

HERITAGE IMPACT ASSESSMENT:

Scoping and Environmental Impact Assessment For the Proposed Development of the 300 MW Paulputs Solar PV Energy Facility on Konkoonsies 91/2/rem and 91/5 near Pofadder, in the Khaî-Ma Local Municipality (Kenhardt Magisterial District, Northern Cape Province)

SAHRA Case Nos:

12580 (Paulputs PV1), 12581 (Paulputs PV2) & 12582 (Paulputs PV3)

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

Report for:

Gaea Enviro (Pty) Ltd

P O. Box 17, Clanwilliam, 8135

Tel: 027 470 0111

Email: lydia@gaeaenviro.co.za

On behalf of:

juwi Renewable Energies (Pty) Ltd



Dr Jayson Orton

ASHA Consulting (Pty) Ltd

40 Brassie Street, Lakeside, 7945

Tel: 083 272 3225

Email: jayson@asha-consulting.co.za

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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 three photo-voltaic (PV) solar energy facilities on the remainder of Portion 2 and on Portion 5 of the farm Konkoonsies 91 which is located 26 km northeast of Pofadder in the Kenhardt Magisterial District. The projects are to be known as Paulputs PV1 (located on Farm 91/5), Paulputs PV2 (located on Farm 91/2/rem) and Paulputs PV3 (located on Farm 91/2/rem).

The three study areas are relatively flat, although the PV3 area slopes gently downhill towards the south. The surface tends to be of fine gravel and vegetation is quite sparse. Rare bedrock outcrops occur but these tend to not be more than 30 cm above natural ground level. Water courses are generally absent but two places where water collects after rain were noted.

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. The PV1 and PV2 study areas were devoid of significant archaeological resources but one significant site was located within the PV3 study area. No graves were seen in the area and there are no structures within 2 km of any of the study areas. 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 of no concern to this study.

There is only one issue of concern which is the archaeological site in the Paulputs PV3 study area. Impacts to this site could be of medium significance. This site would need to be avoided but if this is not possible then archaeological mitigation would need to be carried out by a professional archaeologist under a permit issued to that person by SAHRA. This mitigation could be easily accomplished, and the impact significance would be reduced to very low. Although impacts to the cultural landscape are of medium significance, this is not a great concern since the rating is largely influenced by the high probability of the impact occurring. It is better to cluster electrical facilities and several others are already present in the immediate area. There are no cumulative impacts of concern, largely because of the very low density of heritage resources on the regional landscape.

Because the impacts to heritage resources would be of relatively low significance, it is recommended that the Paulputs PV1, PV2 and PV3 solar energy developments be authorised. However, the following recommendations that should be incorporated into the Environmental Authorisation for each project

Paulputs PV1

- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

Paulputs PV2

- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

Paulputs PV3

- Archaeological site KK2018/001 should be avoided if possible. If this is not possible then a professional archaeologist should be appointed to undertake mitigation prior to construction;
- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

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

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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 three photo-voltaic (PV) solar energy facilities on the remainder of Portion 2 and on Portion 5 of the farm Konkoonsies 91 which is located 26 km northeast of Pofadder in the Kenhardt Magisterial District (Figures 1 - 3). Names and GPS co-ordinates for the mid-point of each PV facility study area are as follows:

- Paulputs PV1: located on Farm 91/5 with centre point at S28° 54' 35" E19° 30' 54";
- Paulputs PV2: located on Farm 91/2/rem with centre point at S28° 55' 12" E19° 31' 54"; and
- Paulputs PV3: located on Farm 91/2/rem with centre point at S28° 55' 52" E19° 33' 23".

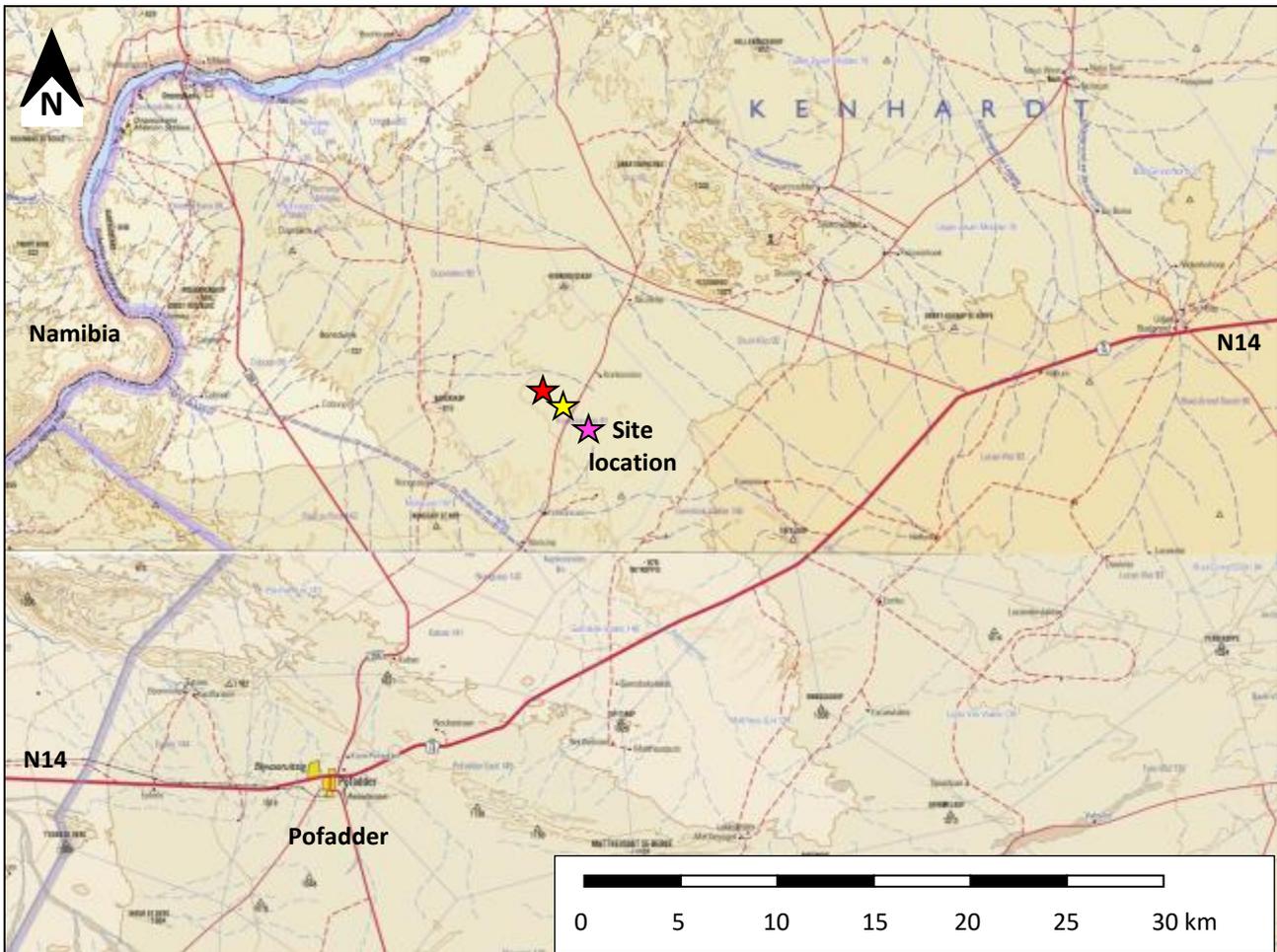


Figure 1: Extract from 1:250 000 topographic maps 2818 & 2819 showing the location of the site. The red, yellow and pink stars indicate Paulputs PV1, PV2 and PV3 respectively. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.

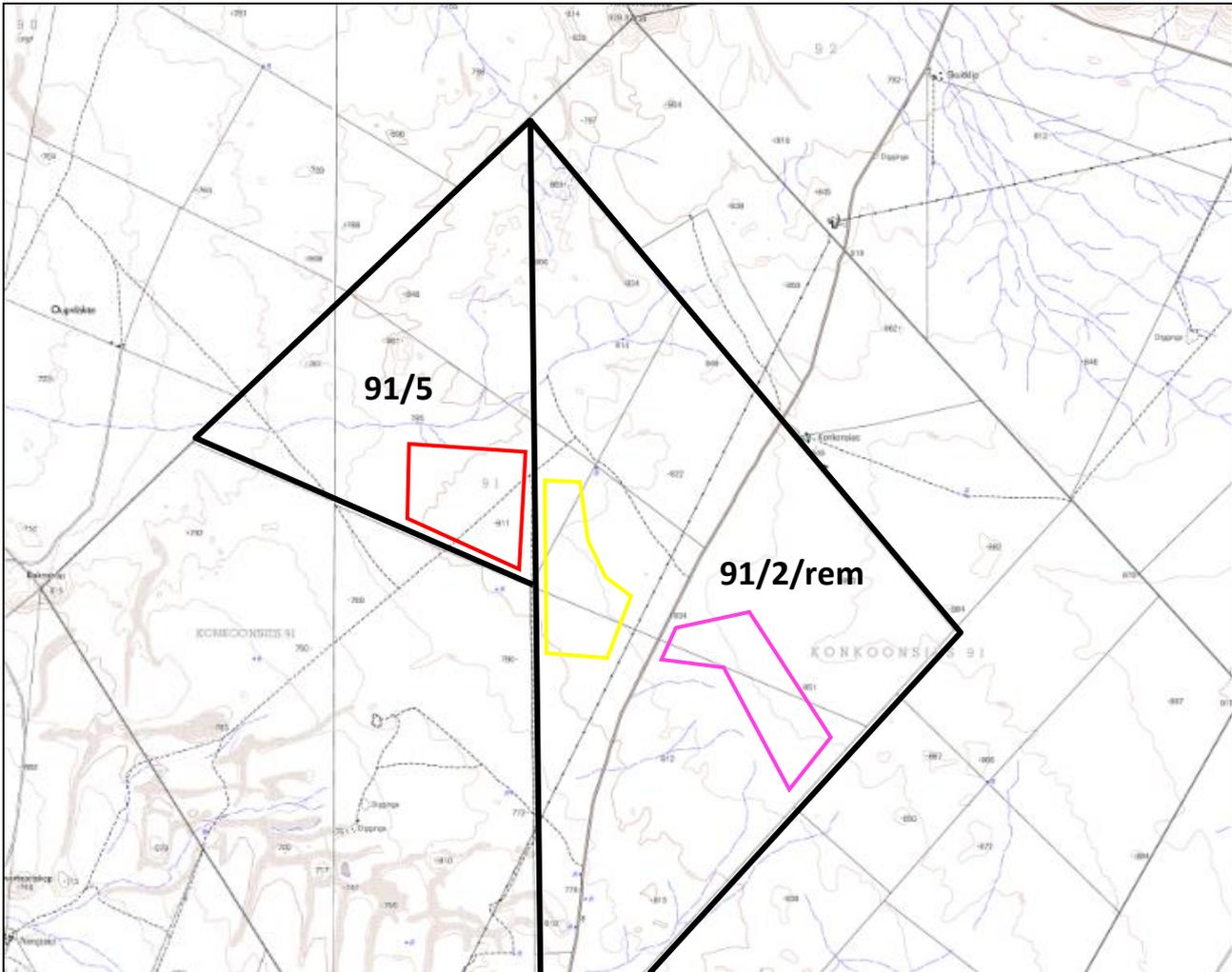


Figure 2: Extract from a 1:50 000 topographic mapsheet 2819DC showing the farm portions (black polygons) and study areas for the Paulputs PV1 (red polygon), PV2 (yellow polygon) and PV3 (pink polygon) facilities.

1.1. Project description

Table 1 provides a description of the proposed developments. It should be noted that this description applies equally to all three developments, although the shape of each development footprint varies according to the landscape constraints.

1.1.1. Aspects of the project relevant to the heritage study

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

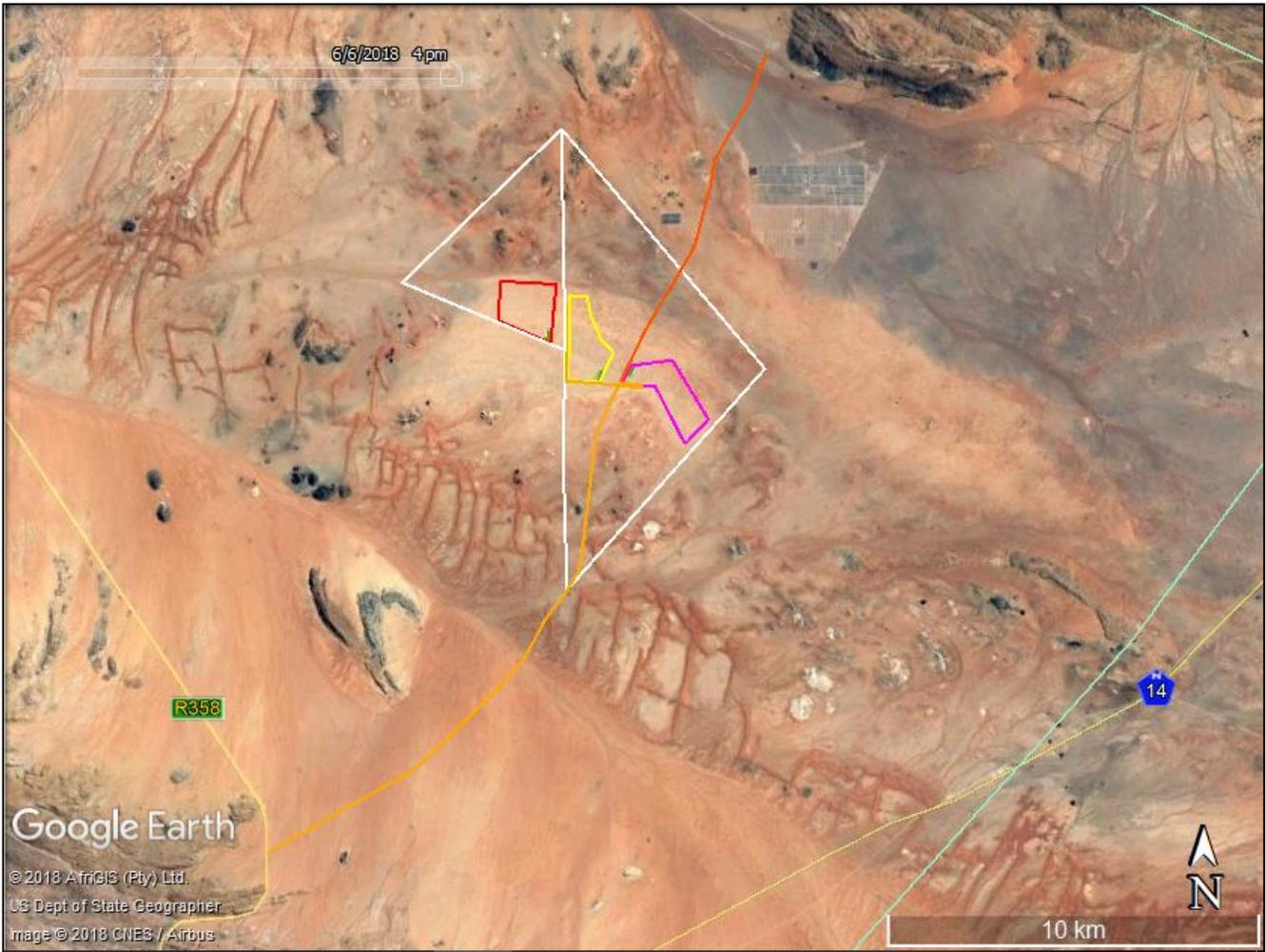


Figure 3: Aerial view of Portions 2/rem and 5 of Konkoonsies 91 (white polygons) showing the study areas for the Paulputs PV1 (red polygon), PV2 (yellow polygon) and PV3 (pink polygon) facilities. The light and dark orange lines represent the south and north access road options. Three existing solar energy facilities are visible to the northwest – a small one just northeast of the remainder of portion 2 and two larger ones side by side to its east.

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 Environmental Impact Assessment (EIA) and grant or withhold authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

Table 1: Description of the various project components involved in each development.

Component	Dimensions
Solar Farm: To be located on Farm 91/5 (PV1) and 91/2/rem (PV2 and PV3)	≤200ha footprint
Battery Storage System: A ≤100MWh battery storage facility for grid storage (stacked containers or multi-storey building) and associated operational, safety and control infrastructure.	≤1ha ≤8m building height
Access road: access to site from the N14 via the R358 (southern access) is approximately 28 km, of which 11 km are travelled on the R358 and the balance on OG73. Access to site from the N14 via the MR759 (northern access) is approximately 31 km, of which 22 km are travelled on the MR759 and the balance on OG73	Maximum width of 13,5 m, including stormwater channels or drainage structures
Service roads: gravel service roads linking the access road and various project components and servicing the solar panel arrays. Roads fitted with traffic control systems and stormwater controls as required.	Maximum width of 6m
Onsite substation complex: ≤2ha (including a 22/132 kV or 33/132 kV onsite collector substation, a switching station, control rooms and grid control yards for both Eskom and the Independent Power Producer (housing unit to control switch gears in the form of a small concrete single storey building) to receive, convert and step up electricity from the PV facility to a grid suitable power supply. A telecommunication tower up to 50m high (lattice or monopole type) will be established in the onsite substation complex.	≤2ha onsite substation complex up to 30m height Up to 50m high telecommunications tower
Operations & Maintenance (O&M) area: ≤1ha hectare O&M laydown area (near / adjacent substation); Parking, reception area, offices and ablutions facilities for operational staff, security and visitors; Workshops, storage areas for materials and spare parts; Water storage tanks or lined ponds (~160kl/day during first 3 months; ~90kl/day during rest of construction period; ~20kl/day during operation; small diameter water supply pipeline connecting existing boreholes or existing pipeline access points to storage.); Septic tanks and sewer lines to service ablution facilities; and Central Waste collection and storage area. Perimeter fencing and internal security fencing and gates as required. Access control gate and guard house on access road;	≤1ha office, ablutions, workshop complex
Temporary infrastructure: -concrete batching facility, -temporary offices, -construction yard and -laydown area. The concrete batching facility and construction yard will have a combined maximum size of 2 hectares. The laydown area will have a maximum size of 2 hectares and will be used mainly for storage of material and equipment during the construction phase.	≤4ha (Temporary)

1.3. Terms of reference

ASHA Consulting was requested to compile a Heritage Impact Assessment 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. It was requested that all three PV facilities be included in a single HIA report but with clearly defined impact assessments and recommendations for each project.

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 an EIA. 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 study¹ by Almond (2018).

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

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 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 system² 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 vast study area it was not feasible to cover it all in great 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.

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. It is noted that no comments related

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

to heritage issues were received during the Scoping Phase with the exception of SAHRA noting submission of the Scoping Report and reiterating their requirement that an HIA be submitted.

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 PV1 study area, while another passes between the PV2 and PV3 study areas.

In recent years, however, 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 the present study area and the other 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 area in which the three PV facilities have been proposed is relatively flat, although the PV3 area does slope gently downhill towards the south. 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 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. No water courses were noted in the study area but a small water hole was found in the southern part of the PV3 area. Figures 4 to 9 illustrate the study area.



Figure 4: View towards the west from the eastern side of the PV1 study area showing the small powerline crossing the site and a patch of quartz gravel.



Figure 5: View towards the northeast across the PV2 study area showing the generally very light vegetation cover with scattered bushes. The rocky hill in the distance is just outside the study area and a powerline running just behind it (between the PV2 and PV3 study areas) is visible.



Figure 6: View towards southwest across the PV2 study area showing a farm track and variable but generally sparse vegetation cover.



Figure 7: View towards southwest across the PV2 study area showing a large area of unvegetated fine gravel.



Figure 8: View towards southwest across the PV3 study area showing one of the better grassed parts of the overall study area.



Figure 9: View towards the west across the PV3 study area showing quartz gravel in the foreground and a small bedrock outcrop in the middleground.

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 Pelsler (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 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.

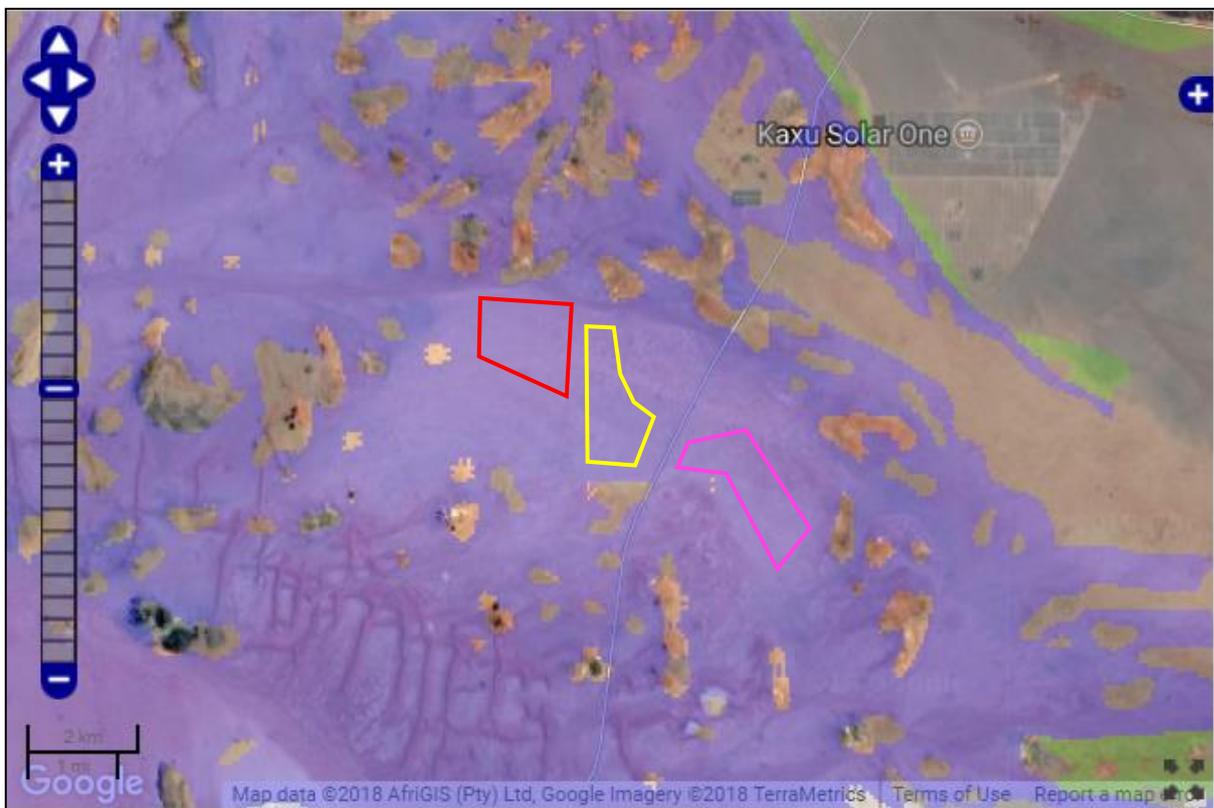


Figure 10: Extract from the SAHRIS Palaeontological Sensitivity Map showing the study areas to be of low palaeontological sensitivity (blue shading) as mentioned by Almond (2018).

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

6.2. Archaeology

6.2.1. PV Site 1

The archaeological survey covered a large amount of ground and found archaeological resources to be very sparsely distributed in the PV study areas. No archaeological resources worthy of recording were

found in the PV1 study area. Isolated artefacts attributable to background scatter were seen from time to time but these have no cultural significance. However, a highly significant archaeological site was found 1 km west of the PV1 study area. This site was similar to those excavated sites reported above but was far larger and far more complex. Because it will not be impacted it is only briefly mentioned here but Appendix 5 can be consulted for further detailed observations. The site consisted of a number of artefact scatters and areas of bedrock grinding around a bedrock hollow that had also been dammed historically with a stone wall to increase its water carrying capacity (Figure 12). Other areas, including a small, deep hole, also trap water (Figure 13). Especially significant at this site was a set of large grooves ground into one bedrock outcrop close to the water source (waypoint 813). These grooves are far deeper than usual and were placed on a steep surface around a single outcrop (Figures 14 & 15). They were clearly not used for grinding food and may have had some sort of ritual significance. Other similar grooves are, to the best of the author's knowledge, unknown. A fragment of a cast iron pot was noted at waypoint 814. Although other historical artefacts were absent, the stone walled dam means that it cannot be confirmed whether this item was left by indigenous or colonial people.

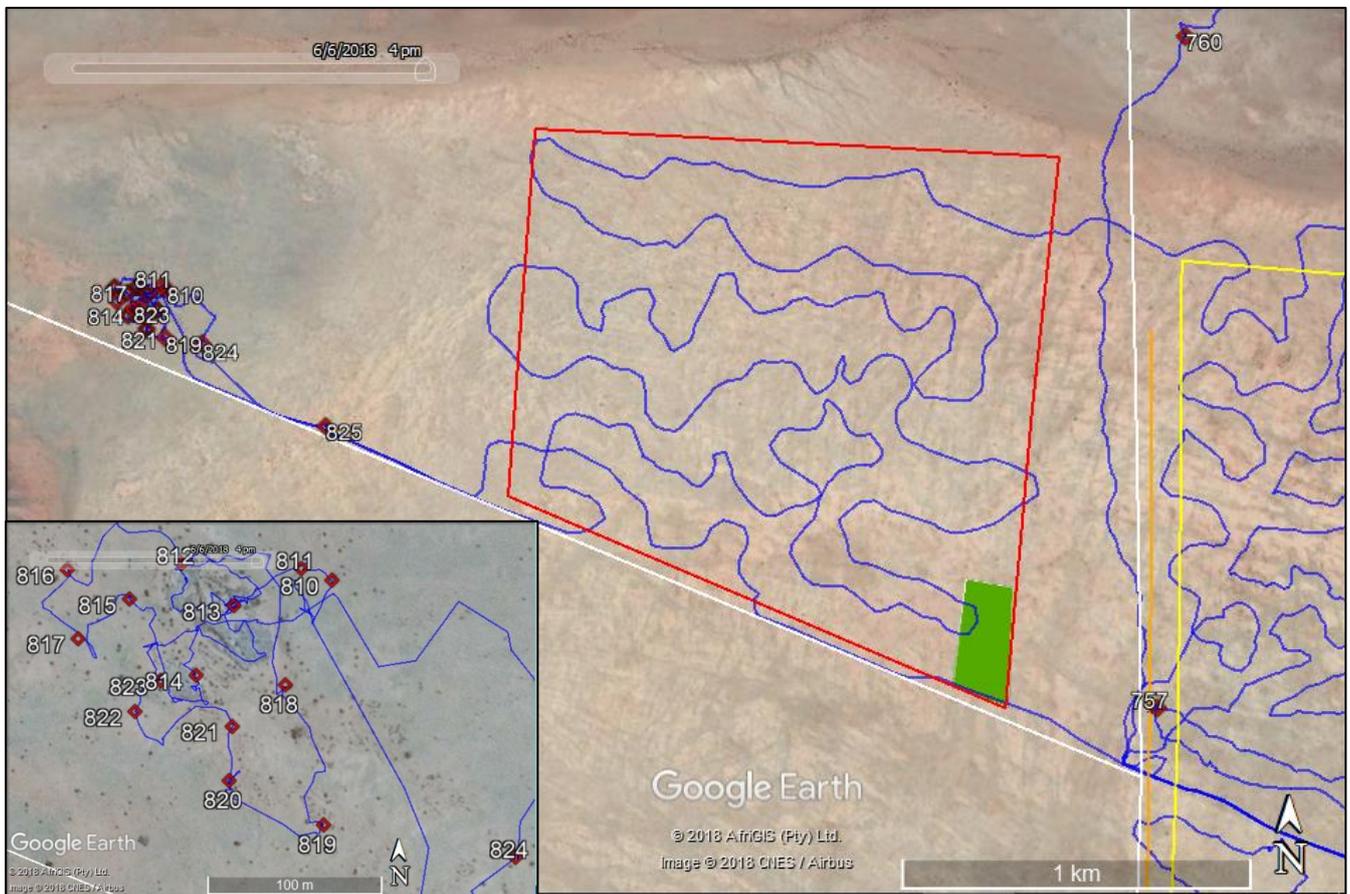


Figure 11: Aerial view of the PV1 study area (red polygon with substation location in green) showing the survey tracks (blue lines) and waypoints (numbered red symbols) recorded during the survey. The inset shows the waypoint cluster in the far west.



Figure 12: Historical stone wall creating a dam at waypoint 813.

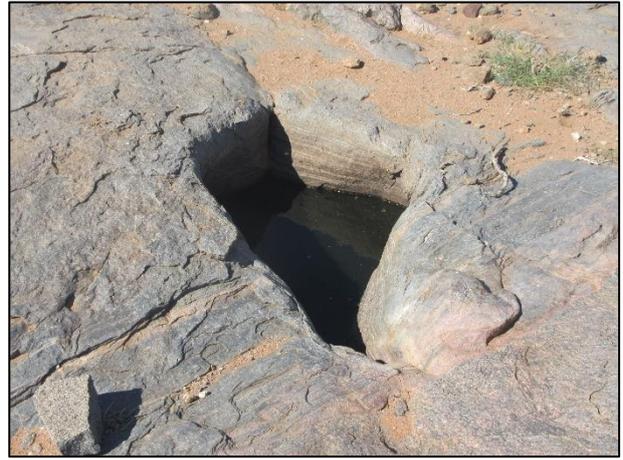


Figure 13: Bedrock hole filled with rain water at waypoint 814.



Figure 14: The bedrock outcrop with the steep grooves ground into its edge at waypoint 813.



Figure 15: Close-up of the partly exfoliated steep grooves at waypoint 813.

6.2.2. PV Site 2

A few sites were found in and around the PV2 area (Figure 16). These included a flaked quartz outcrop (waypoint 756), a small stone artefact scatter on the summit of a rocky hill (waypoint 759), a light scatter of likely mid-20th century rubbish including glass and metal items (waypoint 757) and a small stone structure at the northern foot of the same rocky hill just mentioned (waypoint 758). The structure was 2 m by 4 m in dimension (Figures 17 & 18) and, apart from a sheet of corrugated iron lying nearby, the only historical artefact seen in the area was a small white glass cosmetic bottle (Figure 19). The structure was likely used by a shepherd.

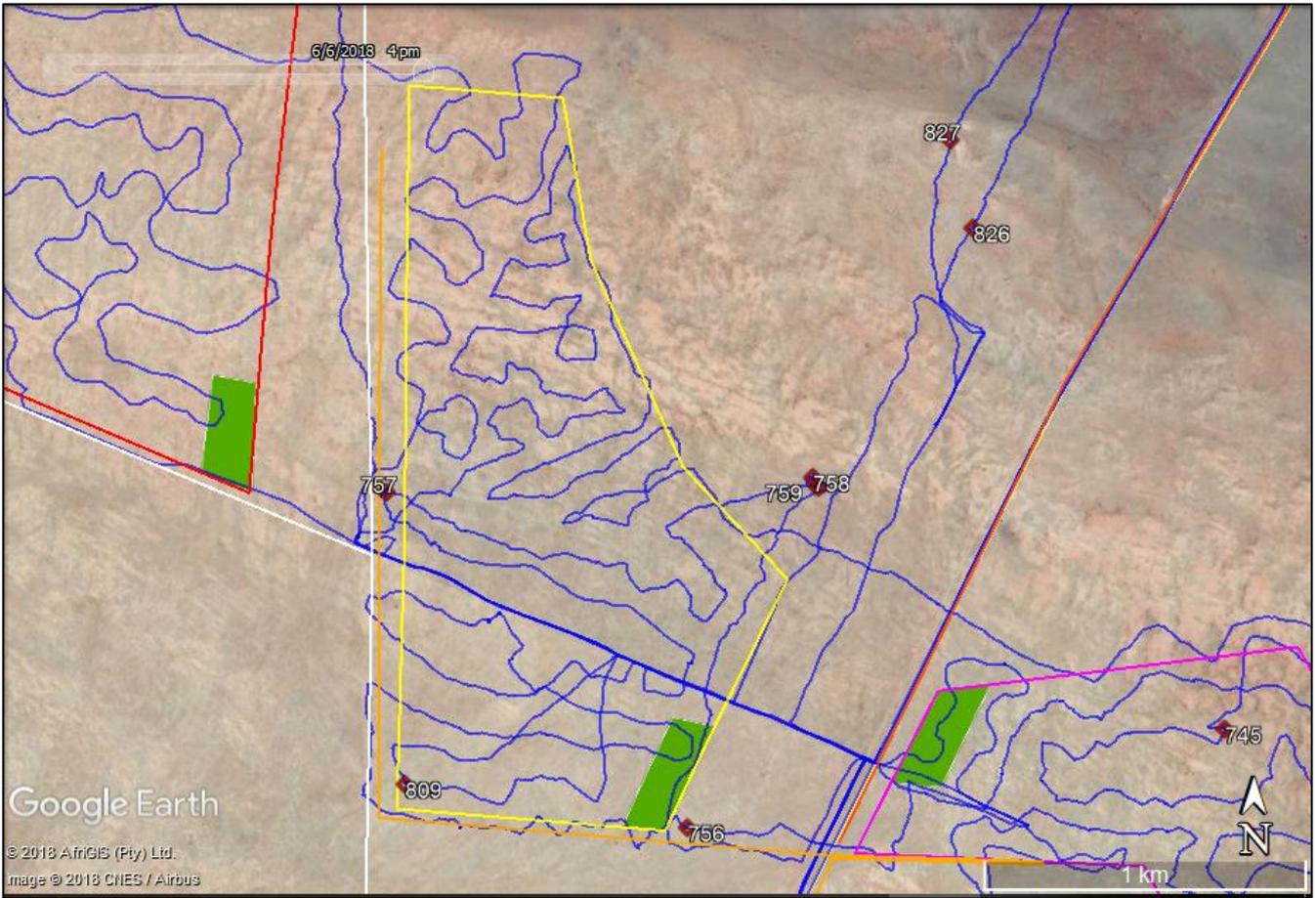


Figure 16: Aerial view of the PV2 study area (yellow polygon with substation location in green) showing the survey tracks (blue lines) and waypoints (numbered red symbols) recorded during the survey.



Figure 17: The stone structure at waypoint 758 facing towards the southwest.



Figure 18: The stone structure at waypoint 758 facing towards the north.



Figure 19: A small glass jar found near waypoint 758.

6.2.3. PV Site 3

The PV3 study area produced two historical cans next to an old tree (waypoint 745), a flaked quartz outcrop (waypoint 754), a granite bedrock outcrop with four ground patches (waypoint 755) and

larger site very similar to those excavated on Konkoonsies 91/6 and described above (Figure 20). The latter site, occurring at waypoints 746 to 753, includes a series of low granite bedrock outcrops with several ground patches (Figures 22 & 23), an area that has been excavated to find water alongside an outcrop (Figure 24), and a light artefact scatter located in a deflated area (Figure 25).

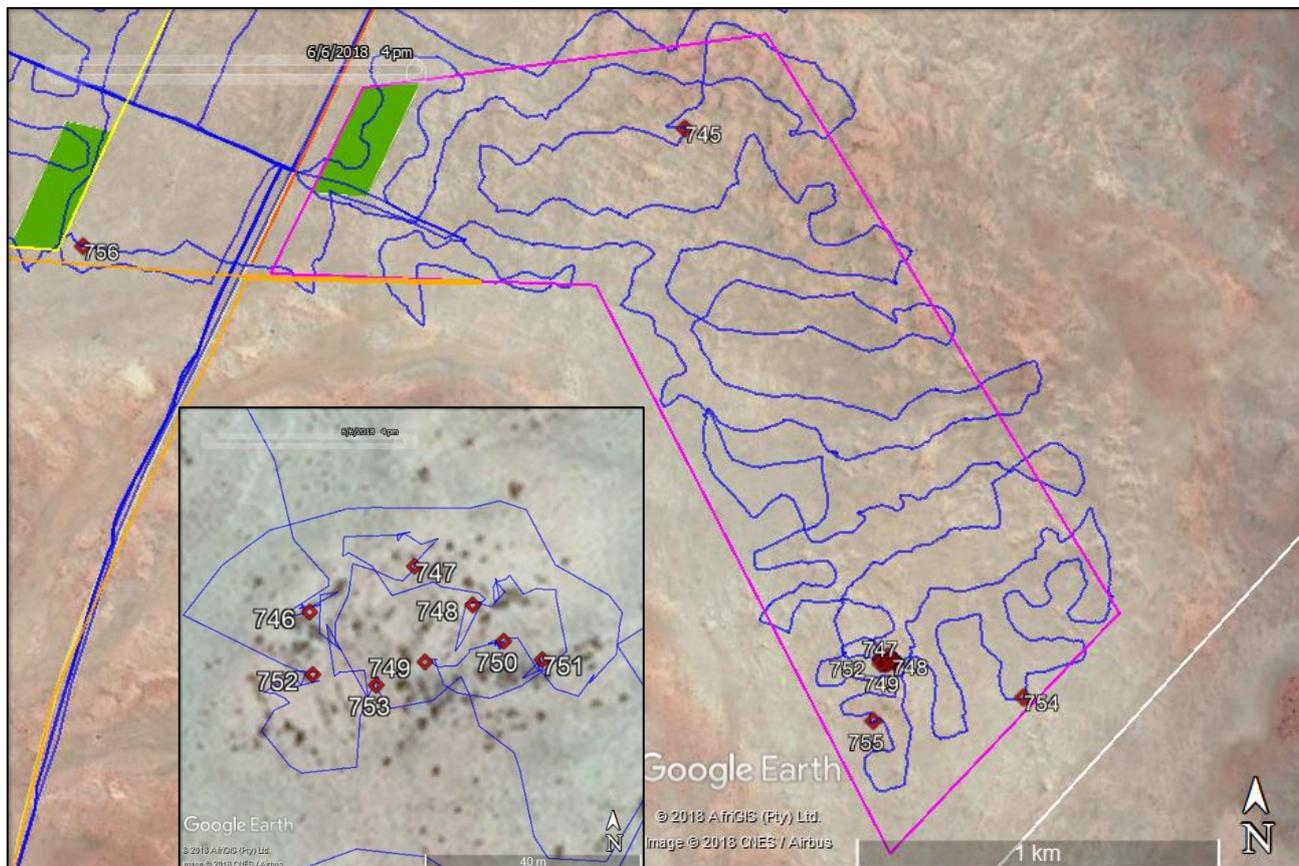


Figure 20: Aerial view of the PV3 study area (pink polygon with substation location in green) showing the survey tracks (blue lines) and waypoints (numbered red symbols) recorded during the survey. The inset shows the waypoint cluster in the southern part of the study area.



Figure 21: View towards the southwest across the large bedrock outcrop at waypoint 746. It had four ground patches on it.



Figure 22: Example of a ground patch at waypoint 746. The scale bar is 30 cm long.



Figure 23: The bedrock shelf under which a hole has been excavated. It acts as a sump and fills with water.

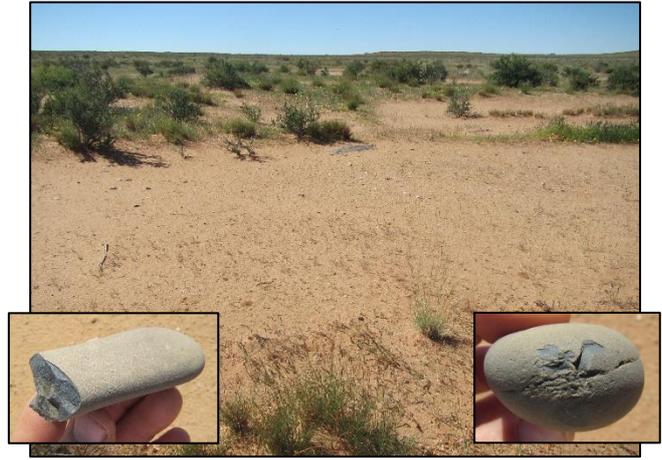


Figure 24: The deflating area with a light quartz scatter at waypoint 752. The inset shows the ends of an elongated hammer stone.

In order to prevent impacts to the site KK2018/001 identified during the heritage specialist fieldwork, a development envelope was created for the PV3 project. The development envelope includes enough area to develop the PV field and associated infrastructure while avoiding site KK2018/001. The development envelope is illustrated in Figure 25 below.

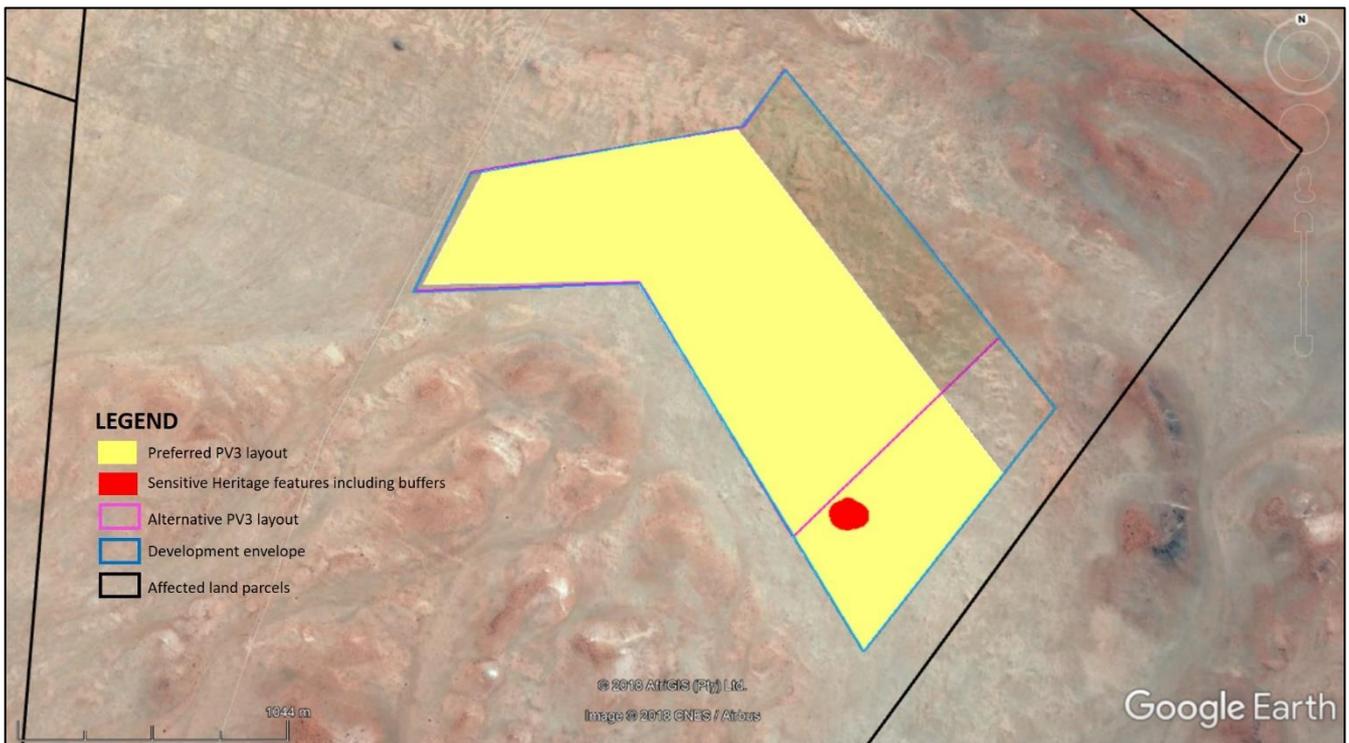


Figure 25: Development envelope for PV3 including the preferred footprint and the alternative footprint.

6.3. Graves

No graves were seen in or near the study areas. 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 2.3 km north of the PV3 study area and 2.8 km northeast of the PV2 study area. They are not visible from these study areas. The 1954 aerial photograph suggests that this farm complex was not present at that time (Figure 26).

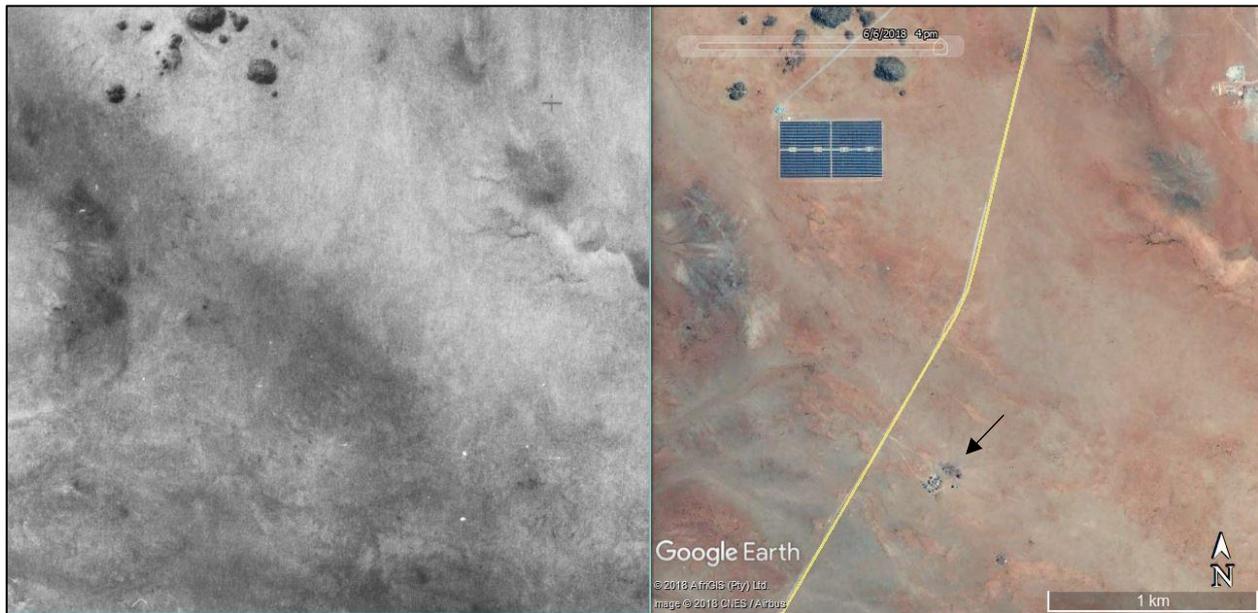


Figure 26: Aerial views from 1954 (Job 345, strip 7, photograph 18136) and 2016 (Google Earth) showing the Konkoonsies 91/6 farm complex (arrowed in modern view) to have not yet been constructed.

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. Figure 27 shows an aerial view of most of the study area in which it is clear that the landscape is almost entirely natural. Significantly, the area has experienced the recent addition of an electrical 'layer' as shown in Figure 28. While the N14 running some 12 km southeast of the PV3 study area can be considered a scenic route, the PV facilities 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. However, with no hills implicated in the present proposals and study areas this aspect is not further investigated here. The one hill next to the PV2 study area was actually found to not be surrounded by archaeology. This may be a function of its isolation and the lack of proximate water sources.



Figure 27: Aerial views from 1954 (Job 345, strip 8, photograph 18022) and 2016 (Google Earth) showing just one anthropogenic feature to be visible – the gravel road.



Figure 28: Aerial view of the broader study area showing the present proposals (red polygons), two existing power lines (black lines), the existing solar energy facilities (white stars), the existing Paulputs Substation (purple star) and the new solar energy facility likely commencing construction in 2018 (white polygons).

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. Archaeological sites are present in the area but only the PV3 study area contains a site of any significance that will need avoidance or mitigation. 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 such facilities is more desirable than spreading them 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, resources in the PV1 and PV2 areas are of very low significance for their scientific value (grade GP C), while the most important site in the PV3 study area is deemed to be of medium 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 but is most strongly developed around the rocky hills which are not of concern to this assessment.

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 and this pertains to the PV3 study area only. 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 Paulputs PV3 facility has the potential to completely destroy a significant archaeological resource should it be built over. This is entirely unacceptable but, with adequate mitigation, scientific data would be rescued and this change would then be deemed acceptable. Mitigation would only be needed in the event that avoidance is not possible. If the one significant site in the PV3 area can be avoided then monitoring will simply aim to ensure that the area is not damaged during construction.

The alternative footprint included in the development envelope proposed for PV3, illustrated in Figure 25, has the potential to avoid the significant archaeological resource identified on the Farm 91/2/rem and therefore would reduce the risk to the archaeological resource to low.

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 (PV1, PV2 & PV3)

Construction phase impacts to palaeontological resources are expected to be identical for all three proposed projects and are presented in Tables 2 and 3.

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 (PV1 & PV2)

Construction phase impacts to archaeological resources are expected to be identical for the PV1 and PV2 projects and are presented in Table 2.

Impacts to archaeological materials would be direct impacts related to the destruction of artefacts 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 very sparse distribution of culturally significant archaeological resources in the landscape, 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 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 archaeological resources (PV3)

Construction phase impacts to archaeological resources for PV3 are presented in Table 3.

Impacts to archaeological materials would be direct impacts related to the destruction of artefacts during preparation of the site for construction and/or during the excavation of foundations. Because a culturally significant site was located in the proposed footprint, an impact of moderate consequence is very likely to occur. The impacts are thus expected to be of **high significance**. Due to the very sparse distribution of culturally significant archaeological resources in the landscape, no possible indirect impacts have been identified. However, should this archaeological site be protected from harm then it would be at risk of indirect impacts occurring. Since it is within the currently proposed development footprint indirect impacts are not assessed here. The significant archaeological site will need to either be avoided with a minimum 30 m buffer (as a best practice principle) or excavated. It is not of such significance as to warrant being a no-go area and mitigation is thus acceptable. With mitigation the impacts would be of **very low significance**.

As indicated previously, the development envelope proposed for PV3 includes the required area to develop the PV field and associated infrastructure and avoid site KK2018/001 and therefore would reduce the risk to the archaeological resources to low significance with indirect impacts being the only concern.

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 (PV1, PV2 & PV3)

Construction phase impacts to the cultural landscape are expected to be identical for all three proposed projects and are presented in Tables 2 and 3.

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**. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures to screen such large developments but one measure that should be applied is to use paint colours that will help built elements of the facility to recede into the background. A visual assessment practitioner can be consulted in this regard. It is understood, however, that some elements of solar energy facilities are required to be painted white. After mitigation the impacts are expected to be of **low significance**.

8.2. Operation Phase

Potential impacts to the cultural landscape (PV1, PV2 & PV3)

Operation phase impacts to the cultural landscape are expected to be identical for all three proposed projects and are presented in Table 4.

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 high probability of occurrence the impacts might be of **medium 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 **medium**.

8.3. Decommissioning Phase

Potential impacts to the cultural landscape (PV1, PV2 & PV3)

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 high probability of occurrence the impacts might be of **medium 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 **medium**.

8.4. Existing impacts

The only impact that currently exists is the potential trampling of archaeological materials at the archaeological site in the PV3 area by grazing livestock and/or farm vehicles. As previously mentioned the development envelope proposed for PV3 and illustrated in Figure 25, would allow for avoidance of the archaeological site identified on Farm 91/2rem if the alternative layout is developed.

8.5. Cumulative Impacts

Cumulative impacts are expected to be identical for all three proposed projects 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 to archaeology 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**. No indirect impacts to the landscape have been identified. There are no feasible mitigation measures to screen such large developments and equipment but the use of pale recessive colours on built elements where technically feasible would marginally reduce the visual intrusion in the landscape. However, the impacts would 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 2: Impact assessment summary table for the Construction Phase: PV1 and PV2.

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 and excavation of foundations	Destruction of palaeontological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
Preparation of site for construction and excavation of foundations	Destruction of archaeological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
All construction activities	Introduction of incompatible elements into the landscape	Negative	Local	Long term	Very low	Very likely	High	Low	Pale recessive paint colours on built elements where technically feasible	Moderate	Low	Moderate

Table 3: Impact assessment summary table for the Construction Phase: PV3.

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 and excavation of foundations	Destruction of palaeontological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
Preparation of site for construction and excavation of foundations	Destruction of archaeological resources	Negative	Site	Permanent	Moderate	Very likely	Low	High	Avoid or archaeological excavation	High	Very low	Very Low
Preparation of site for construction and excavation of foundations based on alternative footprint for PV3 within development envelope	Destruction of archaeological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
All construction activities	Introduction of incompatible elements into the landscape	Negative	Local	Long term	Very low	Very likely	High	Low	Pale recessive paint colours on built elements where technically feasible	Moderate	Low	Low

Table 4: Impact assessment summary table for the Operational Phase: PV1, PV2 & PV3.

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	Very likely	High	Low	None feasible	Moderate	Moderate	Moderate

Table 5: Impact assessment summary table for the Decommissioning Phase: PV1, PV2 & PV3.

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	Very likely	High	Low	None feasible	Medium	Medium	Moderate

Table 6: Impact assessment summary table for Cumulative Impacts: PV1, PV2 & PV3.

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 and excavation of foundations	Destruction of palaeontological resources	Negative	Regional	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
Preparation of site for construction and excavation of foundations	Destruction of archaeological resources	Negative	Regional	Permanent	Moderate	Likely	Low	High	Avoid or excavate sites	Medium	Very low	Very Low
Preparation of site for construction and excavation of foundations based on alternative footprint for PV3 within development envelope	Destruction of archaeological resources	Negative	Site	Permanent	Very low	Rare	Low	High	None required	Very low	Very low	Very Low
All construction activities	Introduction of incompatible elements into the landscape	Negative	Regional	Long term	Very low	Very likely	High	Low	Pale recessive paint colours on built elements where technically feasible	Medium	Medium	Moderate

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 7. Figure 29 shows 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.

Table 7: Mitigation measures suggested for the proposed Paulputs PV1, PV2 and PV3 solar energy facilities.

Heritage aspect	PV1	PV2	PV3
Palaeontology	<ul style="list-style-type: none"> No mitigation required. 	<ul style="list-style-type: none"> No mitigation required. 	<ul style="list-style-type: none"> No mitigation required.
Archaeology	<ul style="list-style-type: none"> No mitigation required. 	<ul style="list-style-type: none"> No mitigation required. 	<ul style="list-style-type: none"> Site KK2018/001 (waypoints 748-753) should be avoided or else excavated by a professional archaeologist prior to construction.
Cultural landscape	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible. 	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible. 	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible.

The archaeological excavation of KK2018/001 should include spatial mapping of the site and excavation of patches where scatters of artefacts occur. Radiocarbon dating may or may not be required depending on the materials recovered. This would need to be done under a permit issued in the name of the appointed professional archaeologist.

9.2. Management

Management measures are listed in Table 8.

Table 8: Management measures suggested for the proposed Paulputs PV1, PV2 and PV3 solar energy facilities.

Heritage aspect	PV1	PV2	PV3
Palaeontology	<ul style="list-style-type: none"> A chance finds procedure should be written into the EMPr. Please see Appendix 4 for details. 	<ul style="list-style-type: none"> A chance finds procedure should be written into the EMPr. Please see Appendix 4 for details. 	<ul style="list-style-type: none"> A chance finds procedure should be written into the EMPr. Please see Appendix 4 for details.
Archaeology	<ul style="list-style-type: none"> 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, 	<ul style="list-style-type: none"> 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, 	<ul style="list-style-type: none"> If site KK2018/001 is avoided then the ECO will need to ensure that the locality is protected from accidental harm during construction activities. This should be monitored whenever the ECO is on site. If the site cannot be avoided and will require mitigation then this should be conducted at least four months prior to construction. Dense accumulations of stone artefacts

	all activities must remain within the authorised footprint.	all activities must remain within the authorised footprint.	found during construction should be reported to the ECO who should then report to an archaeologist or SAHRA. Mitigation may then be required. <ul style="list-style-type: none"> To protect other sites, all activities must remain within the authorised footprint.
Cultural landscape	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible. 	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible. 	<ul style="list-style-type: none"> Pale recessive paint colours should be used on built elements where technically feasible.

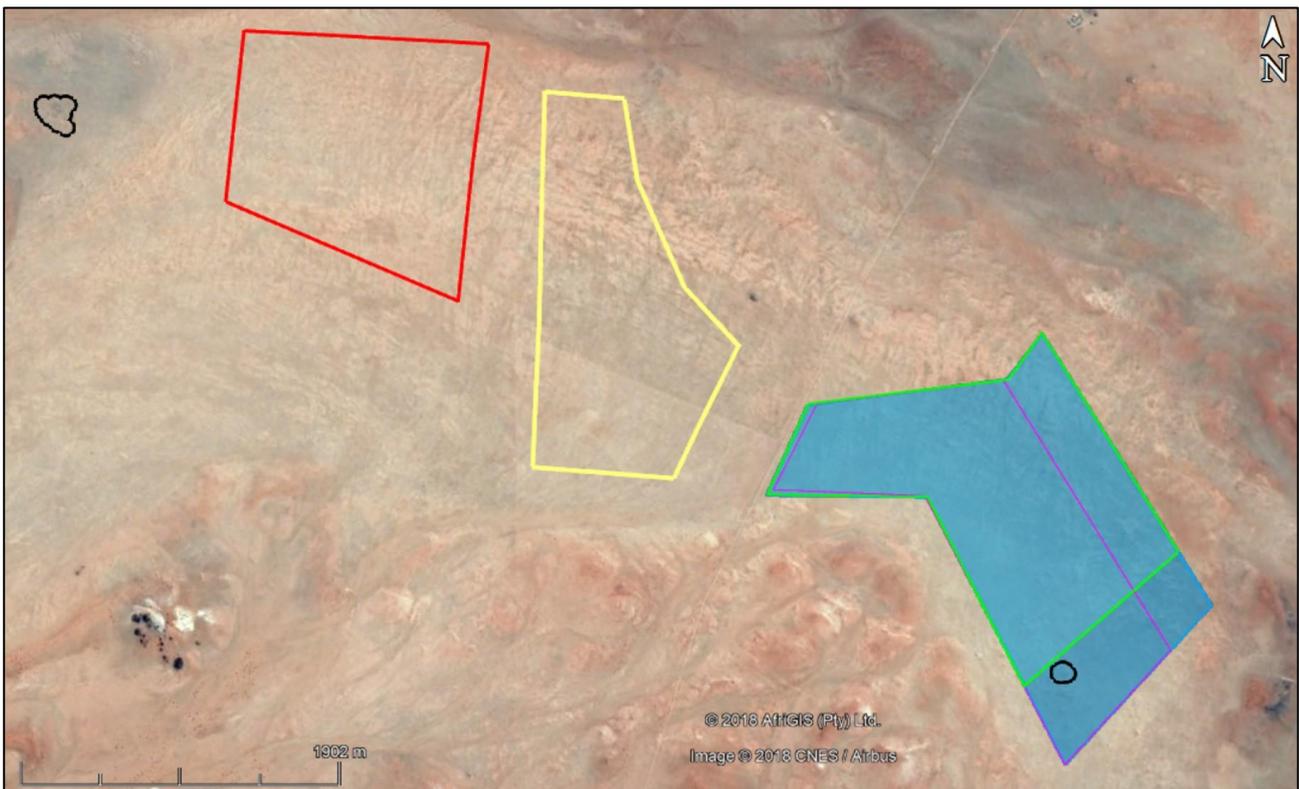


Figure 29: Aerial view of the PV1 (red outlined polygon), PV2 (yellow outlined polygon) and PV3 (pink outlined polygon) with the development envelope for PV3 (blue polygon) and alternative layout (green outlined polygon) and the significant archaeological sites (including buffers) ringed in black. Site KK2018/041 lies to the northwest and KK2018/001 lies to the southeast.

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.

11. CONCLUSIONS

Only one significant heritage resources was found within any of the three study areas – this is an archaeological site within the southern part of the Paulputs PV3 study area. The site can be avoided (by avoiding, fencing and protecting the site during construction or by selection of the alternative footprint for PV3) but is certainly easy to mitigate via archaeological excavation should this be required. There are no fatal flaws for any of the three project areas and it is concluded that development of all three is feasible. 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.

12. RECOMMENDATIONS

Because the impacts to heritage resources would be of relatively low significance and are easily manageable, it is recommended that the Paulputs PV1, PV2 and PV3 solar energy developments be authorised. However, the following recommendations that should be incorporated into the Environmental Authorisation for each project:

Paulputs PV1

- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

Paulputs PV2

- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

Paulputs PV3

- Archaeological site KK2018/001 should be avoided if possible. If this is not possible then a professional archaeologist should be appointed to undertake mitigation prior to construction;

- If KK2018/001 is avoided then the site should be fenced and declared a no-go area during construction;
- 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; and
- Where technically feasible, pale recessive colours should be used on the built elements of the project.

13. REFERENCES

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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.

Name of Specialist: JAYSON ORTON

Signature of the specialist:  _____

Date: 17 OCTOBER 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-	Section 1.4 & Appendix 1
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;	
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;	Section 1.2
(ca) an indication of the quality and age of base data used for the specialist report;	n/a
(cb) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	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-	Section 12
i. whether the proposed activity, activities or portions thereof should be authorised;	
(ii) 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;	
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

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

John E. Almond PhD (Cantab.)
Natura Viva cc, PO Box 12410 Mill Street,
Cape Town 8010, RSA
naturaviva@universe.co.za

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 Konkoonsies 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 powerline and alternative energy developments in the Aggeney's – 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 Khaï-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 (≤ 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).

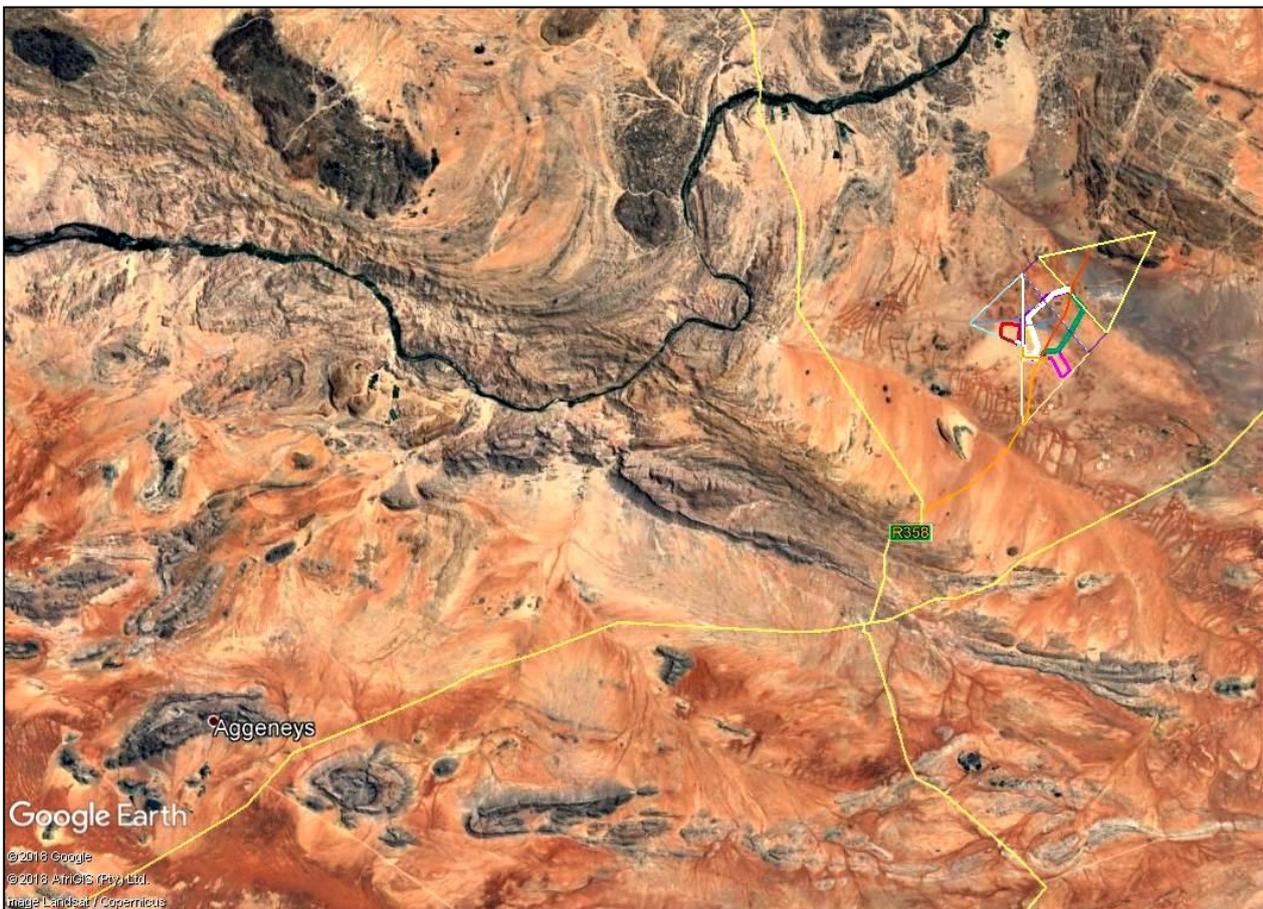


Figure 1: Google Earth© satellite image showing the location of the Paulputs PV Solar Farm project area on Farm Konkoonsies 91 situated between the N14 trunk road and the Orange River (Gariiep), c. 27 km NE of Pofadder.

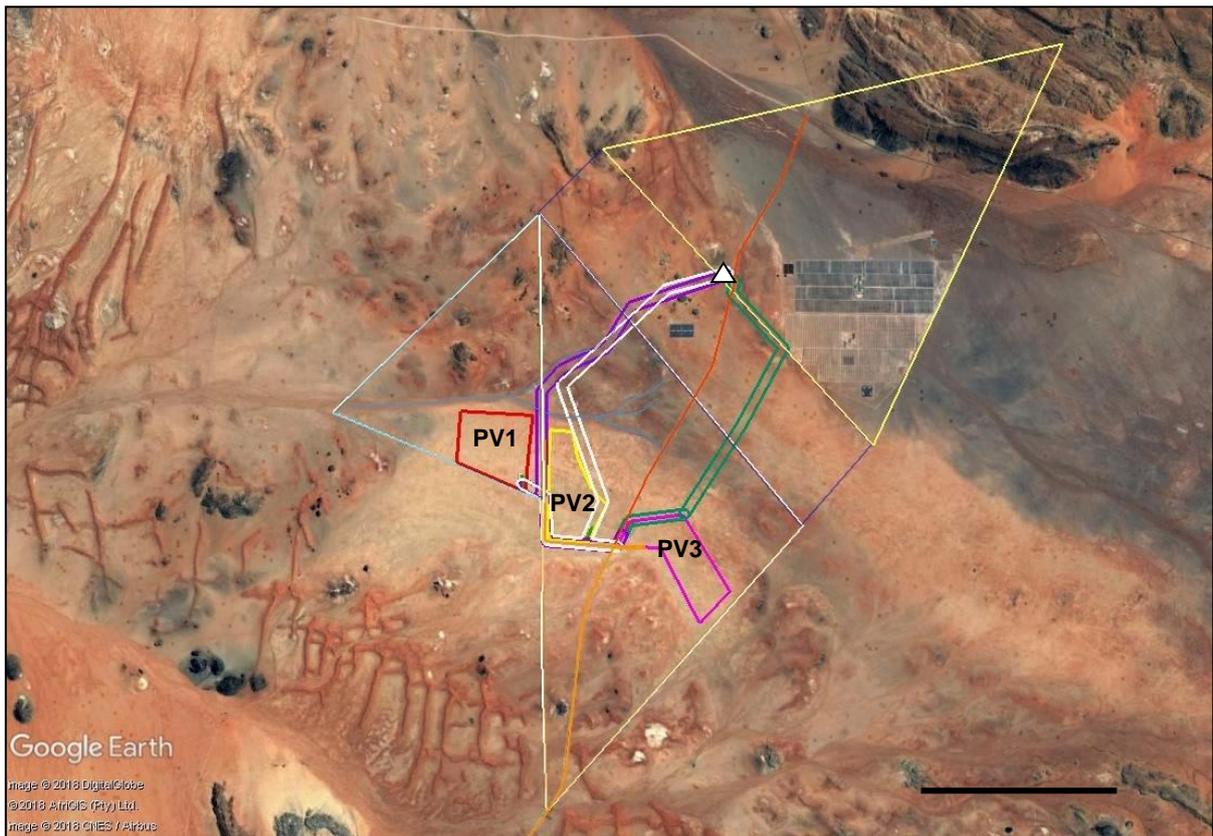


Figure 2: Google Earth© satellite image showing the location of the three proposed phases of the Paulputs PV Solar Farm (PV1, PV2, PV3) on Farm Konkoonsies 91, the main access roads (orange) as well as transmission line corridor options (purple, white, green) to the nearby Paulputs Substation on Farm 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. Scale bar = 4 km. N towards top of image.

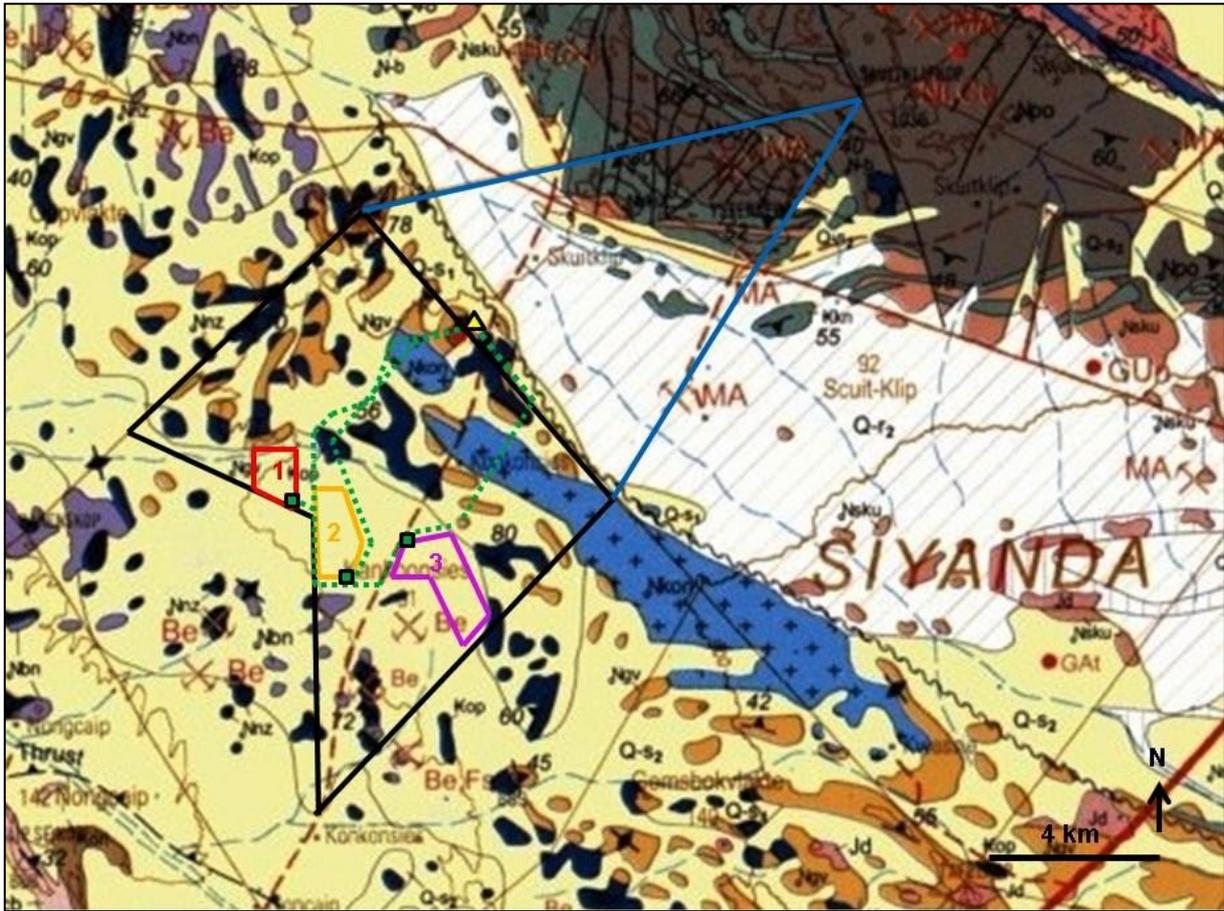


Figure 3: Extract from 1: 250 000 geology sheet 2818 Onseepkans (Council for Geoscience, Pretoria) showing the main rock units represented in the Paulputs PV Solar Farm project area (Phases 1-3 indicated by the red, yellow and purple polygons respectively). These rocks include several different units 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. Nkon, 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 (Gariiep) 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 Gariiep 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-s₂** 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-s₁** 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. PALAEOLOGICAL 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 powerline 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 powerline 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

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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**

CHANCE FOSSIL FINDS PROCEDURE: Paulputs PV Solar Farm and associated electrical infrastructure, Farm Konkoonsies 91	
Province & region:	Khaï-Ma Local Municipality , Northern Cape
Responsible Heritage Management Authority	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
Rock unit(s)	Late Caenozoic alluvium along water courses
Potential fossils	Bones, teeth and horn cores of mammals, freshwater molluscs, petrified wood, calcretised termitaria and other trace fossils
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • 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) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering)
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • 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
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> 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
	4. If required by Heritage Management Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Management Authority
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Management Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Management Authority minimum standards.

APPENDIX 5 – Archaeological finds

Note that this table lists all finds recorded during the survey for the three PV facilities and access roads which are assessed in this report and also the powerline alternatives which are assessed in a separate report. This is purely to emphasise the skewed distribution of archaeological resources which are heavily biased towards rocky areas. The “project component” column in the table indicates which aspect is affected by each archaeological resource (PV1, PV2 & PV3 denote the PV facilities, AR denotes the access road and PL1, PL2, PL3 the powerline alternatives). Names have been allocated to those archaeological sites that are more than just isolated occurrences.

GPS	Project component	Site Name	Co-ordinates	Description	Significance (mitigation)
745	PV3	---	S28 55 33.2 E19 33 11.6	Two cans next to a tree. One was a large (possibly fuel) can that seemed to have been modified for reuse.	---
746	PV3	KK2018/001	S28 56 20.7 E19 33 31.5	A low granite outcrop with four ground patches on it.	Medium (12 hours)
747			S28 56 20.4 E19 33 32.2	Ephemeral artefact scatter with quartz, CCS and ostrich eggshell	
748			S28 56 20.6 E19 33 32.6	Granite outcrop with one ground patch. Also a place where animals have dug into the sand alongside another outcrop in search of water. This outcrop has two ground patches and possibly more under the sand. This place may have been open regularly when more wild animals were around, or even opened by people to facilitate rainwater collection.	
749			S28 56 21.0 E19 33 32.3	A small scatter of ostrich eggshell fragments.	
750			S28 56 20.8 E19 33 32.9	A low granite outcrop with four ground patches on it.	
751			S28 56 20.9 E19 33 33.1	A low granite outcrop with one ground patch on it.	
752			S28 56 21.0 E19 33 31.6	A light quartz artefact scatter in a deflating area with occasional other materials including a long hammerstone/core in fine-grained black rock	
753			S28 56 21.1 E19 33 32.0	A light quartz artefact scatter in a deflating area. Note that this whole site has a very ephemeral scatter over it but it is not always possible to tell what is recent and associated with the site and what is background scatter. A fragment of	

				an upper grindstone was also seen between the GPS points.	
754	PV3	KK2018/002	S28 56 24.1 E19 33 46.0	A quartz outcrop with evidence of having been flaked.	Very low
755	PV3	KK2018/003	S28 56 26.2 E19 33 30.8	A low granite outcrop with four ground patches on it. Three are in a tight cluster and their edges partially overlap.	Very low
756	PV2 AR 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	PV2 AR PL1 PL2 PL3	---	S28 55 09.3 E19 31 35.1	Very widespread but ephemeral scatter of 20 th 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-20 th century.	---
758	PV2 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 (outside study area)
759	PV2 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 (outside study area)
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 here at some point (a few bricks and stones lying across the low point behind the outcrop).	Low
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	KK2018/022	S28 53	A very dense quartz artefact scatter.	Medium

	PL3		02.1 E19 33 18.6		(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		S28 54	A small, low bedrock outcrop with a	---

			06.3 E19 34 13.8	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	PV2 AR PL1 PL2 PL3	KK2018/040	S28 55 39.2 E19 31 37.1	Quartz outcrop with evidence of flaking.	Very low
810	n/a	KK2018/041	S28 54 30.1 E19 29 50.0	Bedrock exposure with 10 ground patches.	High (outside study area)
811	n/a		S28 54 29.9 E19 29 49.3	A low stone alignment of unknown function.	
812	n/a		S28 54 29.8 E19 29 46.8	A bedrock outcrop with a water hole and many ground patches.	
813	n/a		S28 54 30.6 E19 29 47.9	A set of large grinding grooves on rock that is at about a 60 degree angle. They are all around the edge of a single section of bedrock with some leading down into where the pool would be if full.	
814	n/a		S28 54 31.9 E19 29 47.1	A deep water hole in a granite outcrop with stone artefacts around it and a few potsherds (all plain body sherds about 4 mm thick) and a piece of a cast iron potjie.	
815	n/a		S28 54 30.5 E19 29 45.7	An area with dense artefact and ostrich eggshell scatter.	
816	n/a		S28 54 29.9 E19 29 44.4	Bedrock exposure with 5 ground patches and surrounded by a dense artefacts scatter.	
817	n/a		S28 54 31.2 E19	An area with widespread dense artefact scatter.	

			29 44.6		
818	n/a		S28 54 32.1 E19 29 49.0	A stone cluster.	
819	n/a		S28 54 34.7 E19 29 49.8	A bedrock exposure with extensive grinding on it (large areas rather than discrete patches).	
820	n/a		S28 54 33.9 E19 29 47.8	An area with extensive dense artefact scatter. Also a hammer stone/upper grindstone here.	
821	n/a		S28 54 32.8 E19 29 47.9	An area with extensive dense artefact scatter.	
822	n/a		S28 54 32.6 E19 29 45.8	An area with extensive dense artefact scatter.	
823	n/a		S28 54 32.0 E19 29 46.3	A stone cluster.	
824	n/a	---	S28 54 35.2 E19 29 53.8	Bedrock exposure with 2 ground patches.	
825	n/a	KK2018/042	S28 54 43.0 E19 30 07.0	Bedrock exposure with 5 ground patches.	
826	n/a	KK2018/043	S28 54 42.4 E19 32 42.9	A quartz outcrop with evidence of flaking.	Low
827	n/a	KK2018/044	S28 54 33.4 E19 32 40.3	A quartz outcrop with evidence of flaking.	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

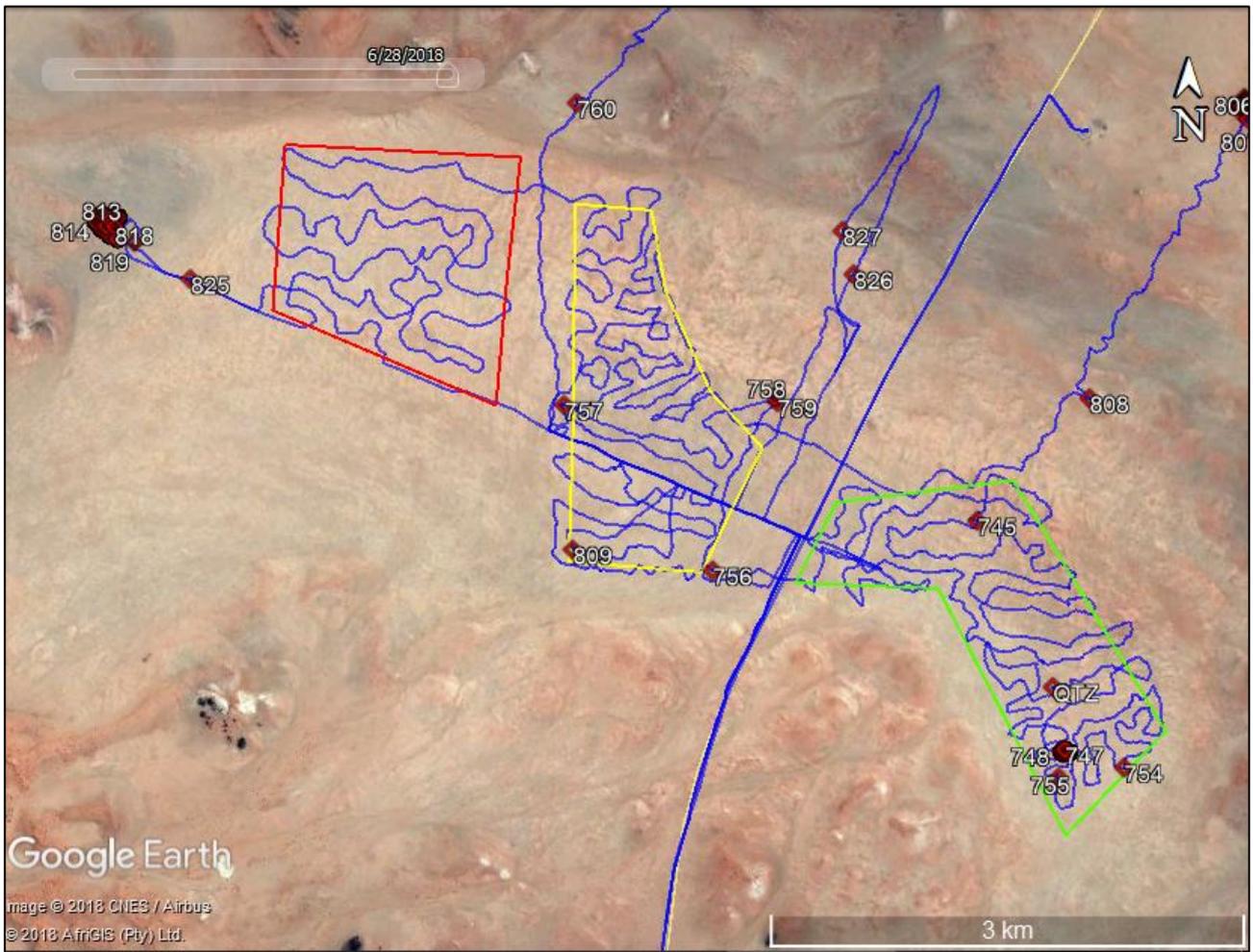


Figure A6.1: Overview of the study area showing all survey tracks (blue lines) and waypoints recorded during the survey (numbered red symbols). Phase 1 in red, Phase 2 in yellow, Phase 3 in green.

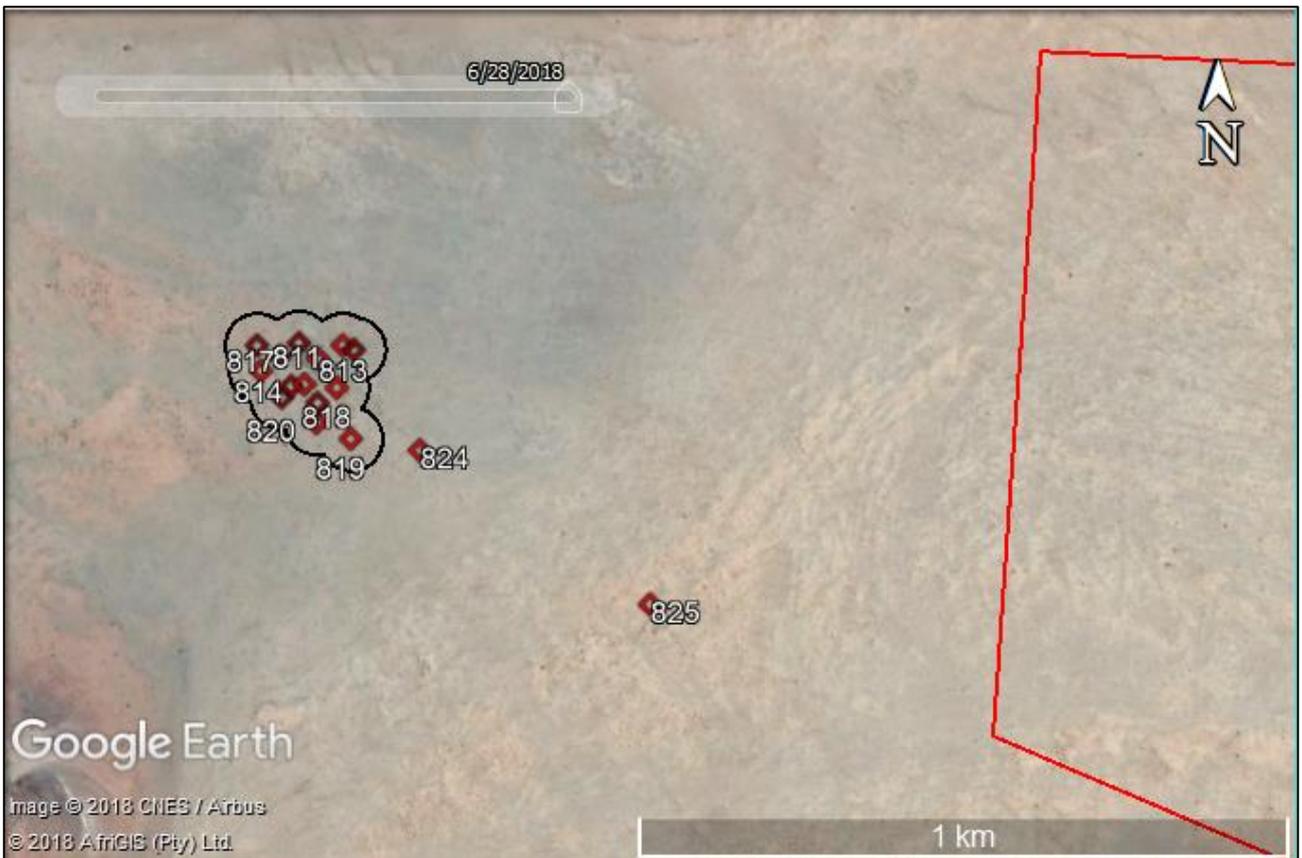


Figure A6.2: Aerial view of the western end of the Phase 1 study area showing a significant site well beyond its boundary.

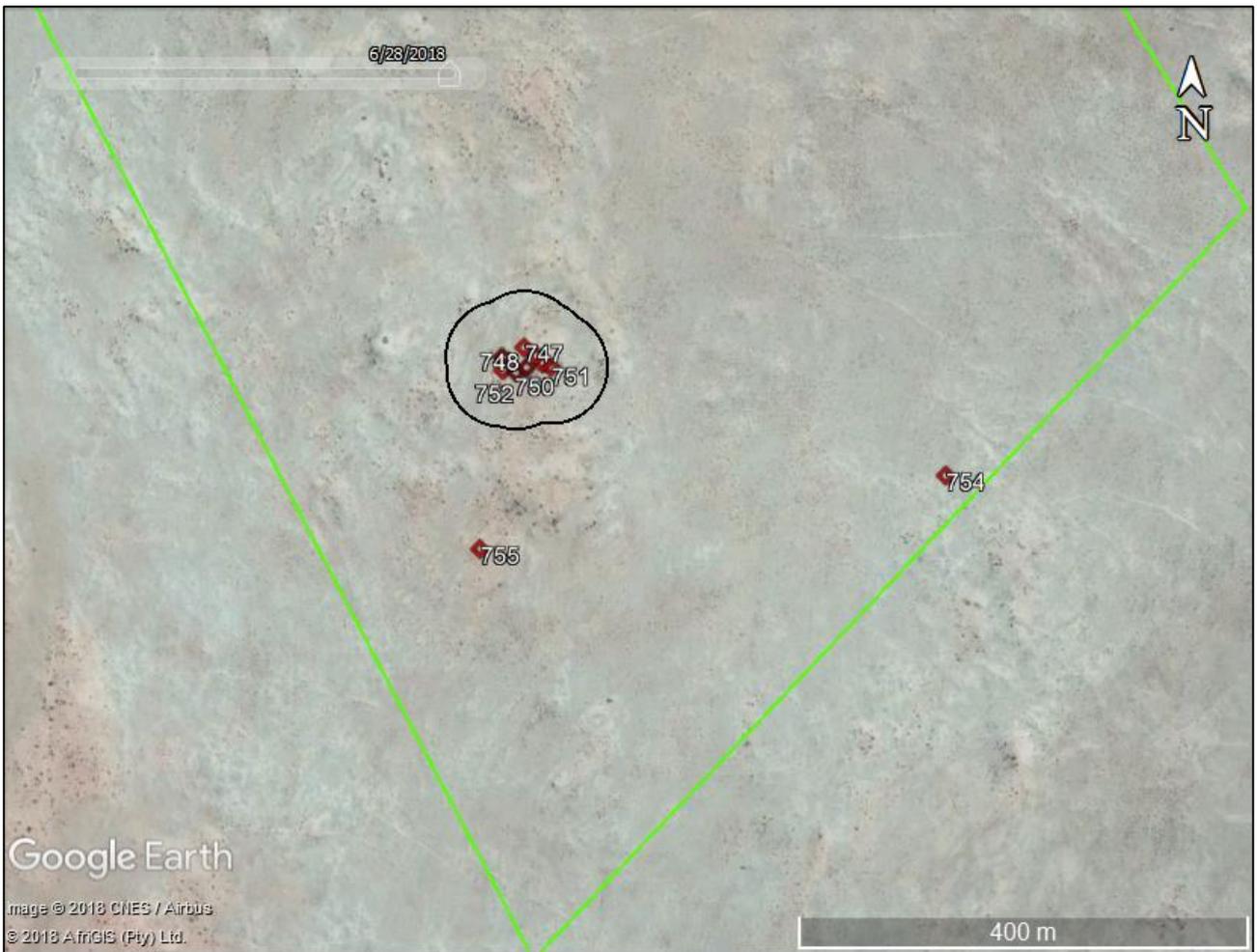


Figure A6.3: Aerial view of the southern end of the Phase 3 study area showing the one significant site.