HERITAGE IMPACT ASSESSMENT:
Scoping and Environmental Impact Assessment for the proposed development of the Faraday PV 100 MW Photovoltaic Facility near Dealesville, Free State

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

Report for:

CSIR – Environmental Management Services
P.O. Box 320, Stellenbosch, 7599
Tel: 021 888 2490
Email: lvdwalt1@csir.co.za

On behalf of:

Twenty Nine Solar (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
6A Scarborough Road, Muizenberg, 7945
Tel: (021) 788 8425 | 083 272 3225
Email: jayson@asha-consulting.co.za

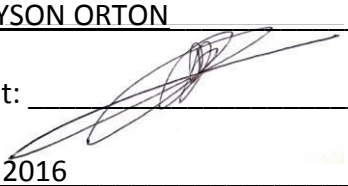
01 February 2016

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: 01 FEBRUARY 2016

EXECUTIVE SUMMARY

ASHA Consulting was appointed by the Council for Scientific and Industrial Research to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction, operation and decommissioning of the 100 MW Faraday PV facility on the remainder of Mooihoek 1551 (in the case of Option A) or Portion 4 of Sterkfontein 639, the remainder of Doornhoek 37 and Portions 2 and 3 of Brakfontein 636 (in the case of Option B) just west of Dealesville in the Boshof Magisterial District, Free State. Electrical infrastructure may be required to cross neighbouring farms. The proposed project is a solar photo-voltaic (PV) energy facility that would generate power to feed into the national electricity grid. The project is one of five being proposed in the same area.

The study area is flat and covered in grass with occasional trees in places, while a few pans and rocky hills occur in the vicinity, including one of each within Option A. Heritage resources located include Stone Age artefact scatters, historical ruins, graves and graveyards, and the cultural landscape. A desktop palaeontological study showed that palaeontological resources could occur on the development site. With the exception of the graves, none of the resources has high significance. Option B has substantially less heritage on it than does Option A.

After mitigation, none of the heritage resources is likely to experience impacts of high significance and, so long as the grave sites are avoided, there are no fatal flaws. The three grave sites in Option A lie close to one another and this area of this site should be avoided. Aside from these, most important resources lie within the electrical grid infrastructure corridor and should therefore be easily avoidable. Overall, it is considered that impacts to heritage resources could be of low-medium significance before mitigation with most occurring during the construction phase. During operation and decommissioning there would be no new impacts but the impact to the cultural landscape would be ongoing.

It is recommended that the proposed Faraday Option B PV facility and its associated infrastructure and access road should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work;
- A palaeontologist should be appointed to appraise the final development footprint and, if necessary, suggest any further measures that may be required to mitigate potential impacts;
- Any significant archaeological sites that cannot be avoided with a buffer of at least 20 m should be mitigated well in advance of the start of construction. It should be noted that it is permissible for transmission lines to span archaeological sites, but any associated service roads and the facility access roads must avoid them;
- All construction and operation activities must take place within the authorised construction footprint so as to minimise damage to nearby heritage resources;
- All graves should be avoided with a buffer of at least 5 m from the actual graves; and
- Earthy-coloured paint should be used on the built elements of the project so as to reduce the visual contrast in the landscape.
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such

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

The Faraday Option A PV facility could also be authorised with the same recommendations, however, based on the heritage resources located within the two sites, especially the number of graves in Option A, Option B is strongly preferred.

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 approximately 10-12 000 years.

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

In situ: found in the original context where it was first deposited.

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.

Patina: a weathering rind formed by a chemical weathering process.

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

Abbreviations

ASAPA: Association of Southern African Professional Archaeologists

ASHA: ASHA Consulting (Pty) Ltd

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

EGI: Electricity Grid Infrastructure

EIA: Environmental Impact Assessment

EMPr: Environmental Management Program

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

HWC: Heritage Western Cape

LSA: Later Stone Age

MSA: Middle Stone Age

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

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

PPP: Public Participation Process

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii, Section 1.5
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
d) the 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;	Section 3.1 – 3.6
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 7.2
g) an identification of any areas to be avoided, including buffers;	Sections 6 & 11
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 11
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, including identified alternatives on the environment;	Sections 6, 8 & 9
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorisation;	Section 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 13
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 7.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 7.1
q) any other information requested by the competent authority.	n/a

Contents

1. INTRODUCTION

ASHA Consulting was appointed by the Council for Scientific and Industrial Research to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction, operation and decommissioning of the 100 MW Faraday PV facility on the remainder of Mooihoek 1551 (in the case of Option A) or Portion 4 of Sterkfontein 639, the remainder of Doornhoek 37 and Portions 2 and 3 of Brakfontein 636 (in the case of Option B) just west of Dealesville in the Boshof Magisterial District, Free State. Electrical infrastructure may be required to cross neighbouring farms. The proposed project is a solar photo-voltaic (PV) energy facility that would generate power to feed into the national electricity grid. The project is one of five being proposed in the same area.

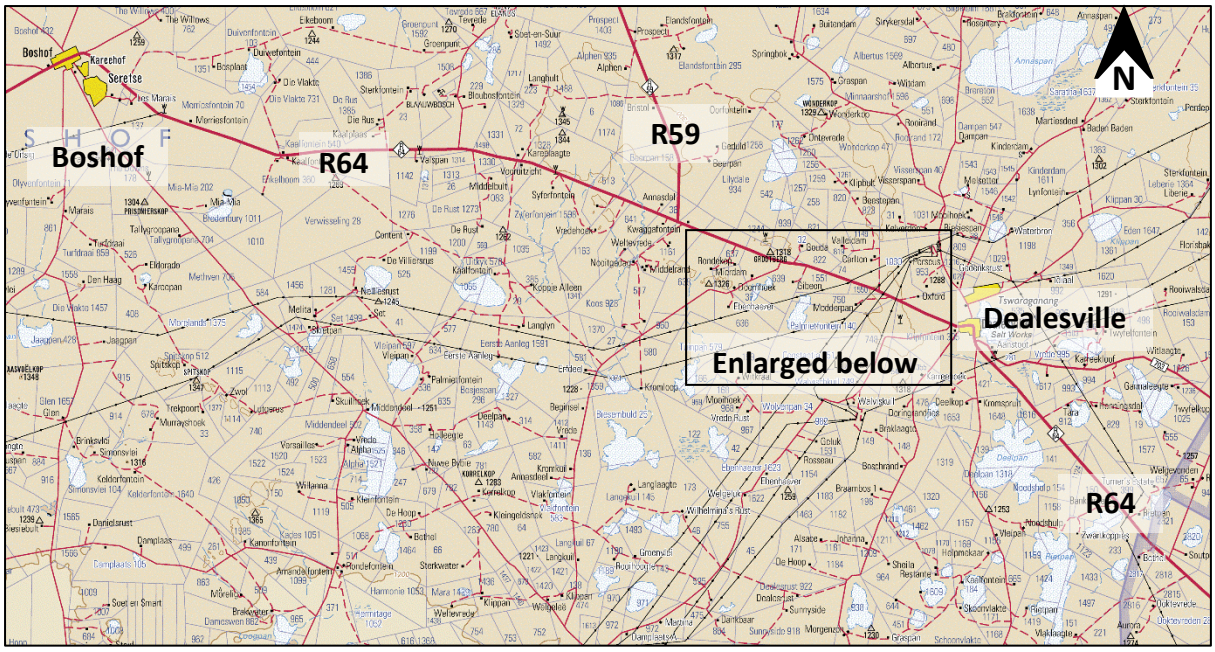


Figure 1: *Mapsheet 2824 (1:250 000) showing the location of the study area along the R64 between Dealesville and Boshof. (Mapping information supplied by Chief Directorate: National Geo-Spatial Information. Website: wwwi.ngi.gov.za)*

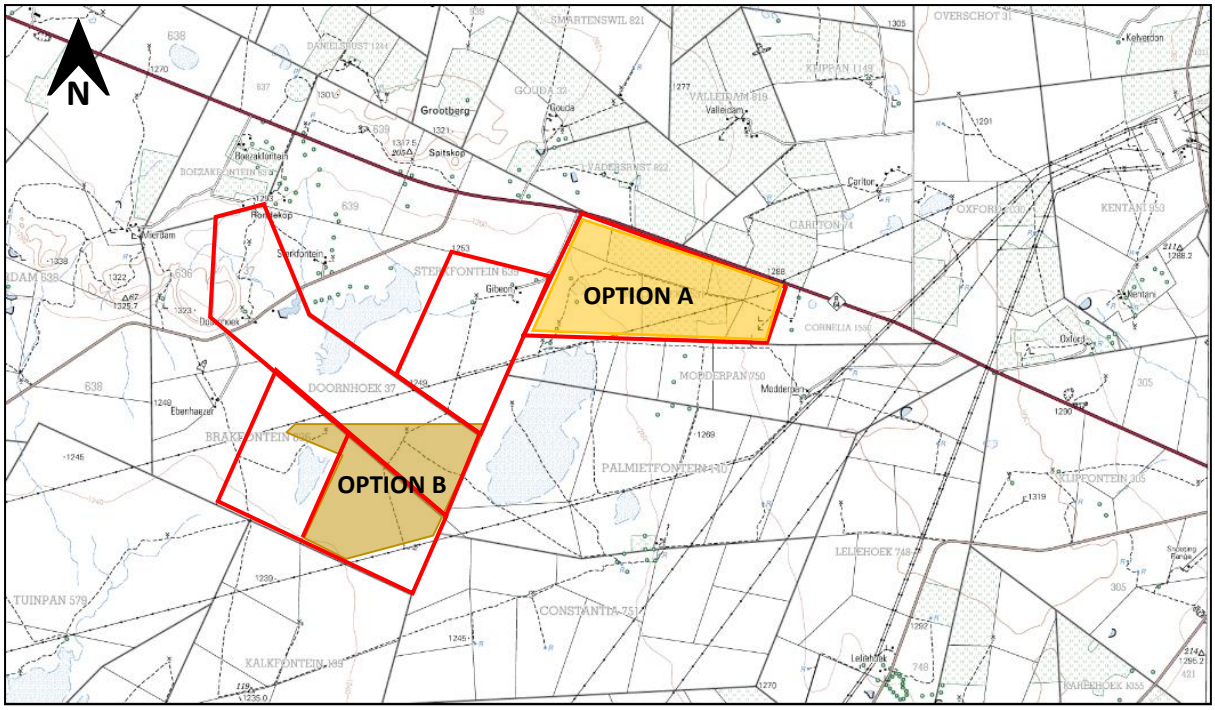


Figure 2: *Mapsheet 2825DA (1:50 000) showing the location of the sites. The red polygons indicate the farms under consideration while the orange and brown shaded polygons show the potential construction footprints of the two Options. (Mapping information supplied by Chief Directorate: National Geo-Spatial Information. Website: wwwi.ngi.gov.za)*

1.1. Project description

The proposed solar field will consist of:

- Solar arrays (panels) and building infrastructure covering a total surface area of approx. 250 - 310 ha (in the case of Option A) or approx. 250 ha (in the case of Option B);
- On-site buildings including operational control centre, offices, warehouse/workshop for spare parts and maintenance equipment, ablution and welfare facilities. The buildings will likely be of single storey design, with the largest building (the warehouse/workshop) unlikely to exceed 5 m in height and maximum footprint of 400m^2;
- Inverter units and 22 kV underground electrical cables; and
- Security enclosures.

The electricity transmission infrastructure will consist of:

- Two 132/33 kV collector stations occupying 120 m x 120 m and 21 m high;
- 275/132 kV Main Transmission Station (MTS) occupying 300 m x 200 m and 25 m high;
- 35 m high 132 kV lines from collector substations to MTS; and
- 35 m high 275 kV line (MTS to Loop-in-Loop-out (LILO) on existing 275 kV line).

It should be noted that the grid infrastructure included in the authorisation application will be the same for all five proposed projects and that a very broad corridor has been proposed to allow for flexibility in the final siting of the infrastructure.

1.2. Terms of reference

ASHA was asked to compile a heritage Impact Assessment (HIA) that examined all aspects of heritage relevant to the project area including built environment, archaeology, palaeontology and graves.

During the scoping phase SAHRA had requested an HIA that included specialist studies of archaeology and palaeontology. It should be noted, however, that following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), even though certain specialist studies may be specifically requested, all heritage resources should be identified and assessed.

1.3. Scope and purpose of the report

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

1.4. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in the Western Cape and Northern Cape provinces of South Africa 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 professional heritage practitioner with the Association of Professional Heritage Practitioners (APHP) and accredited with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

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

2. HERITAGE LEGISLATION

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

- Section 34: structures older than 60 years;

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

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

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;
- Palaeontological material: “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation”; and d) “features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found”;
- Grave: “means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place”; and
- Public monuments and memorials: “all monuments and memorials a) “erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government”; or b) “which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.”

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

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to an EIA. The South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) and Heritage Free State (for built environment and landscapes) are required to provide comment on the proposed project in order to facilitate final decision making by the National Department of Environmental Affairs (DEA).

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The maps were sourced from the Chief Directorate: National Geo-Spatial Information. The palaeontological assessment was based on a desktop report commissioned for this project and appended to the HIA as Appendix 2.

3.2. Field survey

The site was subjected to a detailed foot survey on the 6th to the 8th December 2015. This was during summer and, because of a drought, vegetation was very low and ground visibility was good. The survey did not stay exclusively within the provided project footprints but aimed to rather locate all heritage resources in the immediately surrounding landscape. During the survey the positions of finds were recorded on a hand-held GPS receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

3.3. Impact assessment

For consistency, the impact assessment was conducted through application of a scale supplied by the CSIR.

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 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. Heritage Western Cape (2015), however, uses a system in which resources of local significance are divided into Grade 3A, 3B and 3C. These approximately equate to high, medium and medium-low local significance, while sites of low or very low significance (and generally not requiring mitigation or other interventions) are referred to as ungradable. For convenience, the Heritage Western Cape system is employed here.

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. Palaeontological material is also not often visible at the surface and the assessment is based on 1:250 000 geological mapping and specialist knowledge. It is noted that the accuracy of the mapping may be variable. A major limitation is the lack of knowledge of the depth of quaternary sand cover above the Ecca bedrock. Because exposed shale was not seen during the archaeological survey, it is assumed that impacts to fossils in the shale are unlikely. For the purposes of assessment it is assumed that fossils are evenly distributed through the relevant rock strata, although in practice this is not the case. It is assumed that any access road and any part of the electrical corridors could be used in the implementation of the proposed project so they are assessed in their entirety.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The full list of existing and proposed developments that were taken into consideration for cumulative impacts can be located within the EIA report.

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. However, conversations with some of the landowners did help inform the fieldwork.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The sites lie in a grassland environment that is used variably for grazing and agriculture just south of the R64 regional road (Figure 3). Two large substations occur in the area, one 5.5 km to the northeast of the Option A study area and the other 7.5 km to its south. A large number of overhead transmission lines criss-cross the area, with one going through Option

A and three passing alongside of Option B. A number of other similar PV projects have already been proposed in the immediate vicinity to the east and south of the present study area but none have been constructed.

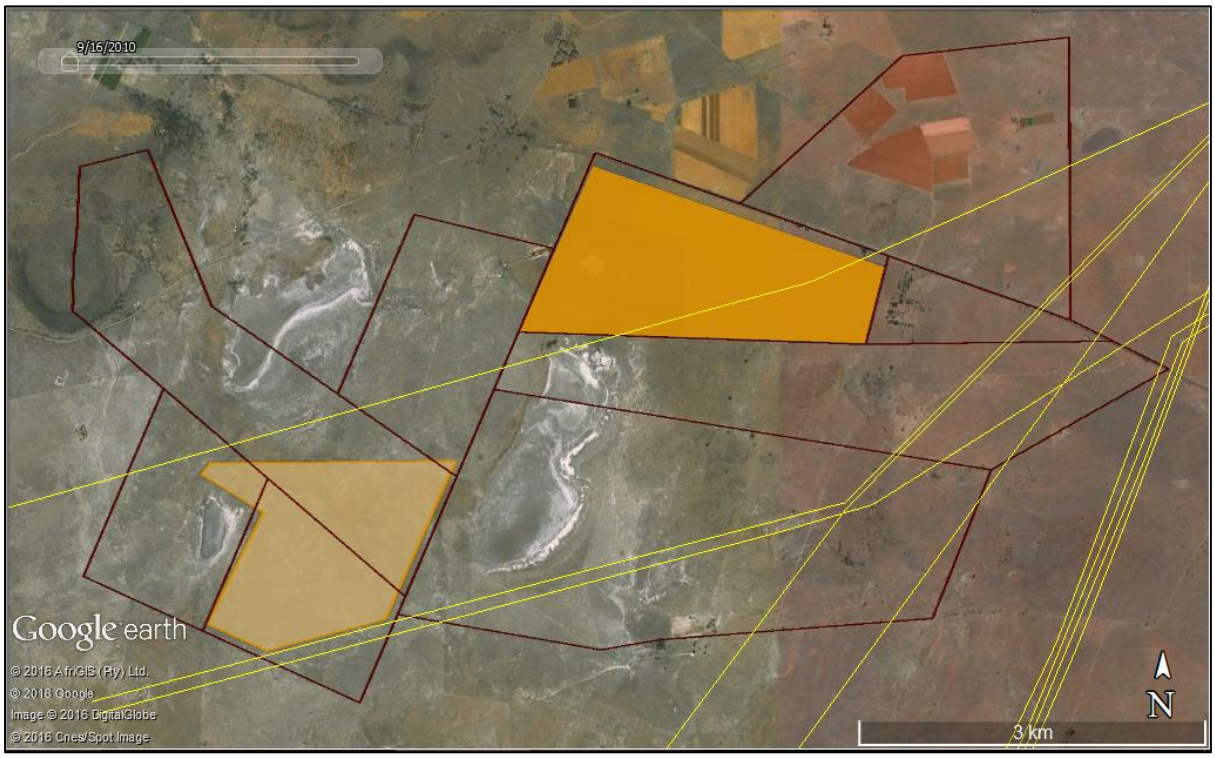


Figure 3: *Aerial view of the study area showing the farm boundaries (brown polygons), project sites (Option A = orange shaded polygon; Option B = brown shaded polygon), existing power lines (yellow lines) and the agricultural fields to the north. Note that there are also agricultural lands within the Option A footprint.*

4.2. Site description

The general vicinity is very flat, although rocky outcrops do occur in the area. The PV and EGI study areas are largely flat and grassed (Figures 4 & 5), although a pan (Figure 4) and a low rocky hill do occur in the western and eastern parts of Option A. The EGI corridor includes a large cluster of trees and a tree-lined avenue in the north on Cornelia, while another large cluster of trees occurs in association with an old farm complex at the far western end of Modderfontein, just outside the south-western corner of the Option A PV site. To the south of Option A and east of Option B there is a very large pan.

Figure 4: *View towards the east across Option A. The trees in the distance at centre are the avenue on the farm Cornelia.* The inset shows a view south over the pan.

Figure 5: *View towards the west across Option B.*

5. CULTURAL HERITAGE 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 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. Palaeontological aspects

The SAHRIS Palaeomap indicates the study area to be underlain by geological rock units with varying sensitivity. Although there are no areas of very high sensitivity, the two proposed project areas do include patches of high and moderate sensitivity (Figure 6). Some areas are known to be unfossiliferous and thus of no sensitivity at all – particularly relevant here are the intrusive dolerite rocks.

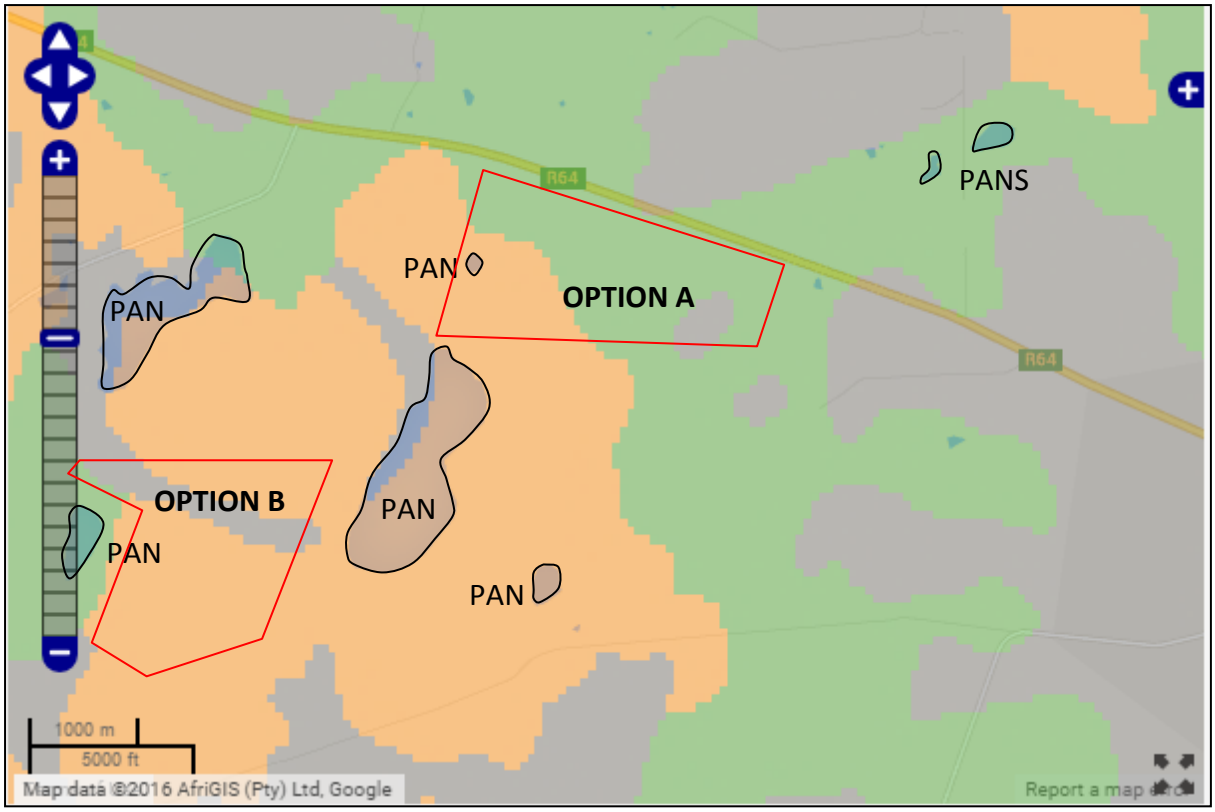


Figure 6: *Palaeontological sensitivity map from SAHRIS (Orange = high sensitivity, Green = moderate sensitivity, grey = zero sensitivity. The primary pans in the area are marked as is the proposed PV footprint (red polygon).*

There are some important fossil sites in the greater region and thus the chance of finding material of significance does exist. Florisbad is a very well-known fossil locality lying some 37 km southeast of the present study area. Here an early human cranium was recovered in 1932 (Dreyer 1935; Rightmire 1978), while mid-Pleistocene fauna and Middle Stone Age stone artefacts have also been recovered (Brink 1987; Dreyer 1938). Because of its importance in terms of both palaeontology and archaeology, Florisbad has been declared a Provincial Heritage Site (SAHRIS n.d.). Erfkroon is another important fossil site that lies along the Modder River some 24 km southwest of the present study area. The fossils occur over a

large area and were revealed in erosion gullies. Stone artefacts from the earlier part of the Middle Stone Age (MSA) and from the Later Stone Age (LSA) have also been found associated with the bones in places (Churchill *et al.* 2000). Further review is provided in Rossouw (2016).

5.2. Archaeological aspects

Stone Age material occurs widely across southern Africa, while the Iron Age, which only occurred within the last 2000 years, is present only in the eastern parts where summer rainfall allowed for the cultivation of summer crops. Stone-walled settlements dating to the Iron Age have been widely documented in parts of the Free State and adjacent Northern Cape (Maggs 1976a, 1976b) but the Iron Age appears to be absent from the immediate study area and its surrounds. Later Stone Age stone-built dwellings occur along the Riet River about 100 km to the southwest (Humphreys 1972, 2009). With the exception of the rich MSA deposits of Florisbad (Kuman *et al.* 1999) and the MSA and LSA stone artefact assemblages from Erfkroon (Churchill *et al.* 2000), significant archaeological resources appear to be quite rare in this flat, open and well-grassed landscape. Archaeological material is, however, more common along the major rivers where artefacts are revealed in the river terrace gravels. Webley (2010) surveyed an area to the southeast of the present study area and reported a complete absence of any archaeological material of any sort. She further noted that stone suitable for the manufacture of flaked tools was not present and that the quantity of other rock available on the surface was insufficient to allow for the construction of stone dwellings. Hutten's (2011) survey of land to the north of Boshoff showed similar results but in that case a pan was present with a large scatter of MSA and LSA artefacts present alongside it. This demonstrates the preference to settle close to water sources that is prevalent across much of the relatively dry interior of southern Africa. Orton's (2015) survey of large areas to the east and southeast of the present area showed heritage resources to be quite common. They included built environment, artefact scatters and a number of rock engravings. The vast majority of resources were located in close proximity to the rock outcrop areas close to Dealesville, while moving south into the grasslands the archaeology dropped off massively. The majority of artefacts located were attributable to Pleistocene-aged background scatter, were associated with gravel exposures, and did not constitute *in situ* living sites. However, some artefacts certainly dated to the Holocene.

Rock engravings occur widely in the interior of South Africa where suitable rock exists. Many sites are located in the Free State with the National Museum, Bloemfontein (2014) listing numerous examples that may be visited by the public. However, neither that museum nor the McGregor Museum in Kimberley has any other records for the vicinity of Dealesville.

5.3. Historical aspects and the built environment

Historical resources will be primarily associated with farmsteads, although most are likely to be fairly recent, perhaps dating to the late 19th or early 20th centuries. Several such resources – buildings, ruins and artefact scatters were located in the area by Orton (2015). The town of Dealesville is relatively recent, dating to 1899 (Raper n.d.). It was laid out on the farm Klipfontein belonging to John Henry Deale and was awarded municipal status in 1914.

The second Anglo-Boer War (1899-1902) played a significant role in South African History, particularly in the interior of the country. Many battles were fought between the British and Boer forces. Significant battles in proximity to the present study area include the Battles of Modder River and Magersfontein 100 km to the southwest and west respectively, the Battle of Paardeberg 60 km to the southwest and the Battle of Driefontein just outside Bloemfontein, some 60 km to the southeast. Graves, graveyards and memorials across the central interior of South Africa serve as reminders of the war.

6. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. The palaeontological information is taken from the specialist desktop study by Rossouw (2016). Table 1 shows a list of all the heritage resources recorded during the ground survey and they are plotted on Figure 7.

Table 1: *List of heritage resources recorded during the field survey. Suggested mitigation is noted in red. Note that in the 'Project' column the following conventions apply:*

"Faraday A/B": the heritage resource is within the Faraday project footprint.

"(Faraday A/B)": the heritage resource is within about 100 – 150 of the Faraday project footprint.

"(near Faraday A/B)": the heritage resource is beyond about 150 m of the Faraday project footprint but still nearby.

"EGI" the heritage resource is within the EGI corridor. (Access roads are not specifically listed because all of the sensitive features along the access roads lie within the EGI corridor.)

Project	GPS No.	Co-ordinates	Description	Heritage significance
EGI	870	S28 39 24.0 E25 41 48.6	Dolerite stone kraal. It is in poor condition with sections of walling having collapsed. It is 27 m long and 12 m wide but with a 10 m by 5 m addition to its northern side.	Medium AVOID or record
EGI	871	S28 39 21.8 E25 41 51.6	Various stone, brick and cement features in this area. Not very old cement. This is also the southern end of the tree-lined avenue. It is only the avenue that is significant.	Medium AVOID avenue
Faraday A EGI	872	S28 39 25.6 E25 41 31.4	Dolerite rock on the crest of a low hill with grinding patches on it. There are also three proper grooves. Another rock a few meters away has two more ground patches. No artefacts were seen.	Low-medium
Faraday A EGI	873	S28 39 25.4 E25 41 32.5	Dolerite rock with a single shallow grinding groove on it.	Low
Faraday A EGI	874	S28 39 25.4 E25 41 31.0	Dolerite rock with a single grinding groove on it.	Low
Faraday A EGI	875	S28 39 22.7 E25 41 35.5	Historical foundation in brick but with lots of calcrete lying around the area.	Low
Faraday A EGI	876	S28 39 25.3 E25 41 34.7	Two dolerite stone features/foundations. Lots of metal lying around the general area and a	Low

			number of 20th century bottles.	
Faraday A EGI	877	S28 39 30.1 E25 41 32.7	Stone foundation of calcrete with some dolerite.	Low
Faraday A EGI	878	S28 39 29.6 E25 41 35.5	Small mound of dolerite and calcrete that is almost certainly a grave. A second patch of rocks is very disturbed and may or may not represent a second grave.	High AVOID
Faraday A EGI	879	S28 39 26.5 E25 41 36.1	Stone foundation of dolerite and calcrete.	Low
Faraday A EGI	880	S28 39 26.3 E25 41 35.5	Stone foundation of dolerite and calcrete.	Low
Faraday A EGI	881	S28 39 25.6 E25 41 35.5	A single grave packed with dolerite and calcrete. There is an ash heap with much glass on it 5 m to the north of the grave.	High AVOID
Faraday A EGI	882	S28 39 25.0 E25 41 36.4	A small hollow that holds water and may have been used in prehistoric and historic times as a water source. (Not a heritage resource but noted for contextual reasons.)	---
Faraday A EGI	883	S28 39 32.0 E25 41 40.4	A graveyard lying up against the southern fence of the property with 13 graves in it. Two are formal graves dated 1902 and 1980, while there is one with head and footstones only and ten stone-packed mounds.	High AVOID
(Faraday A) EGI	884	S28 39 24.5 E25 41 43.6	An alignment of dolerite rocks.	Very Low
EGI	886	S28 39 50.6 E25 41 58.4	Farmhouse ruin with stone foundation and both sun-dried and fired bricks in the walls. Modern (early-mid-20th century) additions have been made. Largely collapsed now.	Medium AVOID or record
EGI	887	S28 39 50.8 E25 41 57.4	A circular dolerite stone feature, maybe the base of a water tank.	Very Low
(Faraday A) EGI	888	S28 39 34.4 E25 40 15.1	Calcrete gravel patch along the margin of the pan with dense hornfels artefact scatter. Most is likely to be MSA.	Medium AVOID or record
(Faraday A) EGI	889	S28 39 36.2 E25 40 13.8	As for 888	Very Low
(Faraday A) EGI	890	S28 39 37.8 E25 40 17.4	As for 888	Low-medium AVOID or sample impacted patches in this area.
(Faraday A) EGI	891	S28 39 39.9 E25 40 15.2	As for 888	Low-Medium See 888
(Faraday A) EGI	892	S28 39 38.0 E25 40 11.7	Two possible graves on the edge of the pan. They are loose piles of dolerite and calcrete.	Low-Medium See 888
(Faraday A) EGI	893	S28 39 37.8 E25 40 12.3	As for 888	Low-Medium See 888
(Faraday A) EGI	894	S28 39 36.3 E25 40 11.7	As for 888	Unknown (?High) AVOID or test and

				exhume
(Faraday A) EGI	895	S28 39 35.4 E25 40 11.7	As for 888 but an extra dense patch of artefacts.	Low-Medium See 888
(Faraday A) EGI	896	S28 39 33.2 E25 40 10.4	As for 888	Low-Medium See 888
(Faraday A) EGI	897	S28 39 30.7 E25 40 01.0	Historical stock enclosure built of dolerite and calcrete. It has four enclosed spaces within it. It should be noted that rocks have been removed from these structures for use along the current fence.	Medium See 888
(Faraday A) EGI	898	S28 39 29.5 E25 40 01.7	Ruin, probably a house. It is entirely collapsed. Stone foundation still in place and bricks are sun-dried, low-fired and high-fired.	Low-Medium See 888
(Faraday A) EGI	899	S28 39 30.0 E25 40 02.3	A large ash heap that has modern materials on it as well, especially glass and metal.	Low-Medium AVOID or record
(Faraday A) EGI	900	S28 39 31.7 E25 39 59.7	House ruin, perhaps the main farmhouse for this complex. It has a double skin and rubble fill walls made from dolerite blocks (both natural and dressed) and dressed calcrete blocks. The walls are 'cemented' together with mud and some modern cement appears on the western face.	Low-Medium Avoid or record
(Faraday A) EGI	901	S28 39 31.2 E25 39 58.3	Two ground patches on a bedrock outcrop. One of them is very light.	Low
(Faraday A) EGI	902	S28 39 30.6 E25 39 56.5	A small dolerite foundation.	Low
(Faraday A) EGI	903	S28 39 31.2 E25 39 56.5	A dolerite stone feature of unknown function.	Very Low
(Faraday A) EGI	904	S28 39 31.8 E25 39 56.7	Low density historical dump with glass, ceramics and metal. One LSA flake.	Low
(Faraday A) EGI	905	S28 39 32.7 E25 39 57.6	Stone features related to the wind pump.	Very Low
(Faraday A) EGI	906	S28 39 33.6 E25 39 58.5	A large stone foundation of dolerite and calcrete.	Low
(near Faraday A) EGI	907	S28 39 36.6 E25 39 57.5	Small boulder with three cupules in it on a 30 degree sloping face. The cupules are 65 mm, 70 mm and 60 mm from west to east. They are definitely Stone Age because, although mostly smooth inside, they are weathered and well-patinated.	Low-Medium AVOID or collect
(near Faraday A) EGI	908	S28 39 37.2 E25 39 57.2	A small stone feature of dolerite blocks.	Very Low
(near Faraday A) EGI	909	S28 39 37.6 E25 39 57.4	A dolerite and calcrete foundation. There are some fragments of metal, glass and ceramics in this general area.	Low
(near Faraday A) EGI	910	S28 39 37.5 E25 39 59.5	A single fenced grave with a cement headstone that has fallen apart.	High AVOID
(near Faraday A) EGI	911	S28 39 37.6 E25 39 58.0	An area on the dolerite ridge with much quarrying evident. No doubt the source of some of the building stone for the complex.	Very Low
(near Faraday A) EGI	912	S28 39 37.0 E25 39 59.0	A graveyard with six formal graves and one stone-packed grave. There are three Van	High AVOID

			Heerden's and three Coetzee's.	
(Faraday A) EGI	913	S28 39 32.1 E25 40 00.2	A stone feature of dolerite.	Very Low
(Faraday A) EGI	914	S28 39 31.7 E25 40 00.8	A stone alignment of dolerite.	Very Low
EGI	918	S28 40 35.6 E25 39 46.3	A patch of calcrete gravel with hornfels artefacts on the edge of the pan.	Low
EGI	929	S28 39 53.8 E25 41 56.0	A dolerite-lined dam which has had modern changes to it but the original structure may be old.	Low
Faraday B	930	S28 40 50.6 E25 38 54.6	Light scatter of hornfels artefacts exposed in farm road.	Very Low
(Faraday B)	931	S28 40 16.1 E25 38 12.5	Hornfels artefacts exposed along the edge of the pan.	Very Low
Faraday B	933	S28 40 07.2 E25 38 48.5	Low density hornfels scatter on the crest of a low hill with dolerite bedrock exposed.	Very low
(Faraday A)	934	S28 39 17.2 E25 39 51.8	Ash heap with modern materials on it. It is unknown whether older material might be preserved below.	Low
(Faraday A)	935	S28 39 16.3 E25 39 51.2	Small ash heap with modern materials on it. It is unknown whether older material might be preserved below.	Low
(Faraday A)	936	S28 39 15.6 E25 39 51.3	Ash heap with modern materials on it. It is unknown whether older material might be preserved below.	Low
(Faraday A)	937	S28 39 15.8 E25 39 49.9	Small ash heap with modern materials on it. It is unknown whether older material might be preserved below.	Low
Faraday A EGI	938	S28 39 28.8 E25 40 00.2	Large historical foundation of dolerite and calcrete.	Low-Medium
Faraday A EGI	939	S28 39 27.9 E25 40 02.0	Stone feature of dolerite and calcrete.	Very Low
Faraday A	940	S28 39 26.8 E25 40 01.8	Dolerite stone feature.	Very Low
Faraday A	941	S28 39 26.5 E25 40 02.4	Dolerite stone feature.	Very Low
Faraday A	942	S28 39 24.8 E25 40 04.7	Stone-lined dam that is silted up and no longer functional. Close to a wind pump.	Low
Faraday A EGI	943	S28 39 27.5 E25 40 18.7	Pile of calcrete blocks that looks a bit like a grave.	Unknown (High?) AVOID or test and exhume
Faraday A EGI	944	S28 39 24.6 E25 40 19.0	A calcrete stone foundation and a second feature that appears to be more of a pile of calcrete rocks.	Low
Faraday A	945	S28 39 03.5 E25 40 12.4	A semi-circular calcrete feature with a few pieces of glass lying around the area. Also several other small indeterminate mounds of calcrete (not graves though).	Low
Faraday A	946	S28 39 04.4 E25 40 12.3	Dolerite and calcrete stone feature and small calcrete stone alignment nearby.	Very Low
Faraday A	947	S28 39 05.3 E25 40 13.0	A dolerite foundation with many pieces of both dolerite and calcrete lying around the immediate area. Some glass and metal fragments also present.	Low

Faraday A	948	S28 39 08.4 E25 40 11.5	Area of calcrete gravel on the edge of a pan containing hornfels artefacts. Some seem fairly fresh though not possible to tell if LSA present. Definitely some MSA material though.	Low
Faraday A	949	S28 39 12.6 E25 40 10.4	Similar hornfels scatter but located with sand a short distance from the edge of the pan.	Low
Faraday A	950	S28 39 11.2 E25 40 16.7	Area of calcrete gravel on the edge of a pan containing hornfels artefacts.	Low
Faraday A	951	S28 39 10.1 E25 40 16.8	Area of calcrete gravel on the edge of a pan containing hornfels artefacts. Definitely includes both LSA and MSA with the former exemplified by a typical thumbnail scraper that is completely unpatinated.	Low
Faraday A	952	S28 39 04.9 E25 40 10.2	Small dolerite stone feature.	Low
Faraday A	953	S28 38 57.8 E25 40 10.2	Small unfenced graveyard with six graves. The mounds are rectangular and built up with dolerite blocks. All have dolerite headstones on their western ends (mostly collapsed) – one of these is engraved with fine horizontal lines similar to a writing slate.	High AVOID

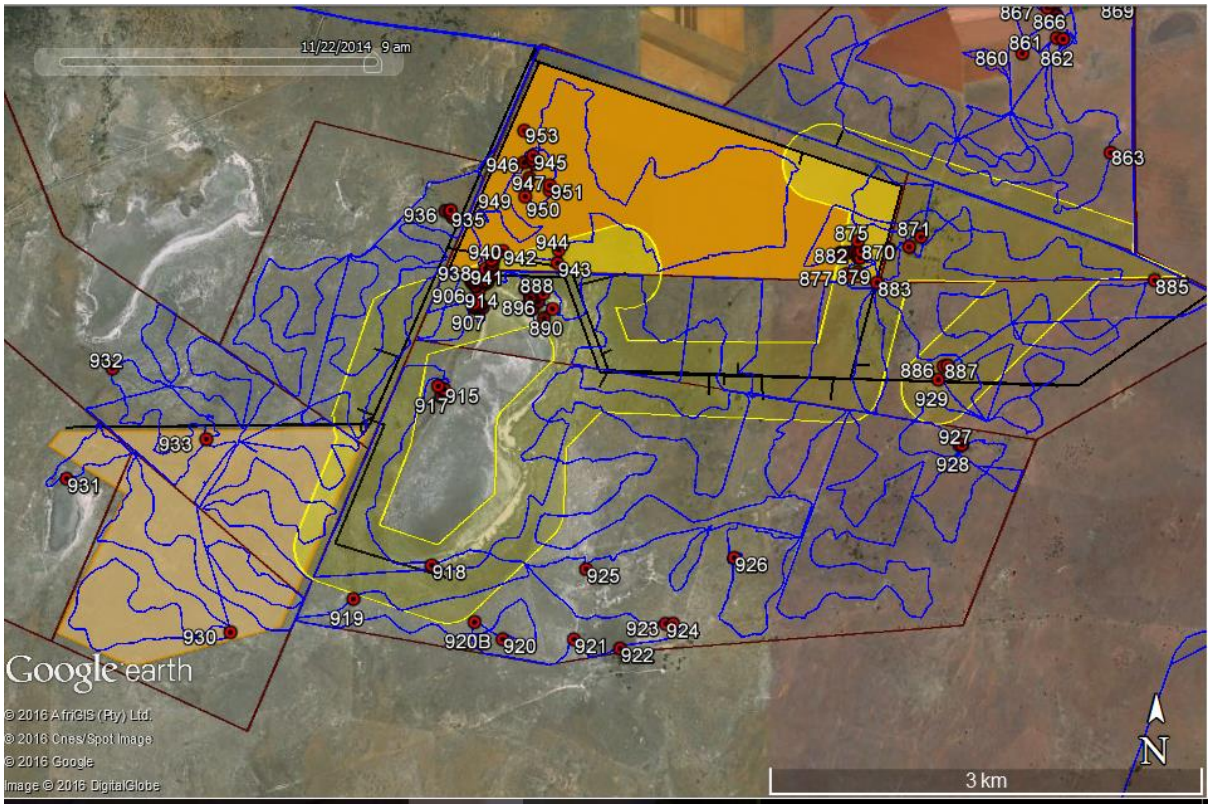


Figure 7: *Aerial view of the study area showing the survey tracks (blue lines) and finds (numbered red dots). The PV study areas are shaded orange (Option A) and brown (Option B) and the EGI corridor in transparent yellow.*

6.1. Palaeontology

The following is summarised from the palaeontological specialist desktop study by Rossouw (2016) which is appended to this document.

The local sediments vary markedly in age. The oldest are the Permian Ecca Shales (Tierberg Formation), Jurassic dolerite intrusions (Karoo Dolerite Suite), well-developed Quaternary calcretes, surface limestones, calcified pandunes and aeolian sands (Kalahari Group). The latter are the most recent geological phase and are comprised of red-brown Kalahari sands (Hutton sands).

The Tierberg Formation contains a variety of sparse trace fossils and burrows, with fossil wood being present in the upper layers of the formation. Rossouw (2016) reviews the various species on record for this formation. The dolerite intrusions are not fossiliferous and are not considered further. Localised spring deposits and calcified pan dunes are potentially sensitive and can occur in the area. Fossilised bone accumulations and sediments (peats) can occur within pan dunes and these dunes may also have houses hyena lairs in the past and also acted as foci for human occupation.

6.2. Archaeology

As expected because of the sand cover over the site, Stone Age archaeological resources were extremely sparse within the PV study areas. At least half of the surface area of Option A was comprised of old agricultural lands which had been thoroughly ploughed and appeared devoid of archaeology – none would be expected in this sand which also lacks gravel. However, in the west of Option A there were four scatters of Stone Age artefacts associated with the margins of the small pan and the low sand dune to its south. In the east of Option A several LSA bedrock grinding grooves were found on the low rocky hill at waypoints 872 to 874 (Figures 8 & 9). These may have been used for grinding seeds. They are not very old because they have yet to develop patina and there were no associated artefacts though. In the area to the south of Option A and within the EGI corridor, along the edge of the large pan, there were many thousands of stone artefacts dating to the MSA and LSA (Figures 10 & 11). Although in poor (eroded) context, they still have scientific value in the technological information they can provide.

Figure 8: *A grinding groove at waypoint 872.*

Figure 9: *Grinding grooves at waypoint 874.*

Figure 10: *Stone artefacts from waypoint 888. The scale is in cm.*

Figure 11: *The ground surface at waypoint 895. All the dark spots are stone artefacts.*

A very interesting find was made at waypoint 907 to the east of the large pan but within the EGI corridor. It was a small boulder with three 'cupules' ground into it (Figure 12). That these are not recent is betrayed by the fact that their inner surfaces are well patinated, having taken on the same colour weathering rind as the rest of the boulder. Such finds are unusual but are known to occur on small, vertical rock faces in the Northern Cape (Orton & Webley 2012). The cupules are clearly older than the grinding grooves described above.

Figure 12: *Small boulder with three ground cupules in it at waypoint 907. Scale in 5 cm intervals.*

Historical archaeological residues were also found. These included ruined stone kraals (Figures 13 & 14), farm houses (Figures 15 & 16) and various other smaller foundations. Most of these were within the EGI corridor but a cluster of small foundations was located to the north of the small pan in Option A and a second cluster occurred on the east side of the low rocky hill in Option A. All of these in Option A were poorly preserved. Most stonework at all these historical sites was constructed using dolerite boulders, although calcrete was also used. The two materials were generally used within the same wall. None of these resources has high significance but the preservation of most as part of the cultural landscape is advisable. Those near the pan in Option A appear to be of lesser significance

than some of the others. There were also some light scatters of historical artefacts and a domestic ash dump within the EGI corridor. They contained glass, metal and ceramics and are not important – they generally seemed to contain 20th century materials (Figure 17).

Figure 13: *The ruined stone kraal at waypoint 870. The inset shows the plan view.*

Figure 14: *Stone kraal at waypoint 897.*

Figure 15: *The ruined farm house at waypoint 886. A modern shed stands to the right.*

Figure 16: *Ruined stone house at waypoint 900.*

Figure 17: *Artefacts from the ash heap at waypoint 899. Scale in cm.*

6.3. Graves

A number of graves and graveyards were located within the EGI corridor, with some being in PV Option A. Some graves were formalised, clustered and fenced into small graveyards (Figures 18 & 19), while others were informal and isolated (Figure 20). In one instance a graveyard contained mostly informal graves and was unfenced, although a few remnant fence poles were present (Figure 21). This graveyard lies right in the south-eastern corner of the Option A footprint, while two isolated graves lie to the northwest in Option A. A small graveyard to the east of the large pan has formal graves but some of its headstones have been vandalised. A single grave nearby is also fenced. The grave is stone-built but it has a cement headstone which may be recycled. It is in very poor condition but appears to have had a skin of cement (which has now peeled off) placed over the original face. Both surfaces have engraved writing on them but their condition is poor. A further graveyard was reported by another specialist in the grass to the north of the pan in the Option A site. It consisted of six stone-built graves in a line, each with a headstone. A possible grave was located in Option B but its lack of structure makes this unlikely. It was comprised of a loose pile of calcrete blocks.

Figure 18: *The small graveyard at waypoint 912 to the east of the large pan.*

Figure 19: *Single formal grave at waypoint 910 to the east of the large pan.*

Figure 20: *An isolated grave at waypoint 881 located close to other historical features. (Note the apparent head- and footstones are actually termite mounds.)*

Figure 21: *An unfenced graveyard at waypoint 883. The Faraday Option A study area extends westwards along the fence and northwards (to the right). The graveyard is also in the middle of the EGI corridor.*

6.4. Built environment

No standing heritage buildings were located within either PV study area. Three stone-built dams were located, one within the EGI corridor (Figure 22) and the other immediately outside of it in the southwest and the third within the western part of Option A alongside what is assumed, from the vegetation pattern evident on aerial photography, to be a spring. The latter one was heavily silted up. The age of these features is unknown but they almost certainly predate the easy access to round concrete reservoirs. They are not significant.

Figure 22: *Stone dam at waypoint 929.*

6.5. Cultural landscape

The cultural landscape is generally related to agriculture and grazing, with farm fences, tracks and occasional tree lines and clusters being the main tangible evidence of this landscape. The feeling of serenity created by the openness also contributes to the character of the landscape. However, the addition of many power lines and the two large substations has introduced an industrial element to the landscape. In the northern part of the EGI corridor was a gum tree-lined avenue leading into the farm Cornelia (Figure 23), while to its east alongside the large pan and falling within the EGI corridor was a large cluster of gum trees marking the site of an old farm complex (Figure 24). In the far west of Option A there is a wind pump with a stone dam, a small concrete reservoir and a cluster of trees alongside the presumed spring. These features also form part of the cultural landscape.

Figure 23: *Gum tree-lined avenue leading into Cornelia located at waypoint 871.*

Figure 24: *Gum tree cluster around the old farm werf on Modderfontein in the vicinity of waypoint 913.*

6.6. Statement of significance

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

The palaeontological resources are considered to be of generally low significance for their scientific value, although the possibility of highly significant but very localised palaeontological resources does exist.

The Stone Age archaeological resources mostly have low-medium cultural significance for their scientific value, but a few resources related to the historical farm complexes are of medium significance for their architectural, historical, scientific and social values.

The graves are deemed to have high cultural significance for their social value.

The built environment resources (stone dams) have low cultural significance for their historical value.

The cultural landscape is considered to be of low-medium cultural significance for its aesthetic values.

6.7. Summary of heritage indicators and provisional grading

The Faraday Option A PV area has many heritage resources on it. While most are not problematic, the graveyard and two isolated graves in the east are significant. There is also a possible, but unlikely, grave in the western part. The Option B area, on the other hand, has no significant heritage resources in it. Issues within the EGI corridor include the gum tree-lined avenue in the north, the ruined farmhouse in the southeast, Stone Age and historical archaeology, a rock art site and the various graves and graveyards. Because of their condition, the majority of these resources are suggested to be Grade 3C, while other resources recorded but not listed here are regarded as ungradable. Only the graveyards are considered to be Grade 3B resources.

7. ISSUES, RISKS AND IMPACTS

7.1. Summary of issues identified during the Scoping Phase

The potential heritage issues identified during the scoping phase of this EIA process include:

- Destruction or disturbance of fossils occurring in potentially fossiliferous geological units;
- Destruction or disturbance of MSA and LSA stone artefact scatters; and
- Destruction or disturbance of LSA engravings on dolerite boulders;
- Destruction or disturbance of historical buildings and ruins
- Destruction or disturbance of graves and graveyards; and
- Destruction or disturbance of living heritage sites.

No formal consultation was carried out specifically for the purposes of the heritage impact assessment because all studies were covered by the PPP. The CSIR conducted a joint PPP for all five proposed PV developments. The comments received that are of relevance to this HIA are indicated in Table 2.

Table 2: *Comments and Response Trail*

Comment	Commenter	Response
Noted the need for an HIA.	Yolisa Kupiso (Environmental Management office: Lejweleputswa District Municipality)	An HIA has been conducted.
Violation of graves on Doornhoek - Anglo Boer War graves of British soldiers will be impacted in the process.	Anna Jacobs (Neighbouring landowner)	The graves lie at the opposite end of the Doornhoek farm to where the Faraday Option B site and the EGI corridor lie. There will thus be no impacts.
Noted potential sensitivity related to palaeontological and archaeological resources and requested specialist studies of these aspects.	SAHRA (commenting heritage authority)	These have been included in the present HIA.

7.2. Sensitivity of the site in relation to proposed activity

The site is sensitive for the heritage resources on its surface and potentially underground that would be damaged or destroyed through construction related activities. These include site preparation and all works related to installation of the project components.

7.3. Identification of potential impacts/risks

After the field study conducted during the EIA Phase of the project, it was possible to eliminate impacts to built environment resources and living heritage from the list of potential issues because they were found to not be relevant to the present study area. No further potential impacts were noted during the fieldwork.

The potential impacts identified during the EIA assessment are:

Construction Phase

- Potential impacts to palaeontological resources;
- Potential impacts to archaeological resources;
- Potential impacts to graves (direct and indirect); and
- Potential impacts to the cultural and natural landscape.

Operational Phase

- Potential impacts to the cultural and natural landscape; and
- Potential impacts to graves (indirect).

Decommissioning Phase

- Potential impacts to the cultural and natural landscape; and
- Potential impacts to graves (indirect).

Cumulative impacts

- Potential impacts to palaeontological resources;
- Potential impacts to archaeological resources;
- Potential impacts to graves; and
- Potential impacts to the cultural and natural landscape.

8. IMPACT ASSESSMENT (OPTION A)

All five aspects of heritage under consideration here could be affected during the construction phase. Only graves and the cultural landscape are deemed to be vulnerable to impacts during operation and decommissioning. These impacts are discussed below.

8.1. Potential direct impacts to palaeontological resources (construction phase)

Note that the EGI corridor has greater potential for impacts than the PV sites so the ratings discussed here reflect those for the EGI. Specific details for the PV site are obtainable from the palaeontological specialist study in Appendix 2.

There is the potential that palaeontological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The PV facility footprint has low sensitivity, but in the EGI corridor the possibility exists that a pylon could be located within a locally sensitive geological feature (pan dune or spring deposit). Because the EGI corridor is more sensitive, the ratings reflected here refer to it rather than to the less sensitive PV layout area. Impacts would be site specific, of substantial consequence and unlikely to happen. This combination results in a significance before mitigation of moderate.

A number of mitigation measures may be employed:

- A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work;
- A palaeontologist should conduct a site inspection once the final layout has been determined in order to ascertain whether there are sensitive spring deposits and/or pan dunes that might require monitoring or mitigation;
- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to palaeontological heritage resources are permanent and non-reversible and the resources cannot be replaced. The chances of indirect impacts occurring are considered to be negligible and these are not assessed further.

8.2. Potential direct impacts to archaeological resources (construction phase)

There is the potential that archaeological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. In general, most impacts would occur through construction of the PV facility because the disturbance footprint for the transmission lines would be very small in comparison, although a pylon footing located within an important archaeological site could have significant impacts. Impacts would be site-specific, of moderate consequence and very likely to happen. This combination results in a significance before mitigation of low.

A number of mitigation measures may be employed:

- The ideal is for all impacts to be avoided during construction with buffers of 20 m from all GPS co-ordinates of significant sites being applied;
- If avoidance is not possible then mitigation should be carried out by a professional archaeologist prior to the commencement of construction. For stone artefact scatters this would involve excavating and collecting samples from the scatters, while for ruined structures it would involve measured drawings to record the structures and compiling detailed photographic records of them (note that in Table 1 the sites marked “AVOID” should be avoided, while those with “AVOID or …” should be avoided if possible but mitigation as indicated is an acceptable alternative);

- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to archaeological heritage resources are permanent and non-reversible and the resources cannot be replaced. The chances of indirect impacts occurring are considered to be negligible and these are not assessed further.

8.3. Potential direct impacts to graves (construction phase)

There is the potential that any graves located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The greatest potential for impacts is through construction of the transmission lines, since all the graves recorded lie within the transmission corridor. One graveyard lies within a few metres of the PV footprint area and should be avoidable. Impacts would be site-specific, of extreme consequence and very likely to happen. This combination results in a significance before mitigation of very high.

A number of mitigation measures may be employed:

- The ideal is for all impacts to be avoided during construction with buffers of at least 5 m from all graves being applied;
- If avoidance is not possible then exhumation should be carried out by a professional archaeologist prior to the commencement of construction and under any stipulations that SAHRA might make. It is likely that a public consultation process would be required because of the high likelihood of identifying relatives of the deceased;
- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to graves are permanent and non-reversible and the resources cannot be replaced.

8.4. Potential indirect impacts to graves (all phases)

There is the potential that any graves located outside of but close to the final development footprint could be indirectly and negatively impacted by workers wandering off site and vandalising the graves or applying graffiti to them. Any such impacts would be site-specific, of moderate consequence and are very unlikely to happen. This combination results in a significance before mitigation of low.

One mitigation measure may be employed:

- The site should be fenced and once construction commences all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to graves are permanent and non-reversible and the resources cannot be replaced.

8.5. Potential direct impacts to the cultural and natural landscape (all phases)

There is the potential that the cultural and natural landscape could be directly and negatively impacted during earthworks and other construction activities because of the introduction of industrial activities to the rural landscape. Both the PV facility and transmission lines and substations would introduce impacts. Impacts would be at the local extent, of moderate consequence and very likely to happen. This combination results in a significance before mitigation of Low.

Mitigation is generally impractical but one measure may be employed:

- Make use of earthy coloured paint on the built elements of the facility so as to reduce the degree of contrast in the landscape.

With mitigation, the significance of potential impacts remains at low. It should be noted that impacts to archaeological heritage resources are permanent and non-reversible and the resources cannot be replaced.

Table 3: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	• A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and • Appoint a palaeontologist to check for sensitive features prior to construction.	Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Site	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	• Avoid sites with a buffer of 20 m from GPS co-ords; or • Archaeological excavation to be undertaken by a professional archaeologist; and • Ensure all works occur inside approved development footprint.	Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very likely	Non-reversible	Irreplaceable	• Avoid graves with a buffer of at least 5 m from actual graves.	Very high	Very low	5	High
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• Use earthy-coloured paint on built elements; and • All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	Irreplaceable	• Ensure that construction footprint is fenced and that workers are not allowed off site.	Low	Very low	5	High

Table 4: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Operation of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
INDIRECT IMPACTS													
Staff wondering off site	**Damage to graves**	Negative	Site	Perm anent	Moderate	Extre mely unlike ly	Non-revers ible	Irreplacea ble	Ensure that PV footprint is fenced and that staff are not allowed off site.	Very low	Very low	5	High

Table 5: Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Removal of facility (i.e. construction vehicles, etc)	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	Irreplaceable	• Ensure that PV footprint is fenced and that staff are not allowed off site.	Very low	Very low	5	High

Table 6: Impact assessment summary table – Cumulative impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	• A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and • Appoint a palaeontologist to check for sensitive features prior to construction.	Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Site	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	• Avoid sites with a buffer of 20 m from GPS co-ords; or • Archaeological excavation to be undertaken by a professional archaeologist; and • Ensure all works occur inside approved development footprint.	Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very likely	Non-reversible	Irreplaceable	• Avoid graves with a buffer of at least 5 m from actual graves.	Very high	Very low	5	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Regional	Long term	Substantial	Very likely	High	Moderate	• Use earthy-coloured paint on built elements; • All staff and vehicles to remain in authorised project footprint.	Moderate	Moderate	4	High

9. IMPACT ASSESSMENT (OPTION B)

All five aspects of heritage under consideration here could be affected during the construction phase. Only graves and the cultural landscape are deemed to be vulnerable to impacts during operation and decommissioning. These impacts are discussed below.

9.1. Potential direct impacts to palaeontological resources (construction phase)

Note that the EGI corridor has greater potential for impacts than the PV site so the ratings discussed here reflect those for the EGI. Specific details for the PV site are obtainable from the palaeontological specialist study in Appendix 2.

There is the potential that palaeontological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The PV facility footprint has low sensitivity, but in the EGI corridor the possibility exists that a pylon could be located within a locally sensitive geological feature (pan dune or spring deposit). Because the EGI corridor is more sensitive, the ratings reflected here refer to it rather than to the less sensitive PV layout area. Impacts would be site specific, of substantial consequence and unlikely to happen. This combination results in a significance before mitigation of moderate.

A number of mitigation measures may be employed:

- A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work;
- A palaeontologist should conduct a site inspection once the final layout has been determined in order to ascertain whether there are sensitive spring deposits and/or pan dunes that might require monitoring or mitigation;
- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to palaeontological heritage resources are permanent and non-reversible and the resources cannot be replaced. The chances of indirect impacts occurring are considered to be negligible and these are not assessed further.

9.2. Potential direct impacts to archaeological resources (construction phase)

There is the potential that archaeological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. In general, most impacts would occur through construction of the PV facility because the disturbance footprint for the transmission lines would be very small in comparison, although a pylon footing located within an important archaeological site could have significant impacts. Impacts would be site-specific, of moderate consequence and very likely to happen. This combination results in a significance before mitigation of low.

A number of mitigation measures may be employed:

- The ideal is for all impacts to be avoided during construction with buffers of 20 m from all GPS co-ordinates of significant sites being applied;
- If avoidance is not possible then mitigation should be carried out by a professional archaeologist prior to the commencement of construction. For stone artefact scatters this would involve excavating and collecting samples from the scatters, while for ruined structures it would involve measured drawings to record the structures and compiling detailed photographic records of them (note that in Table 1 the sites marked "AVOID" should be avoided, while those with "AVOID or …" should be avoided if possible but mitigation as indicated is an acceptable alternative);
- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to archaeological heritage resources are permanent and non-reversible and the resources cannot be replaced. The chances of indirect impacts occurring are considered to be negligible and these are not assessed further.

9.3. Potential direct impacts to graves (construction phase)

There is the potential that any graves located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The greatest potential for impacts is through construction of the transmission lines, since all the graves recorded lie within the transmission corridor. One graveyard lies within a few metres of the PV footprint area and should be avoidable. Impacts would be site-specific, of extreme consequence and very unlikely to happen. This combination results in a significance before mitigation of low.

A number of mitigation measures may be employed:

- The ideal is for all impacts to be avoided during construction with buffers of at least 5 m from all graves being applied;
- If avoidance is not possible then exhumation should be carried out by a professional archaeologist prior to the commencement of construction and under any stipulations that SAHRA might make. It is likely that a public consultation process would be required because of the high likelihood of identifying relatives of the deceased;
- Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to graves are permanent and non-reversible and the resources cannot be replaced.

9.4. Potential indirect impacts to graves (all phases)

There is the potential that any graves located outside of but close to the final development footprint could be indirectly and negatively impacted by workers wandering off site and vandalising the graves or applying graffiti to them. Any such impacts would be site-specific, of moderate consequence and are very unlikely to happen. This combination results in a significance before mitigation of low.

A number of mitigation measures may be employed:

- The site should be fenced and once construction commences all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves not falling within the study area.

With mitigation, the significance of potential impacts would be reduced to very low. It should be noted that impacts to graves are permanent and non-reversible and the resources cannot be replaced.

9.5. Potential direct impacts to the cultural and natural landscape (all phases)

There is the potential that the cultural and natural landscape could be directly and negatively impacted during earthworks and other construction activities because of the introduction of industrial activities to the rural landscape. Both the PV facility and transmission lines and substations would introduce impacts. Impacts would be at the local extent, of moderate consequence and very likely to happen. This combination results in a significance before mitigation of Low.

Mitigation is generally impractical but one measure may be employed:

- Make use of earthy coloured paint on the built elements of the facility so as to reduce the degree of contrast in the landscape.

With mitigation, the significance of potential impacts remains at low. It should be noted that impacts to archaeological heritage resources are permanent and non-reversible and the resources cannot be replaced.

Table 3: *Impact assessment summary table – Construction Phase impacts.*

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	• A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and • Appoint a palaeontologist to check for sensitive features prior to construction.	Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Site	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	• Avoid sites with a buffer of 20 m from GPS co-ords; or • Archaeological excavation to be undertaken by a professional archaeologist; and • Ensure all works occur inside approved development footprint.	Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very unlikely	Non-reversible	Irreplaceable	• Avoid graves with a buffer of at least 5 m from actual graves.	Low	Very low	5	High
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• Use earthy-coloured paint on built elements; and • All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	Irreplaceable	• Ensure that construction footprint is fenced and that workers are not allowed off site.	Low	Very low	5	High

Table 4: *Impact assessment summary table – Operation Phase impacts.*

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Operation of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
INDIRECT IMPACTS													
Staff wondering off site	**Damage to graves**	Negative	Site	Perm anent	Moderate	Extre mely unlike ly	Non-revers ible	Irreplacea ble	Ensure that PV footprint is fenced and that staff are not allowed off site.	Very low	Very low	5	High

Table 5: *Impact assessment summary table – Decommissioning Phase impacts.*

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Removal of facility (i.e. construction vehicles, etc)	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	• All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	Irreplaceable	• Ensure that PV footprint is fenced and that staff are not allowed off site.	Very low	Very low	5	High

Table 6: *Impact assessment summary table – Cumulative impacts*

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	• A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and • Appoint a palaeontologist to check for sensitive features prior to construction.	Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Site	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	• Avoid sites with a buffer of 20 m from GPS co-ords; or • Archaeological excavation to be undertaken by a professional archaeologist; and • Ensure all works occur inside approved development footprint.	Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very unlikely	Non-reversible	Irreplaceable	• Avoid graves with a buffer of at least 5 m from actual graves.	Low	Very low	5	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT IMPACTS													
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Regional	Long term	Substantial	Very likely	High	Moderate	• Use earthy-coloured paint on built elements; • All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High

10. PERMIT REQUIREMENTS

The NHRA does not require the developer to obtain permits prior to construction. However, any archaeological or palaeontological mitigation work (i.e. test excavations, sampling etc.) that may be required (either before development commences or in the event of archaeological resources or graves of significance are found within the development footprint during construction) would need to be conducted under a permit issued to, and in the name of, the appointed archaeologist or palaeontologist. The permit application process allows the heritage authorities to ensure that a suitably qualified and experienced archaeologist or palaeontologist undertakes the work and that the proposed excavation/sampling methodology is acceptable.

11. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

It should be noted that the monitoring that may be suggested in an HIA and requested by the heritage authorities is different to that commonly enforced in the EIA context:

- For heritage purposes monitoring would be to check for previously undiscovered (and generally buried) heritage resources in areas where the probability remains high despite nothing being found during assessment; while
- In the EIA context, monitoring serves to ensure that authorisation conditions have been met. These requirements have been included in the EMPr document.

For heritage purposes then, and based on present information, no monitoring is required. Note, however, that monitoring may still be required based on the outcome of the first recommendation below.

Heritage mitigation requirements that should be incorporated into the EMPr of either Option are as follows:

- A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work;
- A palaeontologist should be appointed to appraise the final development footprint and, if necessary, suggest any further measures that may be required to mitigate potential impacts;
- If any significant archaeological sites (listed in Table 1 and mapped in Figures 24 to 26) cannot be avoided with a buffer of at least 20 m from the provided GPS co-ordinates then provision should be made well in advance of the start of construction (preferably at least 6 months) for archaeological mitigation to be carried out. This will allow the archaeologist time to obtain a permit, conduct the work, analyse the material and obtain a positive comment from SAHRA. If the sites can be avoided then the Environmental Control Officer (ECO) should ensure that they are cordoned off and/or protected from harm as required. The mitigation would entail excavation and collection of samples of artefacts from the Stone Age site and mapping and recording of the historical ruins. It should be noted that it is permissible for transmission lines to span archaeological sites, but any associated service roads and the facility access roads must avoid them;

- It should be ensured that all construction and operation activities take place within the authorised construction footprint so as to minimise damage to heritage resources that have not been mitigated;
- All graves should be avoided with a buffer of at least 5 m from the actual graves; and
- Earthy-coloured paint should be used on the built elements of the project so as to reduce the visual contrast in the landscape.

The project Environmental Control Officer (ECO) should ensure that these requirements are implemented at the appropriate stages of development.

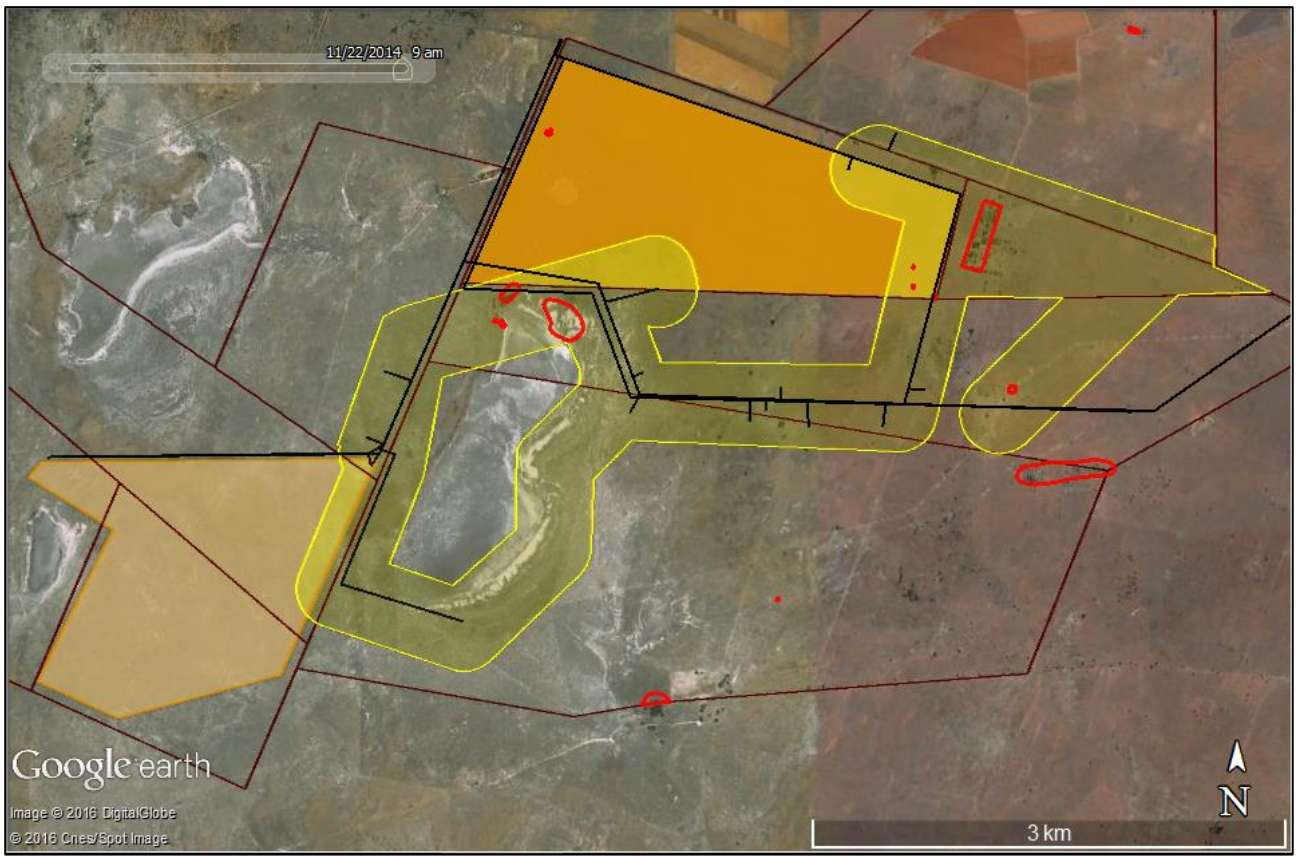
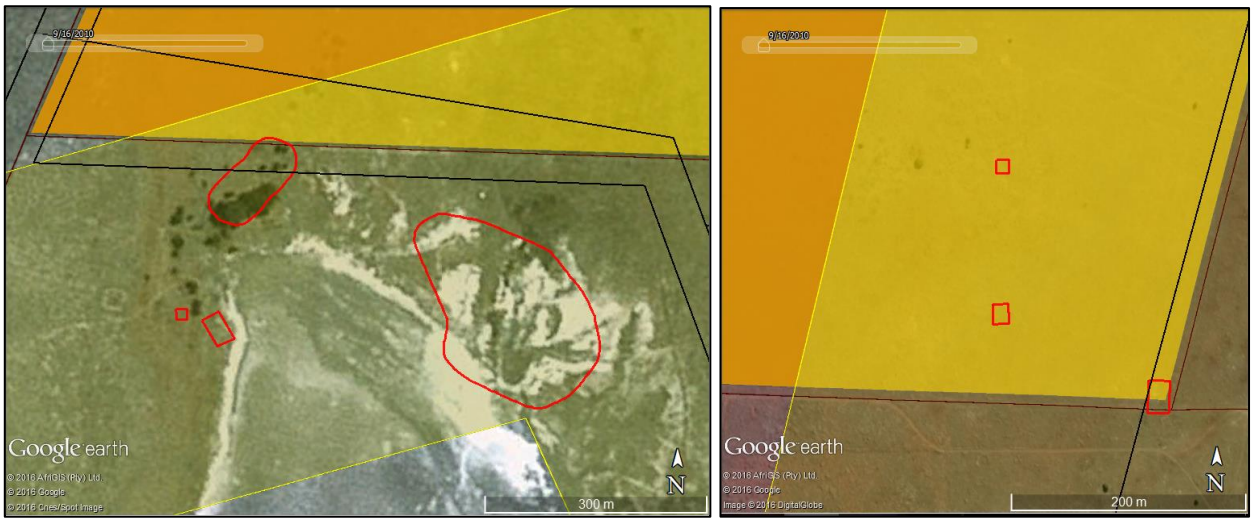


Figure 24: *Aerial view of the project area showing all sensitive heritage sites (red outlines) in or close to the proposed development. Only those affected by the present proposal are listed in Table 1. See enlargements in Figures 25 and 26.*



Figures 25 & 26: *Close-up aerial view of two sections of the project area.*

12. CONCLUSIONS

The two Options (A and B) for the proposed Faraday PV facility and its associated electrical infrastructure have been assessed and it has been found that, overall and with mitigation, the heritage impacts are not likely to be of very high significance and they are entirely manageable. There are three very important heritage sites (all graves) within the Option A footprint though. They are located close to one another in the south-eastern part of the site which should be avoided. A possible grave also occurs in Option A (and also in the EGI corridor; waypoint 943). It has not been listed for exclusion because of the low likelihood of it being a grave. It should, however, still be checked through test excavation. The various graves and other significant heritage sites within the EGI corridor are expected to be avoided by the final layout because of the small surface footprint of transmission lines. There are no fatal flaws, but, from the heritage point of view, Option B is strongly preferred over Option A.

13. RECOMMENDATIONS

It is recommended that the proposed Faraday Option B PV facility and its associated infrastructure and access road should be authorised but subject to the following conditions which should be incorporated into the Environmental Authorisation:

- A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work;
- A palaeontologist should be appointed to appraise the final development footprint and, if necessary, suggest any further measures that may be required to mitigate potential impacts;
- For Option A only, any significant archaeological sites that cannot be avoided with a buffer of at least 20 m should be mitigated well in advance of the start of construction. The possible grave in Option A should also be tested. It should be noted that it is permissible for transmission lines to span archaeological sites, but any associated service roads and the facility access roads must avoid them;

- All construction and operation activities must take place within the authorised construction footprint so as to minimise damage to nearby heritage resources;
- All graves should be avoided with a buffer of at least 5 m from the actual graves; and
- Earthy-coloured paint should be used on the built elements of the project so as to reduce the visual contrast in the landscape.
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

The Faraday Option A PV facility could also be authorised with the same recommendations, however, based on the heritage resources located within the two sites, Option B is strongly preferred.

14. REFERENCES

Brink, J.S. 1987. The archaeozoology of Florisbad, Orange Free State. *Memoirs of the National Museum, Bloemfontein* 24: 1-151.

Churchill, S.E., Brink, J.S., Hutchison, R.A., Rossouw, L., Stynder, D., Hancox, P.J., Brandt, D., Woodborne, S., Loock, J.C., Scott, L. & Ungar, P. 2000. Erfkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. *South African Journal of Science* 96: 161-163.

Dreyer, T.F. 1935. A human skull from Florisbad, Orange Free State, with a note on the endocranial cast, by C.U. Ariens Kappers. *Koninkljke Akademie van Wetenschappen te Amsterdam* 38: 3-12.

Dreyer, T.F. 1938. The archaeology of the Florisbad deposits. Argeologiese *Navorsinge van die Nasionale Museum, Bloemfontein* 1: 65-77.

Heritage Western Cape. 2015. Guide to grading in terms of the NHRA. Version 13, 10th June 2015.

Humphreys, A.J.B. 1972. The Type R settlements in the context of the later prehistory and early history of the Riet River valley. MA thesis, University of Cape Town.

Humphreys, A.J.B. 2009. A Riet River retrospective. *Southern African Humanities* 21: 157-175.

Hutten, M. 2011. Heritage Impact Assessment for the Proposed Boshof Solar Park on the farm Rabenthal north of Boshof, Free State Province. Unpublished report prepared for Africa Geo-Environmental Services. Louis Trichardt: Hutten Heritage Consultants.

Kuman, K., Inbar, M. & Clarke, R.J. (1999) Palaeoenvironment and cultural sequence of the Florisbad Middle Stone Age Hominid site, South Africa. *Journal of Archaeological Science 26*:1409-1425.

Maggs, T.M.O'C. 1976a. *Iron Age Communities of the Southern Highveld*. Occasional Publications of the Natal Museum No 2.

Maggs, T.M.O'C. 1976b. Iron Age patterns and Sotho history on the southern Highveld: South Africa. *World Archaeology* 7: 318-332.

National Museum, Bloemfontein. 2014. Public rock art sites. http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites. Website accessed 15th August 2014

Orton, J. 2015. Heritage impact assessment for the proposed construction of twelve solar PV facilities near Dealesville, Boshof Magisterial District, Free State. Unpublished report prepared for CSIR. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. & Webley, L. 2012. Heritage impact assessment for the proposed Kangnas Wind and Solar Energy Facilities, Namakwa Magisterial District, Northern Cape. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. Diep River: ACO Associates cc.

Raper, P.E. n.d. *Dictionary of Southern African Place Names*. Accessed online on 24 July 2014 at: https://ia600407.us.archive.org/17/items/DictionaryOfSouthernAfricanPlaceNames/SaPlaceNames.pdf.

Rightmire, P. 1978. Florisbad and Human Population Succession in Southern Africa. *American Journal of Physical Anthropology* 48: 475-486.

Rossouw, L. 2016. Palaeontological Desktop Assessment of 5 new Solar Photovoltaic facilities to be established over nine farms near Dealesville, Free State Province. Unpublished report prepared for ASHA Consulting (Pty) Ltd. Langenhoven Park: Palaeo Field Services.

SAHRIS. n.d. Archaeological site, Florisbad, Brandfort District. http://www.sahra.org.za/node/33185. Website accessed 24th July 2014.

Webley, L. 2010. Heritage impact assessment: proposed Southdrift Solar Farm, Free State. Unpublished report prepared for Environmental Resource Management. St James: ACO Associates cc.

15. APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 6A Scarborough Road, Muizenberg, 7945
Telephone: (021) 788 8425
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 –

Memberships and affiliations:

South African Archaeological Society Council member	2004 –
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
ASAPA Cultural Resources Management Section member	2007 –
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 –

Professional Accreditation:

ASAPA membership number: 233, CRM Section member

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)
Accredited professional heritage practitioner.

Fieldwork and project experience:

Extensive fieldwork 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:

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - 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 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
- 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

16. APPENDIX 2 – Palaeontological study