 illustrate the study area.

Figure 4: *View towards the northeast towards the rocky hills at the northeastern end of the Alternative 2 and 3 alignments.*

Figure 5: *View towards the northeast across an area that is crossed by Alternative 3 and showing the generally very light vegetation cover with scattered bushes. The rocky hill in the distance lies just beyond Alternative 3 and one of the existing powerlines runs just behind it.*

Figure 6: *View towards the southwest along part of the overlapping Alternative 2 and 3 corridors showing fresh grass after recent rains.*

Figure 7: *View towards northeast along part of the overlapping Alternative 2 and 3 corridors showing fresh grass after recent rains in the vicinity of the rocky outcrops.*

Figure 8: *View towards southeast along the northern part of the Alternative 1 corridor with an existing solar energy facility visible in the left background.*

Figure 9: *View towards the southeast along the western part of the Alternative 1 corridor.*

Figure 10: *View towards the east along the southern power corridor corridor shared by all three alternatives.*

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

Several archaeological sites have been found and excavated from Konkoonsies 91/6. These were located between 2.5 and 3.2 km northeast of the present PV3 study area (Orton 2015a, 2016a). These sites were late

Holocene sites that included mostly stone artefacts, ostrich eggshell and pottery but also occasional other finds such as bone, charcoal and a historical glass bead. Most were located around granite bedrock outcrops that had depressions or fissures that held water after rain and thus attracted settlement. The outcrops also had smooth, shallow depressions on them that are interpreted as grinding patches (Orton 2016a). These patches are a particular feature of Bushmanland and are frequently found in close proximity to any water source, no matter how temporary. They are assumed to have functioned as lower grindstones for the processing of food. As other examples, Orton & Webley (2012) recorded such finds to the southwest of Pofadder, while Orton (2016b) found a large number around a water hole to the west of Aggeneys.

Two surveys by Pelser (2011, 2012) recorded a number of scatters of ostrich eggshell some 4 km northeast of the present study area, although some of these may have been quite ephemeral. He also found scatters of quartz artefacts. All were ascribed to the Later Stone Age (LSA). They occurred in open areas as well as around the foot of small rocky koppies. Morris (2012) worked slightly further to the northeast and found ostrich eggshell fragments, a small quartz outcrop quarry and a scatter of Early (ESA) and Middle Stone Age (MSA) artefacts.

Examination of the SAHRIS database shows that many small scale mining operations have been applied for and approved in the mountains to the northeast of the Paulputs Substation. For the most part, heritage studies do not appear to have been requested for these projects. However, a survey of certain areas in and around these granite mountains and the larger koppies further to the northeast yielded a variety of Stone Age sites. These included artefact scatters, sometimes with pottery, ostrich eggshell and bone and also granite bedrock outcrops with a number of grinding grooves (Orton & Webley 2013). Historical sites were also found including some stone-packed graves and a stone-built animal trap ('tierhok').

More generally, it can be noted that archaeological sites in the area tend to be more commonly encountered around the fringes of granite hills, on sand dunes or around pans (Beaumont et al. 1995). Other surveys in the region support this contention (Halkett 2010; Morris 2011).

5.2. Historical aspects and the built environment

Because it lies so far from the original Cape Colony (i.e. Cape Town), this area was colonised quite late with most farms only granted in the very late 19th or even early 20th centuries. As a result very few historical structures and features exist on the landscape. The majority of buildings date to the early-mid-20th century and tend to be of low or no heritage significance. A number of surveys in the Bushmanland area have recorded possible isolated graves represented by unusual rocks (either isolated standing rocks or unnatural clusters). These could be related to early '*trekboers*' passing through the area. because they lived a very nomadic lifestyle, their physical traces are extremely ephemeral.

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project.

6.1. Palaeontology

Almond (2018) finds that the general area is underlain by Precambrian basement rocks that are entirely unfossiliferous. These are rocks belonging to the Namaqua-Natal Province. There are late Caenozoic superficial deposits including alluvium, gravels and aeolian sands that overlie the basement rocks and are generally of low to very low palaeontological sensitivity. When they occur along water courses, the superficial deposits may contain very rare inclusions of isolated mammalian bones and teeth or freshwater molluscs. Organic-rich alluvial deposits can also contain pollens, spores and diatoms.

Figure 11: *Extract from the SAHRIS Palaeontological Sensitivity Map showing the study area to be of low to zero palaeontological sensitivity (blue and grey shading respectively) as mentioned by Almond (2018).*

Overall, Almond (2018) finds that there are no sensitive areas within the broader study area that would require further attention.

6.2. Archaeology

Examples of the kinds of archaeological sites encountered are discussed here, while a full list of finds appears in Appendix 5. They are mapped in Appendix 6.

A few quartz outcrops with evidence of quarrying for stone were seen in the study areas for all three corridors. The example at Waypoint 756 is in the southern part of the study area in the corridor section shared by all three alternatives. It is a long outcrop and, although flaked, did not have many quartz flakes scattered around it (Figure 12). The outcrop at Waypoint 760 lies Alternatives 2 and 3 (Figure 13).

Two archaeological sites already excavated by Orton (2016a) in mitigation of a solar energy facility were relocated in the eastern part of the Alternative 1 corridor. These are KK2015/012 and KK2015/016. Both were LSA sites located alongside bedrock outcrops, one of which (KK2015/012) also had a waterhole present. Both had ground patches on the bedrock. The finds from these sites included many stone artefacts, pottery (including lugs at both sites), ostrich eggshell fragments (including one flask mouth fragment at KK2015/012), ostrich eggshell beads (at KK2015/012), a glass bead (on KK2015/012) and an unusual backed artefact made on green bottle glass (on KK2015/012). The glass items date to the colonial era and very likely in this area that would have meant after about 1700. The bead is a German annular bead manufactured after about 1880 (Francis 1988) which shows very recent precolonial occupation of the area. These excavated sites would not require further work. Close to these two sites was a fairly extensive scatter of quartz artefacts that should be sampled if it will be impacted (Waypoint 805). This was not recorded during the previous work in the area.

Figure 12: *Quarried quartz outcrop at Waypoint 756.*

Figure 13: *Quarried quartz outcrop at Waypoint 760.*

A rocky hill just east of the southern part of Alternative 3 had two archaeological sites associated with it. One was a small stone structure built during the colonial era, likely by a shepherd (Waypoint 758; Figures 14 & 15). The only associated materials were a sheet of corrugated iron and a small white glass cosmetic jar. The second site was a light scatter of quartz artefacts located on the summit of the hill at Waypoint 759.

Figure 14: *View of the small stone structure on the northern side of the rocky hill at Waypoint 758.*

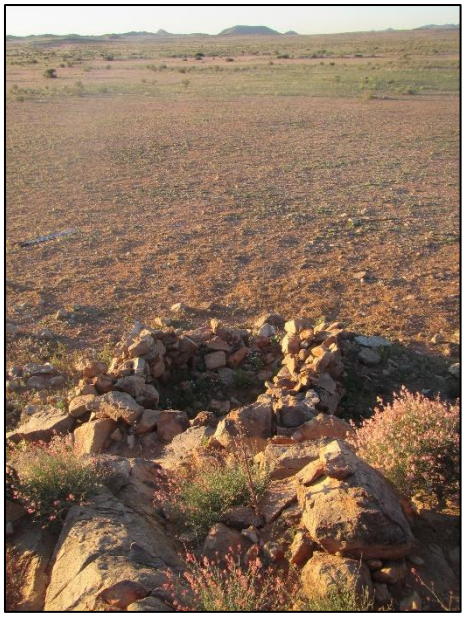


Figure 15: *View of the small stone structure from on the hill above it and looking towards the north.*

The only area of real concern for the power corridors lies in the far north-western area where Alternatives 2 and 3 pass through an area with many small rocky hills. There are numerous archaeological sites associated with these hills. The most important site was located at Waypoints 761 and 762 (Figure 16). It was an area on the north side of a small rocky hill that had many quartz artefacts and ostrich eggshell fragments on it. It is even possible that a subsurface deposit might be present. In front of the scatter was a bedrock outcrop with many grinding patches on it (Figure 17). A fragment of sponge-printed ceramic was also found (Figure 18).

Figure 16: *View towards the south showing the rock outcrop with grinding patches in the foreground and the artefact scatter in the background (yellowish grassed area in front of rocky hill).*

Figure 17: *Two grinding patches at Waypoint 762. Scale in 5 cm intervals.*

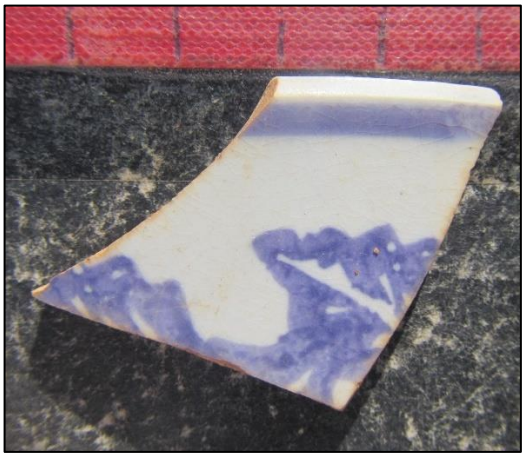


Figure 18: *A sponge-printed plate fragment from Waypoint 761. Scale in 1 cm intervals.*

A number of very dense open artefact scatters were also found. Included among these were those at Waypoints 791 and 794 (Figures 19 & 20) which lie within the Alternative 2 and 3 corridors respectively.

Figure 19: *The ground surface at Waypoint 791 showing the dense quartz artefact scatter.*

Figure 20: *View across the area in which the quartz artefact scatter at Waypoint 794 was found.*

Just to the north of the northern edge of Alternative 3 is a small rocky hill with an extensive area of grinding patches on a flat platform on the north-eastern edge of the hill (Figure 21). Grinding patches always to occur alongside areas where water can be obtained (generally places that water gets trapped after rain) and this site is no exception (Figure 22). Just to the north, on a sandy area, is a large quartz artefact scatter that is very likely associated with the grinding areas.

Figure 21: *View of the extensive ground area at Waypoint 799.*

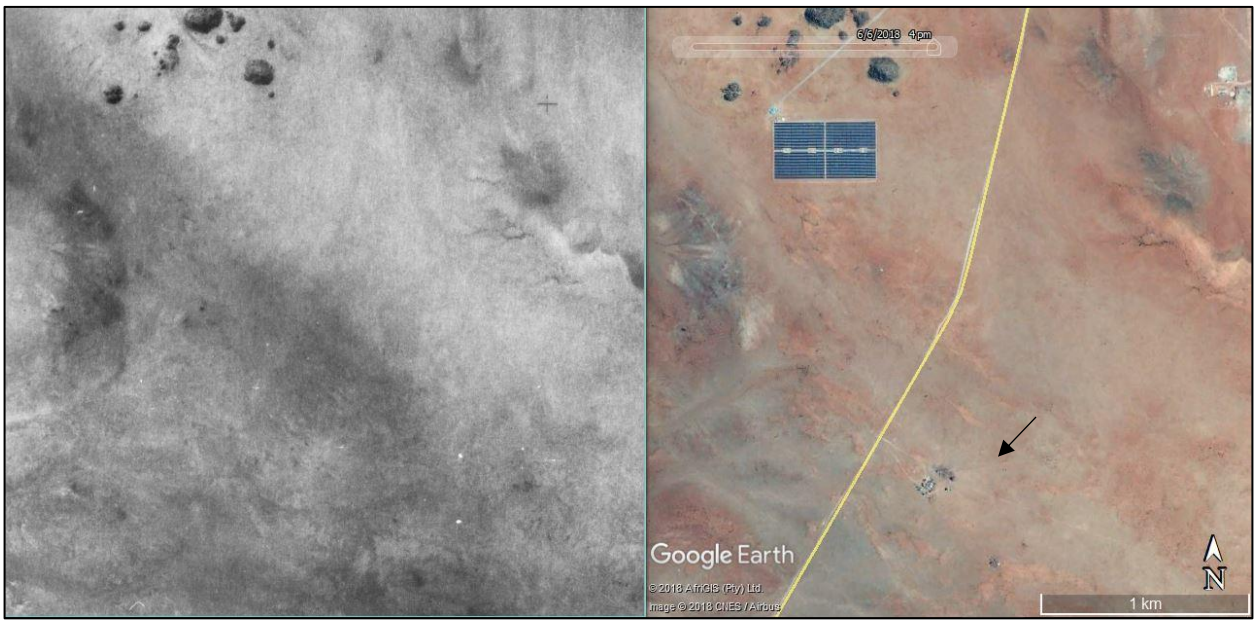
Figure 22: *Depressions in the bedrock at waypoint 799 which would trap water after rain.*

6.3. Graves

No graves were seen in or near the study area. It is still possible that unmarked graves are present but in this landscape where it is very difficult or impossible to excavate graves by hand the chances are extremely small.

6.4. Built environment

No structures occur anywhere within or close to the three study areas. The nearest lie on Konkoonsies 91/6 some 700 m west of the Alternative 1 corridor. The 1954 aerial photograph suggests that this farm complex was not present at that time (Figure 23).



Fgure 23: *Aerial views from 1954 (Job 345, strip 7, photograph 18136) and 2016 (Google Earth) showing the Konkoonsies 91/6 farm complex (arrowed in modern view) to have not yet been constructed.*

6.5. Cultural landscape

The area is very remote and undeveloped. Farm complexes are very far apart and the only other anthropogenic features on the landscape are fences and farm tracks. Aerial photography makes it is clear that the landscape is

almost entirely natural. The oldest available historical aerial photography dates to 1954 and shows just one man-made feature to be present – the gravel road. Significantly, the area has experienced the recent addition of an electrical 'layer' as shown in Figure 25. While the N14 running some 14 km southeast of the Alternative 1 corridor can be considered a scenic route, the power lines would not be visible from that road. The local gravel road through the broader study area provides only farm access and is of no consequence.

There is a precolonial archaeological component to the cultural landscape as well. This is related to the very large number of sites clustered around the rocky hills. The northern part of the study area, where many hills and many archaeological sites occur, is certainly an example of such a precolonial cultural landscape and would be classed as a Type 3 landscape by Orton (2016c).

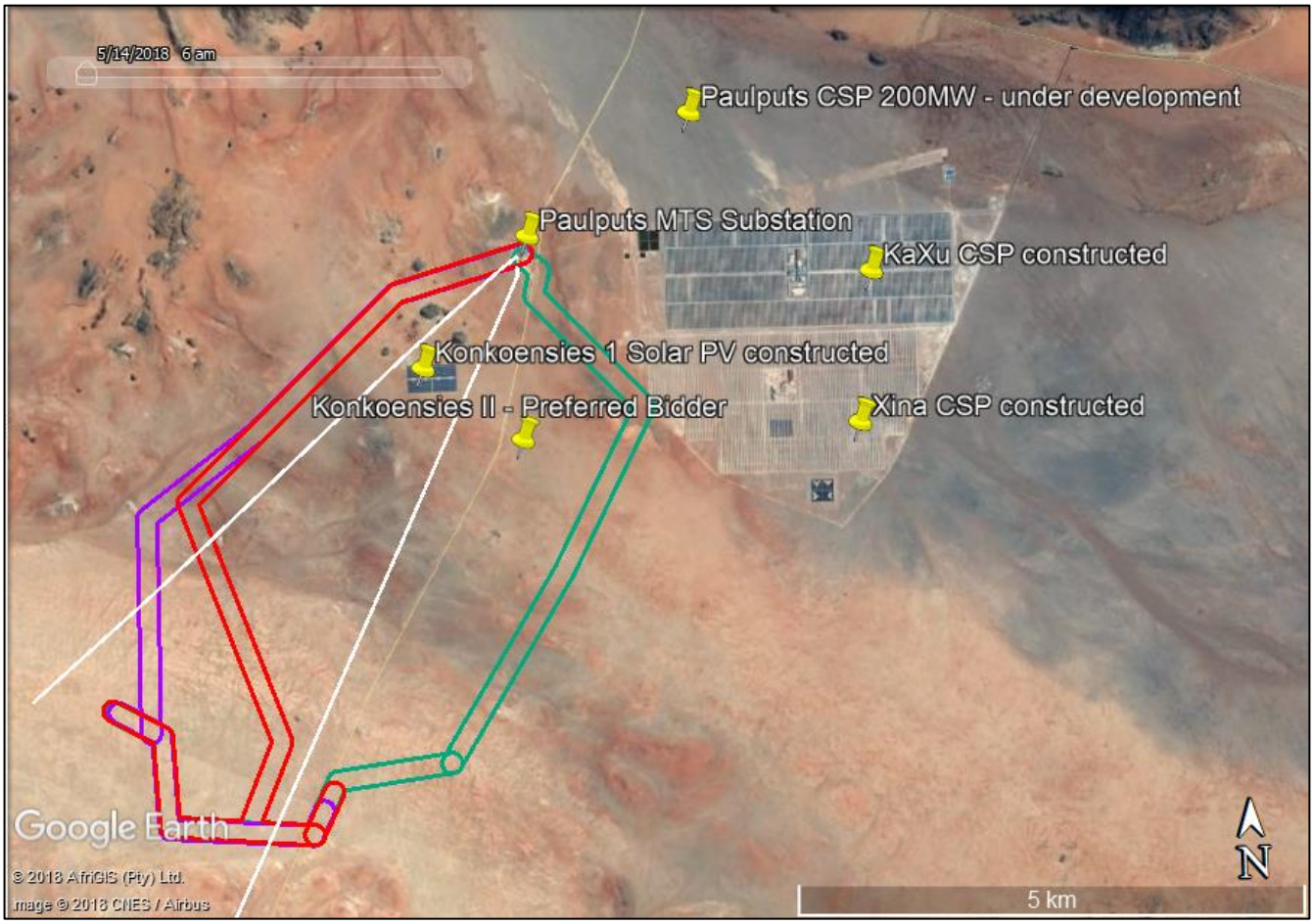


Figure 24: *Aerial view of the broader study area showing the three power corridor alternatives (green, purple, red), two existing power lines (white lines), the existing and proposed solar energy facilities, and the existing Paulputs Substation (labelled yellow pins).*

6.6. Summary of heritage indicators

While rare isolated fossils may exist in the area, the chances of these being present and found are so small as to make palaeontological issues of no further concern to this assessment. Many archaeological sites are present in the area but they tend to be quite tightly associated with the rocky outcrops. A number would need to be avoided or, if this is not possible, mitigated. Unmarked graves are likely to be entirely absent from the study areas and there are no structures present. Until recently, the landscape was largely natural with only very minimal human alteration but now it has gained a strong electrical 'layer' with several solar energy facilities and related infrastructure present. Clustering of this infrastructure is more desirable than spreading it out over the landscape.

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.

While individual fossils in the area could be of high significance if located, the chances of finding such fossils are very low and in general palaeontological resources are considered to be of low cultural significance for their scientific value. A grading cannot be readily applied because no fossils are currently known from the study area.

Archaeological resources of variable cultural significance were found. However, most are of very low significance for their scientific value (grade GP C). The most important site in the study area is deemed to be of medium-high cultural significance for its scientific value and can be graded GP A.

Because it is only very weakly developed (i.e. minimal human imprint on the landscape) and has been altered by modern electrical developments, the cultural landscape is considered to have low cultural significance for its aesthetic and historical values. The archaeological aspect is of greater significance and is most strongly developed around the rocky hills in the far north.

7. ISSUES, RISKS AND IMPACTS

7.1. Key Issues Identified During the Scoping Phase

Potential impacts to palaeontological resources, archaeological resources and the cultural landscape have been identified.

No consultation has taken place during the assessment process.

7.2. Overview of key Impacts resulting from the proposed development

Only one key impact has been identified. It is relevant to all three power corridor alternatives. This is the direct impact to archaeological resources that might occur during the construction phase of the project through destruction of the resources. No impacts to archaeology are envisaged during the operation and decommissioning phases of the project.

Cumulative impacts to archaeology are not considered significant because sites tend to be closely linked with water sources and these are generally avoided by development. Impacts to culturally significant archaeological sites are thus considered unlikely to have occurred through the construction of other renewable energy facilities in the broader region.

7.3. Overview of key Environmental Management Actions and limits of acceptable changes to the Environment due to the proposed development

The development of the proposed power lines may result in impacts to archaeological sites. The sites would not be totally destroyed because of the limited impacts that occur through power line construction. However, they would be compromised enough to lose much of their research value. This is unacceptable but, with adequate mitigation, scientific data would be rescued and the change would then be deemed acceptable. Mitigation would only be needed in the event that avoidance is not possible. If the significant sites can be avoided then monitoring will simply aim to ensure that the relevant areas are not damaged during construction.

The potential impacts identified during the EIA assessment are:

Construction Phase

- Potential impact to palaeontological resources
- Potential impact to archaeological resources
- Potential impact to the cultural landscape

Operational Phase

- Potential impact to the cultural landscape

Decommissioning Phase

- Potential impact to the cultural landscape

Cumulative impacts

- Potential impact to palaeontological resources
- Potential impact to archaeological resources
- Potential impact to the cultural landscape

8. IMPACT ASSESSMENT

8.1. Construction Phase

Potential impacts to palaeontological resources

Construction phase impacts to palaeontological resources are expected to be identical for all three proposed projects and are presented in Tables 1 and 2.

Impacts to fossils would be direct impacts related to the destruction of fossils during preparation of the site for construction and/or during the excavation of foundations. The impacts are expected to be of **very low significance**. Due to the expected very sparse distribution of fossils in the landscape and their generally low cultural significance, no possible indirect impacts have been identified. No mitigation measures are required and there are no areas that need to be avoided by development. Management in the form of a chance finds procedure should be incorporated into the Environmental Management Program (EMPr) such that if any isolated fossils are found during construction then they can be reported, documented and rescued as appropriate. The appended palaeontological specialist study includes the relevant details.

Potential impacts to archaeological resources

Construction phase impacts to archaeological resources are expected to be the same for all three alternatives. The assessment is presented in Table 1.

Impacts to archaeological materials would be direct and/or indirect impacts related to the destruction of sites and/or artefacts during preparation of the site for construction and/or during the excavation of foundations. Direct and indirect impacts are equally likely and the impacts would be of equal significance,

in this case **medium significance**. One site in each corridor will need to be flagged for avoidance, although none were found to require avoidance. This means that if avoidance is not possible then archaeological mitigation would be acceptable. Management in the form of a chance finds procedure should be incorporated into the EMPr such that if any archaeological sites (or graves) are found during construction then they can be reported, assessed and mitigated as appropriate.

Potential impacts to the cultural landscape

Construction phase impacts to the cultural landscape are expected to be identical for all three proposed alternatives and are presented in Table 1.

Impacts to the cultural landscape are direct impacts related to the introduction of incompatible equipment and materials to the rural landscape. The landscape is generally of low cultural significance, partly due to the existing presence of much electrical infrastructure in the vicinity. As such, the expected impacts are rated as being of very low consequence. Although they would definitely occur, the probability is rated as likely because this is the probability that the power lines would result in a visual impact of concern. The significance would otherwise be artificially high. The impacts are thus considered to be of **low significance**. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures to screen power lines. The after mitigation significance thus remains **low**.

8.2. Operation Phase

Potential impacts to the cultural landscape

Operation phase impacts to the cultural landscape are expected to be identical for all three proposed projects and are presented in Table 2.

Impacts to the cultural landscape are direct impacts related to the presence of an industrial type facility in the rural landscape. The landscape is generally of low cultural significance, partly due to the existing presence of much electrical infrastructure in the vicinity. As such, the expected impacts are rated as being of very low consequence but due to the probability being likely (for the same reasons explained in Section 8.1), the impacts would be of **low significance**. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures since it is not possible to screen such large developments. The after mitigation significance thus remains **low**.

8.3. Decommissioning Phase

Potential impacts to the cultural landscape

Decommissioning phase impacts to the cultural landscape are expected to be identical for all three proposed projects and are presented in Table 5.

Impacts to the cultural landscape are direct impacts related to the introduction of incompatible equipment and materials to the rural landscape. The landscape is generally of low cultural significance, partly due to the existing presence of much electrical infrastructure in the vicinity. As such, the expected impacts are rated as being of very low consequence but due to the probability being likely (for the same reasons explained in Section 8.1), the impacts would be of **low significance**. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures since it is not possible to screen such large developments and equipment. The after mitigation significance thus remains **low**.

8.4. Existing impacts

The only impact that currently exists is the potential trampling of archaeological materials by grazing livestock and/or farm vehicles.

8.5. Cumulative Impacts

Cumulative impacts are expected to be identical for all three proposed alternatives and are presented in Table 6.

Palaeontological and archaeological resources tend to be very rare on the Bushmanland landscape and are focused on drainage lines and water sources respectively – both areas typically avoided by developments. Cumulative impacts are thus likely to be of **very low significance** for palaeontology. However, because some water sources can be located in open grasslands, as documented in this report and by Orton (2016), there is the potential for some of these sites to be missed and destroyed and the potential impact before mitigation is therefore rated as being of **medium significance**. With adequate mitigation this would be reduced to **very low significance**.

Impacts to the cultural landscape are direct impacts related to the introduction of incompatible equipment and materials to the rural landscape. The landscape is generally of low cultural significance, partly due to the existing presence of much electrical infrastructure in the vicinity. As such, the expected impacts are rated as being of very low consequence but due to the high probability of occurrence the impacts might be of **medium significance**. This is not so much due to the construction of other power lines but rather to the construction of spatially extensive electrical infrastructure such as substations and solar energy facilities. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures to screen such large developments and equipment and the impacts would thus remain at **medium significance**

8.6. Levels of acceptable change

For palaeontology, archaeology and graves any total or partial destruction of significant fossils, sites or graves without recording or sampling is unacceptable. For the landscape, any development that completely dominates the surroundings would be unacceptable.

Table 1: Impact assessment summary table for the Construction Phase (Alternatives 1, 2, 3).

Impact source/ cause	Description of Impact	Nature of Impact (negative or positive)	Spatial Extent of Impact	Duration of Impact	Consequence / effects of Impact	Probability of Impact	Reversibility of Impact	Irreplaceability of Resource	Potential Mitigation Measures	Significance of Impact		Residual Impact after mitigation
										Without Mitigation/ Management	With Mitigation/ Management	
Preparation of site for construction, creation of service track and excavation of foundations	Destruction of palaeontological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very low
	Destruction of archaeological resources	Negative	Site	Permanent	Moderate	Likely	Low	High	Archaeological mitigation or avoidance	Medium	Very low	Very low
All construction activities	Introduction of incompatible elements into the landscape	Negative	Local	Long term	Very low	Likely	High	Low	None feasible	Low	Low	Low

Table 2: Impact assessment summary table for the Operational Phase (Alternatives 1, 2, 3).

Impact source/ cause	Description of Impact	Nature of Impact (negative or positive)	Spatial Extent of Impact	Duration of Impact	Consequence/ effects of Impact	Probability of Impact	Reversibility of Impact	Irreplaceability of Resource	Potential Mitigation Measures	Significance of Impact		Residual Impact after mitigation
										Without Mitigation/ Management	With Mitigation/ Management	
All activities	Introduction of incompatible elements into the landscape	Negative	Local	Long term	Very low	Likely	High	Low	None feasible	Low	Low	Low

Table 3: Impact assessment summary table for the Decommissioning Phase (Alternatives 1, 2, 3).

Impact source/ cause	Description of Impact	Nature of Impact (negative or positive)	Spatial Extent of Impact	Duration of Impact	Consequence/ effects of Impact	Probability of Impact	Reversibility of Impact	Irreplaceability of Resource	Potential Mitigation Measures	Significance of Impact		Residual Impact after mitigation
										Without Mitigation/ Management	With Mitigation/ Management	
All construction activities	Introduction of incompatible elements into the landscape	Negative	Local	Long term	Very low	Likely	High	Low	None feasible	Low	Low	Low

Table 4: Impact assessment summary table for Cumulative Impacts (Alternatives 1, 2, 3).

Impact source/ cause	Description of Impact	Nature of Impact (negative or positive)	Spatial Extent of Impact	Duration of Impact	Consequence / effects of Impact	Probability of Impact	Reversibility of Impact	Irreplaceability of Resource	Potential Mitigation Measures	Significance of Impact		Residual Impact after mitigation
										Without Mitigation/ Management	With Mitigation/ Management	
Preparation of site for construction, creation of service track and excavation of foundations	Destruction of palaeontological resources	Negative	Regional	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very low
	Destruction of archaeological resources	Negative	Regional	Permanent	Moderate	Likely	Low	High	Avoid or excavate sites	Medium	Very low	Very low
All construction activities	Introduction of incompatible elements into the landscape	Negative	Regional	Long term	Very low	Likely	High	Low	Pale recessive paint colours on built elements where technically feasible	Low	Low	Low

9. MITIGATION MEASURES AND MANAGEMENT ACTIONS

9.1. Mitigation

All mitigation measures would need to be applied at the construction phase since it is then that the impacts initially occur. Mitigation measures are listed in Table 5. Figure 25 to 27 show the locations of significant archaeological resources. The individual waypoints are buffered by 50 m which allows for the area of the site and a further buffer of at least 30 m around each site. The archaeological excavations would need to be done under a permit issued in the name of the appointed professional archaeologist.

Table 5: *Mitigation measures suggested for the three proposed power corridor alternatives.*

Heritage aspect	Alternative 1	Alternative 2	Alternative 3
Palaeontology	• No mitigation required.	• No mitigation required.	• No mitigation required.
Archaeology	• Site KK2018/038 (waypoint 805) should be avoided or else excavated by a professional archaeologist prior to construction.	• Site KK2018/008 (waypoints 761-762) should be avoided or else excavated by a professional archaeologist prior to construction.	• Site KK2018/008 (waypoints 761-762) should be avoided or else excavated by a professional archaeologist prior to construction.
Cultural landscape	• No mitigation required.	• No mitigation required.	• No mitigation required.

9.2. Management

Management measures are listed in Table 6.

Table 6: *Management measures suggested for the three proposed power corridor alternatives.*

Heritage aspect	Alternatives 1-3
Palaeontology	• A chance finds procedure should be written into the EMPr. Please see Appendix 4 for details.
Archaeology	• Dense accumulations of stone artefacts found during construction should be reported to the ECO who should then report to an archaeologist or SAHRA. Mitigation may then be required. • To protect other sites, all activities must remain within the authorised footprint.
Cultural landscape	• To minimise landscape scarring, all activities must remain within the authorised footprint.

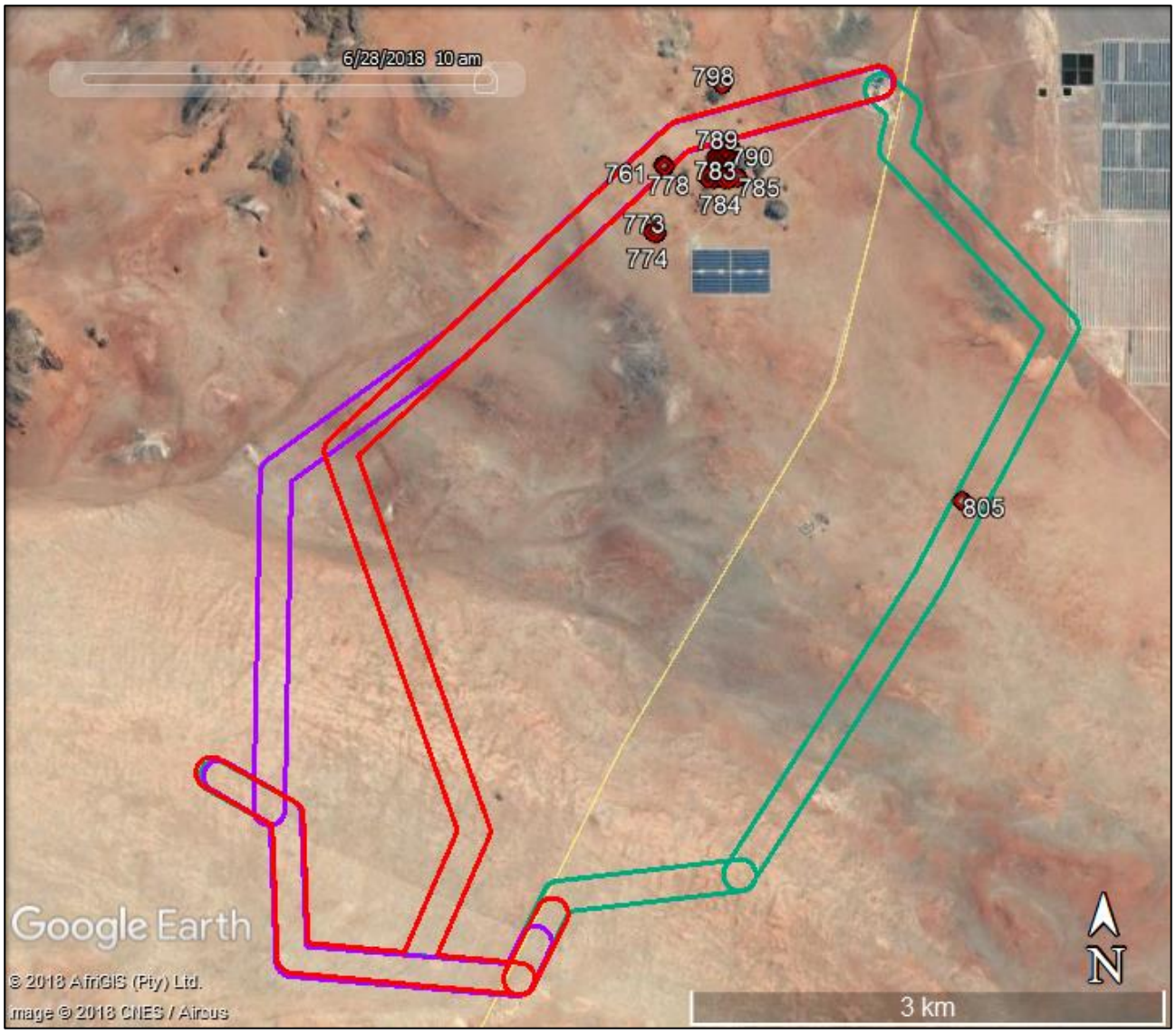


Figure 25: *Aerial view of the study area with the significant archaeological sites (including buffers) ringed in black. See enlargements below.*

10. 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 proposed projects would result in extra electricity generation which would help with the stabilisation of South Africa's electricity supply. This is, in turn, good for economic development. The projects will likely generate some short terms construction jobs and a few long term opportunities during the operational phase. These benefits clearly outweigh the relatively insignificant impacts to heritage resources that might occur.

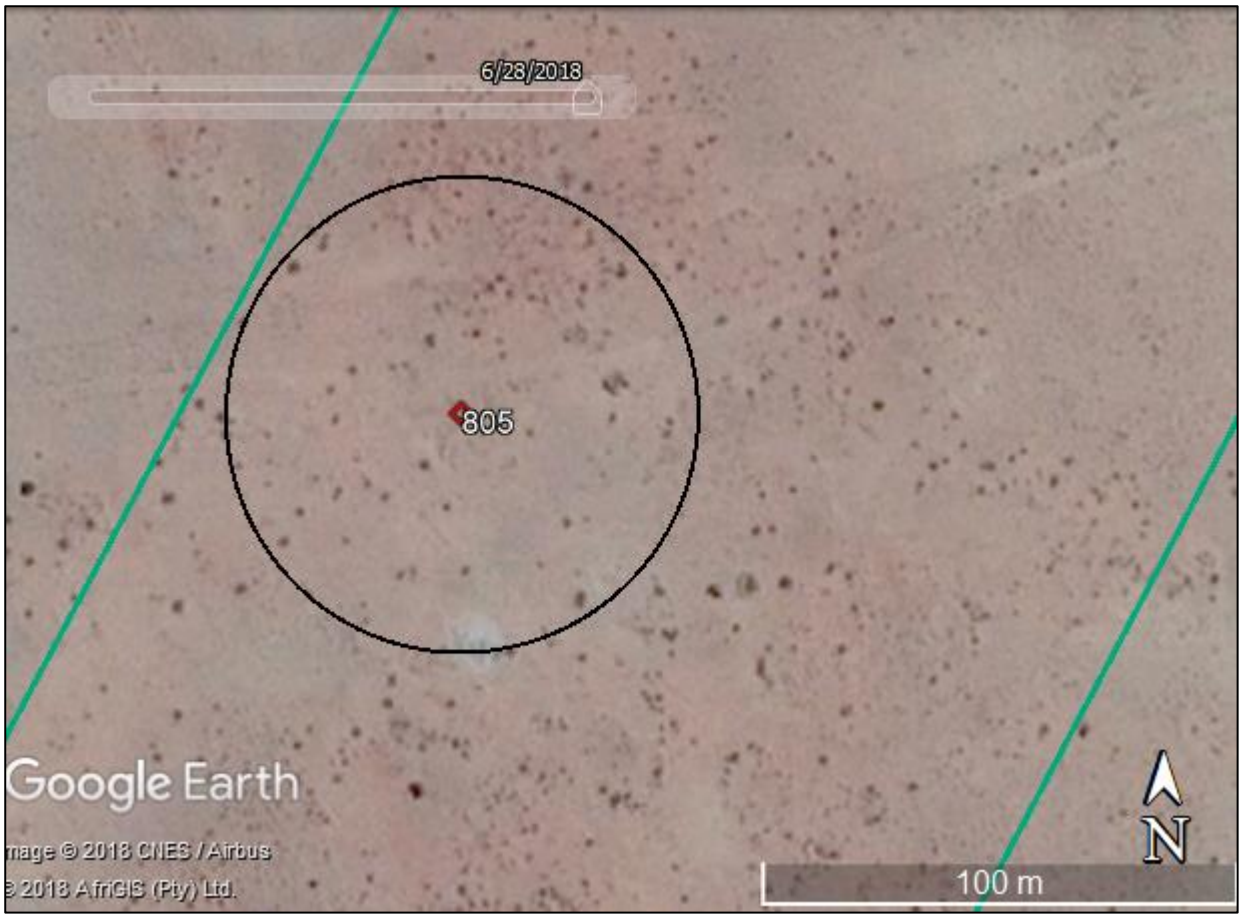


Figure 26: *Aerial view of a section of the western part of the Alternative 1 corridor with the significant archaeological site (including buffer) ringed in black.*

11. CONCLUSIONS

The only significant impact to heritage identified relates to the damage to or destruction of archaeological sites. All sites may well be avoidable but, if not, they would be easy to mitigate via archaeological excavation should this be required. There are no fatal flaws for any of the three alternatives and it is concluded that development of any of the three is feasible. There is no preferred alternative from a heritage point of view. Provision should be made in the EMPr for the protection and reporting of any chance finds of fossils, archaeological materials or human burials. There are no significant concerns from the point of view of cumulative impacts.

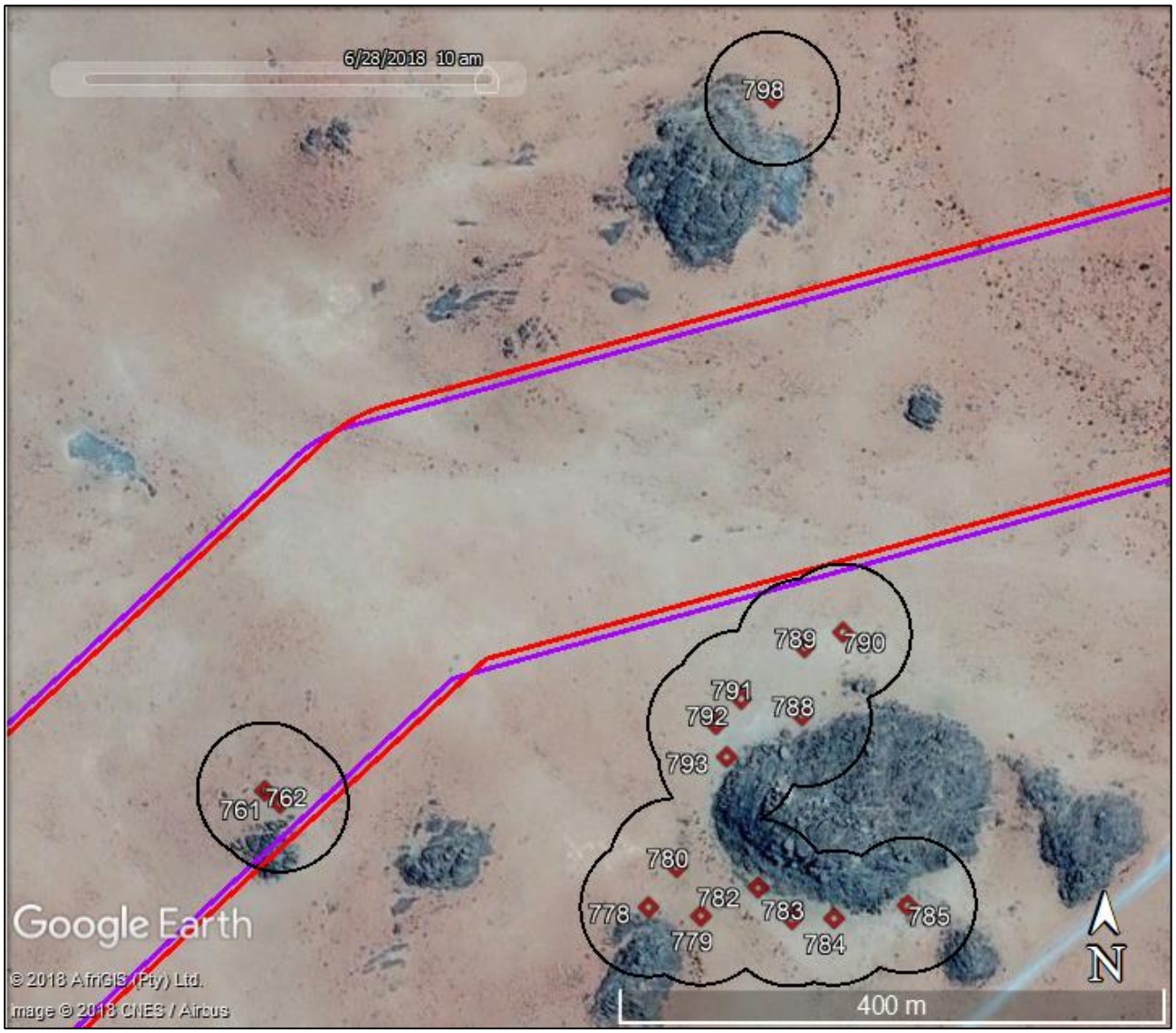


Figure 27: *Aerial view of the northern part of the Alternative 2 and 3 corridors with the significant archaeological sites (including buffers) ringed in black.*

12. RECOMMENDATIONS

Because the impacts to heritage resources would be of relatively low significance and are easily manageable, it is recommended that the proposed power lines be authorised using any of the three alternatives proposed. However, the following recommendations that should be incorporated into the Environmental Authorisation:

- Archaeological sites KK2018/008 (Alt. 2 & 3) and KK2018/038 (Alt. 1) should be avoided if possible. If this is not possible then a professional archaeologist should be appointed to undertake mitigation prior to construction, and
- If any palaeontological or 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

appropriate professional. Such heritage is the property of the state and may require excavation and curation in an approved institution.

13. REFERENCES

Beaumont, P.B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.) *Einiqualand: studies of the Orange River frontier*. Cape Town: UCT Press.

Francis, Jr. P. 1988. The glass trade beads of Europe: Their manufacture, their history, and their identification. World of beads monograph series 8. Lake Placid, New York: Lapis Route Books, The Centre for Bead Research.

Halkett, D. 2010. An assessment of impact on archaeological heritage resulting from replacement of a section of the existing bulkwater supply pipeline from Pella to Pofadder, Northern Cape. Unpublished report prepared for Van Zyl Environmental. St James: ACO Associates cc.

Morris, D. 2011. A Phase 1 Heritage Impact Assessment for the proposed Aggeneis – Paulputs 220kV transmission line. Unpublished report for SSI Engineers and Environmental Consultants. Kimberley: McGregor Museum.

Morris, D. 2012. Pofadder Solar Thermal Facility KaXu Solar One Specialist Input for the Environmental Impact Assessment Phase and Environmental Management Plan: Archaeology. Unpublished report for Savannah Environmental (Pty) Ltd. Kimberley: McGregor Museum.

Orton, J. 2015a. Final archaeological survey for the proposed Konkoonsies II Solar Energy Facility, Kenhardt Magisterial District, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. 2015b. Heritage impact assessment for a proposed 132 kV Power Line and Substation at the Konkoonsies II Solar Energy Facility, Kenhardt Magisterial District, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. 2016a. Archaeological mitigation for the proposed Konkoonsies II Solar Energy Facility, Kenhardt Magisterial District, Northern Cape. Unpublished report prepared for Ramizone (RF) (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. 2016b. Heritage Impact Assessment for the proposed Sol Invictus 4 PV Facility, Namakwaland Magisterial District, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. 2016c. Prehistoric cultural landscapes in South Africa: a typology and discussion. *South African Archaeological Bulletin* 71: 119-129.

Orton, J. & Webley, L. 2013. Heritage impact assessment for proposed granite prospecting near Pofadder, Northern Cape. Unpublished report prepared for Sizisa Ukhanyo Trading 830 cc. Diep River: ACO Associates cc.

Pelser, A.J. 2011. A report on an archaeological impact assessment (AIA) for the proposed solar energy plant on Konkoonsies 91, Pofadder District, Northern Cape. Unpublished report prepared for Robert de Jong and Associates. Wonderboompoort: Archaetnos.

Pelser, A.J. 2011. A report on a heritage impact assessment (HIA) for the proposed photo-voltaic solar power generation plant on Konkoonsies 91, Pofadder District, Northern Cape. Unpublished report prepared for EScience Associates (Pty) Ltd. Wonderboompoort: Archaetnos.

SAHRA. 2007. Minimum Standards: archaeological and palaeontological components of impact assessment reports. Document produced by the South African Heritage Resources Agency, May 2007.

APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 40 Brassie Street, Lakeside, 7945
Telephone: (021) 789 0327
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

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 - 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.

Signature of the specialist: _____

Name of Specialist: JAYSON ORTON

Date: 07 NOVEMBER 2018

APPENDIX 3 – Compliance with requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017

Requirements of Appendix 6 – GN R326 of NEMA EIA Regulations as amended (7 April 2017)	**Please indicate where it is 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;	Appendix 2
c) an indication of the scope of, and the purpose for which, the report was prepared; (ca) an indication of the quality and age of base data used for the specialist report; (cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.2 n/a Sections 8.4, 8.5 & 8.6
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 site alternatives;	Section 1.1.1 Figure 3
g) an identification of any areas to be avoided, including buffers;	Section 9
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;	Figure 28
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;	Sections 6, 7 & 8
k) any mitigation measures for inclusion in the EMPr;	Section 9.1
l) any conditions for inclusion in the environmental authorisation;	Section 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9.2
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (ia) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity 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 12
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3.6
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 or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

APPENDIX 4 – Palaeontological study

PALAEONTOLOGICAL HERITAGE ASSESSMENT: DESKTOP STUDY

Proposed Paulputs PV Solar Farm (Phases 1 to 3) on Farm Konkoonsies 91 near Pofadder and associated transmission lines, Khaî-Ma Local Municipality, Northern Cape Province

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June 2018

EXECUTIVE SUMMARY

It is proposed to construct a PV Solar Farm in three phases (Paulputs PV1, PV2 and PV3) on Portion 5 and Portion 2 / Remainder of Farm Konkonsies 91, located *c.* 27 km NE of Pofadder in the Khaî-Ma Local Municipality of the Northern Cape. The underlying Precambrian basement rocks (granitoids, metasediments) of the Namaqua-Natal Province are unfossiliferous while the overlying Late Caenozoic superficial deposits (alluvium, gravels, aeolian sands *etc*) are generally of low to very low palaeontological sensitivity. No sensitive palaeontological sites or no-go areas have been identified within the Paulputs PV Solar Farm study area or the associated short transmission line corridor options to Paulputs Substation. Narrow zones of Late Caenozoic alluvium associated with minor water courses in the broader study region might contain fossils such as isolated mammalian bones and teeth or freshwater molluscs but these are probably very sparse, at most. Since the Paulputs PV Phase 1-3 project areas are situated away from drainage lines and the placement of pylon footings close to drainage lines is unlikely, direct impacts on alluvial fossils are unlikely.

Impacts on unique or irreplaceable fossil heritage resources due to the proposed development are improbable and their severity is anticipated to be negligible since (1) significant fossil sites are unlikely to be affected, (2) the footprints involved are small, and (3) in most cases any impacts can be mitigated through application of an appropriate Chance Fossil Finds Procedure (See Appendix). The overall impact significance of the proposed Paulputs PV Solar Farm (Phases 1-3) and associated electrical infrastructure developments (overhead transmission lines, on-site substations) is rated as VERY LOW in terms of palaeontological heritage resources. This assessment applies equally to all transmission line route options under consideration. Given the general low palaeontological sensitivity of the region, cumulative impacts inferred for the various powerlines and alternative energy developments in the Aggeneys – Pofadder – Paulputs region of the Northern Cape are assessed as very low.

Pending the potential discovery of significant fossil remains (*e.g.* mammalian bones or teeth) during the construction phase, no further specialist palaeontological studies or mitigation are recommended for the Paulputs PV Solar Farm project (Phases 1-3) and associated electrical infrastructure developments. Chance fossil finds such as vertebrate bones and teeth or shells should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact details: 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). This is so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Please refer to the tabulated Chance Fossil Finds Procedure appended to this report). The palaeontologist concerned with mitigation work would need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved repository (*e.g.* museum or university collection) (SAHRA 2013). These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed developments.

1. INTRODUCTION & BRIEF

It is proposed to construct a PV Solar Farm in three phases (Paulputs PV1, PV2 and PV3) on Portion 5 and Portion 2 / remainder of Farm Konkonsies 91, located some 27 km NE of Pofadder and 100 km west of Kakamas in the Khaî-Ma Local Municipality of the Northern Cape (Fig. 1).

Each phase of the PV Solar Farm would have a footprint of ≤ 200 ha. Associated infrastructure includes a battery storage system (≤ 1 ha), gravel access and service roads (≤ 4-8 m wide), a collector substation (≤ 1 ha) and adjoining operations and maintenance area (≤ 1 ha) as well as a temporary construction yard and laydown area (≤ 4 ha). The Solar Farm will be connected by short overhead transmission lines to the National Grid *via* the existing Paulputs

Substation situated on the adjoining farm Scuit-Klip 92. A proposed layout of the three phases of the Paulputs PV Solar Farm, showing route options for the transmission line corridors to Paulputs Substation, is provided in Figure 2.

The present short palaeontological desktop report contributes to the comprehensive heritage impact assessments for the Paulputs PV Solar Farm and associated transmission lines compiled by Dr Jayson Orton of ASHA Consulting (Pty) Ltd (Contact details: ASHA, 40 Brassie Street, Lakeside, 7945. E-mail: jayson@asha-consulting.co.za. Tel: 021 789 0327. Cell: 083 272 3225. Website: www.asha-consulting.co.za).

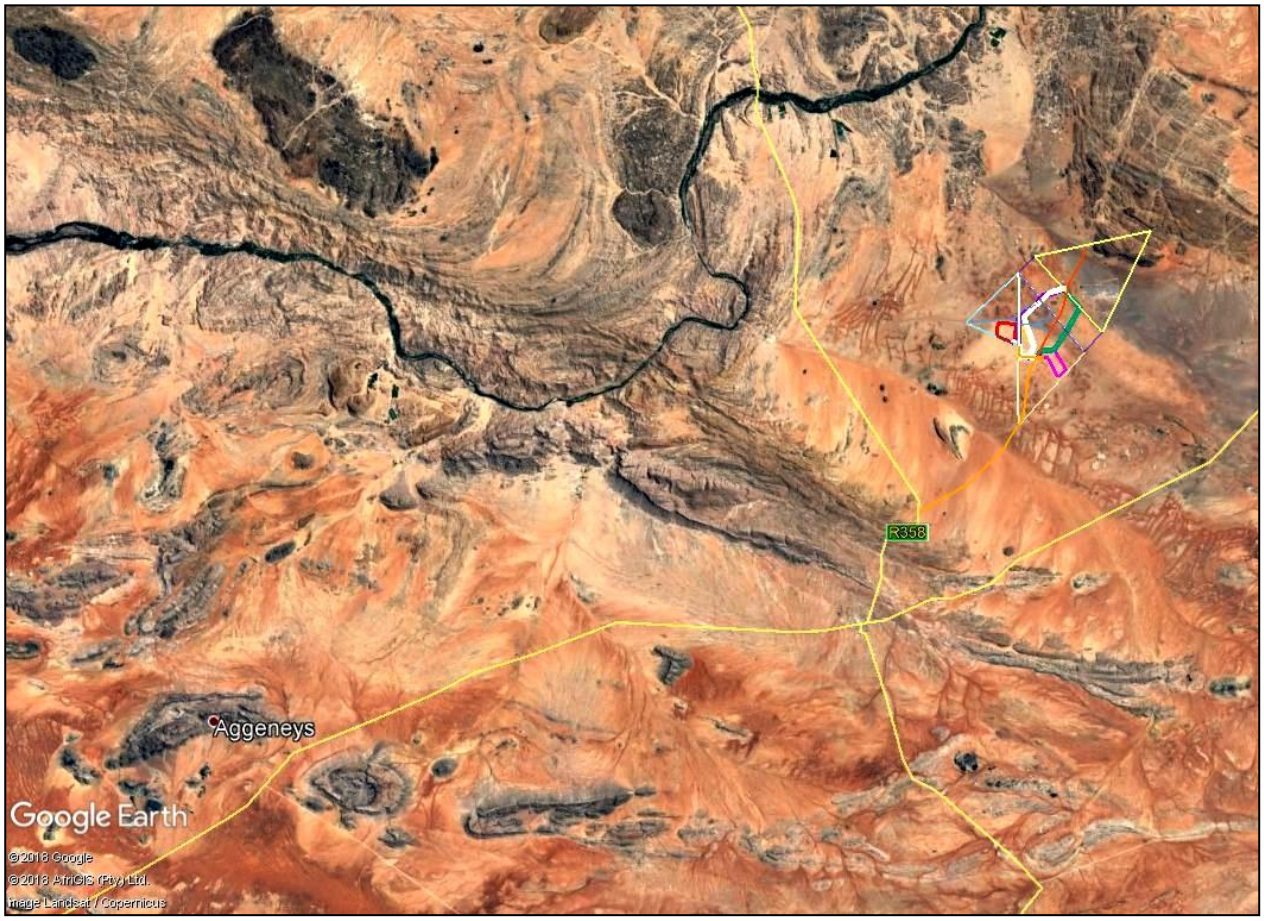

Figure 1: Google Earth© satellite image showing the location of the Paulputs PV Solar Farm project area on Farm Konkoonsies 91 situated between the N14 trunk road and the Orange River (Gariep), *c*. 27 km NE of Pofadder.

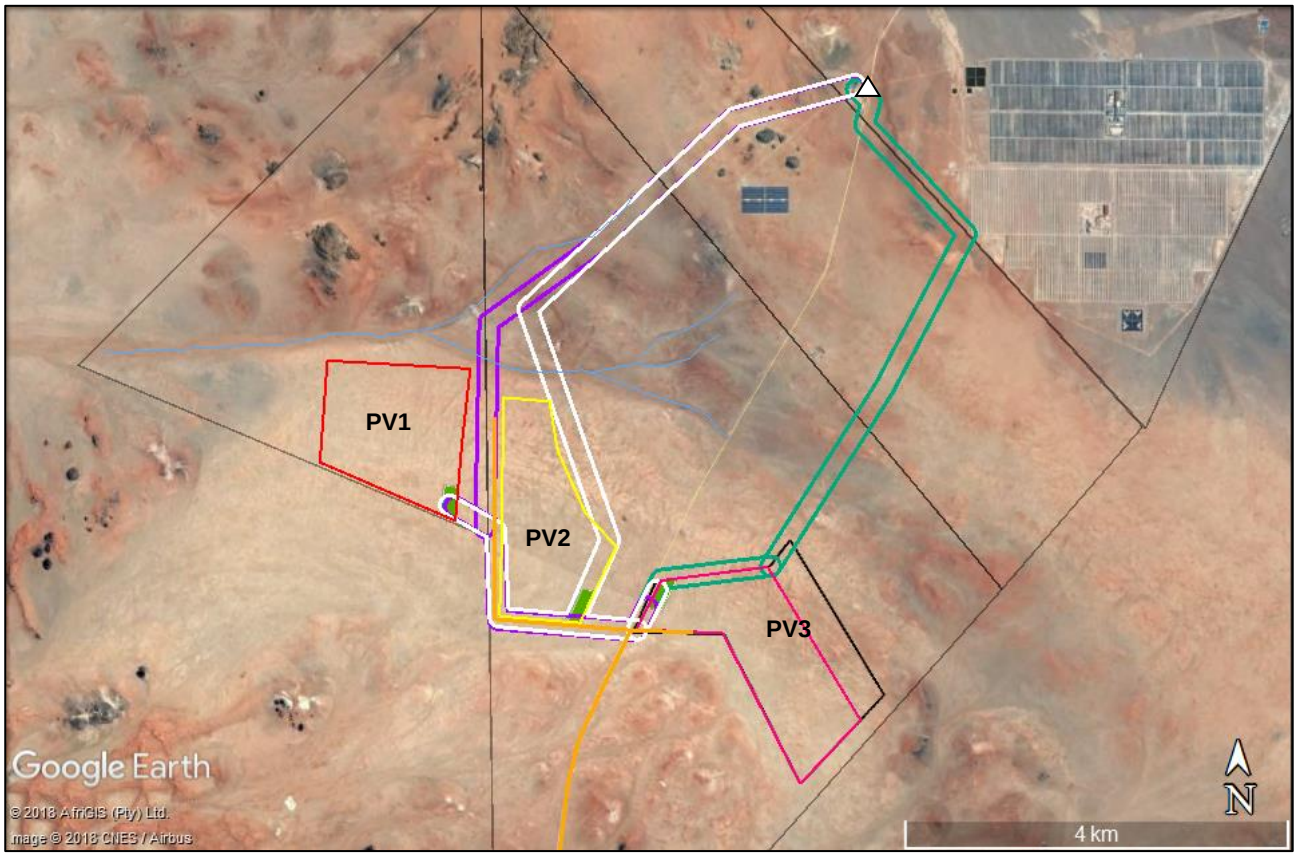

Figure 2: Google Earth© satellite image showing the location of the three proposed phases of the Paulputs PV Solar Farm (PV1, PV2, PV3 and including an expanded development envelope for PV3 in black) on Farm Konkoonsies 91, the main access roads (orange) as well as transmission power corridor alternatives (purple, white, green) to the nearby Paulputs Substation on Farm Scuit-Klip 92 (small white triangle). The desert terrain in this part of northern Bushmanland, situated on the south-western margins of the Ysterberg, features sandy to gravelly *vlaktes* (pale brown / orange), networks of aeolian sand dunes (orange) and numerous small, isolated Inselberge of basement rocks (dark hues). Note that several existing or proposed solar energy facilities, including the Kaxu and Xina CSP projects, are located on the Farm Scuit-Klip.

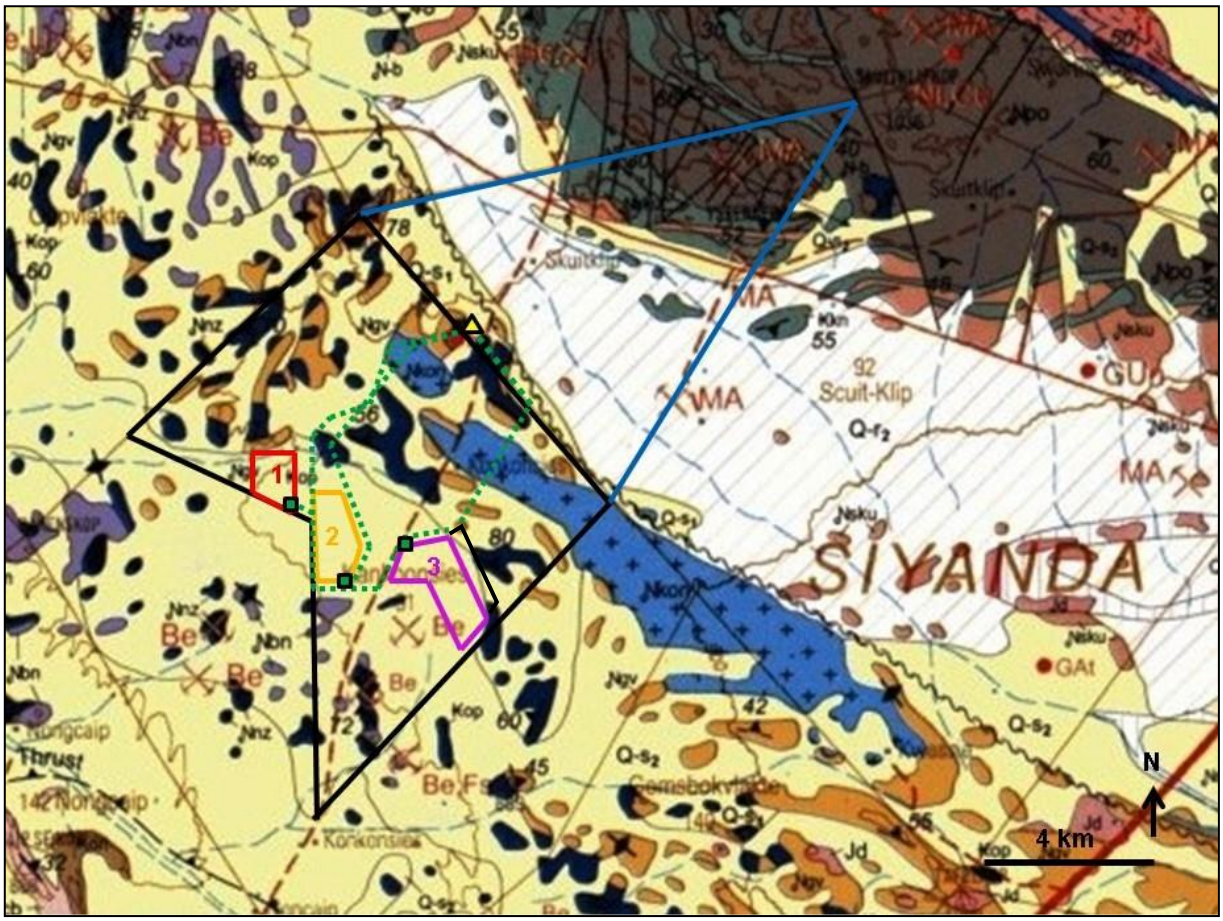

Figure 3: Extract from 1: 250 000 geology sheet 2818 Onseepkans (Council for Geoscience, Pretoria) showing the main rock units represented in the Paulputs PV Solar Farm project area (Phases 1-3 indicated by the red, yellow and purple polygons respectively with the larger development envelope for PV3 in black). These rocks include several different units of Late Precambrian (Mokolian) metasediments and granitoid intrusive rocks of the Namaqua-Natal Province that build the rocky Inselberge shown in dark colours (*e.g.* Ncon, middle blue – Konkonsies Granite) and which are all unfossiliferous. These are mantled with a range of Late Caenozoic superficial deposits – such as aeolian sands (Qs1, dark yellow), scree, rock rubble, sandy and gravelly soils (Qs2, darker yellow), granitic gravels or *grus* (Q-r2, white with cross-hatch) as well as alluvium - that can be broadly included within the Quaternary to Recent Kalahari Group and are, at most, sparsely fossiliferous. Crossed hammer symbols marked Be, Fs, MA are defunct or active beryllium, feldspar and granite mines.

2. GEOLOGICAL BACKGROUND

The Paulputs PV Solar Farm study area is situated within a very arid region of northern Bushmanland between the Orange River (Gariep) and the N14 tar road between Springbok and Kakamas (Figs. 1 & 2). This mixed sandy and rocky desert region – assigned to the Lower Vaal & Orange Valleys Geomorphic Province of Partridge *et al.* (2010) - is drained by non-perennial tributaries of the Gariep drainage system (*e.g.* Kaboep Rivier). The new Paulputs PV solar project area, as well as the existing Paulputs Substation and several recently-constructed or proposed solar energy facilities (*e.g.* Kaxu and Xina CSP, Paulputs CSP, Konkonesies 1 Solar PV facilities) are located on the south-western margins of the Ysterberg (1075 m amsl), some 30 km SE of Onseepkans. The surface terrain within the majority of the present study region, away from the rocky *rante* and *koppies*, is predominantly sandy to gravelly, with low hills and patchy outcrops of basement rocks as well as a number of shallow, ephemeral streams. The Paulputs PV Solar Phase 1-3 project areas are all situated in flat-lying, sandy to gravelly areas between drainage lines at *c*. 800-850 m amsl.

The geology of the Paulputs region is shown on 1: 250 000 geological map 2818 Onseepkans (Council for Geoscience, Pretoria) (Fig. 3) (Moen & Toogood 2007) and has been outlined in a recent palaeontological assessment report for the proposed Aggeneis-Paulputs 400 kV Transmission Powerline by Almond (2017) as well as a desktop palaeontological study for the Farm Scuit-Klip 92 by Pether (2010). The scattered small basement inliers here are composed of a variety of resistant-weathering igneous and high grade metamorphic rocks - mainly granites, gneisses, schists, quartzites and amphibolites - of Late Precambrian (Mokolian / Mid-Proterozoic) age. These ancient basement rocks are assigned to the Namaqua Sector of the **Namaqua-Natal Province** and are approximately one to two billion years old (Cornell *et al.* 2006, Moen 2007, Agenbacht 2007, Moen & Toogood 2007). Since none of these basement rocks is fossiliferous, they will not be treated in more detail in this report.

The flatter, lower-lying portions of the study area – including those parts that will be directly affected by the proposed solar PV and associated electrical infrastructure development - are underlain by a spectrum of unconsolidated superficial sediments of Late Caenozoic age. These are largely mapped as **Quaternary to Recent sands and gravels** of probable braided fluvial or sheet wash origin (**Q-s$_2$** in Fig. 3). The alluvial and colluvial sediments are locally overlain, and perhaps also underlain, by unconsolidated aeolian (*i.e.* wind-blown) sands of the **Gordonia Formation** (**Kalahari Group**) that are Pleistocene to Holocene in age (**Q-s$_1$** in Fig. 3; see network of orange dunes on satellite images, *e.g.* Fig. 2). All these superficial sediments can be broadly subsumed into the Late Cretaceous to Recent **Kalahari Group**, the geology of which is reviewed by Haddon (2000) and Partridge *et al.* (2006). Narrow strips of Late Caenozoic **sandy to gravelly alluvium** occur along local drainage courses that are unlikely to be directly impacted by the proposed development.

3. PALAEONTOLOGICAL HERITAGE

The Mid Proterozoic (Mokolian) igneous and metasedimentary basement rocks of the **Namaqua-Natal Province** are entirely unfossiliferous (Almond & Pether 2008). Fossil biotas recorded from each of the main sedimentary rock units mapped in the Aggeneys region and along the Orange River to the north have been reviewed in several previous palaeontological heritage assessments by Almond (*e.g.* 2011, 2012, 2013a, 2013b, 2014, 2015, 2016, 2017; see also Almond & Pether 2008, Almond 2009, Pether 2010, Almond *in* Macey *et al.* 2011 and extensive references therein).

The various younger superficial deposits of the **Kalahari Group** in Bushmanland, including aeolian sands, alluvium, surface gravels, calcretes and pan deposits, are poorly known in palaeontological terms. The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the adjoining Pofadder and Onseepkans geology sheet explanations by Agenbacht (2007) and Moen and Toogood (2007) respectively. The Kalahari beds may very occasionally contain important Late Caenozoic fossil biotas, notably the bones, teeth and horn cores of mammals (usually isolated and abraded) as well as remains of reptiles like tortoises, non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites), plant remains such as peats or palynomorphs (pollens, spores) in organic-rich alluvial horizons as well as siliceous diatoms in pan sediments. Calcrete hardpans might also contain trace fossils such as rhizoliths, termite nests and other insect burrows, or even mammalian trackways.

4. CONCLUSIONS & RECOMMENDATIONS

Precambrian basement rocks underlying the Paulputs PV Solar project area at depth are unfossiliferous while the overlying Late Caenozoic superficial deposits (alluvium, gravels, aeolian sands *etc*) are generally of low to very low

palaeontological sensitivity. No sensitive palaeontological sites or no-go areas have been identified within the Paulputs PV Solar Farm study area or the associated short transmission line corridor options to Paulputs Substation. Narrow zones of Late Caenozoic alluvium associated with minor water courses in the broader study region might contain fossils such as isolated mammalian bones and teeth or freshwater molluscs but these are probably very sparse, at most. Since the Phase 1-3 project areas are situated away from drainage lines and the placement of powerlines' pylon footings close to drainage lines is unlikely, direct impacts on alluvial fossils are unlikely.

Impacts on unique or irreplaceable fossil heritage resources due to the proposed development are improbable and their severity is anticipated to be negligible since (1) significant fossil sites are unlikely to be affected, (2) the footprints involved are small, and (3) in most cases any impacts can be mitigated through application of an appropriate Chance Fossil Finds Procedure (See Appendix). The overall impact significance of the proposed Paulputs PV Solar Farm (Phases 1-3) and associated electrical infrastructure developments (overhead transmission lines, on-site substations) is rated as VERY LOW in terms of palaeontological heritage resources. This assessment applies equally to all transmission line route options under consideration. Given the general low palaeontological sensitivity of the region, cumulative impacts inferred for the various powerlines and alternative energy developments in the Aggeneys – Pofadder – Paulputs region of the Northern Cape are assessed as very low.

Pending the potential discovery of significant fossil remains (*e.g.* mammalian bones or teeth) during the construction phase, no further specialist palaeontological studies or mitigation are recommended for the Paulputs PV Solar Farm project (Phases 1-3) and associated electrical infrastructure developments. Chance fossil finds such as vertebrate bones and teeth or shells should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact details: 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). This is so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented (Please refer to the tabulated Chance Fossil Finds Procedure appended to this report). The palaeontologist concerned with mitigation work would need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection) (SAHRA 2013). These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed developments.

5. REFERENCES

AGENBACHT, A.L.D. 2007. The geology of the Pofadder area. Explanation of 1: 250 000 geology sheet 2918. 89 pp. Council for Geoscience, Pretoria.

ALMOND, J.E. 2008a. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.

ALMOND, J.E. 2008b. Palaeozoic fossil record of the Clanwilliam sheet area (1: 250 000 geological sheet 3218). Unpublished report for the Council for Geoscience, Pretoria, 49 pp. (To be published by the Council in 2009).

ALMOND, J.E. 2009. Contributions to the palaeontology and stratigraphy of the Alexander Bay sheet area (1: 250 000 geological sheet 2816), 117 pp. Unpublished technical report prepared for the Council for Geoscience by Natura Viva cc, Cape Town.

ALMOND, J.E. 2011. Proposed Sato Energy Holdings (Pty) Ltd photovoltaic project on Portion 3 of Farm Zuurwater 62 near Aggeneys, Northern Cape Province. Recommended exemption from further specialist palaeontological studies or mitigation, 7 pp. Natura Viva cc.

ALMOND, J.E. 2012. Proposed 75 MW solar facility on Farm Zuurwater 62 (Portions 2 & 3) near Aggeneys, Northern Cape Province. Recommended exemption from further specialist palaeontological studies or mitigation, 6 pp. Natura Viva cc.

ALMOND, J.E. 2013a. Proposed wind energy facility and associated infrastructure on Namies Wind Farm (Pty) Ltd near Aggeneys, Northern Cape Province. Palaeontological heritage assessment: desktop study, 16 pp. Natura Viva cc.

ALMOND, J.E. 2013b. Proposed upgrade & repair of water supply infrastructure, Onseepkans, Northern Cape. Recommended exemption from further palaeontological studies, 6pp. Natura Viva cc.

ALMOND, J.E. 2014. Three proposed Mainstream wind energy facilities and a solar energy facility on Farms 209 and 212 near Pofadder, Northern Cape. Palaeontological heritage basic assessment: desktop study 19 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2015. Proposed Sol Invictus 600 MW solar PV development on Portion 5 of Farm Ou Taaisbosmond 66 near Aggeneys, Northern Cape Province. Palaeontological heritage desktop assessment, 7 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2016. Letsoai and Enamandla Solar Energy Facilities on Farm Hartebeestvlei near Aggenys, Northern Cape: palaeontological heritage, 7 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2017. Proposed Aggeneis-Paulputs 400 kV Transmission Powerline and Substation Upgrades, Namaqua & Siyanda Districts, Northern Cape Province. Palaeontological heritage assessment: desktop study, 19 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

CORNELL, D.H. et al. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp 325-379. Geological Society of South Africa, Johannesburg & Council for Geoscience, Pretoria.

DE WIT, M.C.J., MARSHALL, T.R. & PARTRIDGE, T.C. 2000. Fluvial deposits and drainage evolution. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp.55-72. Oxford University Press, Oxford.

HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.

KLEIN, R.G. 1984. The large mammals of southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 107-146. Balkema, Rotterdam.

KLEIN, R.G. 1988. The archaeological significance of animal bones from Acheulean sites in southern Africa. The African Archaeological Review 6, 3-25.

MACEY, P.H., SIEGFRIED, H.P., MINNAAR, H., ALMOND, J. AND BOTHA, P.M.W. 2011. The geology of the Loeriesfontein Area. Explanation to 1: 250 000 Geology Sheet 3018 Loeriesfontein, 139 pp. Council for Geoscience, Pretoria.

MACRAE, C. 1999. Life etched in stone. Fossils of South Africa, 305 pp. The Geological Society of South Africa, Johannesburg.

MALHERBE, S.J., KEYSER, A.W., BOTHA, B.J.V., CORNELISSEN, A., SLABERT, M.J. & PRINSLOO, M.C. 1986. The Tertiary Koa River and the development of the Orange River drainage. Annals of the Geological Survey of South Africa 20, 13-23.

McCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

MOEN, H.F.G. 2007. The geology of the Upington area. Explanation to 1: 250 000 geology Sheet 2820 Upington, 160 pp. Council for Geoscience, Pretoria.

MOEN, H.F.G. & TOOGOOD, D.J. 2007. The geology of the Onseepkans area. Explanation to 1: 250 000 geology Sheet 2818, 101 pp. Council for Geoscience, Pretoria.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

PARTRIDGE, T.C., DOLLAR, E.S.J., MOOLMAN, J. & DOLLAR, L.H. 2010. The geomorphic provinces of South Africa, Lesotho and Swaziland: a physiographic subdivision for earth and environmental scientists. Transactions of the Royal Society of South Africa 65, 1-47.

PETHER, J. 2010. Proposed Pofadder Solar Thermal Plant, Portion 4 of the Farm Scuit-Klip 92, Kenhardt District, Northern Cape. Desktop study, 9 pp.

SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press, Cambridge.

6. 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, Northwest, Mpumalanga, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has previously served as 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 development 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: Paulputs PV Solar Farm and associated electrical infrastructure, Farm Konkoonsies 91</td></tr>
<tr><td>Province & region:</td><td colspan="2">Khaî-Ma Local Municipality , Northern Cape</td></tr>
<tr><td>Responsible Heritage Management 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">Late Caenozoic alluvium along water courses</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Bones, teeth and horn cores of mammals, freshwater molluscs, petrified wood, calcretised termitaria and other trace fossils</td></tr>
<tr><td rowspan="5">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 Management 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 Management 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 Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Management Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Management Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">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 Management Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Management Authority minimum standards.</td></tr>
</table>

APPENDIX 5 – Archaeological finds

The "project component" column in the table indicates which aspect is affected by each archaeological resource (PL1, PL2, PL3 denote the power corridor alternatives). Names have been allocated to those archaeological sites that are more than just isolated occurrences. Note the skewed distribution of archaeological resources which are heavily biased towards rocky areas.

GPS	Project compo-nent	Site Name	Co-ordinates	Description	Significance (mitigation)
756	PL1 PL2 PL3	KK2018/004	S28 55 43.5 E19 32 10.0	A quartz outcrop with evidence of having been flaked. There are some quartz flakes in the gravel around the outcrop.	Very low
757	PL1 PL2 PL3	---	S28 55 09.3 E19 31 35.1	Very widespread but ephemeral scatter of 20th century rubbish. A piece of a small glass, a bottle neck with a screw top, several cans (ham, fuel and other food tin), some sections of piping(?) and some wire. Probably mid-20th century.	---
758	PL3	KK2018/005	S28 55 07.8 E19 32 24.4	A small stone structure located at the base of a small rocky hill on its northern side. It is 2 m by 4 m and the walls are 1 m high. A sheet of corrugated iron nearby suggests it may have been in use not too long ago. Also a small white glass cosmetic bottle nearby but no other artefacts.	Low-medium
759	PL3	KK2018/006	S28 55 08.7 E19 32 25.0	A light scatter of quartz artefacts located on the summit of the rocky hill.	Very low
760	PL2	KK2018/007	S28 54 06.8 E19 31 38.2	Quartz outcrop with evidence of flaking.	Very low
761	PL2 PL3	KK2018/008	S28 52 59.4 E19 33 03.6	Large quartz artefact scatter with much ostrich eggshell in front of a small rocky hill. In front of the scatter is a bedrock outcrop with at least 15 grinding patches on it. The scatter includes quartz, CCS, 'other', ostrich eggshell and a few pieces of bone.	Medium-high (Avoid)
762			S28 52 59.2 E19 33 03.2	Bedrock exposure with at least 15 ground patches.	
763	PL2 PL3	KK2018/009	S28 53 00.4 E19 33 04.3	A light quartz artefact and ostrich eggshell scatter.	Low
764	PL2 PL3	KK2018/010	S28 53 02.0 E19 33 05.0	Bedrock exposure with 3 ground patches.	Low
765	PL2 PL3	KK2018/011	S28 53 01.7 E19 33 07.1	Bedrock exposure with at least 15 ground patches. Also a light quartz artefact scatter around it.	Low
766	PL2 PL3	KK2018/012	S28 53 00.3 E19 33 09.0	A light quartz artefact scatter and 6 ground patches on a low shelf at the base of the rocky hill.	Low
767			S28 53 00.0 E19 33 08.1	Bedrock exposure with 1 ground patch.	Low
768			S28 53 00.0 E19 33 07.7	Bedrock exposure with 3 ground patches. Also a portable lower grindstone in the sand nearby (face up).	Low
769			S28 53 00.1 E19 33 07.3	Bedrock exposure with 2 ground patches. Also a light quartz artefact scatter in the area behind 768 and 769.	Low
770	PL2 PL3	KK2018/013	S28 53 03.0 E19 33 06.8	Bedrock exposure with 10 ground patches. There seems to have been an attempt to dam the water	Low

				here at some point (a few bricks and stones lying across the low point behind the outcrop).	
771	PL2 PL3	---	S28 53 10.2 E19 33 02.8	Portable lower grindstone (face up) with ephemeral quartz artefact scatter nearby.	Low
772	PL2 PL3	KK2018/014	S28 53 10.8 E19 33 01.4	A light scatter of ostrich eggshell and quartz artefacts.	Low
773	PL2 PL3	KK2018/015	S28 53 12.9 E19 33 00.7	A light quartz artefact scatter.	Medium (4 hours)
774			S28 53 13.2 E19 33 01.6	A large quartz artefact scatter.	
775	PL2 PL3	---	S28 53 11.8 E19 33 04.3	Bedrock exposure with 1 ground patch and an ephemeral quartz artefact scatter.	Low
776	PL2 PL3	KK2018/016	S28 53 10.1 E19 33 10.8	Widespread quartz artefact scatter.	Low
777	PL2 PL3	KK2018/017	S28 53 02.4 E19 33 13.1	A light quartz artefact scatter on a shelf at the base of the rocky hill.	Low
778	PL2 PL3	KK2018/018	S28 53 01.9 E19 33 13.6	A huge and very dense quartz artefact scatter with occasional other materials also present.	Medium (8 hours)
779			S28 53 02.1 E19 33 15.0		
780			S28 53 00.9 E19 33 14.4		
781	PL2 PL3	KK2018/019	S28 53 00.7 E19 33 15.7	A light quartz artefact scatter	Low
782	PL2 PL3	KK2018/020	S28 53 01.4 E19 33 16.6	A very dense quartz artefact scatter.	Medium (4 hours)
783	PL2 PL3	KK2018/021	S28 53 02.1 E19 33 17.5	A very dense quartz artefact scatter.	Medium (4 hours)
784	PL2 PL3	KK2018/022	S28 53 02.1 E19 33 18.6	A very dense quartz artefact scatter.	Medium (4 hours)
785	PL2 PL3	KK2018/023	S28 53 01.8 E19 33 20.6	A dense quartz artefact scatter.	Medium (4 hours)
786	PL2 PL3	KK2018/024	S28 53 01.3 E19 33 21.1	A light quartz artefact scatter	Low
787	PL2 PL3	KK2018/025	S28 52 57.0 E19 33 21.1	An extensive but light scatter of quartz artefacts.	Low
788	PL2 PL3	KK2018/026	S28 52 57.3 E19 33 17.8	A dense quartz artefact scatter.	Medium (4 hours)
789	PL2 PL3	KK2018/027	S28 52 55.7 E19 33 17.9	A dense quartz artefact scatter.	Medium (8 hours)
790	PL2 PL3		S28 52 55.4 E19 33 18.9	A dense quartz artefact scatter.	
791	PL2 PL3	KK2018/028	S28 52 57.0 E19 33 16.2	A very dense quartz artefact scatter.	Medium (4 hours)
792			S28 52 57.6 E19 33 15.5		
793	PL2 PL3	KK2018/029	S28 52 58.3 E19 33 15.8	A dense quartz artefact scatter.	Medium (4 hours)
794	PL2 PL3	KK2018/030	S28 52 50.1 E19 33 09.6	A light quartz artefact scatter	Low
795	PL2 PL3	KK2018/031	S28 52 47.3 E19 33 12.8	An extensive but light scatter of quartz artefacts.	Low
796	PL2 PL3	---	S28 52 45.8 E19 33 12.7	Bedrock exposure with 4 ground patches.	Low
797	PL2 PL3	KK2018/032	S28 52 43.6 E19 33 13.5	A scatter of ostrich eggshell fragments. Some burnt pieces present.	Low

798	PL2 PL3	KK2018/033	S28 52 42.6 E19 33 17.0	A dense quartz artefact scatter.	Medium (4 hours)
799	PL2 PL3	KK2018/034	S28 52 44.4 E19 33 17.4	A large bedrock exposure at the foot of a rocky hill and with many grinding patches on it. In one place there is a very large ground area. There is a light quartz artefact scatter around the outcrop.	Low
800	PL2 PL3	KK2018/035	S28 52 49.3 E19 33 20.4	A small light scatter of quartz artefacts.	Low
801	PL1	KK2018/036	S28 53 22.9 E19 34 24.7	A quartz outcrop with evidence of flaking.	Low
802	PL1	KK2015/016	S28 54 06.3 E19 34 13.8	A small, low bedrock outcrop with a light quartz artefact scatter and some pottery. Includes a horizontally pierced lug. Also some CCS. **Excavated in 2016.**	---
803	PL1	KK2018/037	S28 54 07.3 E19 34 13.7	A light quartz artefact scatter. Also one quartzite flake seen. Recorded as waypoint 664 in Orton (2015).	Low
804	PL1	---	S28 54 07.0 E19 34 13.9	Bedrock exposure with 1 ground patch.	Low
805	PL1	KK2018/038	S28 54 08.0 E19 34 12.8	An extensive light quartz artefact scatter. Also some 'other'.	Low- medium (4 hours)
806	PL1	KK2015/012	S28 54 09.5 E19 34 13.2	A low granite outcrop with a water hole in it and five ground patches. There is also a light quartz and CCS artefact scatter around the outcrop. **Excavated in 2016.**	---
807	PL1	---	S28 54 10.7 E19 34 14.7	A large quartz scatter which may be mostly background scatter with some LSA overprinted.	Low
808	PL1	KK2018/039	S28 55 08.0 E19 33 37.7	A quartz outcrop with evidence of flaking.	Low
809	PL1 PL2 PL3	KK2018/040	S28 55 39.2 E19 31 37.1	Quartz outcrop with evidence of flaking.	Very low
665	PL1	---	S28 54 06.0 E19 34 12.7	Bedrock exposure surrounded by wind-blown sand and with two ground patches on it. Recorded by (Orton 2015).	Very low
670	PL1	KK2015/014	S28 53 42.7 E19 34 27.6	A lower grindstone lying on a sand dune on the southern side of a small river bed 250 m outside the north-eastern edge of the layout area. There could be buried archaeological material present. Recorded by (Orton 2015).	Low

APPENDIX 6 – Mapping

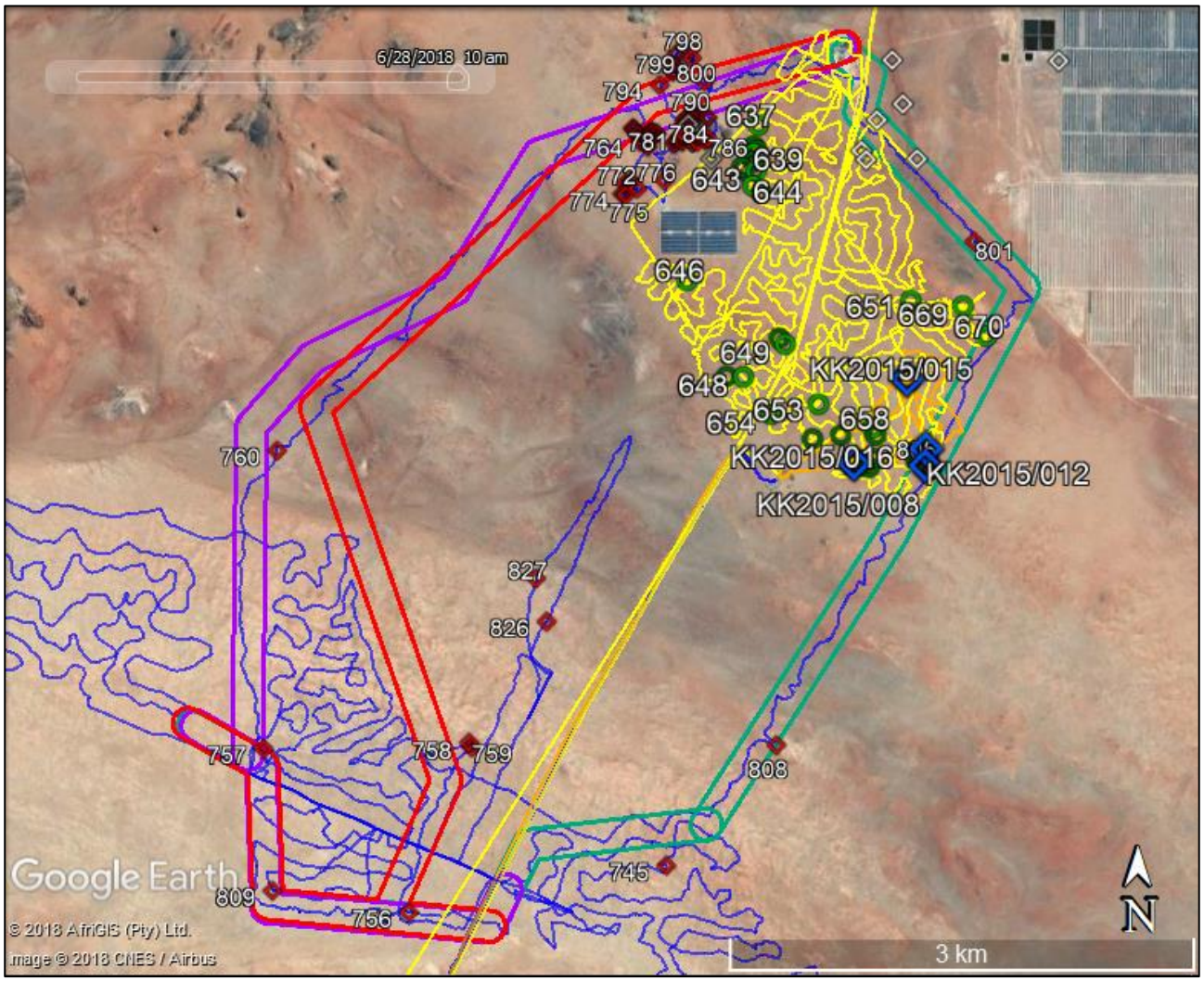

Figure A6.1: *Overview of the study area showing all survey tracks from the present survey (blue lines) and previous relevant work by the author (yellow and orange lines) as well as all waypoints recorded during the present survey (numbered red symbols) and the previous work (numbered green symbols). The blue symbols mark excavated archaeological sites. The white symbols in the northeast are waypoints recorded by others. Alternative 1 in green, Alternative 2 in purple, Alternative 3 in red.*

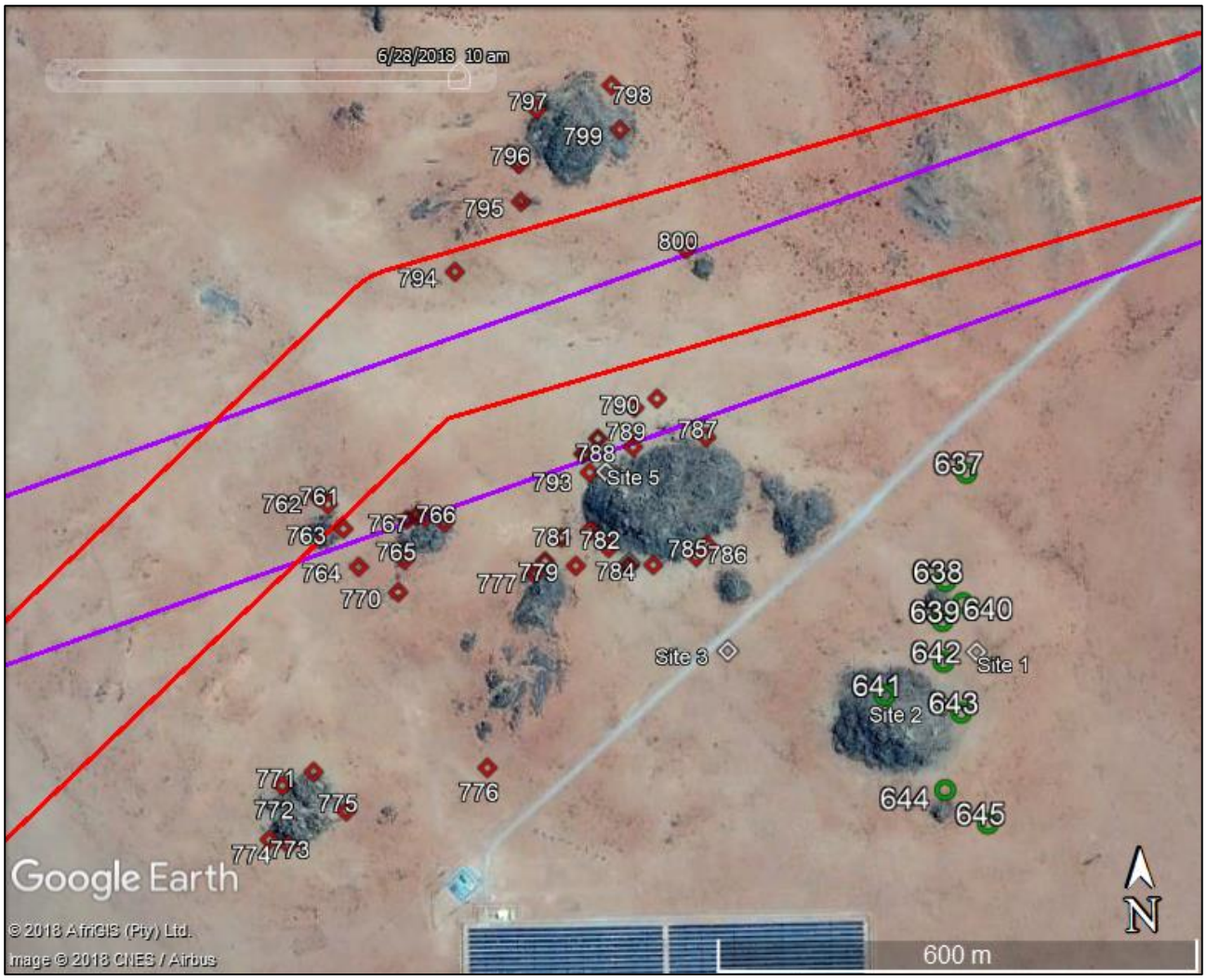

Figure A6.2: *Aerial view of the northern part of the study area showing the sites amongst the rocky hills. Key as for Figure A6.1.*

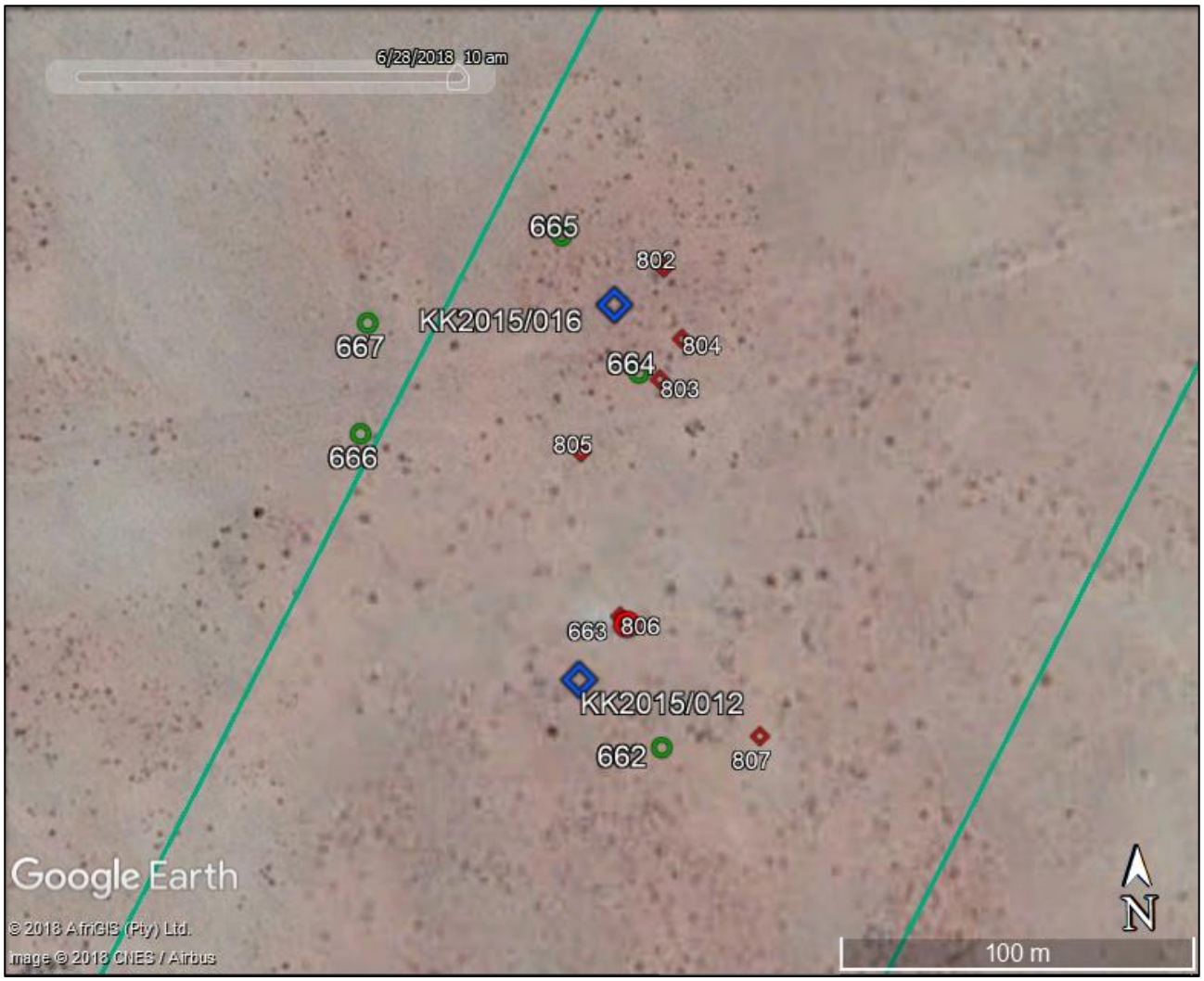

Figure A6.3: *Aerial view of part of the western section of the Alternative 1 corridor. Key as for Figure A6.1.*