

McGregor Museum

Department of Archaeology



HERITAGE IMPACT ASSESSMENT: PROPOSED AGGENEYS PHOTOVOLTAIC SOLAR ENERGY FACILITY AT BLOEMHOEK NEAR AGGENEYS, NORTHERN CAPE PROVINCE

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1. Introduction: background

The author was approached by Solar Capital to carry out a phase 1 heritage impact assessment for the proposed photovoltaic energy generation facility on the farm Bloemhoek east of Aggeneys and south east of the N14 between Springbok and Pofadder in the Northern Cape.

The project is divided into phases with planned commencement at the northern phases 1-6. Typical infrastructure anticipated would include:

- » Arrays of either static or tracking, photovoltaic (PV) panels.
- » Mounting structures to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
- » Cabling between the project components, to be lain underground.
- » Power inverters between the PV arrays.
- » A new on-site substation and power lines to convey the power from each Phase into the Eskom grid.
- » Internal access roads.
- » Water storage facilities.
- » Office, workshop area for maintenance and storage.
- » During construction (temporary infrastructure) such as housing for workers and a laydown area will also be required.

The author was approached by Mercia Grimbeek, Head of Economic Development at Solar Capital (Pty) Ltd (Tel: 021-4330366, Fax: 086 268 9711, www.solarcapital.co.za, 47 Main Road, Green Point, Cape Town, 8005, P.O. Box 1199, Green Point, 8051), to undertake the assessment. It is understood that the

project would be subject to ground-truthing prior to construction. Following Ms Grimbeek's resignation, the author has been in contact with Lilly@solarcapital.co.za on tel 0828046345.

1.1 Focus and Content of Specialist Report

The archaeology specialist study is focused on the development footprint of the proposed PV development areas.

This specialist study is a stand-alone report (as per the EIA Regulations) and incorporates the following information:

- » Introduction (1)
 - Focus and content of report (1.1)
 - Archaeology specialist (1.2)
- » Description of the affected environment (2)
 - Heritage features of the area (2.1)
 - Description and evaluation of environmental issues and potential impacts identified (2.2)
- » Methodology (3)
 - Assumptions and limitations (3.1)
 - Potentially significant impacts to be assessed (3.2)
 - Description and evaluation of environmental issues (3.3)
 - Determining archaeological significance (3.4)
- » Observations and assessment of impacts (4)
 - Fieldwork observations (4.1)
 - Characterising the archaeological significance (4.2)
 - Characterising the significance of impacts (4.3)
- » Conclusions (5)
- » References (6)

1.2 Archaeology/heritage Specialist

The author of this report is an archaeologist (PhD) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. I

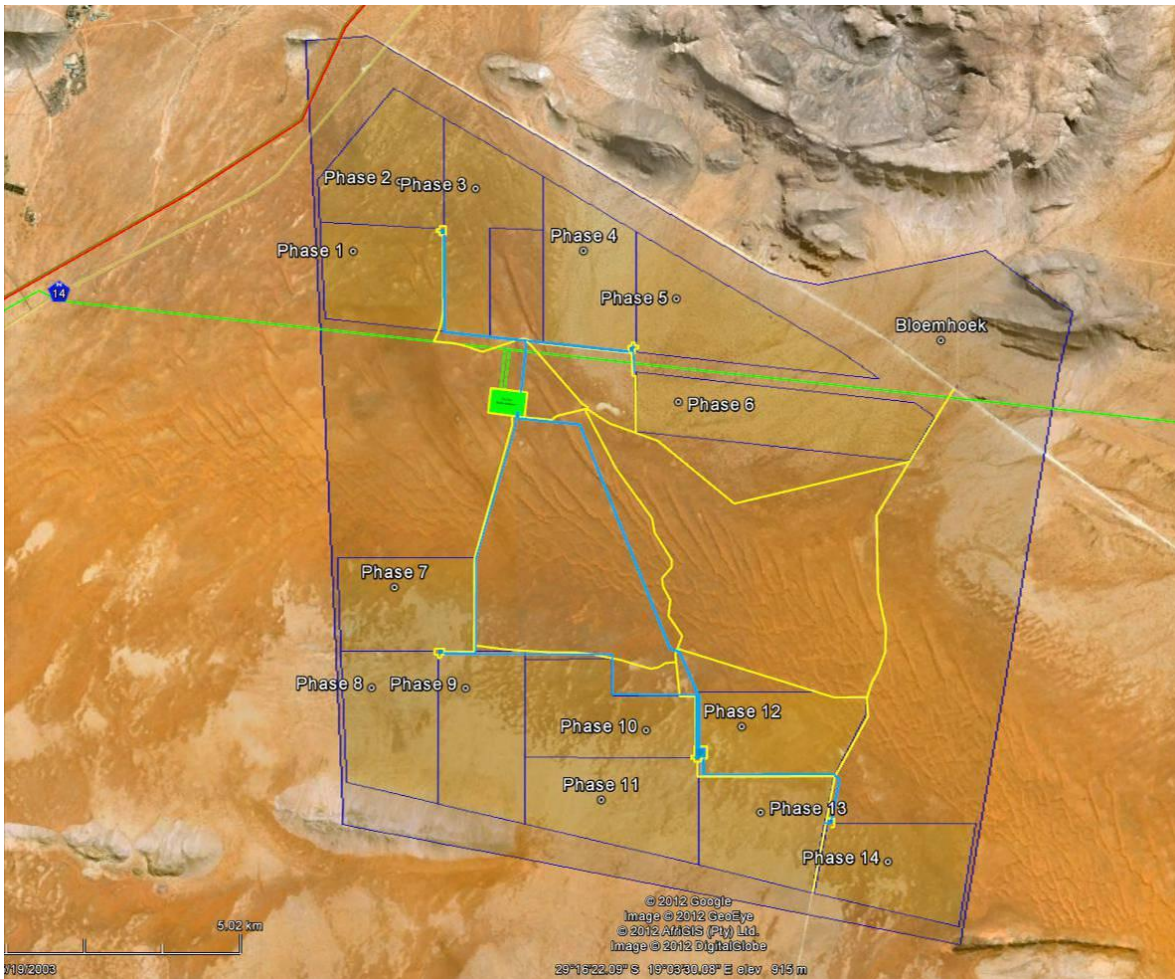
have previously carried out surveys in the vicinity of the proposed activity (Morris 1999a-b, 2000a-c, 2001, 2010, 2013). In addition, the author has received UCT-accredited training in Architectural and Urban Conservation: researching and assessing local heritage environments (S. Townsend, UCT), and is familiar with the broad history of the Northern Cape.

I work independently of the organization commissioning this specialist input, and I provide these preliminary scoping observations within the framework of the National Heritage Resources Act (No 25 of 1999).

The National Heritage Resources Act no. 25 of 1999 (NHRA) protects heritage resources which include archaeological and palaeontological objects/sites older than 100 years, graves older than 60 years, structures older than 60 years, as well as intangible values attached to places. The Act requires that anyone intending to disturb, destroy or damage such sites, objects and/or structures may not do so without a permit from the relevant heritage resources authority. This means that a Heritage Impact Assessment should be performed, resulting in a specialist report as required by the relevant heritage resources authority/ies to assess whether authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The environment in question is arid, comprising relatively flat drainage plains with inselbergs such as the Aggeneys Mountains, Black Mountain and Gamsberg rising above the plains in the wider landscape. In the immediate vicinity of the proposed development the predominant topographic feature is the band of dunes running east to west defining the Koa Valley, a fossil relict of a major Miocene drainage line from the interior. The landscape is on the whole sparsely vegetated, therefore making any surface archaeological traces highly visible. The area investigated includes parts of dune fields and mainly the adjacent plains to the north and south where the major impact is expected.



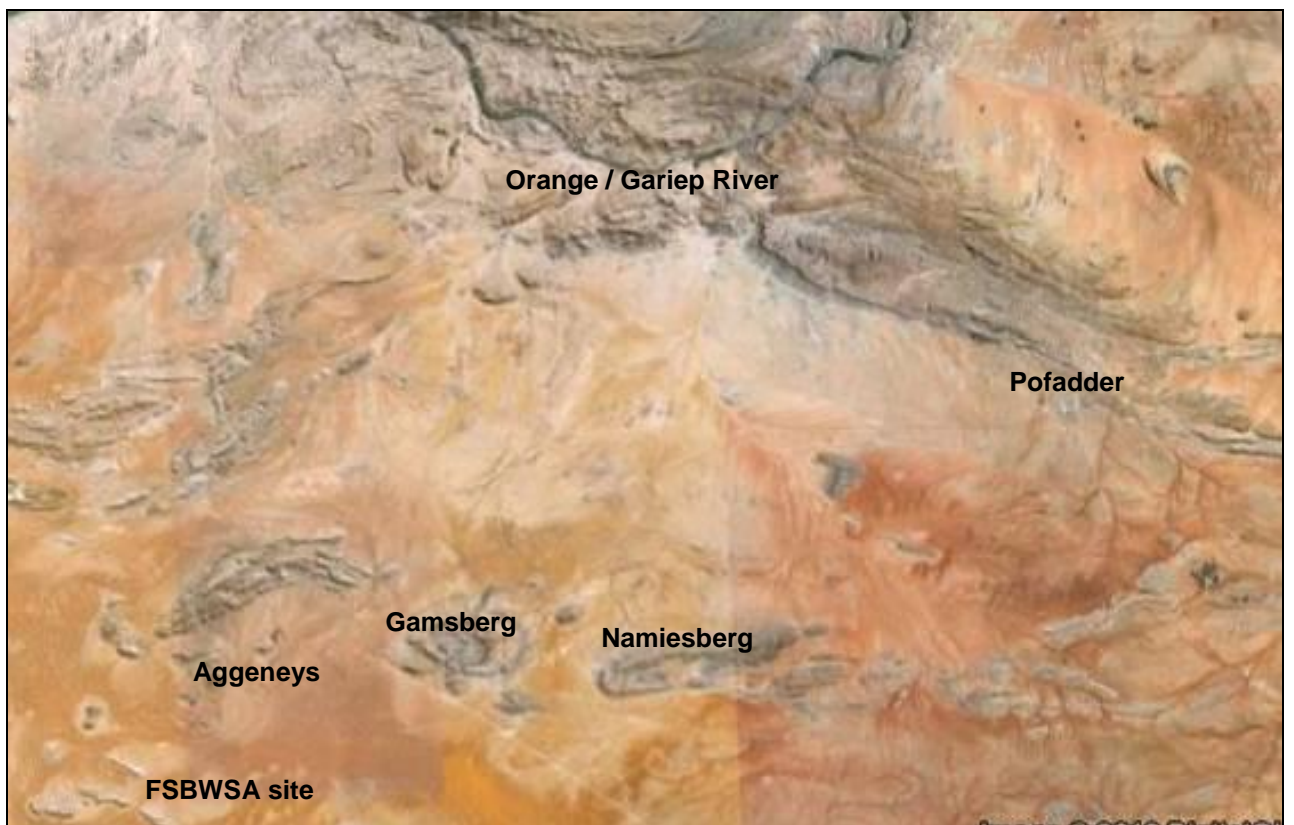
Map of the area showing project area and proposed layout east of Aggeneys and to the south of the Loop 10 road south of the Gamsberg.

2.1 Description of heritage features of the region

2.1.1 Colonial frontier

As has been indicated in a similar survey of an area adjacent to Aggeneys (Morris 2011), the eighteenth- and nineteenth-century records for this region (Penn 2005) include the travelogues of George Thompson (1827) and E.J. Dunn (1931, Robinson 1978), who visited the area in 1824 and 1872 respectively.

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 precolonial/indigenous social geography. A much more prominent appreciation is now emerging concerning the history of genocide against the Bushmen in this area (Anthing 1863), with certain mountainous areas (like Gamsberg and Namiesberg near Aggeneys) being likely massacre sites, referred to by Dunn in 1872 (Robinson 1978) and, more obliquely, by Anthing (1863; de Prada-Samper 2011).



Regional focus: the study area relative to Aggeneys and some other places mentioned.

2.1.2 Later Stone Age

Late Holocene Later Stone Age (LSA) sites are the predominant archaeological trace noted in past surveys in the Aggeneys-Pofadder region (Morris 1999a-b,

2000a-c, 2001, 2010). Beaumont *et al.* (1995) have shown, with reference to the LSA, that “virtually all the Bushmanland sites 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 (Morris & Beaumont 1990), which reflected the “much higher productivity and carrying capacity of these bottom lands.” “Given choice, the optimal exploitation zone for foragers would have been the Orange River.” The appearance of herders in the Orange River Basin, Beaumont *et al.* argue, led to competition over resources and ultimately to marginalisation of hunter-gatherers, some of whom then occupied Bushmanland, probably mainly in the last millennium, and focused their hunting and gathering activities around the limited number of water sources in the region. Surveys have located signs of human occupation mainly in the shelter of granite inselbergs, on red dunes which provided clean sand for sleeping, or around the seasonal pans (Beaumont *et al.* 1995:264). Possibly following good rains, herders moved into the Orange River hinterland, as attested archaeologically at sites with ample pottery near Aggeneys and, east of Pofadder, at Schuitdrift South – Morris 1999a). However, Thompson (1824) refers to herder groups settled at the stronger springs such as Pella dispersing during periods of drought to smaller springs in the region, which could equally well account for the traces referred to here. At such times competition between groups over resources and stress within an already marginalised hunter-gatherer society, must have intensified.

Grinding grooves have been found on rock outcrops in the Aggeneys/Gamsberg area (Morris 2011) and rock paintings are known from a boulder site alongside the Aggeneys/Black Mountain aggregate quarry (Morris 2011). More recently, important engraved cupule sites have been identified at two sites on Black Mountain Mining property, Aggeneys and at the foot of the Swartberg on Zuurwater 62 (Morris 2013 in prep).

2.1.3 Pleistocene: Middle and Earlier Stone Age

Beaumont *et al.* (1995:240-1) note a widespread low density stone artefact scatter of Pleistocene age across areas of Bushmanland to the south where raw materials, mainly quartzite cobbles, were derived from the Dwyka till. Systematic collections of this material made at Olyvenkolk, south west of Kenhardt and Maans Pannen, and east of Gamoep, could be separated out by abrasion state into 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).

Beaumont *et al.* have shown that “substantial MSA sites are uncommon in Bushmanland” (1995:241): and those that have been documented thus far have generally yielded only small samples (Morris & Beaumont 1991; Smith 1995).

The ESA included Victoria West cores on dolerite, long blades, and a very low incidence of handaxes and cleavers. The Middle (and perhaps in some instances Lower) Pleistocene occupation of the region that these artefacts reflect must have occurred at times when the environment was more hospitable than today. This is suggested by the known greater reliance of people in Acheulean times on quite restricted ecological ranges, with proximity to water being a recurrent factor in the distribution of sites.

No substantial sites have been found previously in the survey area. Only very sparse localized scatters of stone tools have been seen in places, with limited traces in the hills (e.g. an MSA site at the top of Gamsberg) or at the bases of hills. ESA including a Victoria West core on quartzite has been noted within the Gamsberg basin (Morris 2010).

2.2 Description and evaluation of environmental issues and potential impacts identified

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Developments such as those envisaged can have a permanent destructive impact on these resources. The objective of an EIA would be to assess the sensitivity of such resources where present to assess the significance of potential impacts on these resources and to recommend no-go areas and measures to mitigate or manage said impacts.

Area impacts would occur in the case of the Bloemhoek PV development and associated infrastructure, where heritage traces occur.

2.2.1 Direct, indirect and cumulative impacts (in terms of nature, magnitude and extent)

The destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity.

3. METHODOLOGY

The site was visited in March 2013 to inspect the terrain on foot, focusing on areas of expected impact. Heritage traces would be evaluated in terms of their archaeological significance (see tables below).

3.1 Assumptions and limitations

It was assumed that, by and large in this landscape, with its sparse vegetation and shallow soil profiles, some sense of the archaeological traces to be found in the area would be readily apparent from surface observations (including assessment of places of erosion or past excavations that expose erstwhile below-surface features). It was not considered necessary to conduct excavations

as part of the EIA to establish the potential of sub-surface archaeology. Dunes may mask sub-surface traces, but a number of erosion and deflation areas afforded opportunities to assess this possibility.

A proviso is routinely given, that should sites or features of significance be encountered during construction (this could include an unmarked burial, an ostrich eggshell water flask cache, or a high density of stone tools, for instance), specified steps are necessary (cease work, report to heritage authority).

With regard to fossils, a preliminary assessment of the likelihood of their occurring here should be obtained from a palaeontologist. The context did not appear promising from a palaeontological point of view.

3.2 Predictions

There was no explicit scoping phase to this particular heritage input other than the review given above on the colonial and precolonial history of the area. It was expected that features such as rock outcrops or the immediate footslopes of hills might be places where Stone Age and probably also colonial era traces would occur, if present. Previous experience has shown that the flat plains away from such features are almost entirely bereft of heritage traces. The dunes may also have been a focus of past human activity.

3.3 Potentially significant impacts to be assessed in the EIA process

Any area or linear, primary and secondary, disturbance of surfaces in the development locales could have a destructive impact on heritage resources, where present. In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by Ngwao Bošwa ya Kapa Bokone (the Northern Cape Heritage Authority). Although unlikely, there may be some that could require preservation *in situ* and hence modification of intended placement of development features.

Disturbance of surfaces includes any construction including any *clearance* of, or *excavation* into, a land surface. In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible). Without context, archaeological traces are of much reduced significance. It is the contexts as much as the individual items that are protected by the heritage legislation.

3.4 Determining archaeological significance

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (nd) and Whitelaw (1997) for assessing archaeological significance has been developed for Northern Cape settings (Morris 2000a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

Estimating site potential

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon nd, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes *any* trace, even of only Type 1 quality, can be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

Assessing site value by attribute

Table 2 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of

a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

Table 1. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, National Monuments Council).

Class	Landform	Type 1	Type 2	Type 3
L1	Rocky surface	Bedrock exposed	Some soil patches	Sandy/grassy patches
L2	Ploughed land	Far from water	In floodplain	On old river terrace
L3	Sandy ground, inland	Far from water	In floodplain or near feature such as hill	On old river terrace
L4	Sandy ground, Coastal	>1 km from sea	Inland of dune cordon	Near rocky shore
L5	Water-logged deposit	Heavily vegetated	Running water	Sedimentary basin
L6	Developed urban	Heavily built-up with no known record of early settlement	Known early settlement, but buildings have basements	Buildings without extensive basements over known historical sites
L7	Lime/dolomite	>5 myrs	<5000 yrs	Between 5000 yrs and 5 myrs
L8	Rock shelter	Rocky floor	Sloping floor or small area	Flat floor, high ceiling
Class	Archaeo-logical traces	Type 1	Type 2	Type 3
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
A2	Shell or bones visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick; shell and bone dense
A3	Stone artefacts or stone walling or other feature visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick

Table 2. Site attributes and value assessment (adapted from Whitelaw 1997)

Class	Attribute	Type 1	Type 2	Type 3
1	Length of sequence/context	No sequence Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context High density of arte/ecofacts
2	Presence of exceptional items (incl regional rarity)	Absent	Present	Major element
3	Organic preservation	Absent	Present	Major element
4	Potential for future archaeological investigation	Low	Medium	High
5	Potential for public display	Low	Medium	High

6	Aesthetic appeal	Low	Medium	High
7	Potential for implementation of a long-term management plan	Low	Medium	High

4. OBSERVATIONS AND ASSESSMENT OF IMPACTS

The manner in which archaeological and other heritage traces or values might be affected by the proposed development may be summed up in the following terms: it would be any act or activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). The most obvious impact in this case would be land surface disturbance associated with infrastructure construction.

4.1 Fieldwork observations

The proposed development footprint areas on the farm Bloemhoek were visited on 11-13 March 2013. In summary the findings can be reported in relation to predictions made in Section 3.2 above.

4.1.1 Reduced archaeological visibility away from landscape features such as hills and rock outcrops:

This notion was not contradicted in the areas surveyed. What was documented was an extremely low to zero incidence of any form of artefact whatsoever, whether Stone Age or colonial in age, over most of the area indicated for phases 1-14 (but see 4.1.2 below). The plains are veneered with sand, a shallow unconsolidated layer over much of the area, but thickening as Aeolian dunes through the middle of the farm between the two main clusters of proposed solar panel fields.

4.1.2 Higher archaeological visibility at or around landscape features such as hills and rock outcrops:

This expectation was confirmed in two significant instances:

- 4.1.2.1 The first is at a small rocky koppie at 29.28555° S 18.95608° E, south of the Loop 10 road, in PV Area 5. Colonial era stone walling occurs on parts of the hill, while what appears to be a grave, of similar age, occurs on the south west side. Later Stone Age artefacts occur in the shelter of a large boulder, on the eastern side of the small hill, and a grinding groove was noted on a boulder at the northern side.



Location of the small rocky hill (red circle) south of the Loop 10 road.



Small rocky koppie at 29.28555° S 18.95608° E



Grave at south western base of hill.



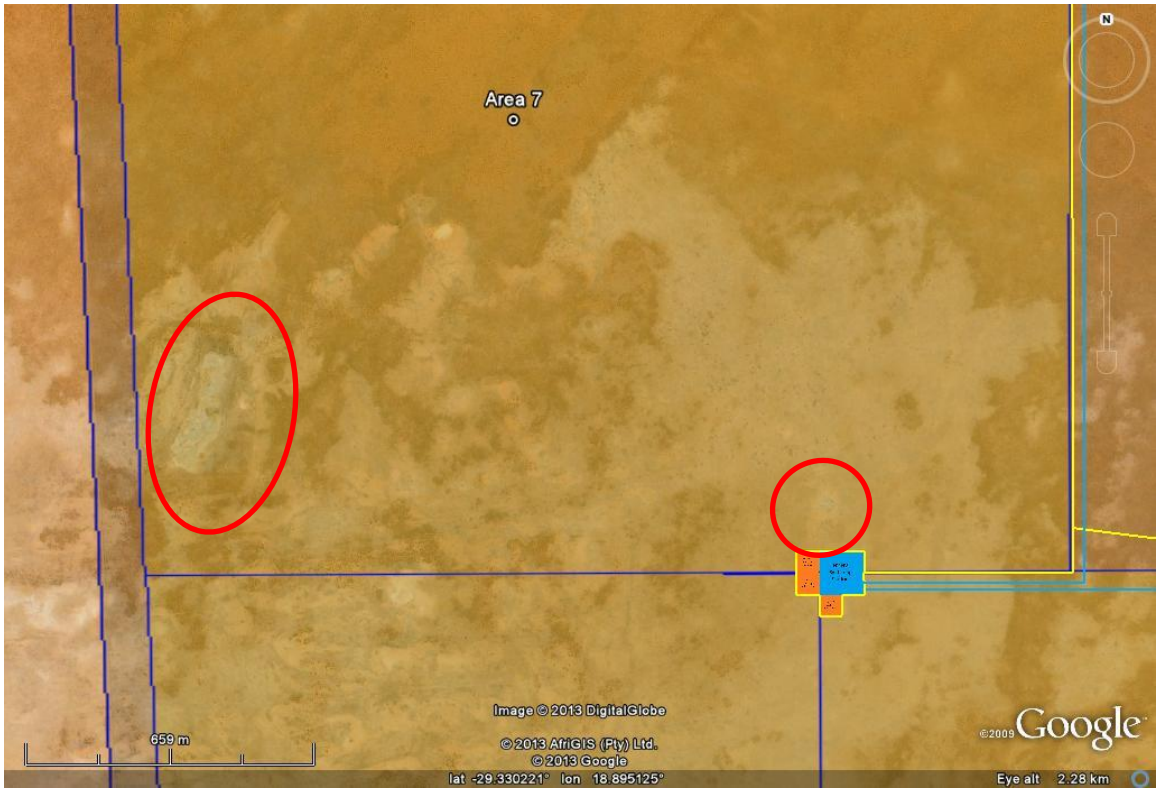
Stone walled feature on top of hill.



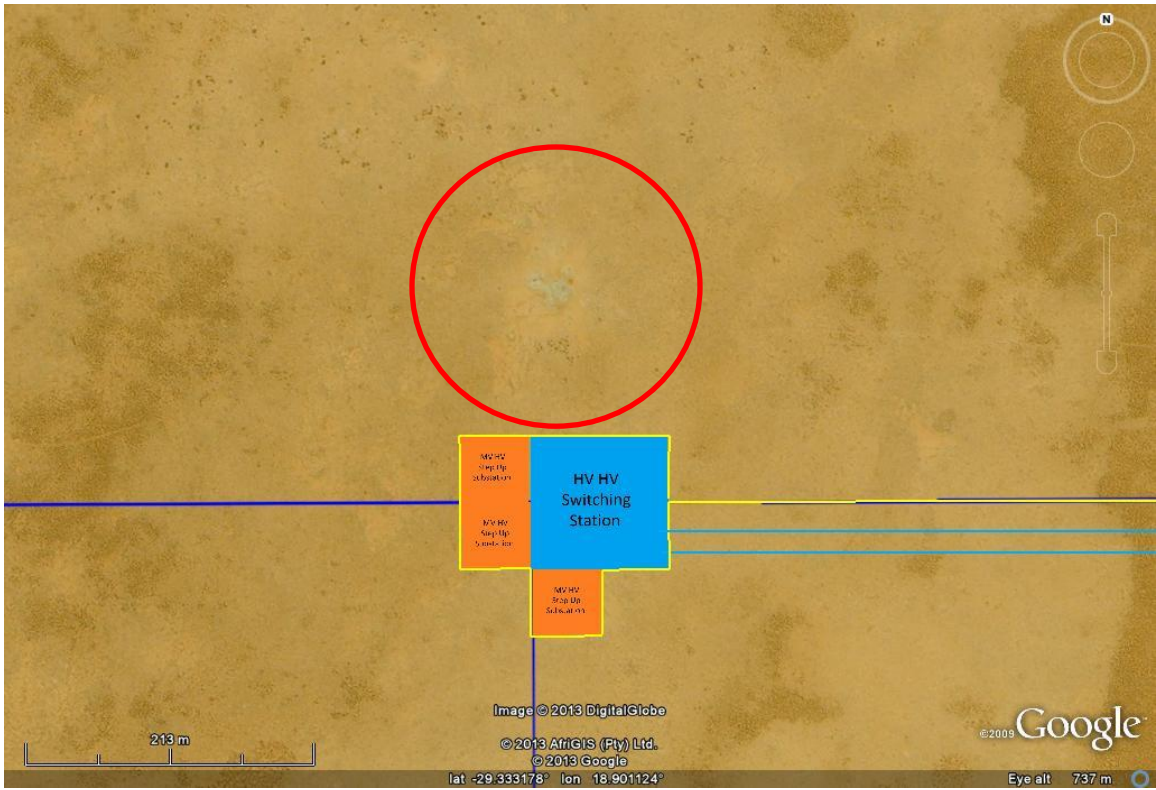
Stone artefacts and ostrich eggshell (above)
from vicinity of sheltering rock (below).



4.1.2.2 The second is a cluster of two bedrock exposures at 29.32940° S 18.88654° E and 29.33251° S 18.90108° E (there is a third nearby on the adjacent far Aggeneys), with hollows where water remains after rains (known locally as goras). In the immediate vicinity of them are moderate to high density scatters of Later Stone Age artefacts, including stone tools, pottery and ostrich eggshell flask fragments. Later Stone Age grinding grooves are festooned across the bedrock surfaces (similar occurrences are known from around Gamsberg and near Aggeneys). There are also glass and porcelain fragments at these sites indicative of the continued use of these temporary water sources in colonial times and into the 1930s, prior to the introduction of bore-hole drilling in the region.



Location of two gora sites (red circle/ellipse) – with amplified view of the eastern site below.





A *gora* or hollow in bedrock where water remains after rains, making these bedrock exposures highly significant for human settlement in this area prior to the advent of bore-hole drilling.



Numerous grinding grooves exist on these exposures.



Stone artefacts, pottery and ostrich eggshell pieces.

4.2 Characterising the archaeological and heritage significance (Refer to 3.4 above)

In terms of the significance matrices in Tables 1 and 2 under 3.4 above, the archaeological observations detailed under 4.1 fall into Landform L1 Type 1 and L3 Type 3. In terms of archaeological traces they fall under A3 Type 1. These tend to reflect low to moderate significance. These indices are augmented by site attribute and value assessment (Table 2), where all of the observations noted fall under Type 2 or 3 for Classes 2-7 (Type 1 for Class 1), reflecting medium to high significance, potential and presence of rare elements or combinations thereof. This suggests that these sites ought to be preserved as no-go zones within the proposed solar field developments.

Of concern is the encroachment of development on the likely site of a San massacre at the south eastern side of the Gamsberg.

In the following map sites noted on the south side of Gamsberg are indicated (yellow circles and ellipses). Higher sensitivity stems from evidence that the

southern/south eastern side of Gamsberg was the site (indicated by a yellow dashed line) of an incident in which a group of San were cornered and shot – part of what historians now characterise as a genocide against the indigenous people of the region. Some evidence suggests that this most likely took place in the kloof known as ‘Inkruip’ (‘Creep in’).



Evidence relating to this history comes from discussion on local place names. In a “Brief history of Aggeneys” published in *The Cape Argus* in July 1973 (Nienaber & Raper 1977:173) the following story is given:

“Aggeneys is the name of a kloof on Vickie Burger’s farm ... Long before the turn of the century, the Bushmen had several strongholds in the mountains between Pofadder and Springbok and from these they carried out raids on the farmers. Finally the farmers could no longer tolerate the marauding Bushmen and formed a commando which followed the spoor of the Bushmen and the livestock that

they had stolen to the kloof, which is today known as Aggeneys. Near the kloof they split into three parties which surrounded and trapped the Bushmen at a spring near the confluence of three ravines. The Bushmen were wiped out and the kloof became known as 'The Place of Blood'. The Nama Coloureds have always known the kloof as 'The Place of Water', as there were several natural springs there, but to this day no-one is quite certain of the origin of the name Aggeneys..." (Nienaber & Raper 1977:173).

Other interpretations are cited by Nienaber and Raper, including the possibility that it means 'Place of Red Clay' or that it is associated with reeds (*riete*) (reviewed in Morris 2000a:10).

An important further source not accessed previously comes in the form of C.R. Burger's (1986) thesis, *'N Ondersoek na die Oorsprong en Betekenis van Plek-en Plaasname in die Landdrosdistrik Namakwaland*, which cites A.J. Burger, a retired farmer, in commentary given in a letter written in 1982 which contradicts the above and links the incident of the killing of Bushmen rather with Gamsberg than with Aggeneys.

"Daar was beslis riete, ook nounog, en daar was ook een of meer fonteine toe my oorlede vader die plaas in 1910 gekoop het. Daar was en is ook nog rooi klei. Ek kan onthou hoe die meide hulle gesigte besmeer het – eintlik 'n rooi sagte klip. Die laaste vesting waar die Boesmans doodgeskiet is deur die Boere, was nie Aggeneys nie, maar baie beslis aan die suiderkant van Gamsberg – so 'n lelike kloof in die berg. Jy kan dit sien as jy met die ou gryspad ry." (Burger 1986 :147-148). (Emphasis added).

[“There were certainly reeds, even now, and there were also one or more springs when my late father purchased the farm in 1910. There was also and still is red clay. I can remember the Coloured women [*meide*] smearing their faces with it – actually a red soft stone. *The last place where the Bushmen were shot dead by*

the farmers was not at Aggeneys, but very definitely on the southern side of Gamsberg – a dreadful kloof in the mountain. You can see it if you drive along the old gravel road”] (Emphasis added).

C.R. Burger thus rejects the meaning ‘Place of Blood’ for Aggeneys, on the one hand, and is inclined to opt for ‘Place of Reeds’ – from the Nama *ḡa* meaning reed and *!keis* meaning place. On the other hand he is quite emphatic and specific about Gamsberg being a site where Bushmen were killed.

Further corroborating the local legend, E.J. Dunn mentioned the incident in an 1872 account of a journey through the area. At ‘Ghaums’ (ie Gams), he mentions a spring: “at this water an affray took place between the Boers and Bushmen. The Bushmen scherms, made of stones, still remain, as well as the marks of the bullets on the rocks” (Dunn in Robinson 1978:62). In the previous Gamsberg study (Morris 2000a:11) it was remarked that this may have been a spring on the eastern side of Gamsberg, but the comments in C.R. Burger’s study make it most likely that this was on the *south* side of the inselberg. Several massacres are recorded as having taken place in the region from the mid 1850s, as reported by Louis Anthing to the Colonial Secretary, Cape Town, in 1863, where he exposes deliberate acts of extermination (it has been referred to as genocide) by Boers and Bastards. Anthing specifically alludes to major incidents of this nature in the vicinities of Bosluis and Namies (immediately east of Gamsberg) where “hundreds must have been killed” – while “smaller affairs [were] equally horrible” (Anthing 1863:10).

More than a quarter of a century prior to this, Thompson noted that the local people, called the *Obseses*, were an amalgamated grouping of various ‘tribes’ which had been “assailed by ... formidable enemies.” The latter enemies had included the raiding bands of Afrikander and probably other frontier bandits and commandos (1827:288, 290-1). The indigenous people of the region had faced sustained onslaughts from at least the 1770s (Penn 2005) and by the later

nineteenth century the independent San had essentially been wiped off the face of the country.

4.3 Characterising the significance of impacts

The following criteria are used in this Environmental Impact Assessment to characterise the significance of direct, indirect and cumulative impacts:

- » The **nature**, which shall include a description of what causes the effect, what will be affected, and how it will be affected.
- » The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional:
 - * local extending only as far as the development site area – assigned a score of 1;
 - * limited to the site and its immediate surroundings (up to 10 km) – assigned a score of 2;
 - * will have an impact on the region – assigned a score of 3;
 - * will have an impact on a national scale – assigned a score of 4; or
 - * will have an impact across international borders – assigned a score of 5.
- » The **duration**, wherein it will be indicated whether:
 - * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
 - * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
 - * medium-term (5–15 years) – assigned a score of 3;
 - * long term (> 15 years) - assigned a score of 4; or
 - * permanent - assigned a score of 5.
- » The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
 - * 0 is small and will have no effect on the environment;
 - * 2 is minor and will not result in an impact on processes;
 - * 4 is low and will cause a slight impact on processes;
 - * 6 is moderate and will result in processes continuing but in a modified way;

- * 8 is high (processes are altered to the extent that they temporarily cease); and
 - * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:
- * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
 - * Assigned a score of 2 is improbable (some possibility, but low likelihood);
 - * Assigned a score of 3 is probable (distinct possibility);
 - * Assigned a score of 4 is highly probable (most likely); and
 - * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- » the **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- » the **status**, which will be described as either positive, negative or neutral.
- » the degree to which the impact can be reversed.
- » the degree to which the impact may cause irreplaceable loss of resources.
- » the *degree* to which the impact can be *mitigated*.

The **significance** is determined by combining the criteria in the following formula:

S= (E+D+M) P; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Impact tables summarising the significance of impacts (with and without mitigation)

The following matrix applies to Areas/Phases 1-4, 6, and 8-14.

Nature: Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected).		
	Without mitigation	With mitigation
Extent	1	
Duration	5	
Magnitude	2	
Probability	2	
Significance	16	
Status (positive or negative)		
Reversibility	No	No
Irreplaceable loss of resources?	Yes, where present – but occurrence is generally extremely low density and of low significance.	Not regarded as necessary
Can impacts be mitigated?	Yes – but not considered necessary.	Not regarded as necessary
Mitigation: Mitigation Measures: Artefact densities are very low/zero over the development footprint areas in question. Unlike biological processes, heritage destruction generally has a once-off permanent impact and in view of this the figures given in the “Without mitigation” column err on the side of caution. Even so, the criteria for significance indicated in this matrix give a Low significance weighting (<30 points). Mitigation measures are not considered necessary.		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events.		
Residual Impacts: -		

The following matrix applies to Areas/Phases 5 and 7.

Nature:

Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected).		
	Without mitigation	With mitigation
Extent	3	1
Duration	5	1
Magnitude	10	2
Probability	5	1
Significance	90	4
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes – fence off the sensitive feature as no-go zone	Fence off as no-go zone.
Mitigation: Mitigation Measures: <i>It is imperative that these sites be fenced off and excluded from the development as no-go zones. It is recommended that fencing should be erected at a distance of 100 m from the edge of the rock exposures to protect the surface spreads of artefacts around these features. There is an existing fence for the gora site at 29.32940° S 18.88654° E.</i>		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events: in this case the no-go option is recommended, excluding these sites from the development footprint..		
Residual Impacts: -		

5. CONCLUSIONS

Very sparse to zero heritage traces were found over most of the development footprint in Areas 1-4, 6 and 8-14 and associated with ancillary infrastructure including powerline routes. Highly significance sites were noted in Areas 5 (1 site) and 7 (2 sites) which, it is recommended, should be excluded from the development footprint by being fenced off.

Concern is raised about encroachment of the development on the landscape in which the last of the San of this area perished in the later nineteenth century.

Subject to pre-construction ground-truthing, including verification of adequate fencing-off of no-go zones, no further 'Phase 2' mitigation work is regarded as necessary in terms of present development layout.

In the event that any other heritage feature (which may be sub-surface, such as an unmarked grave) is encountered during the development or operational life of the facility, work is to be halted immediately and contact made with SAHRA (Ms C. Scheermeyer at 021-4624502) and/or the Northern Cape Heritage Authority Ngwao Bošwa jwa Kapa Bokone (Mr A. Timothy) who would arrange for the evaluation of the find for possible mitigation.

From an archaeological perspective the observed heritage resources are generally of very low significance (low occurrence), but with three exceptions at sites that are deemed to be of high significance and worthy of preservation as no-go zones.

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