HERITAGE IMPACT ASSESSMENT: PROPOSED AGGENEYS PHOTO-VOLTAIC SOLAR POWER PLANT ON PORTION 1 OF THE FARM AROAMS 57, NORTHERN CAPE PROVINCE

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

Prepared for:
Digby Wells Environmental
Private Bag X10046
Randburg, 2125.
Johan Nel
Tel: 011 789 9495
Cell: 072 288 5496
Email: johan.nel@digbywells.com

April 2012

Prepared by:

Lita Webley & David Halkett
ACO Associates
8 Jacobs Ladder
St James
7945

Phone (021) 650 2357
Fax (021) 650 2352

acoassociates@gmail.com
Lita@webleyonline.com

EXECUTIVE SUMMARY

The Archaeology Contracts Office at the University of Cape Town was appointed by Digby Wells Environmental, on behalf of the client Orlight South Africa, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on the farm Aroams 57, in the Namakwa District Municipality, Northern Cape Province. The proposed facility will be located on either side of the N14, half way between Springbok and Pofadder. It is lies on the plains between Black Mountain and the Gamsberg.

This assessment forms part of the EIA process. The Notice of Intent to Develop and Scoping phase was undertaken by Digby Wells Environmental. The NID was submitted to SAHRA (SAHRA file number: 9/2/066/0047) and they have requested a palaeontological and archaeological impact assessment. They have also asked that the "archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance".

This report is based on a background study of the published and unpublished literature for the area as well as fieldwork undertaken by Lita Webley and David Halkett on the 16 April 2012. A desktop palaeontological study was also undertaken by Dr John Pether and is appended. No significant limitations to conducting the survey were encountered.

<u>The following heritage indicators were identified:</u>

Palaeontology:

- The bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The Pre-colonial Archaeology:

- Stone artefacts scatters from the Middle Stone Age are sparsely distributed across the study area and are found on gravel pavements between the vegetation;
- The absence of associated archaeological material, and lack of discrete individual sites reduces the significance of the material overall;
- Further mitigation of sites is considered unnecessary in this case.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- A few cairns were identified but their purpose was unclear. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:

- The proposed solar plant is positioned on both sides of the N14 and is located 2.5km east of the Gamsberg. A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered by the Visual Impact Specialist;
- The cultural landscape of the surrounding area has been significantly impacted by mining activities;
- However, in view of the discussion around the significance of the Gamsberg as a "genocide site" it is recommended that the Visual Impact specialist consider the impact of the proposed development with respect to the mountain.

Summary
The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended. However, the potential cumulative impact of a number of such facilities on the archaeological landscape of the Gamsberg should be examined by the Visual Impact specialist.

SPECIALIST TEAM AND DECLARATION OF INDEPENDENCE

David Halkett (BA, BA Hons, MA (UCT)) is an Archaeologist and Member of the Association of Professional Archaeologists of Southern Africa (ASAPA) accredited with Principal Investigator status. He has been working in heritage management for 23 years and has considerable experience in impact assessment with respect to a broad range of archaeological and heritage sites including those in the Northern Cape. He is a member of the Archaeology, Palaeontology and Meteorites Committee and the Impact Assessment Committee of the Heritage Western Cape (HWC), the Provincial Heritage Resources Authority.

Lita Webley (BA, BA Hons, MA (Stellenbosch), PhD (UCT)) is an Archaeologist and member of ASAPA accredited with Principal Investigator status. She has been involved with heritage and archaeological impact assessments on a part-time basis since 1996 and full time since 2008. Her PhD thesis was concerned with the archaeology of the Namaqualand region of the Northern Cape and she is familiar with the heritage of the region.

John Pether (MSc. Pr. Sci. Nat.(Earth Sci)) is an independent consultant/researcher and authority on coastal-plain and continental-shelf palaeoenvironments.

Mr David Halkett, Dr Lita Webley and Mr John Pether are independent specialist consultants who are in no way connected, financially or otherwise, with the proponent, other than in the delivery of consulting services on the project.

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1. INTRODUCTION

The Archaeology Contracts Office at the University of Cape Town was appointed by Digby Wells Environmental, on behalf of the client Orlight South Africa, to undertake an Impact Assessment for the construction of a 70MW solar facility on 350ha of land on Portion 1 the farm Aroams 57, in the Namakwa District Municipality, Northern Cape Province. The proposed facility will be located on either side of the N14, half way between Springbok and Pofadder. It is lies on the sandy plains between Black Mountain and the Gamsberg (Figure 1). This is to meet the growing demand for electricity generation and cleaner energy production in South Africa.

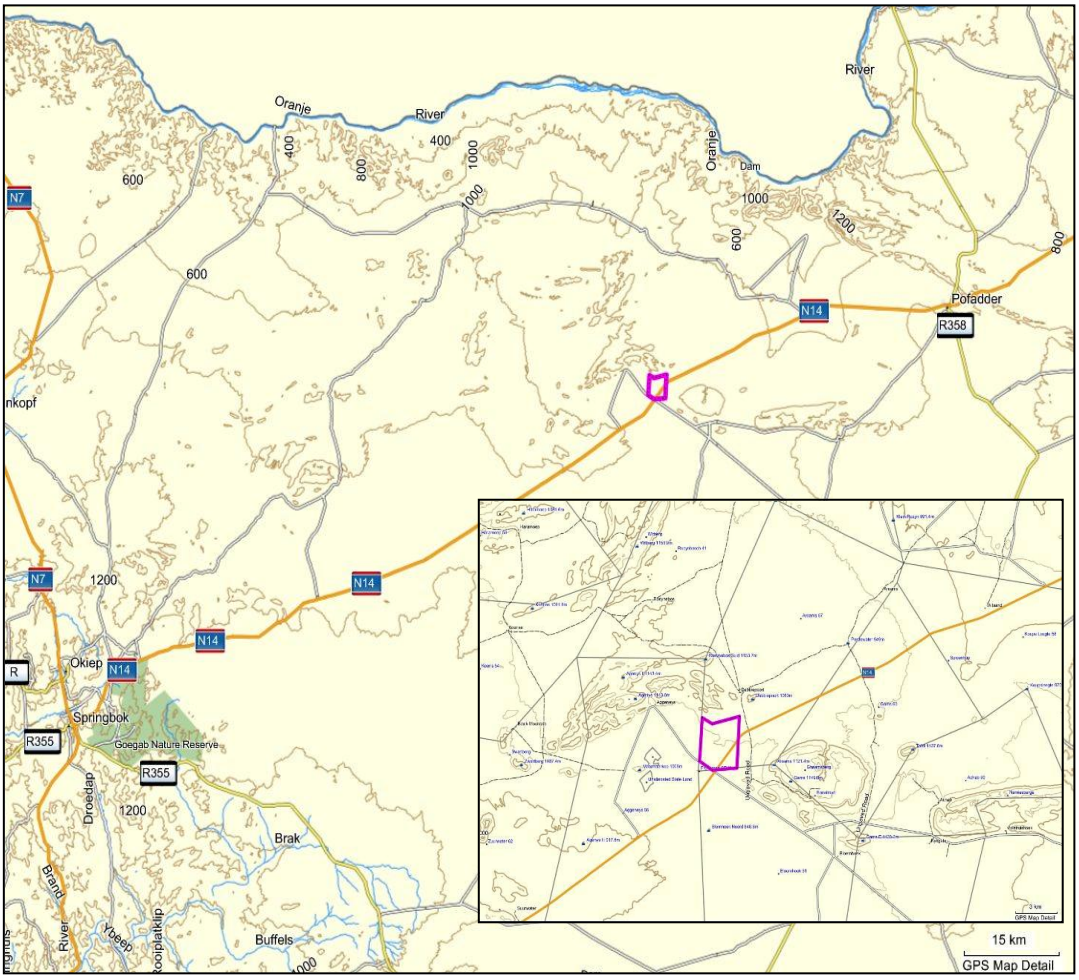

Figure 1: The location of the proposed facility on the N14 between Aggeneys and Pofadder. Note the location of the Gamsberg to the south-east.

2. DEVELOPMENT PROPOSALS

The Aggeneys solar project will have a generation capacity of 70MW resulting in the physical alteration of approximately 350ha of agricultural land on the farm Aroams 57. Only one preliminary layout has been proposed for the development (Figure 2). The facility may connect to the Aggeneys or Gamsberg substation through the establishment of an overheard power line, which could be 66kV or 132kV. Where possible the transmission route will be situated within, or parallel to, an existing servitude. The project will require the establishment of a ground mounting system, solar PV panels, inverters, switchboard and transformers.

Access roads to the facility from the nearest public road onto the site will be required. Internal site roads will also be required to access the solar panels for maintenance purposes. The solar panel plant will be fenced off from the surrounding farms. The site will need to be cleared of vegetation.

The following associated infrastructure will be required:

- Temporary container homes during the construction phase
- Office and technical service buildings
- Electricity distribution lines (from substation to Eskom power line)
- A perimeter high security fence
- Roads within the development footprint

The “no go” option (no development of the site) will also be considered.

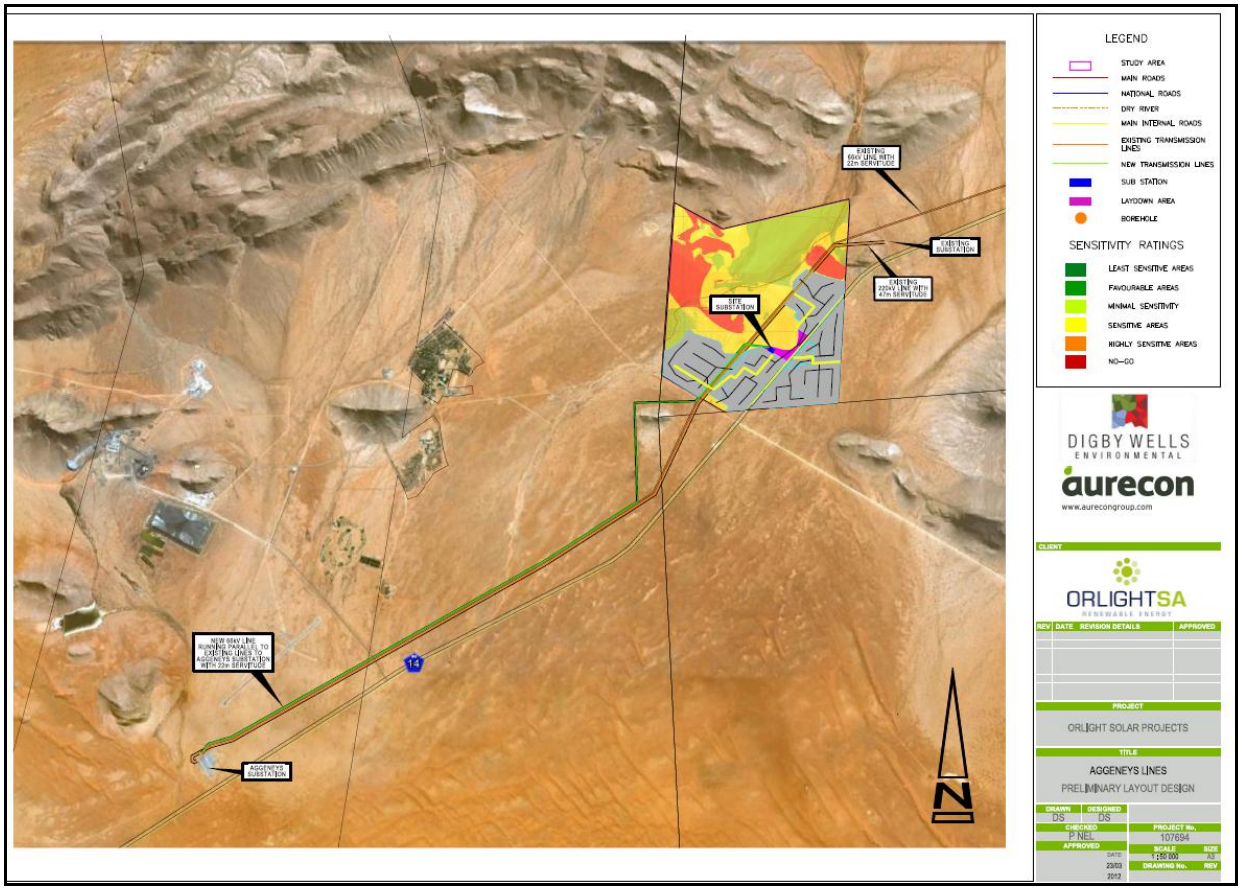

Figure 2: The location and design of the proposed facility on either side of the N14. The town of Aggeneys is located to the west.

The location and design of the proposed facility takes into consideration the position of sensitive features on the landscape, including a drainage channel which crosses the area from north-east to south-west. For this reason, the facility is position in the south-eastern corner of the property (Figure 2).

3. TERMS OF REFERENCE

This assessment includes:

- A site visit and desk top study to determine the pre-history and history of the property;
- The rating of significance of heritage resources on the property;
- An assessment of whether the development of the property 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 5000 m² 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.

Digby Wells Environmental submitted a cultural resources pre-assessment report or Notice of Intent to Develop to SAHRA in January 2012.

SAHRA (SAHRA file number: 9/2/066/0047) have requested a palaeontological and archaeological impact assessment. Further, they have asked that the archaeological impact assessment should also assess whether the cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The topography and landscape is described as fairly uniform. The area has an elevation of 880m above mean sea level and the landscape is north facing. It is flat and bordered on the north by steep hills, the outlying foothills of Aggeneys mountain range. The study area consists of red sandy soils and some rocky sections. There is one major drainage line running in a south-westerly direction from the north-eastern corner to the south-western corner. This drainage line spans up to about 50 metres wide. A smaller drainage line, which

is about 25 metres wide, flows in a south-south-westerly direction to meet up with the larger drainage line in the study area.

Plate 1: View across the flat grassy plains of the proposed facility with the mountains in the background.

Plate 2: View of the drainage channel which flows across the area. Large areas of the surface are covered in gravel consisting of quartz nodules. The stone artefacts occur in these gravels.

Plate 3: There are a few low rocky ridges in the northern portions of the property.

The drainage lines as well as 100m buffer zone adjoining the drainage lines are to be avoided. This results in a decrease in available surface area for infrastructure. Small trees (including kokerbome) occur along drainage lines and on rocky hillsides. The plains are dominated by low shrubs (generally less than 1 m in height) intermixed with grasses, succulents and geophytes.

In terms of human elements, there are farm fences and a small brick building as well as a wind pump. There are two existing transmission lines that divide the site in two. The site can be accessed directly from the N14 via the existing farm road. There is a two track service road that follows the transmission line.

6. BACKGROUND TO THE AREA

6.1 Palaeontology

The report on the palaeontology of the area was undertaken by Dr John Pether and is appended in full. In brief, the PIA report describes the bedrock of the area as comprising ancient basement rocks of the Bushmanland Terrance of the Namaqua Province. These are very old rocks and not of palaeontological interest. The overlying Quaternary sand cover is a combination of alluvium in the drainage lines and colluvium closer to the bedrock outcrops.

6.2 Archaeological Background

Information on the pre-colonial archaeology of the area is largely derived from a number of impact assessment reports which have been undertaken in the last few years. In general, Morris (2011c) notes that archaeological visibility is low around Aggeneys and Pofadder.

Beaumont *et al*. (1995) has described the widespread but low density stone artefact scatter of Early and Middle Stone Age material across areas of Bushmanland to the south of the study area. Systematic collections have been made at “Olyvenkolk, south-west of Kenhardt and at Maans Pannen to the east of Gamoep. The artefacts included a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA)”. This remark is contradicted by Morris’s (2011a) later statement that “substantial MSA sites are uncommon in Bushmanland” (1995:241). Certainly, the CRM studies which have been conducted in the area around Kenhardt during the last two years have shown substantial distributions of Middle Stone Age material.

Less information is available on the Early and Middle Stone Age around Aggeneys and Pofadder. Morris’s (2010) surveys of the northern slopes of the Gamsberg (2.5km east of the proposed facility) have identified five “significant locales” on the northern rim of the mountain. It includes an MSA factory site of high significance, two ESA (Acheulian) workshop site, a mixed ESA and MSA site and a small cave which did not appear to contain any deposit. Morris explains the presence of the MSA site in proximity to the Gamsberg as the need for access to suitable raw material. This is not easily accessible on the plains between Aggeneys Mountain and the Gamsberg.

Pelser (2011) in his survey of an area around the Paulputs substation near Pofadder describes finding material from the Middle and Later Stone Age, although his illustrations appear to be of LSA artefacts made on quartz. He also mentions the presence of ostrich eggshell. According to Morris (2011a) Later Stone Age (LSA) sites are the predominant archaeological trace noted in surveys in the Aggeneys-Pofadder region. Morris’s (2010) surveys of the northern slopes of the Gamsberg identified very few isolated LSA flakes. To the north-west of the Gamberg however, he found two stone cairns which could represent

graves, as well as a ceramic LSA site, comprising ostrich eggshell, pottery, stone tools made on quartz, glass and porcelain. These isolated LSA settlements occur on the plains, near little rocky outcrops, rather than on the slopes of the Gamsberg itself. Morris's site B3, to the north of the N14 linking Aggeneys to Pofadder, also consists of a ceramic LSA site with pottery, stone tools, ostrich eggshell and glass. In addition he reports on "boat-shaped grinding grooves in the outcropping bedrock". These sites probably represent transient settlement by transhumant hunter-gatherers or herders, moving through the area. Morris refers to Beaumont *et al*. (1995) who have written that "virtually all the Bushmanland sites [LSA] so far located appear to be ephemeral occupations by small groups in the hinterland on both sides of the [Orange] river" (1995:263). This was in sharp contrast to the substantial herder encampments along the Orange River floodplain itself.

In fieldwork conducted by Webley & Halkett (2011) for a new transmission line commencing at the Aggeneis substation, it was observed that LSA sites (consisting mainly of quartz flakes) were concentrated at the base of small koppies. This information is supported by Morris (2011a, b & c) and Pelser (2011). "Surveys have located signs of human occupation mainly in the shelter of granite koppies, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *el al*. 1995).

Morris (2010) refers to an unpublished report by Janette Deacon of rock paintings on a boulder next to the Aggregate Quarry at Black Mountain Mine, Aggeneys. These are simple finger paintings including two "Star" motifs and an indented oval shaped image.

Finally, field work undertaken during the Scoping Phase (Digby & Wells Environmental 2012) describes quartz lithics scattered throughout the area. The authors report that the artefacts are mainly flakes with some formal scrapers noted. The authors briefly surveyed rock outcrops on the site for rock art, but no evidence of this was found.

5.2 Historical Background

Morris (2010) has summarised the colonial history of this frontier zone in his reports for the Aggeneys and Gamsberg areas. Early travel accounts show that "Place names were becoming fixed in this colonial frontier period (in a cadastral sense, on maps and in farm names), many such names having Khoe-San origins encapsulating vestiges of pre-colonial/indigenous social geography".

Morris (2010) comments that place names, such as Aggeneys/Aggeneis and Gams (Gamsberg) are derived from Nama names. He reviews the various interpretations for the name Aggeneys including the oral history which suggests that a massacre of Bushmen took place in a kloof at Aggeneys (Nienaber & Raper 1977:173). Other interpretations include the possibility that it means "place of red clay" or that it is associated with reeds. Morris (2010) also refers to the thesis by Burger (1986) which links the killing of the Bushmen with the Gamsberg rather that Aggeneys.

Nienaber and Raper cite a local farmer who similarly asserted that the origin of *Gams* or *Gaams* was in the word *Tha-aams*, where *Tha* means "grass" and *aams* means "mouth". The Nama |*Gâ-ams* literally means "Grasmond" or "Grasfontein" (Nienaber & Raper 1977).

Morris (2010) comments that recently appreciation has started emerging regarding the "genocide against the Bushmen in this area, with certain mountainous areas (like Gamsberg near Aggeneys) being likely massacre sites". This has resulted in moves to include the Gamsberg in a potential /Xam and Khomani Heartland World Heritage Site. This is further discussed below.

According to the Surveyor General's records, the farm Aroams 57 was surveyed and granted in 1895. This suggests a relatively recent date for the settlement of the area. Morris (2011c) explains that the name is derived from the Nama ǂ*aro*- meaning "wag-'n-bietjie" tree (*Ziziphus mucronatus*) and *am* or *am-s* meaning "mouth". The name could thus be translated as "Wag-'n-bietjiebosfontein" (Nienaber & Raper 1977).

7. SURVEY METHODS

The property was visited by Lita Webley and David Halkett on the 16 April 2012. The survey was conducted by vehicle and on foot, and a Garmin GPS unit was used to record sites. No archaeological material was removed from the project area, but recorded and photographed *in situ*. Walk paths and site locations were recorded with GPS and finds were photographed and described. The assessment was primarily concerned with palaeontology and archaeology (as per the recommendations of SAHRA), but consideration was also given to the built environment where appropriate.

6.1 Limitations

We were able to access both sides of the N14. Although there are few roads across the property, the low shrub and the level topography meant that we could drive in the veld. Archaeological visibility was good.

- As with all archaeological surveys, it is not possible to be completely confident that all archaeological sites were identified during the fieldwork. Surface distributions give only a general indication of sub-surface remains. It is always possible that sub-surface archaeological sites may be present which were not identified during the survey;
- The only significant limitation is that we were not able to follow the route of the proposed new transmission line (Figure 2) as it crosses adjoining lands. These are not accessible because of locked gates. The transmission line crosses behind a koppie, and there may be Stone Age material on the lower slopes of the koppie. This is not considered to be a major limitation;
- Morris (2010) has also commented elsewhere in the area on the considerable "background noise" of massively preponderant small nodules of white quartz strewn over most the land surfaces. This may hamper the identification of artefacts, as local assemblages of are dominated by stone artefacts made from such nodules.

8. FINDINGS

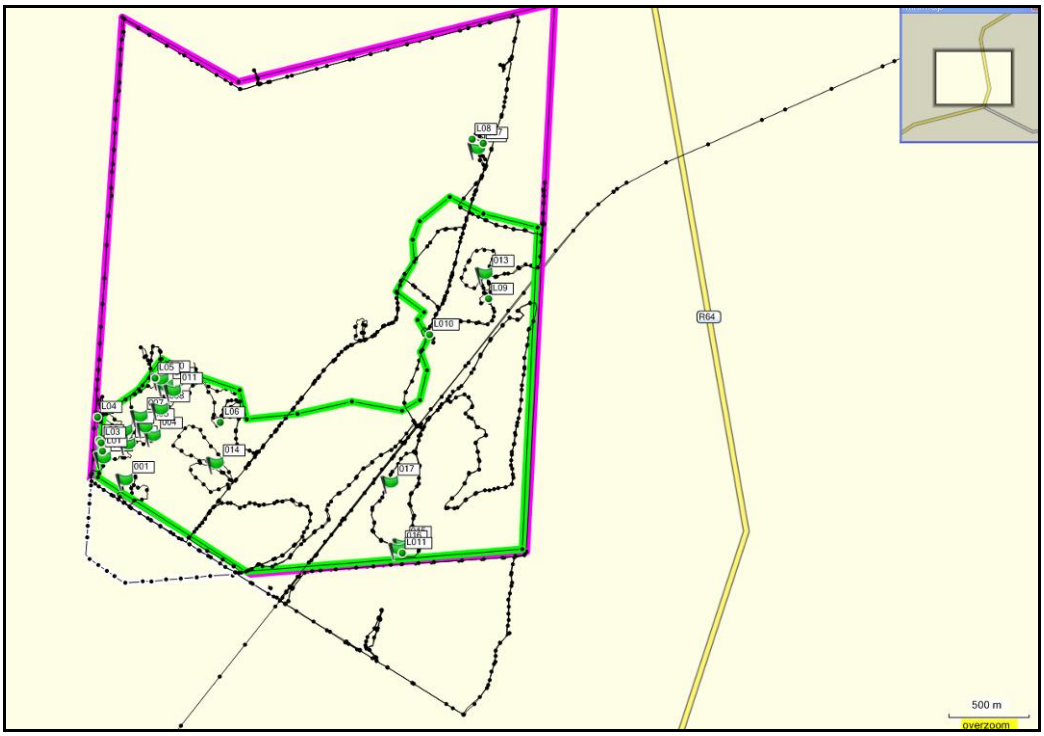

Figure 3: Map of tracks and location of sites recorded in Table 1.

8.1 Pre-colonial Archaeology

We found a dense background scatter of quartz flakes across the south-western section of the property. The material is particularly prevalent in those areas where the soil surface is covered in quartz pebbles and cobbles. These quartz "floors" occur in patches between the knee high grasses and are easy to see (Plate 4). The concentrations of stone tools appear to be highest near the drainage channel (see Figure 3).

Plate 4: Stone artefact scatters are found in these open patches of soil between the vegetation cover.

The artefacts comprise predominantly quartz flakes, cores and chunks, although quartzite stone artefacts are also present. Some of the quartzite flakes were side-struck and most of the flakes are quite large. The size of the artefacts suggests that they are of Middle Stone Age date. There are no distinctive features of the artefacts to categorically classify them as MSA, but they certainly do not conform to LSA design or size. In general, the scatter of stone tools is very widely distributed and does not appear to be concentrated in any specific location. The identification of "sites" in Table 1 is not a reflection of a site with *in situ* artefact distribution related to prehistoric settlement. It is merely a centre point of a scatter of stone tools.

Plate 5 & 6: Site L03 quartz and quartzite flakes. The scale is in centimetres.

Plate 7: Site 002 (scale 14 cm); **Plate 8**: A small (Fauresmith?) handaxe from Site 003.

Site 003 included a small handaxe which may be attributed to the Fauresmith, a final phase of the Early Stone Age.

Site L06 consisted of a single quartz bladelet which was the only suggestion of a Later Stone Age presence on the site.

A small koppie to the north of the proposed facility (Figure 3) contained a higher concentration of stone artefacts, particularly in quartzite. The koppie is located near a small farm building, and there are fragments of glass in the area, suggesting that livestock may have been kraaled in the shelter of the koppie in the recent past.

Rocky outcrops to the north of the area were also examined for signs of engravings, but the rock was not of a suitable dolerite material for engravings. A slight overhang in one of the

rocky outcrops outside the study area was examined for signs of rock paintings, but none were found.

8.2 Built Environment

There is a small brick farm building located to the north of the proposed facility (Plate 9). It was constructed within the last few decades and has no heritage significance.

There is also evidence of some recent drilling in the area, including some stone cairns with glass and tin nearby (Plate 10). Although the cairns could indicate graves, they are more likely to relate to mining activities.

Plate 9: Small farm building near a rocky koppie outside the study area; **Plate 10**: Evidence for drilling in the study area.

8.3 Cultural Landscape

Morris (2010) comments in his "Cultural Heritage of the Gamsberg" that "a call has been made for massacre sites to be identified and declared as Provincial Heritage Sites". This Morris points out would influence plans with respect to mining at Gamsberg. He also notes that sites such as the Gamsberg could ultimately form part of a /Xam and Khomani Heartland World Heritage Site, already on South Africa's tentative list. However, it is likely that the main centre for the /Xam WHS will be further south-east, between Kenhardt and Carnarvon.

Gamsberg is about 2.5km directly east of the proposed facility (Figure 1) and the facility will therefore be clearly visible from the mountain, which forms a significant element of the cultural landscape of the area. It is likely that there will be a cumulative visual impact on the Gamsberg since several solar facilities are proposed for this particular area.

However, this Cultural Landscape has already been impacted by open cast mining at Black Mountain and mining shafts sunk into the northern rim of the Gamsberg. It could be argued that the landscape has already been significantly transformed by mining activities.

9. IMPACT IDENTIFICATION AND ASSESSMENT

The construction of the proposed facility may result in the physical disturbance and potential destruction of the context of surface and sub-surface material as a result of site clearance, the construction of lay down areas, the installation of solar PV panels during the construction phase and the construction of access roads.

With respect to Palaeontology, the PIA report indicates that the bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The stone artefact scatters which we have recorded during our survey are considered to be of minor significance. They are probably not in original context, and not associated with other archaeological material, such as bone, which could provide valuable information on prehistoric lifeways. There do not appear to be "archaeological sites" with stone tools left in their original context. For this reason, we believe the impact of the proposed development on the archaeology of the area to be low.

Table 2: Summary of impacts to archaeological material

Nature of Impact: Impacts to archaeological material could involve destruction of material at solar panel footings, underground cabling, access roads, etc.		
	Pre- Mitigation	**Post- Mitigation**
Extent	Local	Local
Magnitude	On-site	On-site
Duration	Permanent	Permanent
Intensity	Negligible	Negligible
Probability	Definite	Definite
Significance	Low	Low
Mitigation: Although some archaeological material will be impacted, the impact is considered Low. Lack of site boundaries or associated organic remains or reduces scientific value greatly. In the unlikely event that unmarked graves are present and found during the construction phase, work at that location must be halted, the feature should be cordoned off and the heritage authority (SAHRA) notified. They are likely to suggest mitigation in the form of exhumation. No mitigation has been suggested.		
Cumulative Impacts: The cumulative impact of several such facilities will result in the potential destruction of large scatter of archaeological material.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

* Once archaeological material is destroyed, it cannot be renewed or replaced.

There are no buildings or structures on that portion of the property identified for the development of the facility. The impacts to the Built Environment are considered to be negligible.

Table 3: Summary of impacts to Cultural Landscape

Nature of Impact: The proposed facility may have a negative visual impact on the cultural landscape and its archaeological significance		
	Pre- Mitigation	**Post- Mitigation**
Extent	Local	Local
Magnitude	Regional	Local
Duration	Long term	Long term
Intensity	Medium	Medium
Probability	Definite	Definite
Significance	Medium	Medium
Mitigation: A Visual Impact Assessment by a specialist which considers the proposed impact of the development on the Cultural Landscape, particularly the archaeological landscape.		
Cumulative Impacts: The cumulative impact of several such facilities will result in "industrialization" of the archaeological landscape.		
Operational Phase: n/a		
Decommissioning Phase: n/a		

10. MITIGATION AND ASSESSMENT OF ALTERNATIVES

No Palaeontological mitigation will be required. The PIA report recommends that “an alert for the uncovering of fossil bone and implements be included in the construction EMP for the project”.

The lack of *in situ* archaeological surface sites or indications of stratified archaeological deposits means that the archaeological material on site has limited scientific value. We have photographed and recorded small collections of material across the solar plant site and believe that these are representative of the material as a whole. Further mitigation is unlikely to result in a greater understanding of the material and the various time periods, and as a result we do not believe further intervention from an archaeological point of view is necessary.

In the event that human remains are uncovered beneath the soil surface during the construction of the facility, work in that location should stop, and the heritage authorities (SAHRA) should be notified. They may recommend exhumation.

There are no issues relating to the Built Environment (e.g. buildings or structures older than 60 years which are protected by the NHRA). No mitigation is required.

SAHRA have requested that the assessment should whether the “cumulative impact of the solar energy facilities proposed on the same property may compromise the cultural landscape and its archaeological significance”. The most significant aspect of the archaeological landscape in the area is the Gamsberg, which is located 2.5km east of the proposed facility. Morris (2010) has discussed the importance of the Gamsberg as a potential “genocide site for the San” and the possibility (albeit unlikely) of its incorporation into a /Xam and Khomani Heartland World Heritage Site”. Morris (pers. com.) points to the impact of mining both at Aggeneys Mountain and at Gamsberg and the fact that the area has already been transformed by not only mining, but also by a substation and transmission lines.

Nevertheless, it is recommended that the Visual Impact Specialist consider the cumulative visual impact of several solar facilities in this area, on the archaeological landscape of the Gamsberg.

According to the NID application completed by Johan Nel of Digby Wells Environmental for SAHRA, at least two other applications for solar energy facilities are proposed on the same property and the cumulative impact of several facilities may be high.

The “no-go” alternative would mean that the status quo is retained and that the heritage resources of the area are maintained in their current condition.

11. CONCLUSIONS

In conclusion, the following heritage indicators were considered:

Palaeontology:

- The bedrock under the property is unfossiliferous and of no palaeontological significance. The potential for fossils in the Quaternary sand cover is very low.

The Pre-colonial Archaeology:

- Stone artefacts scatters from the Middle Stone Age are sparsely distributed across the study area and are found on gravel pavements between the vegetation;

- The absence of associated archaeological material, and lack of discrete individual sites reduces the significance of the material overall;
- Further mitigation of sites is considered unnecessary in this case.

The Built Environment:

- There are no buildings of heritage significance on the site.

Graves:

- A few cairns were identified. They probably relate to drilling on site but could possibly be graves. Due care should be taken during construction of the site and if human remains are uncovered, work should stop in that area and SAHRA should be notified.

Cultural Landscape:

- The proposed solar plant is positioned on both sides of the N14 and is located 2.5km east of the Gamsberg. A number of solar facilities have been proposed for this area and the cumulative impact needs to be considered;
- The cultural landscape of the surrounding area has been significantly impacted by mining activities;
- However, in view of the discussion around recognising the Gamsberg as a "genocide site" it is recommended that the Visual Impact specialist consider the impact of the proposed development with respect to the mountain.

The potential impacts resulting from the installation of a solar power plant on the heritage resources of the sites are considered to be of minor significance, and no mitigation is recommended. However, the potential cumulative impact of a number of such facilities on the nearby archaeological significance of the Gamsberg should be examined by the Visual Impact specialist.

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Appendix 1: Location of archaeological sites.

Site Name	GPS Co-ordinates	Description	Significance	Mitigation
L01	S29.24015100 E18.88197200	Quartz flakes in an open area between grasses	Low	No
L02	S29.23894600 E18.88050100	Quartz flakes	Low	No
L03	S29.23818300 E18.88215000	Quartz flakes	Low	No
L04	S29.23771400 E18.88386000	Black quartz core	Low	No
L05	S18.88386000 E18.88331100	Two side struck flakes out of a dark quartz	Low	No
L06	S29.23743100 E18.88194500	One quartz bladelet on clear quartz, not retouched. Possibly LSA	Low	No
L07	S18.88194500 E18.88295700	One large quartzite flake near koppie	Low	No
L08	S29.23625600 E18.88435500	One quartzite flake, possibly MSA	Low	No
L09	S29.23496400 E18.88469600	Single quartz flake on plains	Low	No
L010	S29.23460300 E18.88437100	Two quartz flakes and 3 quartz cores near the koppie	Low	No
L011	S29.23524000 E18.88521400	On other side of N14 in plains, 5 quartz flakes.	Low	No
001	S29.24015100 E18.88197200	old borehole w cement cap (BH-AMS-1)	Low	No
002	S29.23894600 E18.88050100	widely dispersed stone artefact scatter including cores and flakes on fine quartzite and quartz on a generally gravel strewn pavement - msa	Low	No
003	S29.23818300 E18.88215000	isolated core/biface (Fauresmith?)	Low	No
004	S29.23771400 E18.88386000	widely dispersed stone artefact scatter including cores and flakes on fine quartzite and quartz on a generally gravel strewn pavement - msa?	Low	No
005	S29.23724400 E18.88331100	more concentrated scatter of stone flakes on gravel pavement,	Low	No

		quartzite and quartz - msa		
006	S29.23743100 E18.88194500	isolated large quartzite core - msa	Low	No
007	S29.23664700 E18.88295700	general artefact scatter - msa	Low	No
008	S29.23625600 E18.88435500	general artefact scatter - msa	Low	No
009	S29.23496400 E18.88469600	general artefact scatter - msa	Low	No
010	S29.23460300 E 18.88437100	general artefact scatter - msa	Low	No
011	S29.23524000 E18.88521400	general artefact scatter - msa	Low	No
012	S29.22190200 E18.90572800	small overhang below boulders on edge of a koppie just outside solar area. Ephemeral stone age artefact “scatter” (lsa/msa?). Also tins, and metal frags, bottle glass. Sandy floor but no real deposit	Low	No
013	S29.22878100 E18.90623200	isolated artefact - flake	Low	No
014	S29.23922900 E18.88809200	isolated artefact - flake	Low	No
015	S29.24372100 E18.90065900	isolated artefact - flake	Low	No
016	S29.24396000 E18.90038400	isolated artefacts including a core at a residual dry pan - msa	Low	No
017	S29.24027900 E18.89987000	Heap of rocks with bully beef can nearby. Probably an old prospecting drill hole.	Low	No

Appendix A: Palaeontological Impact Assessment

BRIEF PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED ORLIGHT SA DEVELOPMENT OF A SOLAR PHOTOVOLTAIC POWER PLANT NEAR AGGENEYS, NORTHERN CAPE PROVINCE
Portion 1 of Farm Aroams 57 RD

By

John Pether, M.Sc., Pr. Sci. Nat. (Earth Sci.)
Geological and Palaeontological Consultant
P. O. Box 48318, Kommetjie, 7976
Tel./Fax (021) 7833023
Cellphone 083 744 6295
jpether@iafrica.com

Prepared at the Request of

Digby Wells & Associates (Pty) Ltd.
Fern Isle, Section 10, 359 Pretoria Ave, Randburg
Private Bag X10046, Randburg, 2125
Co. Reg. No. 1999/05985/07
Tel: 011 789 9495, Fax: 011 789 9498
johan.nel@digbywells.com, www.digbywells.com

For

ORLIGHT SA (PTY) LTD

23 April 2012

DEA REF. NO. 12/12/20/2630
NEAS REF. NO. DEA/EIA/0000818/2011

CONTENTS

SUMMARY

Orlight SA (Pty) Ltd (Orlight SA) proposes to construct five new Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces. Three proposed sites for development of the Orlight SA Solar PV Power Plants are located in the Northern Cape Province near the towns of Aggeneys, Kenhardt and Loeriesfontein. Two proposed sites are in the Western Cape Province adjacent to the towns of Vanrhynsdorp and Graafwater. Digby Wells Environmental (Digby Wells) is appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) processes for the proposed projects.

This desktop palaeontological assessment pertains to the Solar PV Plant near Aggeneys in the Namakwa District Municipality, viz. on Portion 1 of the farm Aroams 57 RD (Figure 1).

The solar PV panels will be mounted on metal frames (Figure 2) which are anchored to the ground with either concrete or screw pile foundations. These footings will be either hammered into the earth or anchored in a 1.5 m deep concrete foundation.

The bedrock underlying the property is unfossiliferous and of no palaeontological interest.

The overall potential for fossils in the Quaternary sand cover is very low. Furthermore, the scale of subsurface disturbance and exposure is quite limited, comprising mainly “post holes” to support the PV panel frames.

In view of the low fossil potential it is proposed that only a basic degree of mitigation is required. It is recommended that an alert for the uncovering of fossil bone and implements be included in the Construction Phase EMP for the project. Appendix 1 outlines monitoring by construction personnel and general Fossil Find Procedures. This is a general guideline, to be adapted to circumstances.

In the event of possible fossil and/or archaeological finds, the contracted archaeologist or palaeontologist must be contacted. For possible fossil finds, the palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

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The author, John Pether, is an independent consultant/researcher and is a recognized authority in the field of coastal-plain and continental-shelf palaeoenvironments and is consulted by exploration and mining companies, by the Council for Geoscience, the Geological Survey of Namibia and by colleagues/students in academia pursuing coastal-plain/shelf projects.

Expertise

- Shallow marine sedimentology.
- Coastal plain and shelf stratigraphy (interpretation of open-pit exposures and on/offshore cores).
- Marine macrofossil taxonomy (molluscs, barnacles, brachiopods).
- Marine macrofossil taphonomy.
- Sedimentological and palaeontological field techniques in open-cast mines (including finding and excavation of vertebrate fossils (bones).
- Analysis of the shelly macrofauna of modern samples e.g. for environmental surveys.

Membership of Professional Bodies

- South African Council of Natural Scientific Professions. Earth Science. Reg. No. 400094/95.
- Geological Society of South Africa.
- Palaeontological Society of Southern Africa.
- Southern African Society for Quaternary Research.
- Heritage Western Cape. Member, Permit Committee for Archaeology, Palaeontology and Meteorites.
- Accredited member, Association of Professional Heritage Practitioners, Western Cape.

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1 INTRODUCTION

Orlight SA (Pty) Ltd (Orlight SA) proposes to construct five new Solar Photovoltaic (PV) Power Plants in the Western Cape and Northern Cape Provinces. Orlight SA is the local company established by BSG Resources Limited (BSGR), an international natural resources company that operates in the fields of mining, energy and engineering services.

Three proposed sites for development of the Orlight SA Solar PV Power Plants are located in the Northern Cape Province near the towns of Aggeneys, Kenhardt and Loeriesfontein. Two proposed sites are in the Western Cape Province adjacent to the towns of Vanrhynsdorp and Graafwater. Digby Wells Environmental (Digby Wells) is appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) processes for the proposed projects

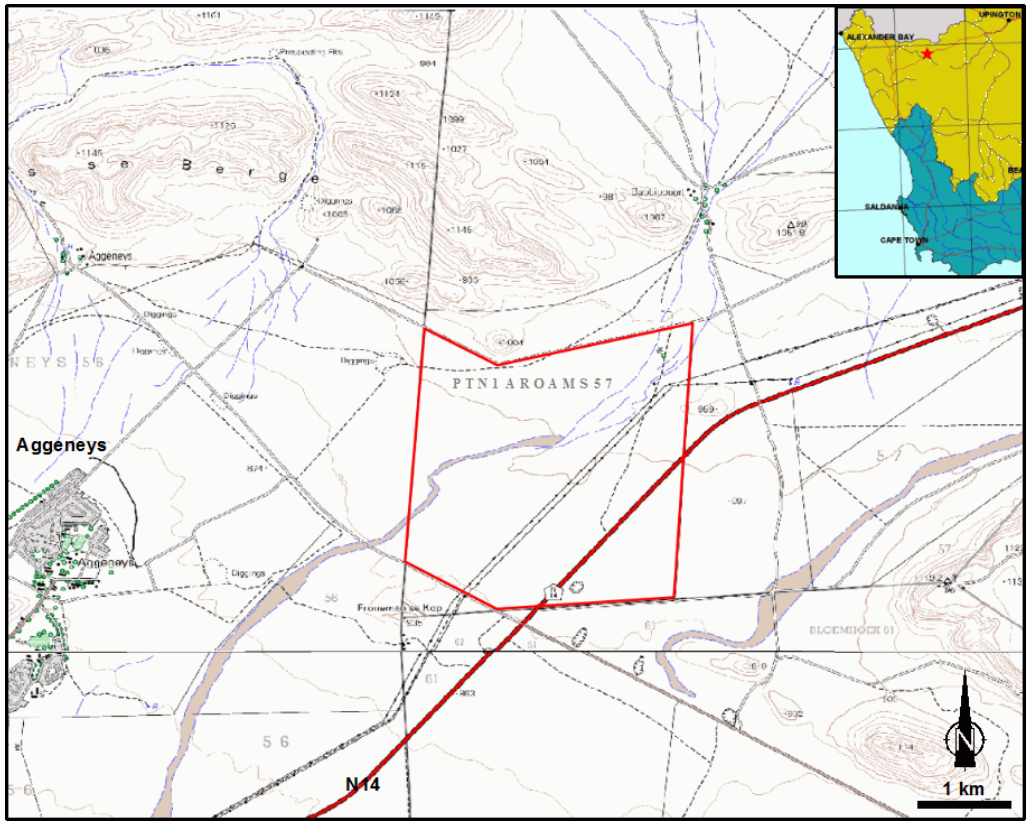

Figure 1. Location of the proposed Aggeneys Solar PV Plant. Extracts from 2918BB_2003_ED2_GEO.TIF and 2918BB_2003_ED2_GEO.TIF 1:50000 topo-cadastral maps. Chief Directorate: Surveys & Mapping.

This desktop palaeontological assessment pertains to the Solar PV Plant near Aggeneys in the Namakwa District Municipality, viz. on Portion 1 of the farm Aroams 57 RD (Figure 1). The preliminary generation capacity of the proposed Aggeneys Solar PV Power Plant is ~40 MW, but may be up to 150 MW. During the EIA Phase, studies will be undertaken to determine the optimal generation capacity that can be accommodated in the study area

based on ecological, cultural and socio-economic characteristics and other technical factors.

The power plant infrastructure will consist of a ground mounting system, solar PV panels, cabling, inverters, switchboards and transformer/s and transmission lines to connect the proposed Solar PV Power Plant to an existing Eskom transmission line. Also involved are access roads and temporary construction-related laydown areas, temporary site offices and a workshop.

The solar PV panels will be mounted into metal frames (Figure 2) which are anchored to the ground with either concrete or screw pile foundations. These footings will be either hammered into the earth or anchored in a 1.5 m deep concrete foundation.

Figure 2. Example of a Solar PV installation (supplied by Digby Wells).

Figure 3. Simulated oblique view of the project area, looking north. From Google Earth.

2 GEOLOGICAL SETTING

The project area is situated on a flat, sandy plain (Figure 3) between ~880 m asl. in the southwest, rising to ~915 m asl. in the northeast. To the immediate north is the eastern end of the Aggeneys se Berge, a range of hills rising sharply as inselbergs above the plain. An ephemeral drainage crosses the area.

The bedrock of the study area (Figure 4) is comprised of ancient basement rocks of the Bushmanland Terrane of the Namaqua Province (Cornell *et al*., 2006). The Bushmanland Terrane here consists of metasediments and metavolcanics (Khurisberg Subgroup) that both overlie and are intruded by granitic gneisses (Stalhoek Complex, Achab Suite gneisses). These very old rocks (>1000 Ma) are not of palaeontological interest.

The Quaternary sand cover (pale yellow, Figure 4) is likely a combination of alluvium in the drainage lines and colluvium closer to bedrock outcrops, with a contribution of windblown, redistributed sands. Rock outcrops at several places in the project area suggests that the sand cover is not very thick.

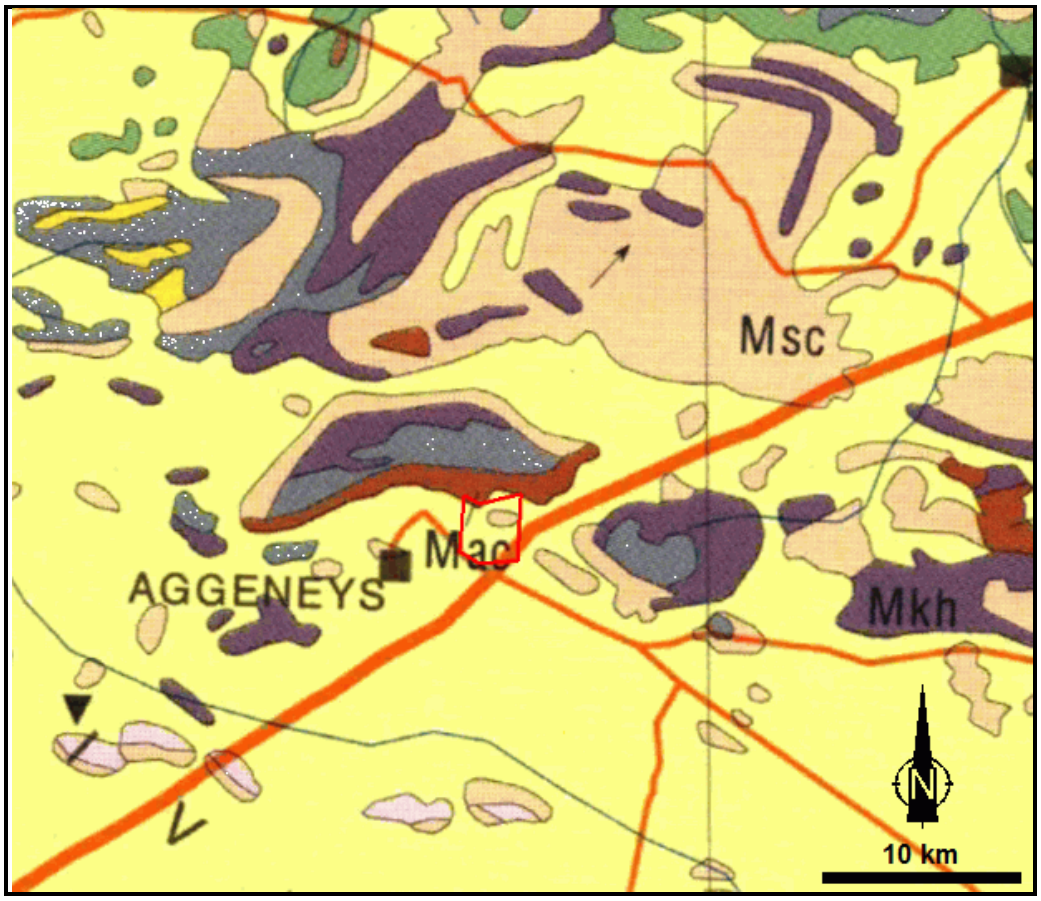

Figure 4. Geology of the study area. 1:1000000 Geological Map (CGS, 1997).

Mac – Achab Suite gneisses.
Msc – .Stalhoek Complex schists and gneisses.
Mkh – Khurisberg Subgroup metasediments and volcanics.

3 EXPECTED PALAEONTOLOGY

The bedrock underlying the property is unfossiliferous and of no palaeontological interest.

The overall potential for fossils in the Quaternary sand cover is very low. Furthermore, the scale of subsurface disturbance and exposure is quite limited, comprising mainly “post holes” to support the PV panel frames.

4 RECOMMENDATIONS

In view of the low fossil potential it is proposed that only a basic degree of mitigation is required.

It is recommended that an alert for the uncovering of fossil bone and implements be included in the construction EMP for the project.

Appendices 1 and 2 outline monitoring by construction personnel and general Fossil Find Procedures. This is a general guideline, to be adapted to circumstances.

In the event of possible fossil and/or archaeological finds, the contracted archaeologist or palaeontologist must be contacted. For possible fossil finds, the palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

5 APPLICATION FOR A PALAEONTOLOGICAL PERMIT

A permit from SAHRA is required to excavate fossils. The applicant should be the qualified specialist responsible for assessment, collection and reporting (palaeontologist). Should fossils be found that require rapid collecting, application for a palaeontological permit must be made to SAHRA immediately.

The application requires details of the registered owners of the sites, their permission and a site-plan map. All samples of fossils must be deposited at a SAHRA-approved institution.

6 REPORTING

Should fossils be found a detailed report on the occurrence/s must be submitted. This report is in the public domain and copies of the report must be deposited at SAHRA. The report must fulfil the reporting standards and data requirements of SAHRA.

7 REFERENCES

Cornell D.H. *et al*. 2006. The Namaqua-Natal Province. In: Johnson, M. R., Anhaeusser, C. R. and Thomas, R. J. (eds.), *The Geology of South Africa*. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. 325-379.

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8 GLOSSARY

~ (tilde): Used herein as “approximately” or “about”.

Aeolian: Pertaining to the wind. Refers to erosion, transport and deposition of sedimentary particles by wind. A rock formed by the solidification of aeolian sediments is an aeolianite.

AIA: Archaeological Impact Assessment.

Alluvium: Sediments deposited by a river or other running water.

Archaeology: 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.

asl.: above (mean) sea level.

Bedrock: Hard rock formations underlying much younger sedimentary deposits.

Calcrete: An indurated deposit (duricrust) mainly consisting of Ca and Mg carbonates. The term includes both pedogenic types formed in the near-surface soil context and non-pedogenic or groundwater calcretes related to water tables at depth.

Colluvium: Hillwash deposits formed by gravity transport downhill. Includes soil creep, sheetwash, small-scale rainfall rivulets and gullying, slumping and sliding processes that move and deposit material towards the foot of the slopes.

Coversands: Aeolian blanket deposits of sandsheets and dunes.

EIA: Environmental Impact Assessment.

EMP: Environmental Management Plan.

Fluvial deposits: Sedimentary deposits consisting of material transported by, suspended in and laid down by a river or stream.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

HIA: Heritage Impact Assessment.

Palaeontology: The study of any fossilised remains or fossil traces of animals or plants which lived in the geological past and any site which contains such fossilised remains or traces.

Palaeosol: An ancient, buried soil whose composition may reflect a climate significantly different from the climate now prevalent in the area where the soil is found. Burial reflects the subsequent environmental change.

Palaeosurface: An ancient land surface, usually buried and marked by a palaeosol or pedocrete, but may be exhumed by erosion (*e.g*. wind erosion/deflation) or by bulk earth works.

Pedogenesis/pedogenic: The process of turning sediment into soil by chemical weathering and the activity of organisms (plants growing in it, burrowing animals such as worms, the addition of humus *etc.*).

Pedocrete: A duricrust formed by pedogenic processes.

PIA: Palaeontological Impact Assessment.

SAHRA: South African Heritage Resources Agency – the compliance authority, which protects national heritage.

8.1 GEOLOGICAL TIME SCALE TERMS

ka: Thousand years or kilo-annum (10^3 years). Implicitly means "ka ago" *i.e*. duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present. Sometimes "kyr" is used instead.

Ma: Millions years, mega-annum (10^6 years). Implicitly means "Ma ago" *i.e.* duration from the present, but "ago" is omitted. The "Present" refers to 1950 AD. Generally not used for durations not extending from the Present.

Holocene: The most recent geological epoch commencing 11.7 ka till the present.

Pleistocene: Epoch from 2.6 Ma to 11.7 ka. Late Pleistocene 11.7–135 ka. Middle Pleistocene 135–781 ka. Early Pleistocene 781–2588 ka (0.78-2.6.Ma).

Quaternary: The current Period, from 2.6 Ma to the present, in the Cenozoic Era. The Quaternary includes both the Pleistocene and Holocene epochs.

Pliocene: Epoch from 5.3-2.6 Ma.

Miocene: Epoch from 23-5 Ma.

Oligocene: Epoch from 34-23 Ma.

Eocene: Epoch from 56-34 Ma.

Paleocene: Epoch from 65-56 Ma.

Cenozoic: Era from 65 Ma to the present. Includes Paleocene to Holocene epochs.

For more details, see www.stratigraphy.org.

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9 APPENDIX 1 - FOSSIL FIND PROCEDURES

A regular monitoring presence over the period during which excavations are made, by either an archaeologist or palaeontologist, is generally not practical.

The field supervisor/foreman and workers involved in digging excavations must be encouraged and informed of the need to watch for potential fossil and buried archaeological material. Workers seeing potential objects are to report to the field supervisor who, in turn, will report to the ECO. The ECO will inform the archaeologist and/or palaeontologist contracted to be on standby in the case of fossil finds.

In the context under consideration, it is improbable that fossil finds will require declarations of permanent "no go" zones. At most a temporary pause in activity at a limited locale may be required. The strategy is to rescue the material as quickly as possible.

The procedures suggested below are in general terms, to be adapted as befits a context. They are couched in terms of finds of fossil bones that usually occur sparsely. However, they may also serve as a guideline for other fossil material that may occur.

Bone finds can be classified as two types: isolated bone finds and bone cluster finds.

9.1 ISOLATED BONE FINDS

In the process of digging the excavations, isolated bones may be spotted in the hole sides or bottom, or as they appear on the spoil heap. By this is meant bones that occur singly, in different parts of the excavation. If the number of distinct bones exceeds 6 pieces, the finds must be treated as a bone cluster (below).

Response by personnel in the event of isolated bone finds

- **Action 1:** An isolated bone exposed in an excavation or spoil heap must be retrieved before it is covered by further spoil from the excavation and set aside.
- **Action 2:** The site foreman and ECO must be informed.
- **Action 3:** The responsible field person (site foreman or ECO) must take custody of the fossil. The following information to be recorded:
    - Position (excavation position).
    - Depth of find in hole.
    - Digital image of hole showing vertical section (side).
    - Digital image of fossil.
- **Action 4:** The fossil should be placed in a bag (*e.g.* a Ziplock bag), along with any detached fragments. A label must be included with the date of the find, position info., depth.
- **Action 5:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of isolated bone finds
The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established.

9.2 BONE CLUSTER FINDS

A bone cluster is a major find of bones, *i.e*. several bones in close proximity or bones resembling part of a skeleton. These bones will likely be seen in broken sections of the sides of the hole and as bones appearing in the bottom of the hole and on the spoil heap.

Response by personnel in the event of a bone cluster find

- **Action 1:** Immediately stop excavation in the vicinity of the potential material. Mark (flag) the position and also spoil that may contain fossils.
- **Action 2:** Inform the site foreman and the ECO.
- **Action 3:** ECO to inform the developer, the developer contacts the standby archaeologist and/or palaeontologist. ECO to describe the occurrence and provide images asap. by email.

Response by Palaeontologist in the event of a bone cluster find
The palaeontologist will assess the information and liaise with the developer and the ECO and a suitable response will be established. It is likely that a Field Assessment by the palaeontologist will be carried out asap.

It will probably be feasible to "leapfrog" the find and continue the excavation farther along, or proceed to the next excavation, so that the work schedule is minimally disrupted. The response time/scheduling of the Field Assessment is to be decided in consultation with developer/owner and the environmental consultant.

The field assessment could have the following outcomes:

- If a human burial, the appropriate authority is to be contacted (see AIA). The find must be evaluated by a human burial specialist to decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an archaeological context, an archaeologist must be contacted to evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.
- If the fossils are in an palaeontological context, the palaeontologist must evaluate the site and decide if Rescue Excavation is feasible, or if it is a Major Find.

9.3 RESCUE EXCAVATION

Rescue Excavation refers to the removal of the material from the just the "design" excavation. This would apply if the amount or significance of the exposed material appears to be relatively circumscribed and it is feasible to remove it without compromising contextual data. The time span for Rescue Excavation should be reasonably rapid to avoid any or undue delays, *e.g*. 1-3 days and definitely less than 1 week.

In principle, the strategy during mitigation is to “rescue” the fossil material as quickly as possible. The strategy to be adopted depends on the nature of the occurrence, particularly the density of the fossils. The methods of collection would depend on the preservation or fragility of the fossils and whether in loose or in lithified sediment. These could include:

- On-site selection and sieving in the case of robust material in sand.
- Fragile material in loose/crumbly sediment would be encased in blocks using Plaster-of Paris or reinforced mortar.

If the fossil occurrence is dense and is assessed to be a “Major Find”, then carefully controlled excavation is required.

9.4 MAJOR FINDS

A Major Find is the occurrence of material that, by virtue of quantity, importance and time constraints, cannot be feasibly rescued without compromise of detailed material recovery and contextual observations.
A Major Find is not expected.

Management Options for Major Finds
In consultation with developer/owner and the environmental consultant, the following options should be considered when deciding on how to proceed in the event of a Major Find.

Option 1: Avoidance

Avoidance of the major find through project redesign or relocation. This ensures minimal impact to the site and is the preferred option from a heritage resource management perspective. When feasible, it can also be the least expensive option from a construction perspective.

The find site will require site protection measures, such as erecting fencing or barricades. Alternatively, the exposed finds can be stabilized and the site refilled or capped. The latter is preferred if excavation of the find will be delayed substantially or indefinitely. Appropriate protection measures should be identified on a site-specific basis and in wider consultation with the heritage and scientific communities.

This option is preferred as it will allow the later excavation of the finds with due scientific care and diligence.

Option 2: Emergency Excavation

Emergency excavation refers to the “no option” situation wherein avoidance is not feasible due to design, financial and time constraints. It can delay construction and emergency excavation itself will take place under tight time constraints, with the potential for irrevocable compromise of scientific quality. It could involve the removal of a large, disturbed sample by excavator and conveying this by truck from the immediate site to a suitable place for “stockpiling”. This material could then be processed later. Consequently, emergency excavation is not the preferred option for a Major Find.

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Appendix B: Visual Impact Assessment (refer to EIA report)