

Annex G

Paleontological,  
Archaeological and Cultural  
Heritage Specialist Report

PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED  
GRASPAN SOLAR FARM, PIXLEY KA SEME DISTRICT MUNICIPALITY,  
NORTHERN CAPE PROVINCE

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05 March 2012

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## EXECUTIVE SUMMARY

A solar farm is planned at the substation Graspan in the Northern Cape Province. Due to the National Heritage Resources Act, a palaeontological impact assessment is required to detect the presence of fossil material at the proposed developments. The Graspan solar farm will only affect Ecca and Quaternary deposits. The low-lying relief and absence of potentially fossiliferous gulleys suggests that exposed fossils are absent from the proposed development area. Considering the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e. steep-sided gulleys) on the site, the impact on palaeontological material will be negligible.

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## 1. INTRODUCTION

A solar development is proposed at the substation Graspan in the Northern Cape Province, approximately 50 km north-east of Hopetown. This development will involve excavating and will thus modify the existing topography. As palaeontological material is unique and non-renewable, it is protected by the National Heritage Resources Act (Act No. 25 of 1999, section 35). A Palaeontological Impact Assessment (PIA) of the proposed development is thus necessary to ensure that palaeontological material is either removed, or is not present.

### 1.1 Objective

To conduct a desktop study on the substation Graspan, Pixley ka Seme District Municipality, Northern Cape Province to determine the impact on potential palaeontological material at this site.

## 2. BACKGROUND TO THE GEOLOGICAL AND PALAEOLOGICAL HISTORY

### **Graspan Solar Farm, Northern Cape Province**

The geology of Graspan contains rocks of the Tierberg Formation, Eccca Group, Karoo Supergroup, which are Early Permian in age (approximately 270 million years old). The rocks consist of mudstone, siltstone, sandstone, minor conglomerate and coal (in some areas), and in the study area, were deposited in a shallow marine setting (Catuneanu et al., 2005). Most fossils from the Eccca group have been recovered from the underlying Whitehill Formation and include several species of fish, crustaceans, deep water marine reptiles such as *Mesosaurus* and insects such as beetles (MacRae, 1999). However, the Tierberg Formation does preserve parts of small vertebrates such as fish teeth and scales (Zawada, 1992) and plant fragments of leaves and petrified wood (Wickens, 1996). The most common fossils to be found in this formation are trace fossils. They include several ichnogenera such as simple burrows of *Planolites* and *Palaeophycus*, small sinusoidal surface traces (*Cochlichnus*), small star-shaped feeding burrows (*Stelloglyphus*), zigzag horizontal burrows (*Beloraphe*), small scratch burrows (*Cruziana*), arthropod trackways (*Umfolozia*), resting impressions (*Gluckstadtella*), fish swimming trails (*Undichna*), horizontal epichnial gastropod furrows (*Scolicia*), arthropod feeding excavations (*Vadoscavichnia*), beaded traces ("*Hormosiroidea*" or "*Neonereites*"), the four-pronged trace of *Broomichnium*, which may represent arthropod resting places, fucoid structures that may represent seaweeds, gardening burrows or *agrichnia* and microbial mats assigned to *Kenneyia* (MacRae, 1999; Braddy and Briggs, 2002; Seilacher, 2007; Almond, 2008).

The Eccca Group sediments on Graspan are intruded by non-fossiliferous Early Jurassic Karoo dolerite and cover a large portion of the development area. The Karoo Dolerite Suite comprises a network of igneous intrusions (dykes, sills) that intruded into older sediments of the Beaufort Group in the main Karoo Basin. These intrusions represent major eruptions of volcanic lava, which were triggered by the separation of Gondwana (an amalgamation of today's southern continents) approximately 183 million years ago.

Part of the Eccca Group on Graspan is overlain by Late Cenozoic superficial deposits, which are approximately 2.6 million years old (Quaternary) to Recent (Walker and Geissman,

2009). Those on Graspan contain Quaternary Calcrete. Although the flatter areas containing these deposits generally contain few fossils, numerous quaternary fossils have been found in river gulleys. These fossils are known as the Florisian Mammal Fauna. Most species of this time have modern counterparts, but there are some extinct animals such as the giant long-horned buffalo *Pelorovis* and the giant hartebeest, *Megalotragus*. The Florisian Mammal fauna includes mostly mammals such as lagomorphs, rodents, carnivores, perissodactyls, numerous artiodactyls and bovids. Amphibians, reptiles and birds are rarely found in Florisian deposits (Brink, 1987).

### 3. NAME AND GEOGRAPHICAL LOCATION OF THE SITE

Graspan Solar Farm: Graspan Substation, Pixley ka Seme District Municipality, Northern Cape Province (29° 21' 10.03" S, 24° 26' 06.24" E).

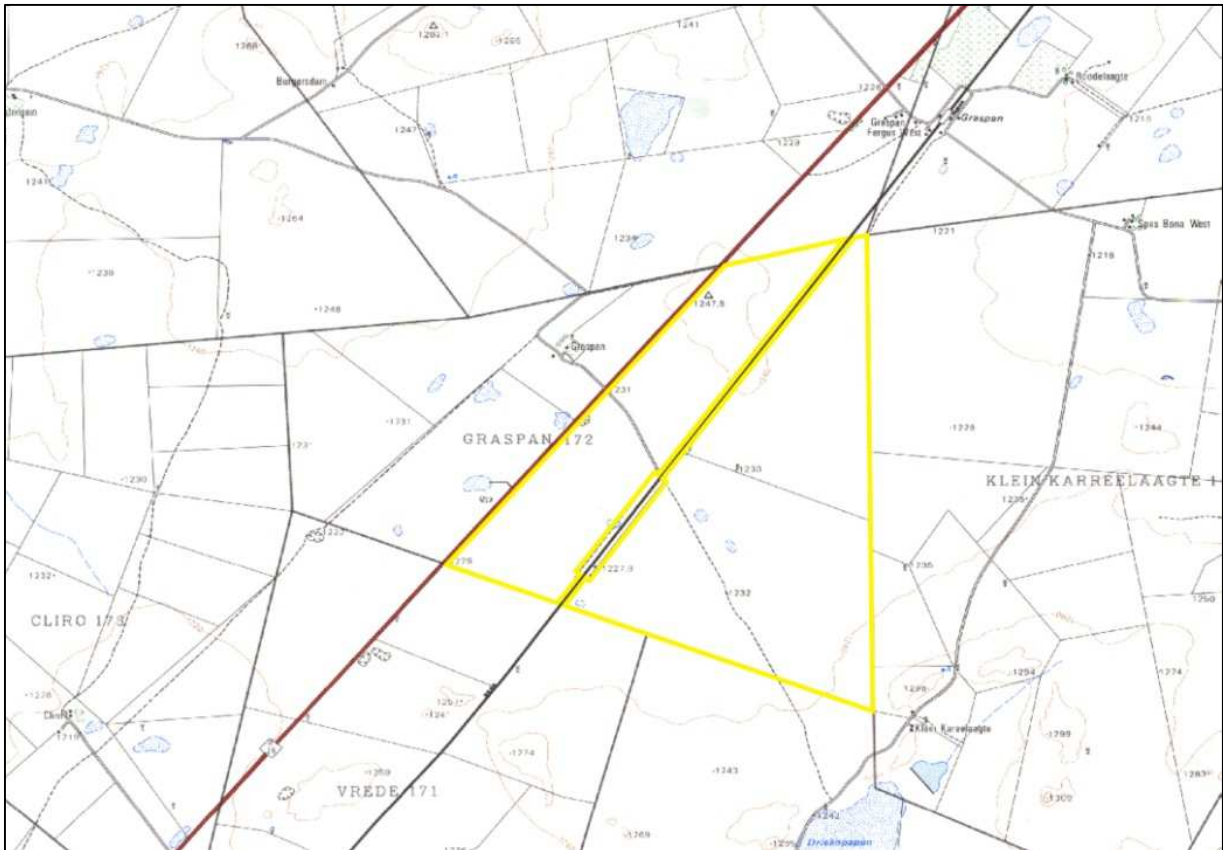


Figure 1. Proposed Graspan Solar Farm, Northern Cape Province (1: 50 000 map of Belmont 2924AD).



Figure 2. Google Earth satellite image of Graspan Solar Farm (bordered in black), Northern Cape, showing the low relief and semi-arid environment.

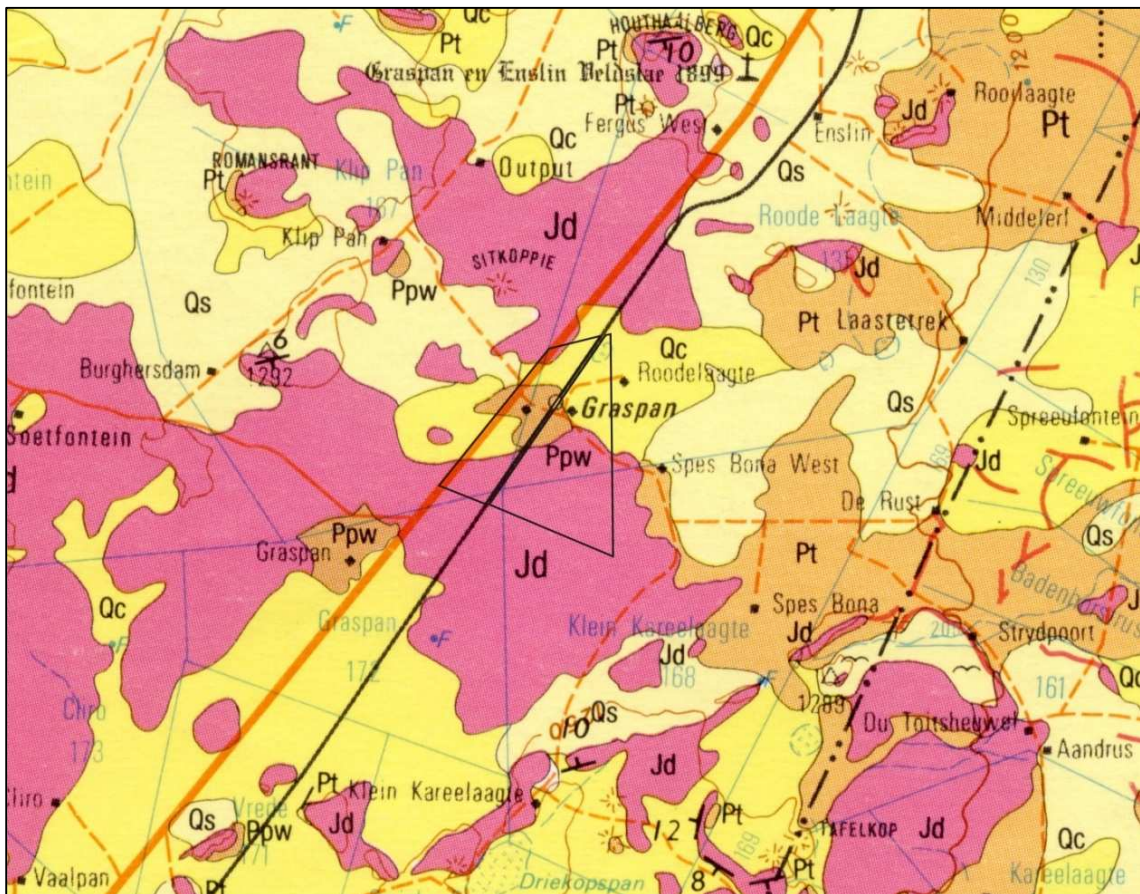


Figure 3. Geological map (1: 250 000, Koffiefontein 2924), showing the geology of Graspan (bordered in black). Jd (pink), Jurassic dolerite; Qc (bright yellow), Quaternary Calcrete; Pt, (light brown), Tierberg Formation, Ecca Group.

## 4. METHODS

A desktop study was conducted to assess the potential risk to palaeontological material (fossils, trace fossils) in the proposed area of development. The author's experience, aerial photos (using Google, 2012), topographical and geological maps were used to assess the proposed area of development. Where necessary, experts in particular specialized palaeontological fields were also consulted.

### 4.1 Assumptions and Limitations

The accuracy of Palaeontological Impact Assessments may be limited by old fossil databases that have not been kept up-to-date or are not computerized and/or do not include pertinent locality or geological information, and the accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been overlooked. Much of South Africa has not been studied palaeontologically due to there being so few palaeontologists in the field. As with most desktop studies, this PIA infers the presence of fossil heritage in the development area based on the presence of such heritage in the same rock units elsewhere.

## 5. FINDINGS AND RECOMMENDATIONS

### **Graspan Solar Farm, Northern Cape**

The solar farm will affect areas that contain non-fossiliferous Jurassic dolerite, Quaternary deposits and rocks of the Tierberg Formation, Ecca Group. Quaternary fossils are usually found in gulleys (dry river beds) and the low-lying relief and absence of potentially fossiliferous gulleys suggests that fossils of this geological age are absent here. Fossils from the Ecca Group are exceedingly rare, and only a small portion of the development will encroach into rocks of this age. Thus, considering the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e. steep-sided gulleys) at the proposed site, the impact on palaeontological material is negligible (rated Low or negative).

Thus, pending the discovery of significant new fossil material at this site, no further specialist palaeontological studies are considered to be necessary.

It is recommended that:

The ECO responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all substantial excavations into sedimentary bedrock for fossil remains;

In the case of any significant fossils (e.g. vertebrate teeth, bones, burrows, petrified wood) being found during construction, they must be safeguarded and the relevant heritage management authority (SAHRA) be informed so that a professional palaeontologist should be consulted in order to facilitate the necessary rescue operations.

## 6. ACKNOWLEDGEMENTS

Thank you to Dr Lloyd Rossouw, Head of the Archaeology Department at the National Museum, Bloemfontein for assisting with information on Quaternary Deposits.



## 7. REFERENCES

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## QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Jennifer Botha-Brink has an Honours Degree in Zoology and a PhD in Palaeontology from the University of Cape Town, South Africa. She has conducted extensive field work in South Africa for the past 14 years and currently holds the position of Head of the Karoo Palaeontology Department at the National Museum in Bloemfontein. Her current research interests comprise Permo-Triassic vertebrate palaeobiology, with a special focus on the end-Permian mass extinction. She is also trained in the specialized field of palaeohistology (the study of fossil bone microstructure). Dr Botha-Brink has published more than 30 scientific articles in both nationally and internationally accredited journals, has written several popular articles on palaeontology and is currently lecturing Zoology students in Vertebrate Evolution at the University of the Free State. Dr Botha-Brink began conducting palaeontological impact assessments for developments in 2011. She is currently the President of the Palaeontological Society of Southern Africa (PSSA) and is registered with the South African Heritage Resources Agency.

### **Declaration of Independence**

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

Sincerely,

A handwritten signature in black ink that reads "J. Botha-Brink". The signature is written in a cursive style with a large initial 'J'.

Dr Jennifer Botha-Brink

Palaeontologist

**HERITAGE IMPACT ASSESSMENT: PROPOSED CONSTRUCTION  
OF THE 90 MW GRASPAN PHOTOVOLTAIC POWER FACILITY,  
PIXLEY KA SEME DISTRICT MUNICIPALITY, NORTHERN CAPE  
PROVINCE**

(Assessment conducted under Section 38(8) of the  
National Heritage Resources Act 25 of 1999)

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## EXECUTIVE SUMMARY

ACO Associates cc were appointed by ERM Southern Africa (Pty) Ltd, on behalf of the client, Solaire Direct, for the construction of the 90 MW Graspan photovoltaic power facility on the farm Graspan 172, some 50km north-east of Hopetown in the Pixley Ka Seme District Municipality, Northern Cape Province.

A survey of the land was conducted by Lita Webley and Jayson Orton on the 18 February 2012. The Basic Assessment Report for the 10 MW facility was completed in March 2012. This assessment forms part of the EIA process which comprises the initial 10 MW facility and an additional 80 MW facility; i.e. a facility of 90 MW in total. Two alternative locations are assessed.

The desktop Palaeontological Impact Assessment was conducted by Dr Jennifer Botha-Brink of the National Museum in Bloemfontein.

The following heritage indicators were identified:

- According to the desktop PIA report, the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e steep-sided gulleys) at the proposed site, means the impact on palaeontological material is negligible (rated Low or negative);
- Scatters of Middle Stone Age and possibly Later Stone Age artefacts occur around koppies and pans;
- Grinding surfaces on dolerite boulders on the southern koppie and historical graffiti on the northern koppie;
- A circular stone structure near the railway line which may be the remains of an historic fortification;
- Late 19<sup>th</sup> and early 20<sup>th</sup> century historic dump material related to the railways and possibly to South African War activity along the railway line;
- The Cultural Landscape of the adjoining property incorporates the Battle of Graspan which was an important military engagement of the South African War.

The following mitigation measures are recommended:

- No palaeontological mitigation is required as the impact on palaeontological material is considered negligible (rated Low or negative);
- However, the Environmental Control Officer (ECO) responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all substantial excavations into sedimentary bedrock for fossil remains. If any fossils are found during construction, SAHRA should be notified immediately;
- It is recommended that no construction should be allowed on the koppie to the north and south of the proposed new 80 MW facility. This includes access roads, underground cabling or power lines;
- It is recommended that no development takes place within 100m of the railway line to ensure the stone structure and historical material relating to the railway line and possibly the South African War, are not destroyed;
- No mitigation measures are recommended with regard the Built Environment;
- If any human remains are uncovered during the construction of the site, work should stop in that area and the SAHRA Burials Unit should be notified. They will investigate and propose a way forward;
- It is recommended that Visual Impact Specialist consider the visual impact of the proposed facility on the Cultural Landscape and the N12. Most importantly, the Visual

Impact Specialist should consider whether the proposed PV facility will be visible from the rocky koppies of the Graspan Battlefield, adjoining the farm.

The most significant heritage indicator which would prevent development on the site is of a visual nature. It is important to ensure that the development will not have a negative visual impact on the Battle of Graspan site.

Two alternative locations were proposed for the new 80 MW solar facility. This report does not favour one above the other, both are acceptable.

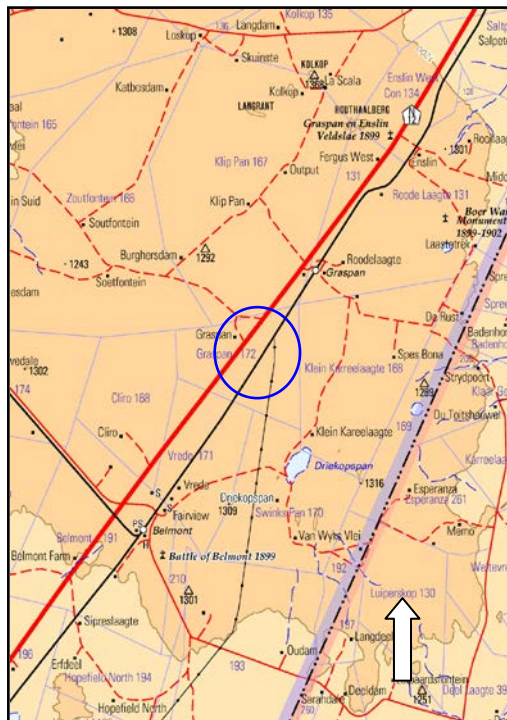
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## 1. INTRODUCTION

ACO Associates cc were appointed by ERM Southern Africa (Pty) Ltd, on behalf of the client, Solaire Direct Southern Africa (Pty) Ltd (Solaire Direct), for the construction of the 90 MW Graspan photovoltaic power facility on the farm Graspan 172, in the Pixley ka Seme District Municipality, Northern Cape Province. The proposed facility will be situated 75km south-west of Kimberley and to the east of the N12 (Figure 1).

The land identified for the facility is bounded to the west by the N12 and is bisected by the railway line between De Aar and Kimberley (Figure 2).



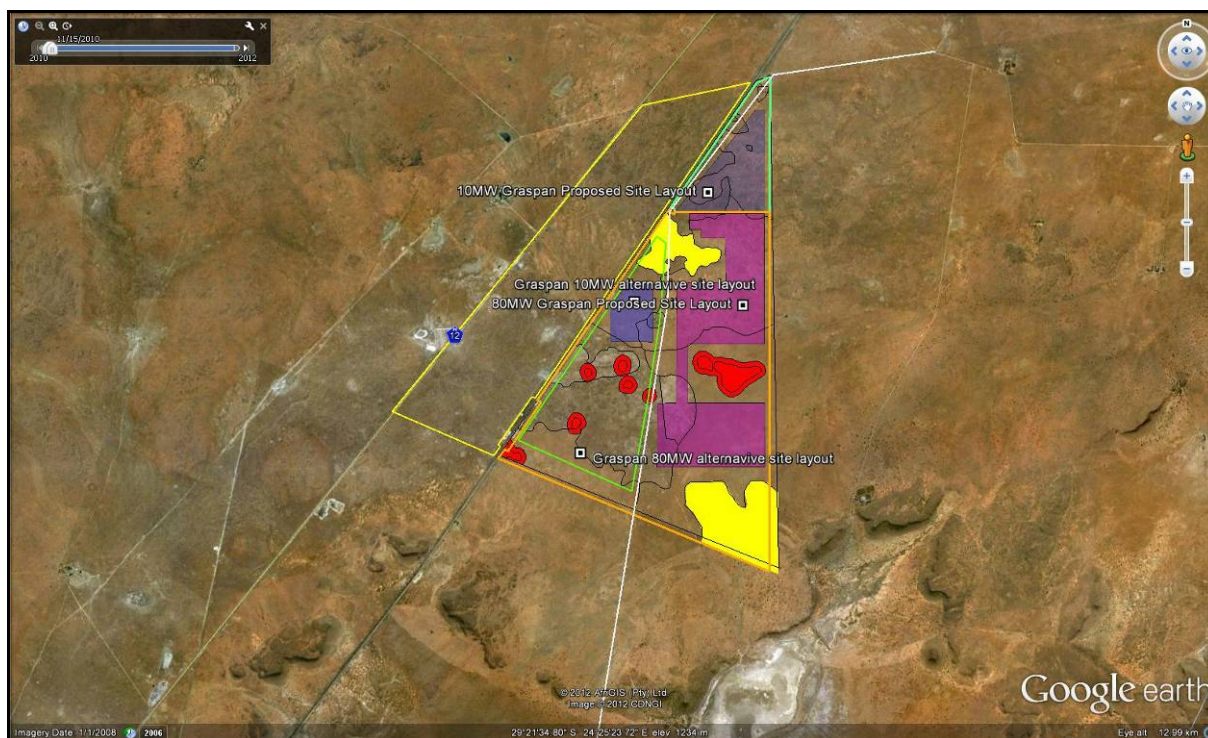
**Figure 1:** 1:250 000 map sheet 2924, showing location of the proposed PV power facility next to the N12 between Hopetown and Kimberley.

## 2. DEVELOPMENT PROPOSALS

It is anticipated that the project will feed a total of 90 MWs into the national grid. The key components of the proposed PV power plant include the following:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters and transformers;
- New grid connection substation;
- Underground cabling/ overhead power lines;
- On-site buildings (including an operational control centre, office, ablutions and a guard house);
- Access roads and internal road network; and
- Ancillary infrastructure.

The proposed development will include PV solar panels that will occupy less than 20 ha (0.2 km<sup>2</sup>) of the site area in total. The PV panels will be mounted on aluminium fixed frame structures approximately 3.33 m in height from the ground. The aluminium structures will be mounted on steel screw piles or concrete foundations 1500 mm deep, depending on soil conditions. The distance or spacing between rows will be approximately 6.2 m. The 132kV power from the new grid connection substation will be connected to the existing Eskom Graspan Traction Substation, located in the northern part of the site, by two overhead power lines of approximately 800 m in length. Existing gravel roads will be upgraded to 6 m in width.



**Figure 2:** Aerial view of the location of the PV power facility to the east of the N12 and bisected by the railway line. The two alternative locations for the 10 MW facility are indicated by the dark purple areas and the two alternative locations for the 80 MW facility are indicated in mauve. The red and yellow areas are sensitive areas.

The two alternative locations for the position of the 80 MW facility are assessed in this report (Figure 2). Combined with the initial 10 MW facility, this makes a facility with a total capacity of 90 MW.

### 3. TERMS OF REFERENCE

The assessment includes:

- A desk top study to determine the pre-history and history of the property;
- A site visit to locate and map heritage resources;
- The rating of significance of heritage resources on the property;
- An assessment of whether the construction of the solar facility will result in a loss of significant heritage resources;
- Recommendations for mitigation if necessary.



## **4. LEGISLATION**

The National Heritage Resources Act, No 25 of 1999 (Section 38 (1)) makes provision for a compulsory notification of the intent to development when any development exceeding 5000m<sup>2</sup> in extent, or any road or linear development exceeding 300m in length is proposed.

The NHRA provides protection for the following categories of heritage resources:

- Cultural landscapes (Section 3(3))
- Buildings and structures greater than 60 years of age(Section 34)
- Archaeological sites greater than 100 years of age(Section 35)
- Palaeontological sites and specimens
- Shipwrecks and aircraft wrecks
- Graves and grave yards (Section 36).

Only the Western Cape and Kwa-Zulu Natal have functioning Provincial Heritage Authorities, and consequently SAHRA administers heritage in the remaining provinces particularly where archaeology and palaeontology are the dominant concerns. Heritage Northern Cape (Ngwao Boswa Kapa Bokoni) deals largely with built environment issues at this stage. Amongst other things the latter administers:

- World Heritage Sites
- Provincial Heritage Sites
- Heritage Areas
- Register Sites
- 60 year old structures
- Public monuments & memorials

Archaeology, including rock art, graves of victims of conflict and other graves not in formal cemeteries are administered by the national heritage authority, SAHRA.

The Palaeontological Impact specialist report was conducted by Dr Jennifer Botha-Brink of the National Museum in Bloemfontein. The report is attached in full at the end of this HIA.

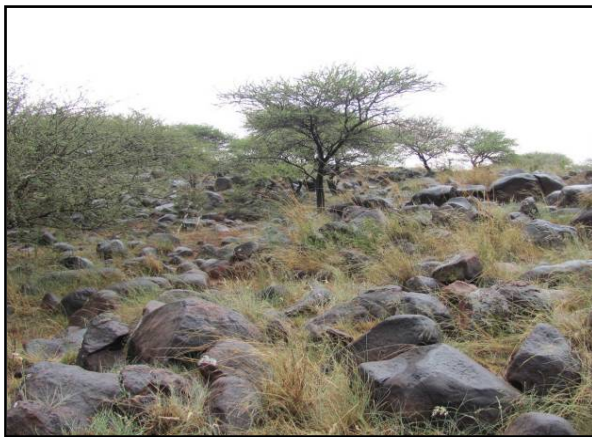
The heritage component of the Basic Assessment was undertaken by Webley & Orton (March 2012).

## **5. RECEIVING ENVIRONMENT**

The majority of the land is flat and covered in knee high vegetation. There is a low range of rocky koppies in the south-east and a small koppie to the north-west. There are also a number of shallow pans on the property. The land is bounded on the west by the N12 and is crossed in a north-easterly direction by the railway line to Kimberley. The existing 132kV Graspan Traction Substation is located within the northern section of the site, and an existing 132kV power line traverses the site from the Graspan Traction Substation in a north south direction, exiting the southern boundary of the site.



**Plate 1:** The landscape for the solar facility looking north-westward toward the farm house of Graspan. The hills in the background were the focus of the skirmishes during the battle of Graspan. Note the flat topography, knee-high grass and anthills in the foreground.



**Plate 2:** The small koppe in the north of the property is covered in dense thorn trees; **Plate 3:** View of the small pan adjoining the railway line in the south.

### **5.1 Palaeontological Background**

The geology of the farm Graspan is described in detail in Appendix 2. It contains rocks of the Tierberg Formation, Ecca Group, Karoo Supergroup which are Early Permian in age (approximately 270 million years ago). The rocks consist of mudstones, sandstone and minor conglomerate deposited in a shallow marine setting. Most of the fossils of the Ecca Group have been recovered from the underlying Whitehill Formation and include several species of fish, crustaceans, deepwater marine reptiles and beetles. The Tierberg Formation preserves parts of small vertebrates such as fish teeth and scales, plant fragments and petrified wood. The most common fossils in this formation are trace fossils. The Ecca Group sediments on Graspan are intruded by non-fossiliferous Early Jurassic Karoo dolerite. Part of the Ecca Group on Graspan is overlain by Late Cenozoic superficial deposits.

### **5.2 Archaeological Background**

Very little is known of the pre-colonial archaeology of this area. There are no records on the national SAHRA database (2009) with the exception of the survey conducted by Nel (2008) along the railway line. The closest archaeological surveys were conducted along the Riet River some 40km north-east of the site.

The Riet River area has attracted prehistoric human settlement since early Stone Age times and is particularly interesting because of the occurrence of the so-called “Riet River Burials” along the banks of the river (Humphreys 1970). Some 57 burials were excavated around the

Koffiefontein area by an amateur archaeologist from 1922-1946. Brink et al. (1992) have undertaken a rescue excavation of human remains at Pramberg, some 15km south of Jacobsdal. They recorded at least 11 cairns on the site and a physical anthropological study of the human remains indicated that they were of Khoisan origin.

Rossouw (2011) has investigated an area on the lower reaches of the Riet River and notes that the river terraces contain Stone Age sites, pastoralist settlements, rock art and rock engravings and remnants of 19th century farmsteads and kraals. In addition Rossouw (2011) observes that rock engravings are frequently found on rocky outcrops (dolerite koppies) along the Riet River and the surrounding hills. Rossouw's survey, however, failed to find any Stone Age exposures.

Van Jaarsveld's (2006) survey of the Hydra-Perseus and Beta-Perseus transmission lines, which pass to the east of the area, was of a very general nature and failed to identify specific heritage resources along the route with the exception of towns.

### **5.3 Historical Background**

This area is of historical importance because of the Battle of Graspan (also known as Enslin or Rooilaagte) which took place over a large area, commencing some 2.5 km to the north of the proposed facility (Figure 3). The battle was an important engagement of the Second Anglo-South African War of 1899-1902. By the end of 1899, Lord Methuen was moving northward along the railway line with a large British force, intent on relieving the siege of Kimberley.

The Battle of Belmont had taken place on the 23 November 1899. The Boers, some 2 500 strong, fell back to the next railway station, Graspan along the line, where they occupied positions on the neighbouring koppies. They were in possession of a number of guns and they were posted on five koppies over 200 feet in height, overlooking the railway line.

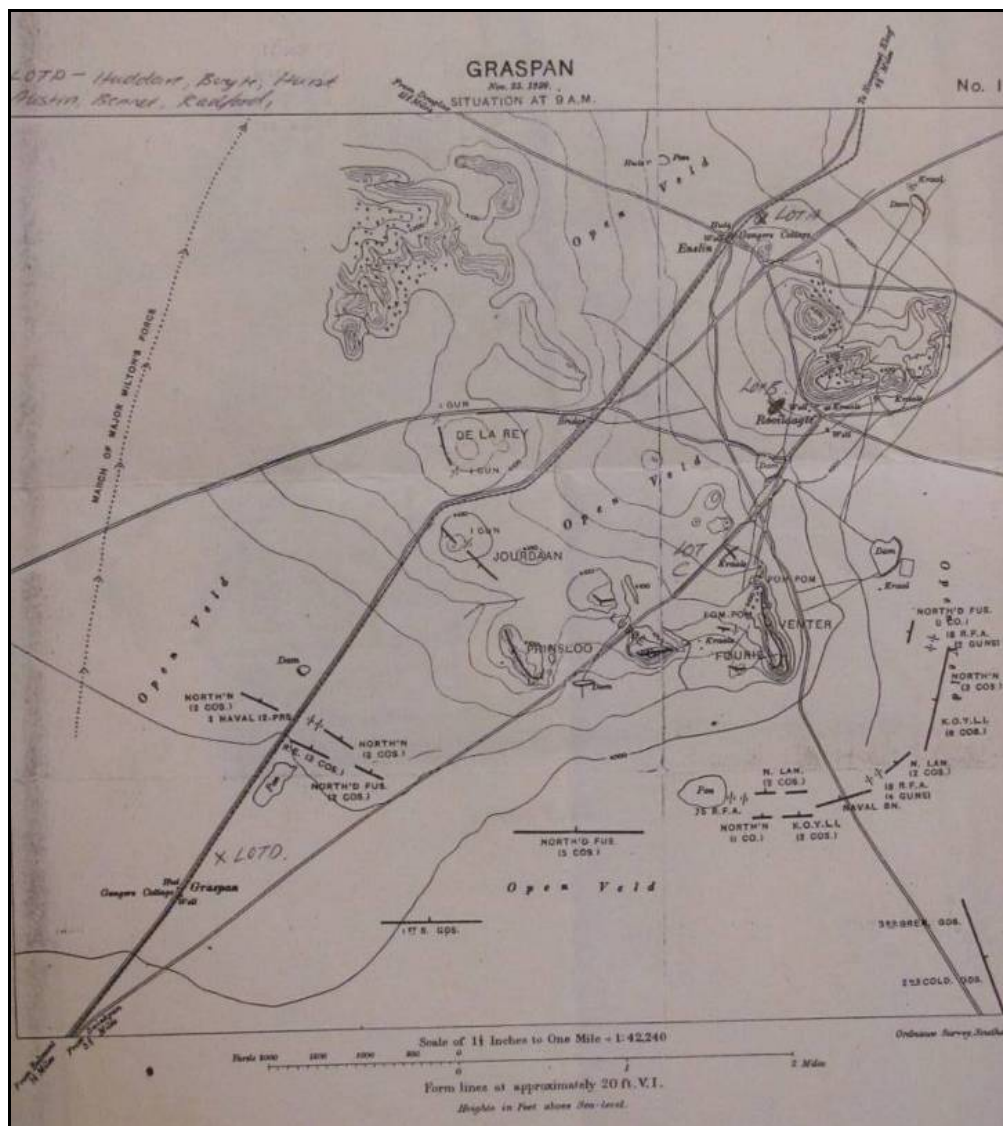
The railway line to Kimberley had been completed in 1885. The introduction of barbed wire fencing dates to about the same time. The accounts of the battle describe the veld as being hard red sandy soil covered in low shrub, with the occasional ant hill, behind which soldiers attempted to seek shelter. The koppies were precipitous, needing both hands to scale the heights.

The British troops advanced up along the railway line from Belmont to Graspan. In advance of the troops was an armoured train. The naval guns were brought by rail behind the armoured train and they came under attack as soon as they reached the station, indicating that the sphere of battle extended over a wide area, commencing at the Graspan railway station in a north-easterly direction (Figure 3).

The Battle of Graspan dates to the 25 November 1899. British troops advanced across the open countryside and stormed the Boer's hilltop positions. After taking the koppies, they gave chase to the Boers as they rode away across the veld. Most of the military action therefore seems to have taken place between Graspan station and the surrounding hills.

The British casualties amounted to some 197 men, while the Boers are thought to have lost around 20 men. The dead were buried in graves near to the battlefield, but according to Morris (pers comm.) were exhumed in 1963 and re-interred in the Garden of Remembrance, West End Cemetery, Kimberley. Since the exhumation was undertaken by an undertaker, it is possible not all human remains were recovered and that some might still be located at the original place of burial.

In the accounts of the battle, one of the soldiers mentions that he shared a 1 lb tin of beef and a little bread with his servant, but according to Morris (pers. comm.) British soldiers were under strict instructions to bury all rubbish while on campaign and it therefore seems unlikely that late 19<sup>th</sup> century middens relate to the South African War unless they are clearly related to a camp site.



**Figure 3:** Map dating to 1899, showing the position of the British and Boer forces during the Battle of Graspan. An overlay of this map has been inserted on the map of the proposed solar energy facility to indicate their spatial relationship.

## 6. METHODOLOGY

The survey was conducted by Lita Webley and Jayson Orton on the 18 February 2012. Walk paths and site locations were recorded with GPS and finds were photographed and described. No archaeological material was removed from the project area, but recorded and photographed *in situ*. The reader of this report is referred to Appendix 1 which contains the details of observations made in the field.

### 6.1 Limitations

There were no restrictions to the survey. However, there are a limited number of farm roads across the property which means that not all areas are easily accessible.

We have made certain assumptions about the archaeology based on the specific landscape characteristics of the site, and knowledge of the broader archaeological issues. The lack of significant landscape features such as greatly reduces the likelihood of finding significant sites.

## 7. RESULTS OF THE SURVEY

A range of different heritage sites were identified during the survey. This includes stone artefact scatters, dolerite boulders with grinding surfaces, a single incidence of historical graffiti on a dolerite boulder, a circular stone structure near the railway line, some calcrete cairns and a distribution of late 19<sup>th</sup>/early 20<sup>th</sup> century historical dump material along the railway line.

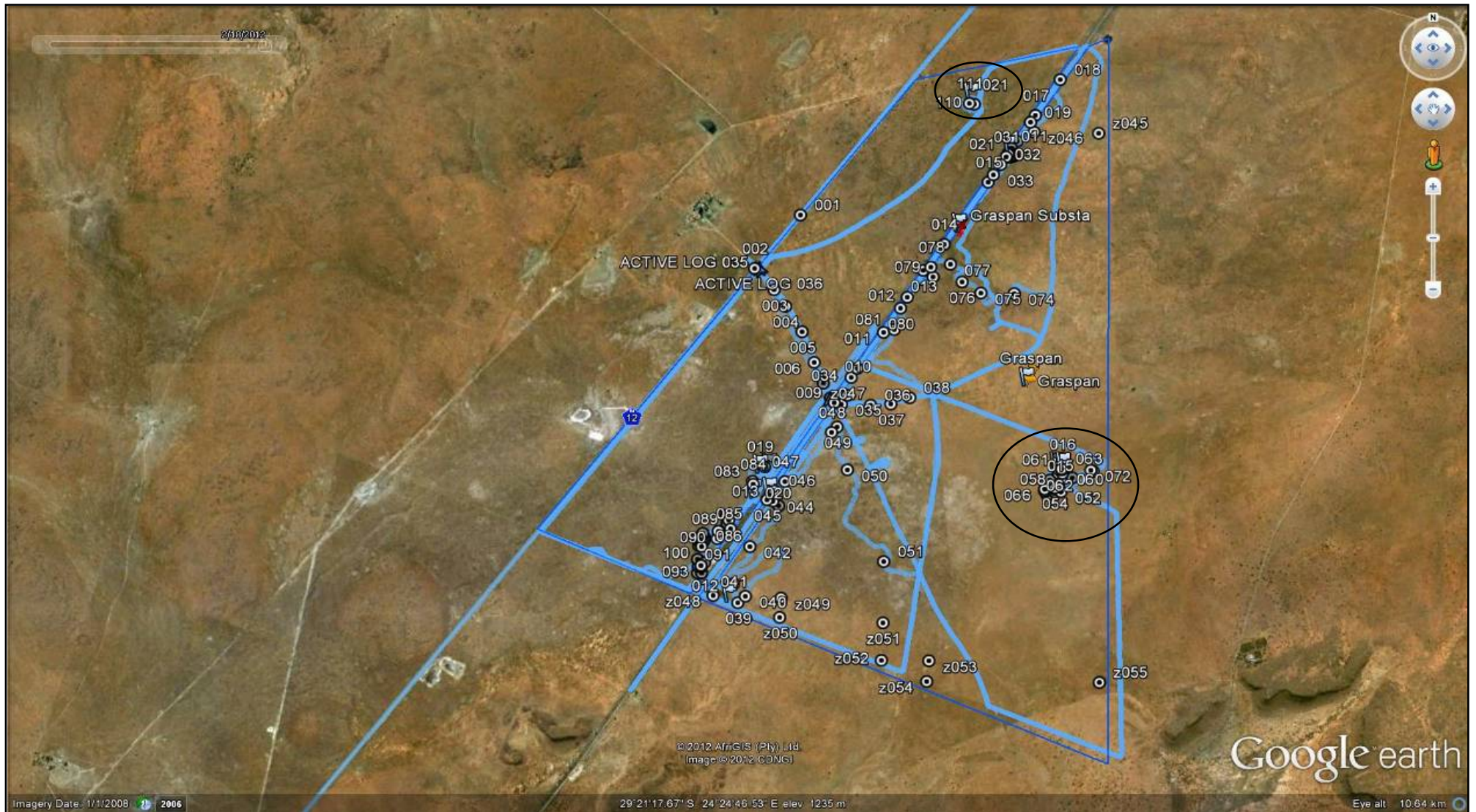
The stone artefact scatters were found concentrated around and in two pans, and on the southern koppie (Figure 5). The very weathered Middle Stone Age flakes on indurated shales were found on the southern koppie and around a pan. Another pan near the railway line contained a number of less heavily patinated indurated shale flakes, some of which appeared to be from the Later Stone Age. None of the artefact scatters suggested *in situ* material, and they were not associated with any bone, pottery or ostrich eggshell.

Fineline rock engravings from the interior of South Africa have been described by Morris (1988) and observed at Ruinte, near Jacobsdal (Webley & Orton 2012). Morris defines these incised engravings as hairline or fineline petroglyphs, generally fully patinated. Fineline engravings may include figurative motifs, comprising of only outlines but there are also many geometric designs and “many apparent random lines” (1988:110). However, no fine line engravings were recorded at Graspan, although a fairly thorough survey was conducted of the southern koppie (Figure 5).

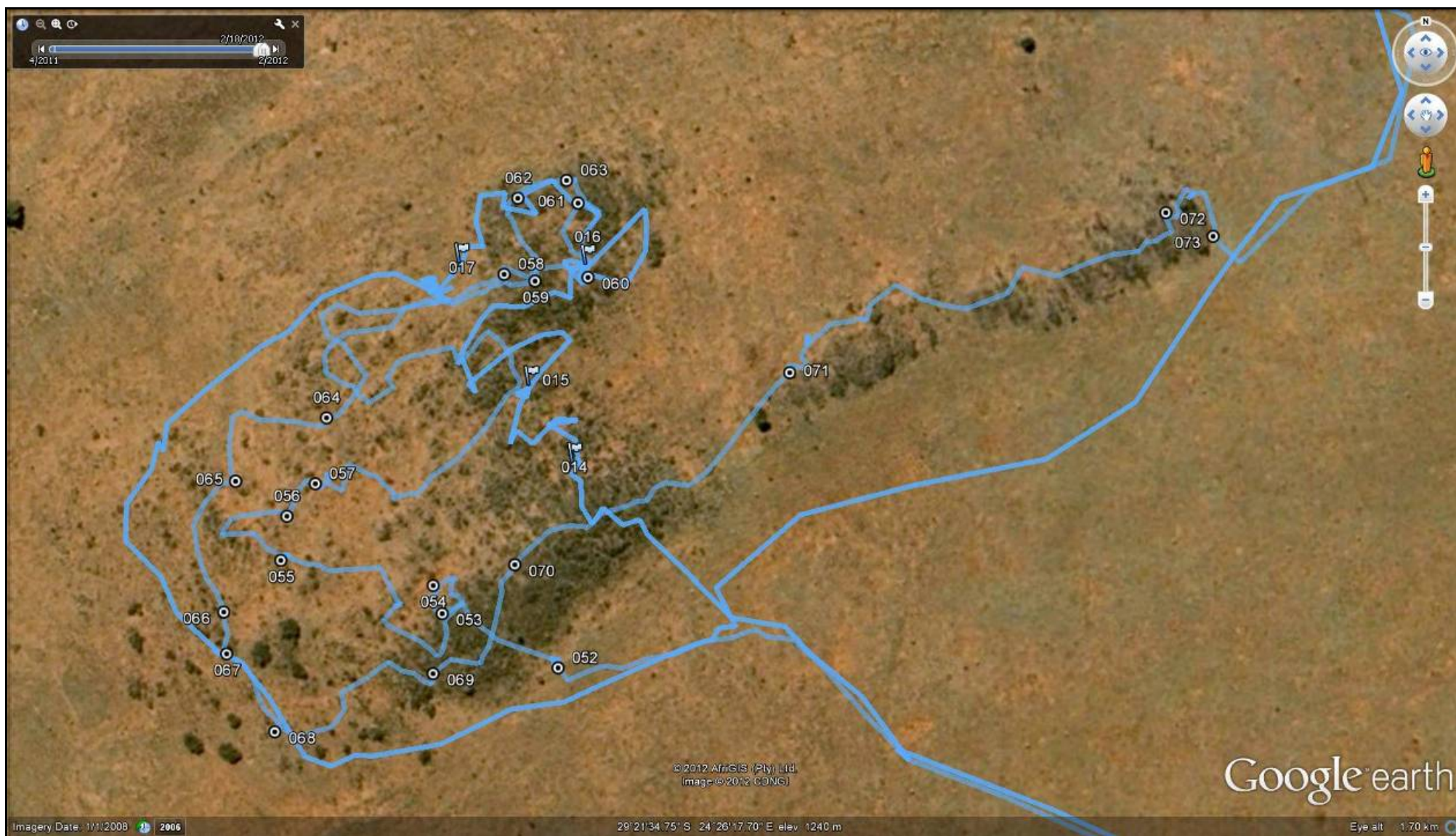
No “pecked” engravings were recorded such as those from Ruinte, near Jacobsdal in the Free State Province (Webley & Orton 2012).



**Plate 4:** Very weathered Middle Stone Age artefacts from the southern koppie; **Plate 5:** Less patinated indurated shale artefacts from a small pan.



**Figure 4:** Aerial view of the survey with the blue lines indicating our tracks and the heritage sites. The positions of the northern and southern koppies are enclosed in circles. Note the dense distribution of historical material/sites along the railway line.



**Figure 5:** The southern koppies with the distribution of heritage sites focussed on the higher lying areas (see Table 1 for description of sites).



**Plate 6:** Grinding surfaces on a boulder on the southern koppie; **Plate 7:** Dolerite boulder on the northern koppie with historical graffiti.

However, a number of grinding surfaces were recorded on the dolerite boulders of the southern koppie. In addition to grinding surfaces, one of the boulders has scratched historical graffiti. It appears to be “KMV”. Elsewhere, recent engravings have been attributed to Europeans, Griquas and Khoekhoen groups. Some may have been made by late 19<sup>th</sup> century farm workers of Khoisan descent.



**Plate 8:** Calcrete cairn. Two of the cairns cover a metal rod sunk in concrete, suggesting they may be markers.

Site 011 represents two concentric circles of packed stone, the inner circle with a diameter of 4m, the outer with diameter of 1m (Plates 9 & 10). It is made of substantial stone boulders and is located next to the railway line. It appears to be associated with late 19<sup>th</sup> century historical tin and glass debris nearby, also a flat dolerite boulder with scratch marks. The stone is not dressed and is roughly packed. It may have served as the base of a corrugated iron fortification erected along the railway line during the South African War.

The historic material strewn around the stone structure includes one square and one round metal can. The square can resembles late 19<sup>th</sup> century bully beef cans. Similar historic material is found mainly concentrated along the railway line (see Figure 6), but in particularly large numbers along the southern section of the track.

The distribution of historic late 19<sup>th</sup>/early 20<sup>th</sup> century dump material, including glass bottles, tin cans, etc is illustrated in Plates 11-18. They are particularly concentrated within a swathe



of 50-100m from the railway line. There are some areas of dense concentration which may represent a single dumping incident.



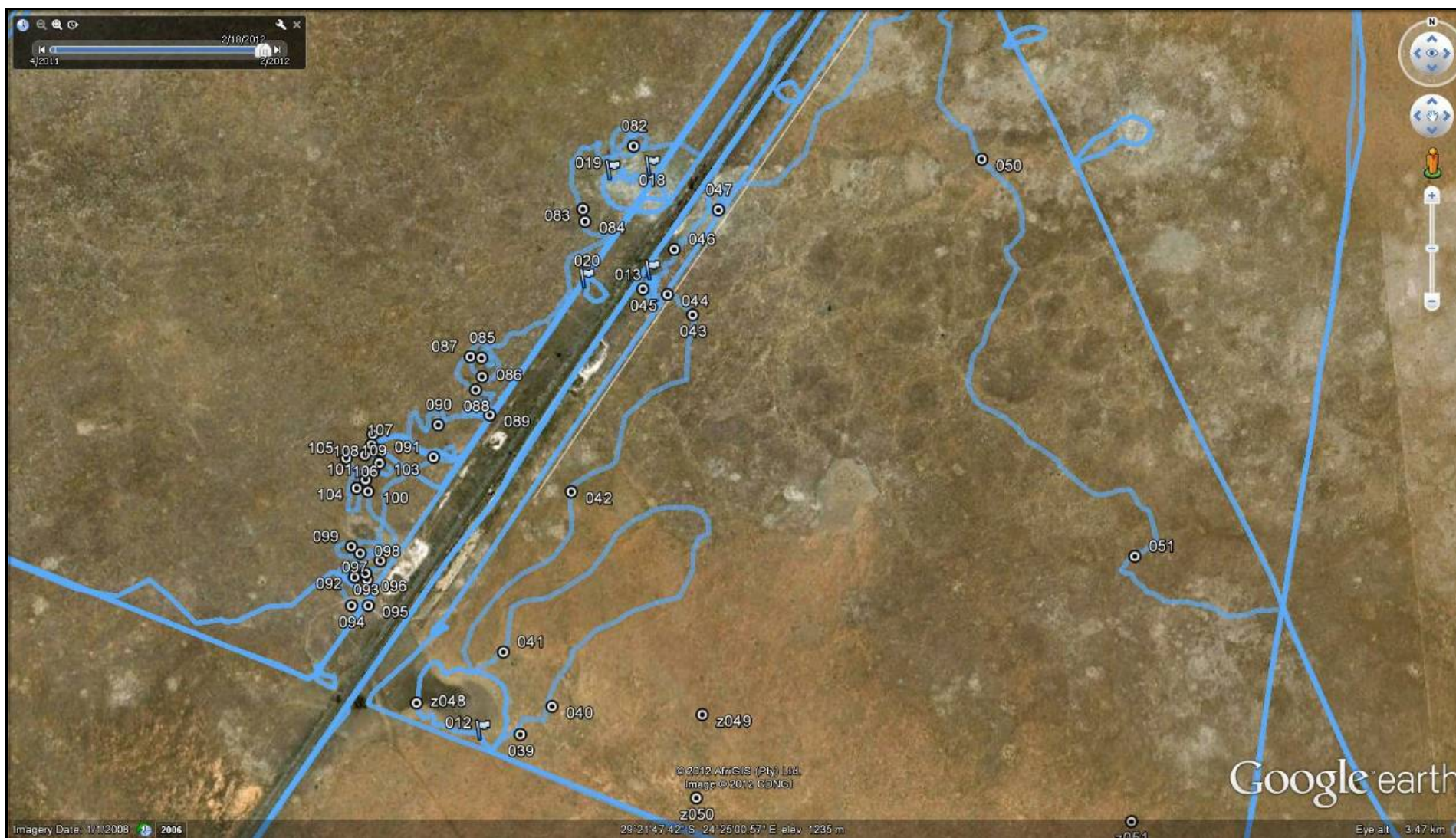
**Plate 9:** Aerial view of round stone structure (indicated by arrow) next to the railway line; **Plate 10:** View of outer concentric line of stone.



**Plate 11:** Two tin cans, one with a “whole-in-cap” closure with the pinhole in the centre of the lid sealed with lead. Note the seams of the circular can. **Plate 12:** A 20<sup>th</sup> century fragment of ceramic with a green under-glaze transfer emblem of the South African Railways.



**Plate 13:** Distribution of late 19<sup>th</sup> century historic rubbish; **Plate 14:** Unusual oval shaped tin cans.



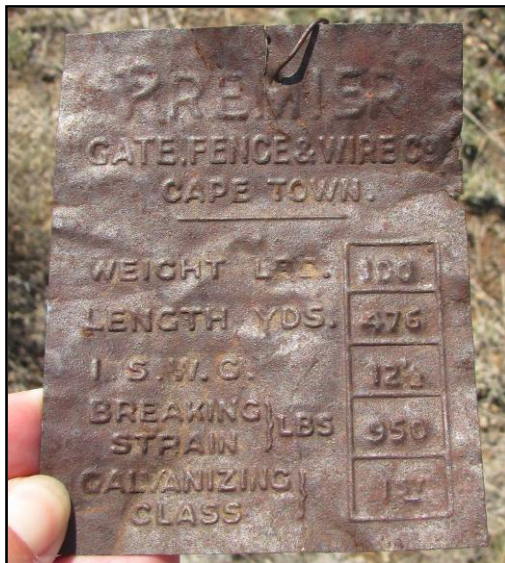
**Figure 6:** Distribution of late 19<sup>th</sup>/early 20<sup>th</sup> century historical dump material along side the railway line.



**Plate 15:** Historic Westley Richards cartridge case.



**Plate 16:** Different colour glass containers.



**Plate 17:** Metal label from Premier, the Gate, Fence and Wire Company. **Plate 18:** A sardine can.



## 8. ASSESSMENT OF IMPACT AND SIGNIFICANCE

The activities likely to result in impacts to surface and subsurface material include: site preparation, creation of roads, and construction of buildings and installation of cables. The installation of the solar panel frames will be secondary to the previous activities and so the impacts would be minor.

### 8.1 Palaeontology

With regard the palaeontology of the area (see Appendix 2 at the end of the report): the PV power facility will be constructed in areas that contain non-fossiliferous Jurassic dolerite, Quaternary deposits and rocks of the Tierberg Formation, Ecca group. Quaternary fossils are usually found in gulleys and the low-lying relief and absence of potentially fossiliferous gulleys suggests that fossils of this geological age are absent here. Fossils from the Ecca Group are exceedingly rare, and only a small portion of the development will encroach into rocks of this age. Thus, considering the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e steep-sided gulleys) at the proposed site, the impact on palaeontological material is negligible (rated Low or negative).

Drilling or screwing the solar frames into place would however represent a possible threat to palaeontological resources if they existed on site.

**Table 1: Impacts to Palaeontology**

Criteria	Without Mitigation	With Mitigation
Extent	Local	Local
Duration	Permanent (loss of palaeontological resources is permanent)	n/a
Intensity	Low	Very Low
Probability	Medium	Low
Confidence	Medium	Medium
Significance	Low	Low
Nature of cumulative impact	Low	
Can impact be reversed?	No, palaeontological resources are non-renewable	
Impact may cause irreversible loss of resources	No, this is unlikely	
Can impact be mitigated?	Not required	

## 8.2 Archaeology

The pre-colonial archaeological remains include: MSA (and possibly LSA) artefact scatters around koppies and pans and grinding surfaces on dolerite boulders on the southern koppie.

The historical period archaeological remains on the site include: historical graffiti on the northern koppie; a circular stone structure (possibly the remnant of an historical fortification) next to the railway line; historical 19<sup>th</sup>/early 20<sup>th</sup> century dump material including tin cans and bottle fragments concentrated along the railway line. It seems likely that the historic material relates to the railway line. There is a small possibility that the material may date to the South African War, but according to Morris (pers. comm.) British soldiers were under strict instructions to bury all rubbish while on campaign. It seems unlikely that the Boers would have camped in an exposed area around the railway line.

The proposed development will have a negative impact on the archaeology of the area. However, the pre-colonial and historical archaeological remains are of low to medium significance. The historical archaeological material (including the circular stone structure) in proximity to the railway line is of low-medium significance.

**Table 2: Impacts to Historical Archaeology**

Criteria	Without Mitigation	With Mitigation
Extent	Local	Local
Duration	Permanent (loss of archaeological resources is permanent)	n/a
Intensity	Very Low	Very Low
Probability	Medium	Low
Confidence	Medium	Medium
Significance	Low	Low
Nature of cumulative impact	Low	
Can impact be reversed?	No, archaeological resources are non-renewable	
Impact may cause irreversible loss of resources	No, although engraved rocks may occur on koppies which are vulnerable to development.	

Can impact be mitigated?	Avoid construction on low koppie to the north and south of the proposed facility to avoid destruction of grinding surfaces and historical graffiti on dolerite boulders.
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### **Table 3: Impacts to Historical Archaeology**

The construction of the 80 MW solar facility may result in the destruction of historical period archaeological material, i.e material on either side of the railway line (Figure 6).

Criteria	Without Mitigation	With Mitigation
Extent	Local	Local
Duration	Permanent (loss of archaeological resources is permanent)	n/a
Intensity	Very Low	Very Low
Probability	Medium	Low
Confidence	Medium	Medium
Significance	Low - Medium	Low
Nature of cumulative impact	Low	
Can impact be reversed?	No, archaeological resources are non-renewable	
Impact may cause irreversible loss of resources	Destruction of historical dump material, including a circular stone structure, in proximity to the railway line.	
Can impact be mitigated?	Institute a 100m buffer around the railway line.	

### **8.3 Cemeteries and Graves**

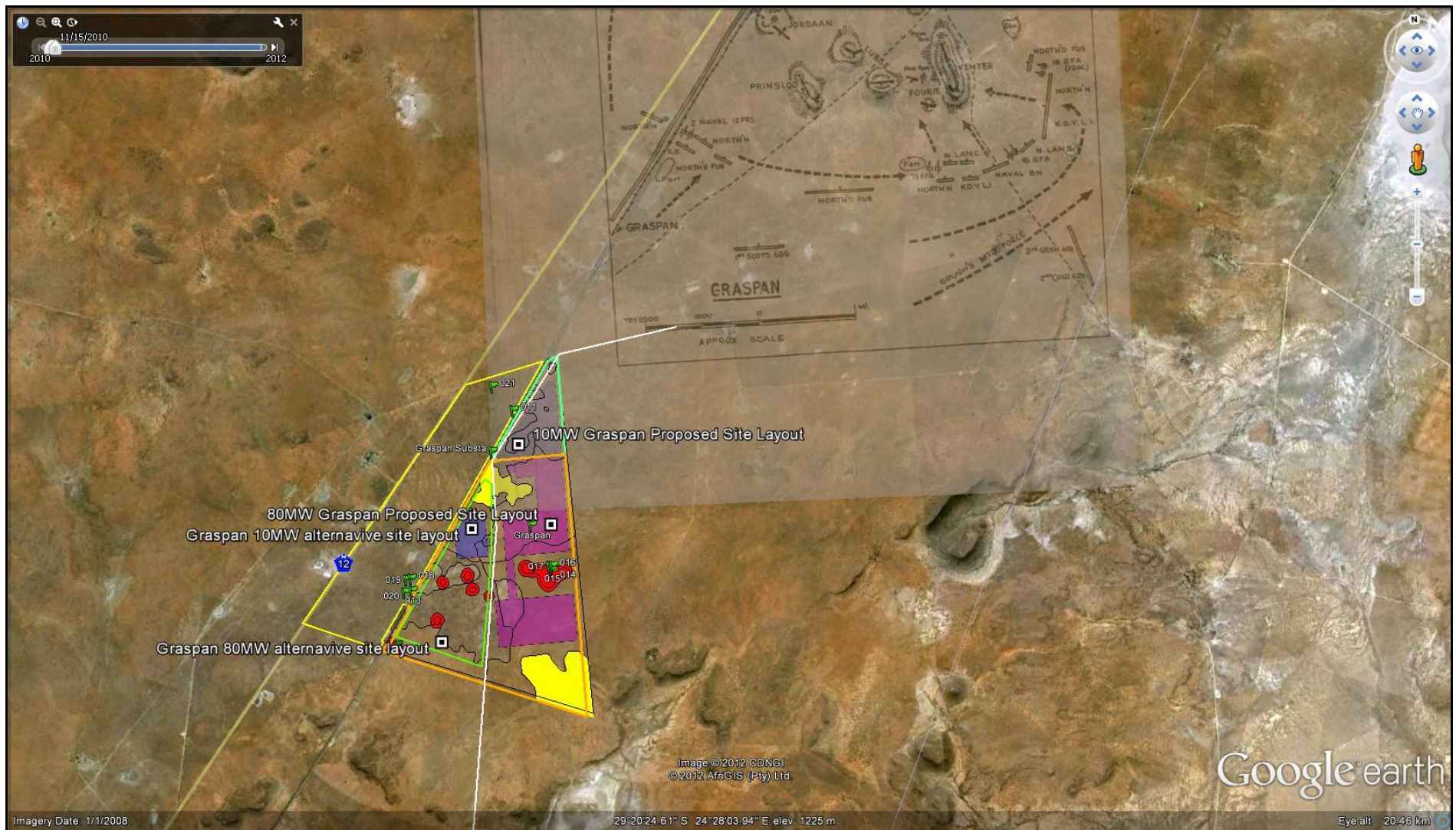
A few calcrete cairns were recorded to the west of the railway line. However, they are more likely to represent markers than burials.

### **8.4 Built Environment.**

No aspects of the Built Environment were recorded during the survey.

### **Table 4: Impacts to Built Environment**

Criteria	Without Mitigation	With Mitigation
Extent	Local	Local
Duration	n/a	n/a
Intensity	Low	Low
Probability	Low	Low
Confidence	Medium	Medium
Significance	Low	Low
Nature of cumulative impact	None	
Can impact be reversed?	No impact	
Impact may cause irreversible loss of resources	No	
Can impact be mitigated?	Not required	



**Figure 7:** The overlay of the Graspan battlefield shows the location of the proposed 80 MW solar facility with respect to the battlefield.

## 8.5 Cultural Landscape

The Cultural Landscape primarily relates to the Battle of Graspan (South African War) which took place to the north-east of the proposed facility (Figure 7). The station of Graspan is 2.5km to the north of the northern property boundary. The proposed 80 MW facility could have a negative visual impact on the battlefield.

**Table 5: Impacts to Cultural Landscape**

Criteria	Without Mitigation	With Mitigation
Extent	Regional	Local
Duration	Long term	Long term
Intensity	Low	Low
Probability	Medium	Low
Confidence	Medium	Low
Significance	High	Low
Nature of cumulative impact	High. Any additional facilities will increase the risks of a cumulative impact.	
Can impact be reversed?	Yes, after facility is de-commissioned	
Impact may cause irreversible loss of resources	Yes, the visual impact of the facility may have a negative impact on the battlefield of Graspan.	
Can impact be mitigated?	Yes, visual impact specialist to consider whether the facility will be visible from the koppies of the Graspan battlefield.	

## 9. MITIGATION

### 9.1 Palaeontology

No specific mitigation is required with regard the palaeontology, but the ECO responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all substantial excavations into sedimentary bedrock for fossil remains. If any fossils are found during construction, SAHRA should be notified immediately.

### 9.2 Archaeology

The stone artefacts comprise a background scatter and are of low significance and no mitigation is required. However, the grinding surfaces on the dolerite boulders on the low-lying southern koppie are of some archaeological significance and they should not be destroyed. For this reason it is recommended that the koppies (both the southern and northern koppies) should be avoided (Figure 4).

The circular stone structure may be the remnants of a fortification dating to the South African War, built expressly to protect the railway line. However, it is unlikely that it dates to the battles of Belmont and Graspan, as the military moved through this area fairly rapidly. Nevertheless, the dense distribution of historic dump material alongside the railway line is of interest (Figure 6). The material may have been dumped over a long period of time, from the construction of the line in 1885, and does not necessarily relate to the Battles of Belmont and Graspan of 1899. It is recommended that a buffer of around 100m is maintained on both sides of the railway line to ensure that the material is not destroyed.

### **9.3 Cemeteries and Graves**

If any human remains are uncovered during the construction of the site, development should cease and SAHRA should be notified.

### **9.4 Built Environment**

No issues of the Built Environment were observed during the survey.

### **9.5 Cultural Landscape**

The Visual Impact Specialist should ensure that the proposed 80 MW development is not visible from the koppies of the Battlefield of Graspan. Other considerations include visibility from the N12.

## **10. RECOMMENDATIONS**

The client proposes to build an 80 MW solar facility, in addition to an earlier 10 MW solar facility, on the farm Graspan 172.

The following heritage indicators were identified:

- According to the desktop PIA report, the rarity of fossil-bearing sediments and lack of appropriate exposure (i.e steep-sided gulleys) at the proposed site, means the impact on palaeontological material is negligible (rated Low or negative);
- Scatters of Middle Stone Age and possibly Later Stone Age artefacts occur around koppies and pans;
- Grinding surfaces on dolerite boulders on the southern koppie and historical graffiti on the northern koppie;
- A circular stone structure near the railway line which may be the remains of an historic fortification;
- Late 19<sup>th</sup> and early 20<sup>th</sup> century historic dump material related to the railways and possibly to South African War activity along the railway line;
- The Cultural Landscape of the adjoining property incorporates the Battle of Graspan which was an important encounter of the South African War.

The following mitigation measures are recommended:

- No palaeontological mitigation is required as the impact on palaeontological material is considered negligible (rated Low or negative);
- However, the ECO responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all substantial excavations into sedimentary bedrock for fossil remains. If any fossils are found during construction, SAHRA should be notified immediately;
- It is recommended that no construction should be allowed on the low-lying koppie to the north and south of the proposed facility. This includes access roads, underground cabling or power lines;
- It is recommended that no development takes place within 100m of the railway line to ensure the stone structure and historical material relating to the railway line (and possibly the South African War), are not destroyed;
- No mitigation measures are recommended with regard the Built Environment;



- If any human remains are uncovered during the construction of the site, work should stop in that area and the SAHRA Burials Unit should be notified. They will investigate and propose a way forward;
- It is recommended that Visual Impact Specialist consider the visual impact of the proposed facility on the Cultural Landscape and the N12. Most importantly, the Visual Impact Specialist should consider whether the proposed PV facility will be visible from the rocky koppies of the Graspan Battlefield, adjoining the farm.

Two alternative locations were proposed for the 80 MW solar facility. This report does not favour one above the other, both are acceptable.

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**Appendix 1: List of heritage sites recorded during the assessment**

<b>Site Name</b>	<b>GPS co-ordinates</b>	<b>Discussion</b>	<b>Significance</b>
011	S29 20 14.37 E24 26 01.09	Two concentric stone circles, inner with diameter of 4m, outer with diameter of 1m. Made of substantial stone boulders. Next to the railway line. Late 19 <sup>th</sup> century history tin and glass debris nearby, also a flat dolerite boulder with scratch marks.	Medium-High
012	S29 22 05.38 E24 24 43.69	Ephemeral scatter of indurated shale flakes around the perimeter of a shallow pan at one corner of the property. At least one flake is identifiable as MSA, with a faceted platform. The other flakes are very weathered.	Low
013	S29 21 39.6 E24 24 54.4	Concentration of around 30 rusted square and round tins in an area of about 5m <sup>2</sup> . Associated some dark green and aqua fragments of round bottle glass. Representing a single dump.	Low-Medium
014	S29 21 35.16 E24 26 15.47	On edge of little dolerite ridge or koppie, in the southern section of the property, a scatter of very weathered indurated shale flakes, probably MSA.	Low
015	S29 21 34.15 E24 26 14.88	A few metres from Site 014, another scatter of weathered indurated shale flakes also on the koppie. This site has some more freshly flaked quartzite flakes.	Low
016	S29 21 32.81 E24 26 15.66	More scatters of indurated shale and quartzite flakes in a little deflated area between some dolerite boulders on the koppie.	Low
017	S29 21 32.83 E24 26 13.98	More scatters of very weathered MSA indurated shale flakes in a deflated area on the koppie. Less weathered quartzite flakes may be LSA.	
018-019	S29 21 33.13 E24 24 54.85  S29 21 33.45 E24 24 52.26	Points at 2 ends of a small pan between the railway line and the N12. Large number of fresh black indurated shale flakes lying on the baked mud floor of the pan – one with retouch. Probably LSA. Also on the pan floor, some fragments of dark green bottle glass and a horseshoe. More 19 <sup>th</sup> century historic material around the margins of the pan.	Low-Medium
020	S29 21 39.55 E24 24 50.56	Calcrete cairn next to iron peg, possibly survey beacon.	Very Low
021	S29 20 01.57 E24 25 50.24	On a little dolerite koppie at the northern end of the property, a boulder with historical graffiti reading "KMV"	Low-medium
J39	S29 22 05.0 E24 24 46.3	Background MSA scatter near pan	Low
J40	S29 22 03.4 E24 24 48.4	Background MSA scatter and 1 ?LSA artefact near pan	Low

J41	S29 22 00.3 E24 24 45.2	Background MSA scatter near pan	Low
J42-43	S29 21 41.1 E24 24 57.6	Single can lid and several bits of metal sheeting and wire in the area	Low
J44-46	S29 21 39.6 E24 24 54.4	Rubbish dump recorded as Site 013 (see above).	Low-Medium
J47-50	S29 21 32.2 E24 25 16.5	Distribution of: Ephemeral glass, ceramic and can scatter and some wiring, also metal sheeting fragment.	Low
J51	S29 21 54.8 E24 25 26.5	Single cartridge case	Low
J52	S29 21 37.6 E24 26 15.3	Two stone cairns, grave-like but probably unlikely – see Site 020	Low
J53	S29 21 37.0 E24 26 13.8	Grindstone/rubbed stone	Low
J54	S29 21 36.6 E24 26 13.6	MSA scatter in hollow on low koppie	Low
J55-J70	S29 21 35.8 E24 26 11.7	Dolerite boulders with evidence of use as a grindstone/rubbed stone	Low
J71	S29 21 34.1 E24 26 18.4	Mixed MSA/LSA artefact scatter	Low
J72-J73	S29 21 32.5 E24 26 24.2	Dolerite boulders with evidence of use as a grindstone/rubbed stone	Low
J74-J76	S29 20 48.5 E24 25 53.2	Clear bottle glass fragments, a broken wine bottle and several bits of barbed wire in the area.	Low
J77	S29 20 41.4 E24 25 44.8	Grindstone/rubbed stone	Low
J78-81	S29 20 52.2 E24 25 31.1	2 tin cans, wire, 1 ceramic (railways), several wire fragments, cans and barbed wire spindle: ISCOR, Barbed wire 100lbs, IOWA pattern 535 yds min.	Low
J82-83	S29 21 35.0 E24 24 50.4	Bottle base, lots of cans, bullet case (WESTLEY RICHARDS No 2 MUSKET). Historic material distributed up to 30 m further north and also up to 50-60 m to the west, single rifle cartridge.	Medium
J84	S29 21 35.7 E24 24 50.6	Background MSA scatter	Low
J85-89	S29 21 44.6 E24 24 43.8	Tin cans, including kidney shaped “can” lids, one ceramic fragment	Medium
J90	S29 21 47.3 E24 24 41.0	Two calcrete mounds, 2 glass frags, 1 can fragment, copper wire, 1 kidney-shaped can ‘lid’	Low
J91-108	S29 21 50.0 E24 24 36.7	Large distribution of historic material: Fragment of metal sheeting, dark green glass, wire, bottle base, metal strip with punched holes, cans, fragments of glass, shotgun cartridge (base rusted so no details), 1 can lid with handle, 2 small aqua/green bottle neck frags, 4 light green bottle frags, with inscriptions: “...NDSEY”, “...(M)ONAD”, “...GE WA...” & 1 tent peg.	Medium
J109	S29 21 47.9 E24 24 36.7	Big can dump with lots of fragments of coloured glass.	Medium
J110	S29 20 01.8	A few ceramic fragments	Low

	E24 25 51.4		
J111	S29 20 01.6 E24 25 50.0	Engraved rock (pecked – looks fresh?). See Site 021.	Low