HERITAGE IMPACT ASSESSMENT FOR A PROPOSED PHOTOVOLTAIC ENERGY PLANT ON THE FARM VOGELSTRUISBULT NEAR COPPERTON, NORTHERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act (No. 25 of 1999) as part of an EIA)

Prepared for

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EXECUTIVE SUMMARY

The UCT Archaeology Contracts Office was requested by Aurecon South Africa (Pty) Ltd to assess the potential impacts to heritage resources that might occur through construction of a solar energy facility on Portion 1 of the farm Vogelstruisbult 104. Mulilo Renewable Energy (Pty) Ltd proposes to establish a 100 MW photovoltaic solar energy facility with a footprint of 300 ha that will connect to the nearby Cuprum Substation via a 4.2 km overhead transmission line. Roads, a perimeter fence and small structures would also be required. The chosen site lies just southeast of the town of Copperton and northeast of the Prieska Copper Mine. A 300 MW alternative layout exists for the same site.

The site is a flat plain which rises gently to the northeast and has two pans in the south-western part. Vegetation is low and the surface is either silty or gravelled.

A background scatter of Early Stone Age (ESA) and Middle Stone Age (MSA) artefacts was found across the site and is of very low archaeological significance. Several discrete Later Stone Age (LSA) sites were found focused around Perdepan. These sites are more significant and would require mitigation should they be under threat. Furthermore, evidence from elsewhere suggests that the possibility of finding important subsurface material close to pans exists. No buildings exist on the site and no cultural landscape elements were noted. Visual impacts to scenic routes and sense of place will be limited due to the partial screening effect from a large berm and the presence of existing abandoned mining infrastructure in the vicinity.

Archaeological impacts are assessed as being of high significance for both alternatives but Low with mitigation. Impacts of visual concern are rated as of Low significance and no mitigation is suggested.

Impacts to heritage resources are not considered to be highly significant and it is thus concluded that the project may proceed but subject to the following recommendations:

- The suggested archaeological mitigation should be implemented as necessary;
- Test excavations around the pan should be done to check for buried archaeological material (if development encroaches within 100 m of the pan margin but excluding for access roads);
- Transmission lines should stay at least 100 m away from the edge of any pans implicated in the final route; and
- If any human remains are uncovered during development then work in the immediate vicinity should be halted and the finds protected and reported to SAHRA (021 462 4502).

Contents

1. INTRODUCTION

The UCT Archaeology Contracts Office (ACO) was requested by Aurecon South Africa (Pty) Ltd (Aurecon) to assess the potential impacts to heritage resources that might occur through construction of a solar energy facility on Portion 1 of the farm Vogelstruisbult 104 (Figure 1). Mulilo Renewable Energy (Pty) Ltd proposes to establish a 100 MW photovoltaic solar energy facility with a footprint of 300 ha that will connect to the nearby Cuprum Substation via an overhead transmission line. The chosen site lies just to the southeast of the town of Copperton and northeast of the Prieska Copper Mine.

The project components would include the following:

- Installation of arrays of panels comprised of photovoltaic cells;
- Construction of a 4.2 km long 132 kV overhead transmission line to evacuate the power to the Cuprum Substation;
- Upgrading of farm roads and construction of new roads to facilitate access to the site for construction and maintenance vehicles;
- Construction of small buildings to house an office, connection centre and guard; and
- Construction of an electric fence to protect the site from trespassers and livestock.

The plant is expected to be operational for approximately 20 years after which it would likely be decommissioned and the land rehabilitated.

Alternatives being assessed include the following:

- Layouts allowing generation of 100 MW (preferred) or 300 MW (alternative) on the same site;
- Technology alternatives include method of power generation (PV or CSP) as well as various ways of mounting the panels on various types of foundations (but note that CSP has been ruled out during scoping due to the high water requirements of this technology); and
- The only activity alternative to solar energy generation is the No-Go option in which the status quo would be maintained.

For the purposes of heritage assessment, the technology alternatives make little or no difference so this report therefore concentrates on assessing the layout alternatives. The ACO was asked to conduct a detailed assessment of the proposed site but to also consider the broader farm context so that should other specialist reports determine a need to shift the facility then some data would be available to further inform the relocation.

2. TERMS OF REFERENCE

Undertake a Heritage and Archaeological Impact assessment of the sites in accordance with the requirements of Section 38(3) of the NHRA which would include:

- Conducting a detailed desk-top level investigation to identify all archaeological, cultural and historic sites in the proposed development areas;
- Undertaking field work to verify results of desktop investigation;
- Document (GPS coordinates and map) all sites, objects and structures identified on the candidate sites;
- Compile a report which would include:

  - Identification of archaeological, cultural and historic sites within the proposed development areas;
  - Assess the sensitivity and significance of archaeological remains in the site;
  - Evaluation of the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources, in terms of the scale of impact (local, regional, national), magnitude of impact (low, medium or high) and the duration of the impact (construction, up to 10 years after construction (medium term), more than 10 years after construction (long term));
  - Recommendation of mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance;
- The preparation of a heritage resources management plan which includes recommendations on the management of the objects, sites or features, and also guidelines on procedures to be implemented if previously unidentified cultural resources are uncovered during later developments in the area;
- Consideration of relevant guidelines; and
- Cognisance must be taken of the Department of Environmental Affairs and Development Planning guideline: “Guideline for involving heritage specialists in EIA processes”.

3. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources including palaeontological, prehistoric and historical material (including ruins) more than 100 years old (Section 35), human remains older than 60 years and located outside of a formal cemetery administered by a local authority (Section 36) and non-ruined structures older than 60 years (Section 34). Landscapes with cultural significance are also protected under the definition of the National Estate (Section 3 (3.2d)). Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

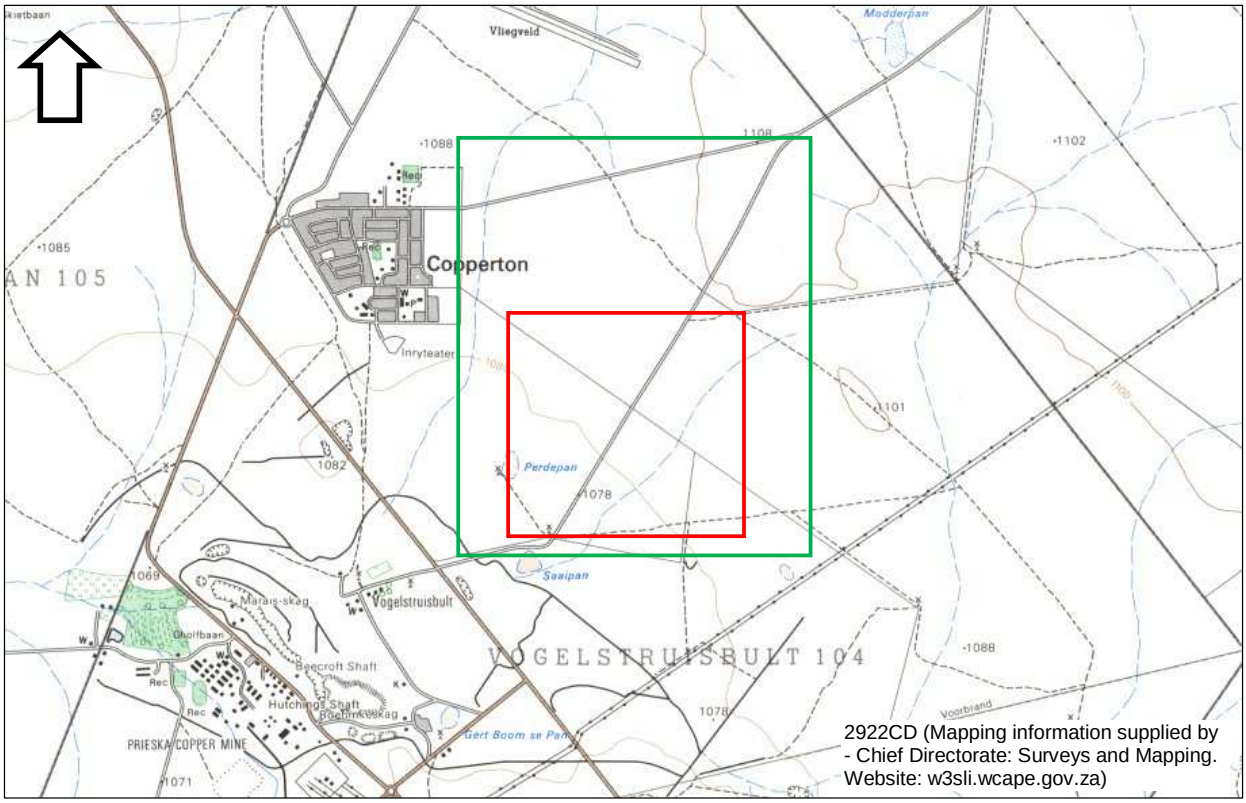

Figure 1: Map showing the location of the proposed 100 MW solar energy facility (red rectangle) on Vogelstruisbult, immediately southeast of Copperton as well as the alternative 300 MW site (green rectangle).

Since the project is subject to an Environmental Impact Assessment, the heritage authorities are required to provide comments on the proposed project in order to facilitate final decision making by the Department of Environmental Affairs (DEA). The relevant heritage authorities are Ngwao Boswa Kapa Bokoni (Heritage Northern Cape) for built structures and the South African Heritage Resources Agency for archaeology.

4. METHODS

The site was surveyed on the 11th December 2011 by a Principal Investigator (Jayson Orton) and a student assistant (Ross Lyall) through a combination of driving and walking. The driving aimed to locate areas that, through experience, would be more likely to contain archaeological and/or other heritage remains. These typically consisted of hills, dense gravel patches and pan and stream margins. Such areas were searched most intensively, but many other areas were walked in order to confirm expectations in those areas. All heritage resources were recorded photographically and GPS co-ordinates were taken and walk and drive paths were recorded using a hand-held GPS receiver set to the WGS84 datum.

Field numbers were allocated on the GPS during the survey and these points are indicated by a '#' in the text. All occurrences of heritage were recorded thus and only those deemed to have good integrity were actually given site numbers. These numbers are constructed through combination of a three-letter acronym for the farm name, the year of discovery (2011) and a sequential site number. The sites and other occurrences are listed in Appendix

1 and gradings, following the grading system proposed by Baumann and Winter (2005: box 5), are assigned to indicate overall heritage conservation-worthiness where appropriate. Note that this system makes no provision for sites not worthy of conservation and these are thus left ungraded. The definitions of the various grades are provided in Table 1.

Grade	Level of significance	Description
1	National	Of high intrinsic, associational and contextual heritage value within a national context, i.e. formally declared or potential Grade 1 heritage resources.
2	Provincial	Of high intrinsic, associational and contextual heritage value within a provincial context, i.e. formally declared or potential Grade 2 heritage resources.
3A	Local	Of high intrinsic, associational and contextual heritage value within a local context, i.e. formally declared or potential Grade 3A heritage resources.
3B	Local	Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources.
3C	Local	Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources.

Table 1: Grading of heritage resources (Source: Baumann & Winter 2005: Box 5).

In assessing the significance of impacts standard criteria provided by Aurecon were employed. These use the combination of magnitude, extent and duration in the determination of significance.

4.1. Limitations and assumptions

The site was relatively flat and but generally coated in knee-high bushes and grass. This made ground visibility difficult in many areas, but some gravel patches and open, pan-type localities provided opportunities to examine the substrates in these areas. Aside from this, it is acknowledged that the survey density did not allow comprehensive coverage of every part of the site but it is believed that the outcome of this report would not be significantly altered by any further detailed coverage.

The survey could not practically cover the entire project areas and, in terms of pre-colonial archaeology, it is assumed that, through focusing on finding and examining landscape features that seemed most likely to yield finds, an understanding of the overall archaeological and historical landscape has been attained. Furthermore, the strip of land in the far north could not be accessed due to a failure to find any gates through the tall fences lining the road that crosses the site.

Due to the difficulties associated with accessing linear routes crossing many camps and fences, the power line routes were not searched. The footprints of the pylons are small and it is assumed that they will not have impacts of any magnitude.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The site occupies a flat area (Figure 2) but slopes ever so gently uphill towards the northeast as evident from the contours on Figure 1. Although predominantly covered in gravel and low density, knee-high vegetation, some areas have underlying calcrete that is exposed at the surface (Figure 3), while others are very sandy (Figure 4). Two pans are present on the site,

although numerous areas were found to hold ephemeral water after rain. These latter had silty surfaces. The edges of the pans tend to be sandy with calcrete exposures in places (Figure 5). Ground visibility is generally very good. Existing power lines do occur in the area (Figure 6).

Figure 2: View across the study area showing the generally flat terrain.

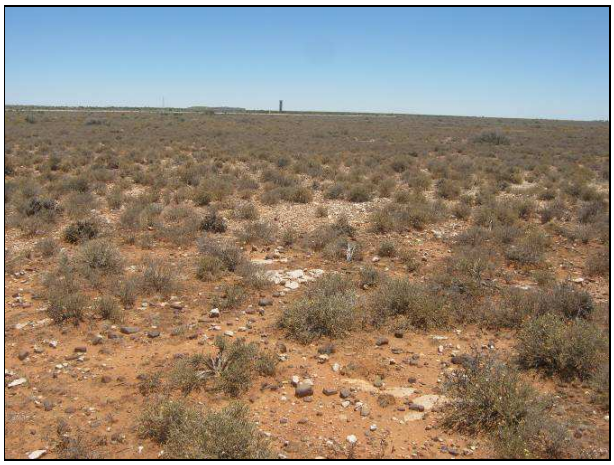

Figure 3: A calcrete outcrop on the site.

Figure 4: A sandy area on the site.

Figure 5: Sandy area near the edge of a pan as viewed looking away from the pan.

Figure 6: Sandy area and existing power lines along the southern edge of the site.

6. HERITAGE CONTEXT

Much of the Karoo is covered by gravels that contain abundant stone artefacts in varying densities (personal observation). Of the Bushmanland area, Beaumont *et al.* (1995: 240) declared that “thousands of square kilometres of Bushmanland are covered by a low density lithic scatter”. These artefacts are generally very well weathered and mostly pertain to the Early (ESA) and Middle Stone Age (MSA). They can be considered as background scatter in that their fine-scale distribution is conditioned more by geological actions than human actions. Occasional Later Stone Age (LSA) artefacts are also present within this scatter and these were no doubt dropped there during recent millennia. These kinds of finds were made by Kaplan (2010) and Wiltshire (Kaplan & Wiltshire 2011) on proposed PV and wind energy sites nearby. The ESA is said to be characterised by the presence of long blades, Victoria West cores and relatively few hand-axes and cleavers. Substantial MSA sites are rare with only a few isolated examples known (Beaumont *et al.* 1995). The open landscape holds few cave sites but one called Zoovoorbij Cave close to the Orange River near Upington did reveal an early MSA occupation (Smith 1995a).

A significant aspect of the Northern Cape archaeological record is the presence of pans which frequently display associated archaeological material. The only detailed work in this regard is that of Kiberd (2001, 2005, 2006) who excavated a site known as Bundu Pan, some 25 to 30 km northwest of Copperton. The site had initially been revealed by excavations to obtain gravel for surfacing local roads with early observations noting MSA artefacts on quartzite eroding from the sections. The artefacts were accompanied by warthog and equid teeth (Beaumont *et al.* 1995). The site was subsequently excavated between 1998 and 2003 and, importantly, found to actually contain stratified deposits ascribable to the ESA, MSA and LSA. The preserved Pleistocene faunal material was confirmed and found to include, in decreasing order of abundance, the bones of wildebeest, warthog, extinct giant hartebeest, two species of equid (horse/zebra), baboon, springbok and blesbok (Kiberd 2006). The only other site in the Northern Cape Province to contain all three Stone Ages is Wonderwerk Cave near Kuruman with its deep stratified deposits (Humphreys & Thackeray 1983). Such sites are generally rare in South Africa. Local pans were also examined by Wiltshire (Kaplan & Wiltshire 2011) and found to have greater densities of archaeological material surrounding them.

Several LSA sites in the Bushmanland area to the northwest, west and southwest of Copperton have been investigated by Beaumont and colleagues (1995), Smith (1995a) and Parsons (2003, 2004, 2007, 2008). Work on these sites led to a distinction between hunter-gatherer and herder sites, based on stone artefact assemblages (Beaumont *et al.* 1995; Beaumont & Vogel 1984, 1989; Parsons 2003), which has recently been called into question (Parsons 2007). Briefly, the hunter-gatherer assemblages, termed ‘Swartkop’, were said to be dominated by hornfels, but with some quartz, and to have many blades with backed blades a common retouched type (Morris 1990; Orton 2002/3). Earlier assemblages have proportionally more blades and fewer potsherds with later sites the reverse. Ceramics are usually grass-tempered (Beaumont & Vogel 1989). The herder sites, termed ‘Doornfontein’, were said to be mostly irregular flakes usually made on quartz and to have many potsherds, including lugs and spouts, associated with them, but with lugs absent on sites older than about AD 700 (Beaumont *et al.* 1995). Smith (1995a) notes that Doornfontein sites tend to occur along the river, while Swartkop sites are usually found further from the river. Sites dating more than about 2000 years ago belong to a group that Beaumont *et al.* (1995) refer to as Springbokoog. Such sites are likely the predecessors of the Swartkop sites and also have high frequencies of backed blades though to the east backed blades and scrapers may

be more equal in proportion as shown by a sample from Prieska. All these LSA sites have very few, if any, organic items on them. The only organic find usually present is fragments of ostrich eggshell which originated either from eggs eaten or else whole shells used as flasks. Many such flasks have been found across the Northern Cape (Morris 1994; Morris & Von Bezing 1996). One of the farmers during the present study mentioned that his family had found several ostrich eggshell flasks with three holes in them. One end had one hole which was used for drinking and otherwise lugged. The other two holes were placed at the opposite end and were threaded for the purposes of carrying the suspended flask.

Rock art, in the form of engravings, is widely known from Bushmanland and the Northern Cape in general (Beaumont *et al.* 1995; Beaumont & Vogel 1989; Rudner & Rudner 1968; Rusch & Parkington 2010; Wilman 1933) where sites such as Wildebeest Kuil, Driekopseiland are well known. Various styles occur and are attributed to different time periods; incised finelines extend back the furthest in time, while pecked and scraped engravings occur within the last 2000 years. The latter have the smallest distribution between Kenhardt, Beaufort West and De Aar (Beaumont & Vogel 1989). During our time in the field one of the farmers pointed out an engraving site along the road between Copperton and Vanwyksvlei. At this site we found scraped engravings of eland and ostrich as well as very recent (historical) incised (perhaps better termed scratched) engravings including horses with riders, one chariot and some writing. This site is known to researchers and is probably the nearest engraving site to Copperton (David Morris, pers. comm. 2012).

The last Stone Age archaeological concern is stone circles. These low structures are not well studied but work further east along the Orange River (Sampson 1968), in the Seacow Valley in the eastern Karoo (Sampson 1986) and also at Bloubos northwest of Upington (Parsons 2004) suggests they may well have been the bases in which huts or windbreaks were constructed. Similar stone circles have recently also been discovered at De Aar in the central Karoo (Orton 2011). Such stone circles are very different to the far more substantial piled stone kraals commonly encountered in the central and eastern Karoo regions (Hart 1989, 2005; Orton & Halkett 2010; Sampson 1984, 1985, 1986, 2010).

Indigenous people were present in this area until quite recently with one of the farmers, Frans Ekkert, informing us that when his grandfather began farming in the area in 1864 there were still many Bushman living there. Smith (1995b) notes that around that time white farmers were making extensive use of Bushmanland for summer grazing and that this led to the extermination of the massive springbok herds on which the indigenous population subsisted. This in turn led to the locals turning to the farmers for food (and employment), effectively ending the span of prehistory in the region.

More recent heritage relevant to the study area includes the typical flat-roofed Karoo-style houses commonly found in the small towns. None were noted to occur close to Copperton with the town itself being quite recent and related to the start of copper and zinc mining there during the 1970s. Mining ceased during the 1990s. Much of the town was demolished after this. Being so arid, the farms in the area are large and used only for livestock grazing. Farm complexes are rarely seen on the landscape and tend to be relatively recent.

The Anglo-Boer War included action in Bushmanland with the British fort at Prieska being a fine example. War graves are also present there (Southerncape 2010).

7. FINDINGS

Figure 7 shows the distribution of archaeological resources recorded during the survey as well as the walk- and drive-paths taken. It can be seen that the majority of recorded occurrences are situated in two clusters that relate to the larger pans on the site. Further afield, most finds were examples of background scatter. While all the discrete sites relate to LSA occupations, the background scatter is almost all ESA and MSA. These two types of archaeological occurrences will be addressed separately.

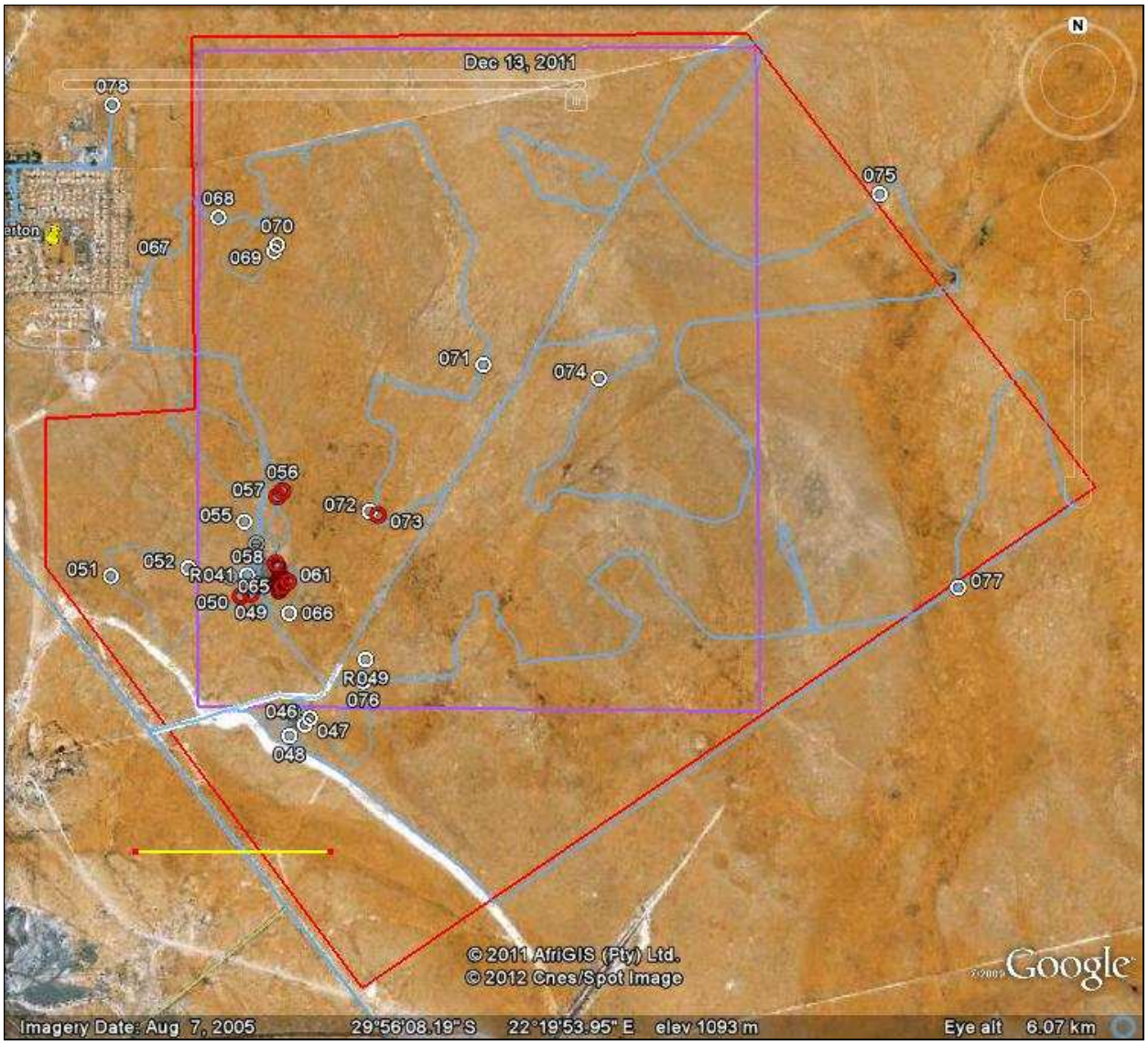

Figure 7: Aerial view of the study area taken from Google Earth and showing the distribution of recorded archaeological occurrences by their field numbers. The purple block shows the Alternative 2 location, while Alternative 1 is located entirely within this area. Yellow bar at lower left for scale is 1 km. (Red points require mitigation, white points do not.)

7.1. Background Stone Age artefact scatter

Artefacts were observed in low densities over much of the study area and Figure 8 shows a selection of these. Materials varied but quartzite was certainly most commonly encountered.

Weathering states also varied indicating a vast span of time over which the artefacts have accumulated. Such finds have no discernible original context and have little to no archaeological value. However, in places we were able to find slightly higher concentrations in one place. This is not due to human factors. At #047 the artefacts were found within a sandy substrate close to a pan (Figures 9 & 10) but others were scattered widely in gravel patches or sandier areas, sometimes in places where calcrete was visible at the surface. Figures 11 to 14 show a selection of these occurrences. Quartzite dominates and CCS is frequently present but hornfels is absent.

Figure 8: Selection of isolated artefacts from the background scatter on Vogelstruisbult showing the variability in materials and weathering states.

Figure 9: Artefacts from #047.

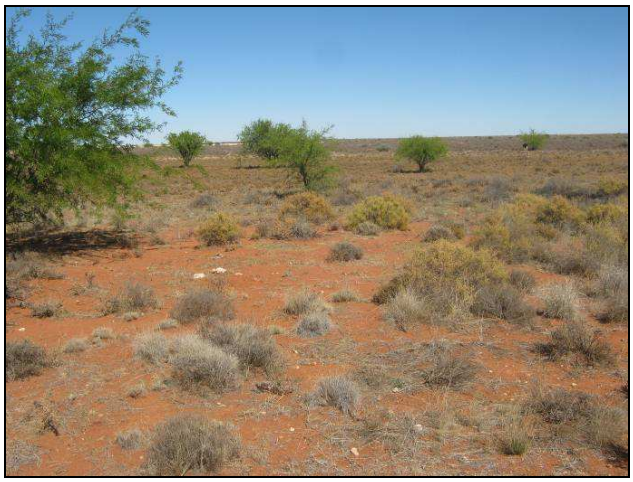

Figure 10: The sandy area at #047.

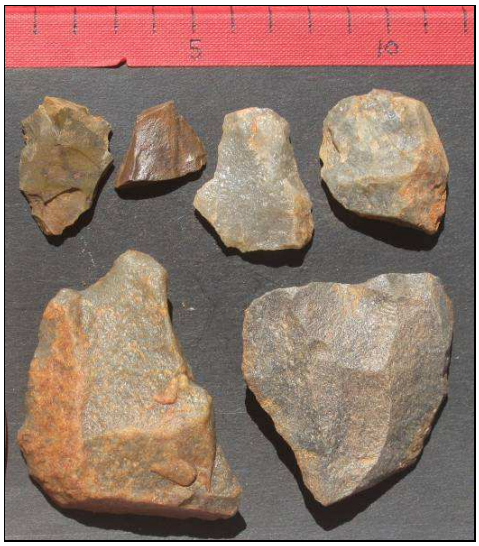

Figure 11: Artefacts from #051.

Figure 12: Artefacts from #067.

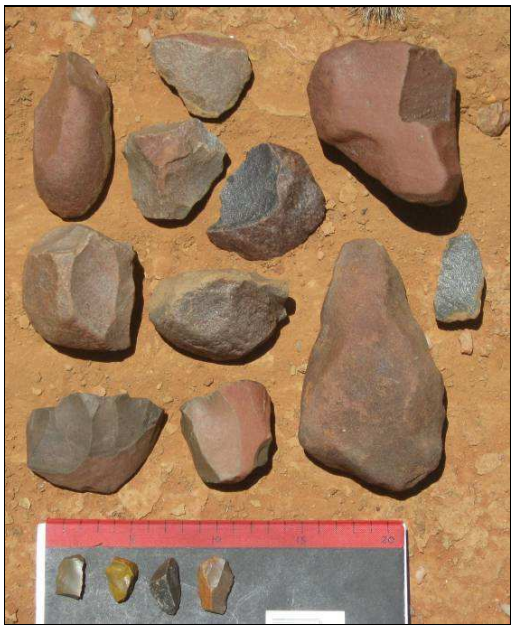

Figure 13: Artefacts from #074.

Figure 14: Artefacts from #076.

Among the background scatter were occasional hand-axes pertaining to the ESA. These were, without fail, heavily weathered testifying to the great length of time over which they have been exposed at the surface (Figures 15 & 16). One further bifacial artefact was rather different and might even represent a broken and reworked hand-axe (Figure 17). It is somewhat less weathered than the complete hand-axes.

Figure 15: Hand-axe from #074. **Figure 16:** Hand-axe from #R041. **Figure 17:** Bifacial artefact from #067.

7.2. Discrete Stone Age sites

A number of LSA archaeological sites were found during the survey. These focus on the margins of the pans, particularly the larger one, Perdepan. Most were small and of limited importance. VSB2011/001 (found at points #049 & #050) is one such site where cryptocrystalline silica CCS, quartz and quartzite were found in a sandy area close to Perdepan. CCS was strongly dominant and one double-endscraper on this material was noted.

Site VSB2011/002 was similar but of lower density and with quartz outnumbering quartzite. CCS was still most common. It included one fragment of ostrich eggshell. At VSB2011/004 quartz dominated the LSA assemblage (Figure 20) but one patch did have more CCS than elsewhere. Artefacts relating to the background scatter were also present in the area. The site lay on the sandy edge of Perdepan where vegetation is less dense – presumably a major factor in the choice of settlement location.

Figure 18: Artefacts from site VSB2011/001 (#049 & #050).

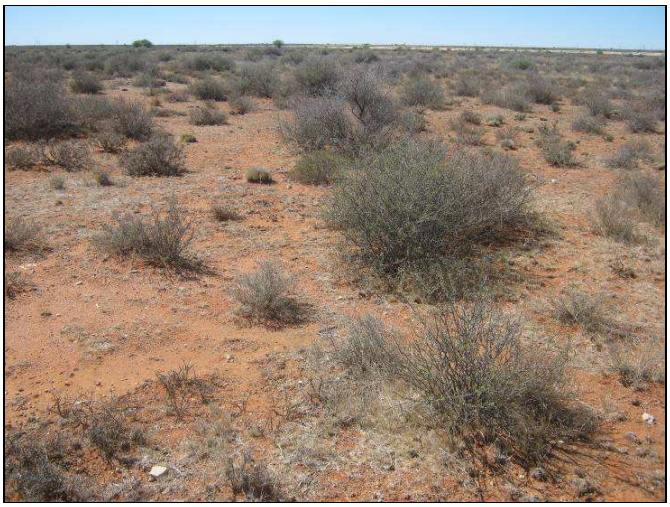

Figure 19: Location of VSB2011/001 in a sandy area to the south of Perdepan.

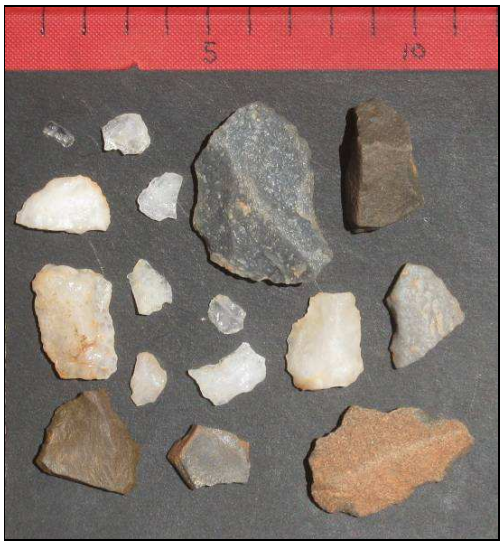

Figure 20: Artefacts from VSB2011/004. They include some background scatter but the LSA component is dominated by quartz.

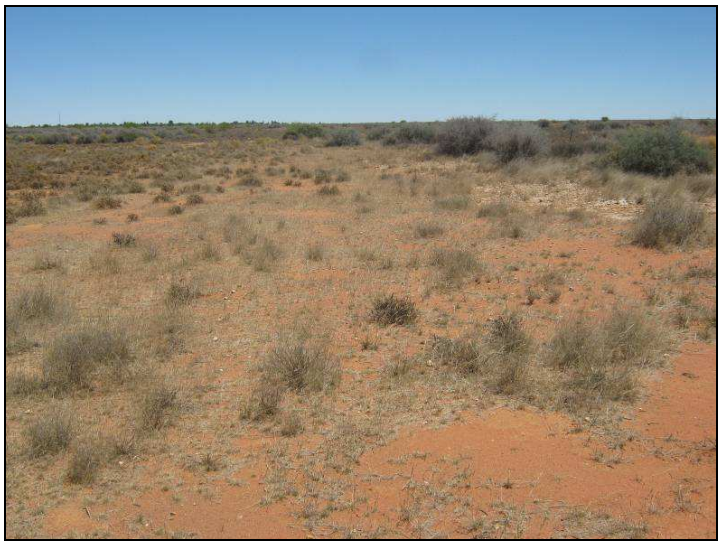

Figure 21: The situation of VSB2011/004. The site was found scattered in a sandy area along the edge of Perdepan (visible at far left as low, dense vegetation).

VSB2011/005 was the most significant site located on Vogelstruisbult. It is represented by field numbers #060 to #065. Several spatially related patches of dense artefact scatter were found, but the general scatter was fairly continuous over the whole area of the site. Due to the high degree of significance attached to this site no attempt was made to gather and photograph artefacts but Figure 22 shows a typical view of the surface with artefacts scattered about. The site covers some 100 m north-south by 90 m east-west and lies close to the margin of Perdepan (Figure 23). The western edge of the site, close to the pan, is quite well defined but the eastern side, where the density drops off, tends to just fade away. Potentially of very high significance were three ‘piles’ of stones. These were located in sandy areas and are quite obviously anthropogenic. The possibility exists that they are graves but this could never be verified without excavation. They could also represent some other type of feature (Figure 24). Two of these mounds were located at #063 while a third was found at #064.

Site VSB2011/008 was interesting in that it was a small, discrete site far away from the pan (1.6 km to its north). It was no doubt a small campsite and may be quite recent given the very limited spatial extent of the scatter. It was about 5 m in diameter.

At VSB2011/010 (#073) there was a good and very discrete scatter of CCS and quartz about 5 m in diameter (Figure 25). The site was also away from the pan, about 650 m distant from it, and was in a sandy area, again probably deliberately chosen for occupation. Ostrich eggshell fragments were also present, which, although not very accurate due to the correction factor required (Vogel *et al.* 2001), allows the opportunity to date the site.

Figure 22: View of the surface of VSB2011/005. Not everything visible is artefactual but many pieces are.

Figure 23: View across part of the site with Perdepan in the background (green area with Acacia trees).

Figure 24: View of one of the stone mounds at VSB2011/005 (#063).

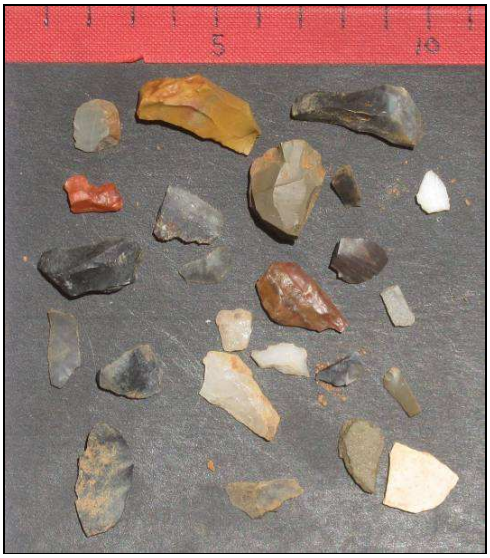

Figure 25: Artefacts from VSB2011/010 (#073). CCS dominates, followed by quartz.

7.3. Built environment

There are no buildings or other structures on the subject site. The nearest buildings are the remaining houses in Copperton to the west of the site. These are modern (1960s/1970s) and of no heritage value.

7.4. Cultural landscapes

No cultural landscape features were identified on the site. It is open, undeveloped farm land crossed only by a few fences.

7.5. Scenic routes, sense of place and visual concerns

The R357, which connects Prieska with Vanwyksvlei via Copperton, is generally scenic in that one experiences the typical vast, undeveloped open space of the Karoo while driving along it. The nearest part of the site to this road is some 4.6 km to the north and the proposed development is unlikely to be visible from the R357. Very few people use the road making any slight visual impacts to it of very little concern. Furthermore, being to the north of the site, the panels will be angled away from the road which means that visual intrusion into the landscape through reflection will be eliminated. The now abandoned Prieska Copper Mine lies a short way to the west of the proposed site. Its remaining infrastructure and slimes dam are far higher than the proposed development and serve to reduce the quality of the general environment of the site. The solar energy facility would not exceed 4.5 m in height and would also be partially screened by a large berm that has been built along the south-western part of the site.

8. ASSESSMENT OF IMPACTS

Impacts to archaeological resources and scenic routes/sense of place are assessed. No buildings of heritage value will be affected either physically or visually by the proposed facility and so no assessment of the built environment is provided. It should be noted that the visual impact assessment (being conducted by Karen Hansen) will further inform on the visual impacts.

8.1. Archaeology

Most archaeology present on the site is of low significance but important LSA archaeological sites do occur. These are focused around the pans with the exception of a few very small camps that occur further away. Given the smaller size of Alternative 1, it will result in a smaller cumulative impact through loss of less archaeology.

Table 2: Assessment of archaeological impacts for PV2 Alternative 1.

	Before mitigation	**After mitigation**
Magnitude	High	Low
Extent	Local	Local
Duration	Long term	Long term
Significance	High	Low
Probability	Probable	Probable
Status	Negative	Negative
Reversible	No	
Cumulative impacts	Considering the scale of archaeological research in other parts of South Africa, relatively little is known of Bushmanland with no excavated sites known from close to Copperton. It is considered that the loss of any significant LSA sites will impact on our knowledge of the wider region. With many energy generation facilities planned in the region the potential to lose many sites exists.	

Table 3: Assessment of archaeological impacts for PV2 Alternative 2.

	Before mitigation	**After mitigation**
Magnitude	High	Low
Extent	Local	Local
Duration	Long term	Long term
Significance	High	Low
Probability	Probable	Probable
Status	Negative	Negative
Reversible	No	
Cumulative impacts	Considering the scale of archaeological research in other parts of South Africa, relatively little is known of Bushmanland with no excavated sites known from close to Copperton. It is considered that the loss of any significant LSA sites will impact on our knowledge of the wider region. With many energy generation facilities planned in the region the potential to lose many sites exists.	

8.2. Scenic routes and sense of place

The R357 to the south of the site is little used aside from a few local farmers and, although scenic, is not considered an important scenic route. This makes the significance of visual impacts to it very low. The landscape setting is typical of the Karoo region, however it is not unique and has been compromised by the presence of the now abandoned Prieska Copper Mine to the west. Given the site's location relative to the R357, no mitigation is proposed for this set of impacts.

Table 4: Assessment of impacts to scenic routes and sense of place for PV2 Alternative 1.

	Before mitigation	**After mitigation**
Magnitude	Low	-
Extent	Local	-
Duration	Long term	-
Significance	Low	-
Probability	Definite	-
Status	Negative	-
Reversible	Yes (with rehabilitation)	
Cumulative impacts	A number of PV and wind energy facilities are planned for the area (with one PV already approved on the same farm) and if all are constructed then cumulative visual impacts to the landscape will be of concern and will detract from peoples' experience of the place.	

Table 5: Assessment of impacts to scenic routes and sense of place for PV2 Alternative 2.

	Before mitigation	**After mitigation**
Magnitude	Low	-
Extent	Local	-
Duration	Long term	-
Significance	Low	-
Probability	Definite	-
Status	Negative	-
Reversible	Yes (with rehabilitation)	
Cumulative impacts	A number of PV and wind energy facilities are planned for the area (with one PV already approved on the same farm) and if all are constructed then cumulative visual impacts to the landscape will be of concern and will detract from peoples' experience of the place.	

9. CONCLUSIONS & RECOMMENDATIONS

The impacts to heritage resources are not considered to be highly significant and the known archaeological sites can very easily be mitigated. This mitigation would consist of excavation and sampling of sites as well as test excavations around the pans to check for subsurface archaeology which may also require sampling. This is deemed significant considering the presence of MSA with preserved fauna at Bundu Pan to the north of Copperton (see Section 5 above). Note that such mitigation should only be implemented for archaeogical sites that will be disturbed during construction.

Sites deemed to require mitigation (Figure 26) are:

- VSB2011/001 (#049 – #050);
- VSB2011/002 (#056);
- VSB2011/003 (#057);
- VSB2011/004 (#058 – #059);
- VSB2011/005 (#060 – #065); and
- VSB2011/010 (#073).

Although three of the six sites listed above will not contribute much to our knowledge on their own, as part of a suite of sites they would be important. It is thus recommended that they be sampled if impacted. All the above sites fall within the proposed Alternative 2 and only

VSB2011/001 appears to lie outside of Alternative 1. However, it is so close to the edge of that alternative that it is probably best regarded as potentially under threat.

The addition of new power lines to the area will not have a significant impact on the general character of the area due to the electrical and mining infrastructure already in place. However, the presence of high densities of archaeological material around pans suggests that these should be avoided in the routing of the lines. It should be noted that it is not only the pylons that have an impact here but the service roads that are made beneath them. It is suggested that a buffer of approximately 100 m from the edge of any pans be employed. Furthermore, access roads would require surface sites to be mitigated but no subsurface testing is required for roads passing close to pans.

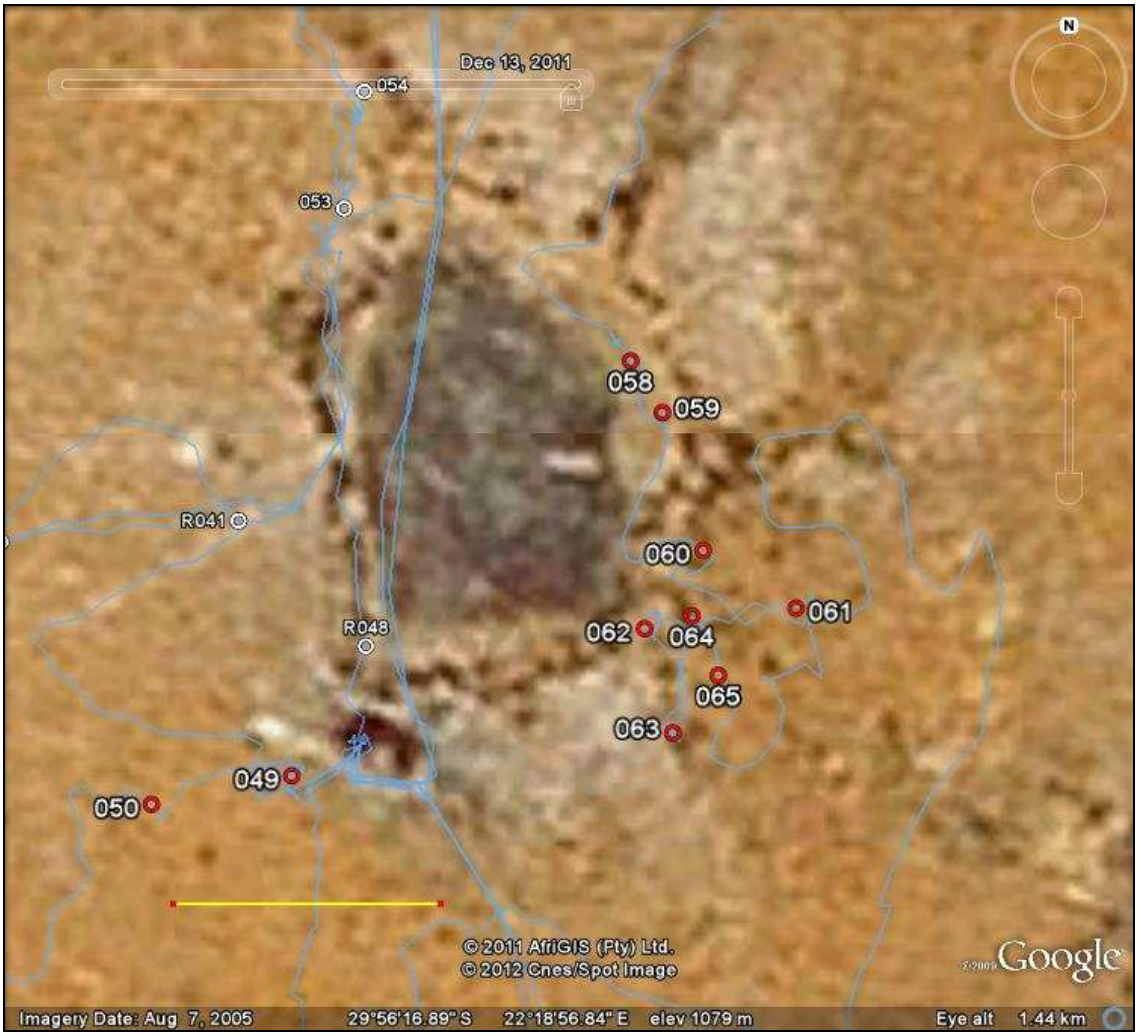

Figure 26: Aerial view of the vicinity of Perdepan on Vogelstruisbult. Sites requiring mitigation are in red. The yellow bar at lower left for scale is 100 m.

From a heritage and visual perspective, a smaller development footprint will always be preferable but, given the identified heritage indicators on site, neither alternative is strongly preferred. It is recommended that the proposed project be allowed to proceed with either alternative, but subject to the following:

- The suggested archaeological mitigation should be implemented as necessary for any sites that fall within the final chosen area to be disturbed;
- Test excavations around the pan should be done to check for buried archaeological material (if development encroaches within 100 m of the pan margin);
- Transmission lines should stay at least 100 m away from the edge of any pans implicated in the final route; and
- If any human remains are uncovered during development then work in the immediate vicinity should be halted and the finds protected and reported to SAHRA (021 462 4502).

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11. INVESTIGATION TEAM

Fieldwork:	J. Orton (Principal Investigator) R. Lyall (Student assistant)
Report:	J. Orton

APPENDIX 1: LIST OF ARCHAEOLOGICAL OCCURRENCES

Note that in this table the columns are interpreted as follows:

Field No: number allocated by the GPS in the field for each occurrence (numbers with '∞' alongside them denote occurrences illustrated and/or described in the text);
Site No: number allocated afterwards for those occurrences deemed suitable to be called archaeological sites (they have spatial integrity and are not 'background scatter');
Description: short description of the occurrence; and
Significance, grade & mitigation requirements: how important the occurrence is in archaeological terms, the assigned heritage conservation grading (where applicable) and the estimated time requirement for appropriate mitigation (where applicable and excluding any new sites discovered through test excavations).

Field No.	Site No.	Co-ordinate location	Description	Significance, grade & mitigation requirements
046		S29 56 40.2 E22 19 04.1	Quartzite artefacts in sandy area alongside pan.	Very low
047∞		S29 56 41.3 E22 19 03.2	Higher density artefacts in sandy area alongside pan. Mixed age (differential weathering).	Very low
048		S29 56 43.1 E22 19 00.3	Low density background scatter in gravel area near pan.	Very low
049∞	VSB2011/001	S29 56 20.0 E22 18 53.0	LSA CCS scatter with some quartz close to pan. One double-endscraper. Lots of CCS present.	Low-medium (1 day)
050∞		S29 56 20.3 E22 18 51.0	As above with even more CCS visible.	
051∞		S29 56 17.1 E22 18 26.6	Low density background scatter in gravel area. Artefacts appear to be ESA, MSA and LSA.	Very low
052		S29 56 15.8 E22 18 41.2	Background scatter in sandy area with calcrete.	Very low
053		S29 56 13.2 E22 18 53.7	Mixed age background scatter on calcrete next to pan.	Very low
054		S29 56 11.8 E22 18 54.0	20th C glass, cans and ceramics. Less than 100 years.	n/a
055		S29 56 08.2 E22 18 51.7	LSA Quartz scatter plus some background scatter in an open area.	Very low
056∞	VSB2011/002	S29 56 03.3 E22 18 58.9	LSA CCS and quartz scatter with some quartzite and one ostrich eggshell fragment.	Low (0.3 day)
057	VSB2011/003	S29 56 04.1 E22 18 58.0	Extensive, low density LSA quartz scatter with some quartzite and CCS.	Low (0.3 day)
058∞	VSB2011/004	S29 56 15.0 E22 18 57.7	Extensive LSA quartz scatter with some background scatter on sandy edge of pan.	Low-medium (0.5 day)
059∞		S29 56 15.6	More of 058 but with more CCS	

		E22 18 58.1	here.	
060∞	VSB2011/005	S29 56 17.3 E22 18 58.7	Extensive LSA scatter of quartz, quartzite, CCS and other.	Medium-high (site only) or Very high (if graves present) Grade 3C (3 days)
061∞		S29 56 18.0 E22 19 00.0	More of the above.	
062∞		S29 56 18.2 E22 18 57.9	Very dense LSA scatter as above but in a clear area (easy to mitigate here).	
063∞		S29 56 19.5 E22 18 58.3	More of the above. Also two possible stone-packed graves.	
064∞		S29 56 18.1 E22 18 58.5	One more possible stone-packed grave.	
065∞		S29 56 18.8 E22 18 58.9	Another very dense patch of LSA artefacts. Site continues at least 20 – 30 m east of these GPS points but drops in density.	
066	VSB2011/006	S29 56 23.1 E22 19 00.2	LSA scatter of quartz, CCS and quartzite in an area disturbed by animals.	Low
067∞		S29 55 23.7 E22 18 34.9	Background scatter with a peculiar biface.	Very low
068		S29 55 18.8 E22 18 46.9	Background scatter with several cores and flakes in quartz and quartzite.	Very low
069	VSB2011/007	S29 55 24.3 E22 18 57.4	Low density but quite widespread LSA scatter of quartz and CCS with some background scatter present.	Very low
070∞	VSB2011/008	S29 55 23.3 E22 18 58.0	Small LSA CCS and quartz scatter in discrete area about 5 m in diameter.	Low
071		S29 55 42.7 E22 19 36.8	Several heavily weathered ESA artefacts in a gravel area.	Very low
072	VSB2011/009	S29 56 06.5 E22 19 15.4	Ephemeral LSA quartz scatter in sandy area.	Low
073∞	VSB2011/010	S29 56 07.1 E22 19 16.9	Discrete small LSA scatter of CCS and quartz in area of 5 m diameter. Sandy area. OES present.	Low (0.3 day)
074∞		S29 55 44.9 E22 19 58.5	Background scatter of varying age in gravel area. One hand-axe included.	Very low
075		S29 55 15.0 E22 20 51.1	Small pan area with ESA and MSA in the area.	Very low
076		S29 56 34.2 E22 19 14.2	Scatter of artefacts of mixed age so they are probably background scatter.	Very low
077		S29 56 18.8 E22 21 06.0	Ephemeral scatter of LSA quartz, quartzite and CCS artefacts in open sandy area but with some older artefacts.	Very low
078		S29 55 00.5 E22 18 26.9	Copperton graveyard from 2005 onwards.	n/a
R037		S29 56 39.3 E22 19 00.9	Dense background scatter in sandy area with calcrete along	Very low

			margin of pan. Artefacts of mixed age but including an LSA component. At least one scraper present. Nice MSA retouched / edge-damaged point.	
R041∞		S29 56 16.9 E22 18 52.3	Dense background scatter alongside pan and including one hand-axe.	Very low
R044		S29 56 17.2 E22 18 49.0	Background scatter in gravel area.	Very low
R048		S29 56 18.4 E22 18 54.0	Background scatter in pan.	Very low
R049		S29 56 30.7 E22 19 14.6	Background scatter in gravel area.	Very low