McGregor Museum
Department of Archaeology

XINA
SOLAR THERMAL FACILITY

Specialist Input for the Environmental Impact Assessment Phase and Environmental Management Plan for the proposed XINA SOLAR THERMAL FACILITY, POFADDER, NORTHERN CAPE PROVINCE

ARCHAEOLOGY

David Morris
May 2014

XINA SOLAR THERMAL FACILITY

SPECIALIST INPUT FOR THE SCOPING PHASE OF THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED XINA SOLAR THERMAL FACILITY, POFADDER, NORTHERN CAPE PROVINCE

ARCHAEOLOGY

David Morris, McGregor Museum, Kimberley
P.O. Box 316 Kimberley 8300
Tel 082 2224777 email mmkarchaeology@yahoo.co.uk
May 2014

Background

A scoping phase evaluation of the full site as indicated is a desk-top study was aimed to provide high-level identification of potential areas of sensitivity together with a recommended methodology for the EIA process. The KaXu solar plant has since been built on the northern part of the property, subject to EIA phase assessment (Morris 2012).

The study site is on the Farm Scuit-Klip 92, portion 4, which is located east of Pofadder in the Northern Cape. The proposed further activities include the construction and operation of a second Solar Thermal Plant (for power generation purposes), and associated infrastructure including a steam turbine and generator, a generator transformer and substation, overhead power lines, water supply lines extension to the facility from an existing extraction point on the Gariep River, a water treatment plant, a blow down pond, workshops, storage areas and access roads.

1.1 Focus and Content of Specialist Report: Archaeology

The archaeology specialist study (commissioned by Savannah Environmental (Pty) Ltd), P.O. Box 148, Sunninghill 2151, Gauteng, email info@savannahsa.com, tel 011-2346621 fax 086 6840547) is focused on the development footprint of the proposed Solar Thermal Plant known as ~~Xina~~XiNa, and ancillary infrastructure.

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

» Introduction to the Specialist in terms of qualifications, accreditation and experience to undertake the study (1.2, below)
» Description of the affected environment (2)
» Description of heritage features of the region (2.1)
» Description of issues identified during the Scoping process (2.2)
» Methodology of determining the significance of the impacts and assumptions as well as scoping phase predictions (3)
» Observations and Assessment of impacts, including a summary in tabular format (4)
» Comparative assessment of alternatives (4.3.2)
» Recommendated measures for draft Environmental Management Plan and site-specific mitigation (5)
» Conclusions (6)

1.2 Archaeology 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, 2012).

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

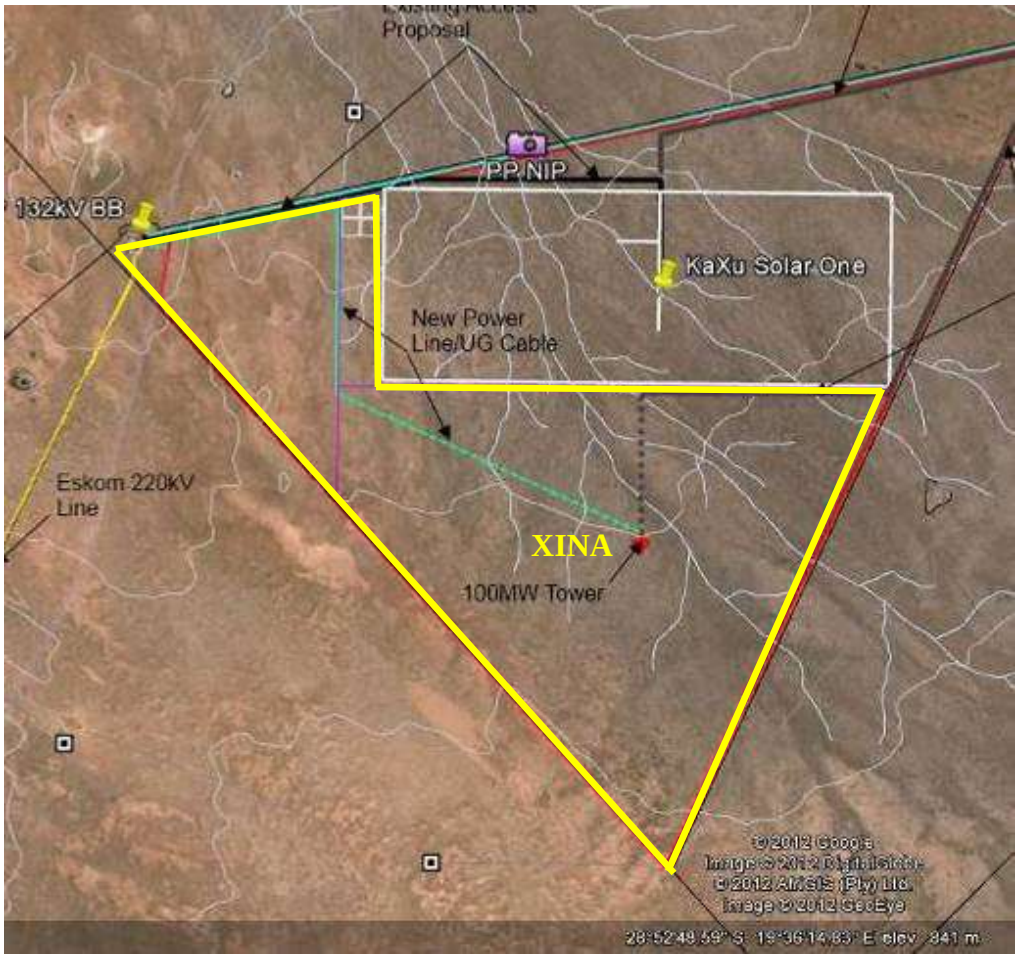
authorisation may be granted for the disturbance or alteration, or destruction of heritage resources.

2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

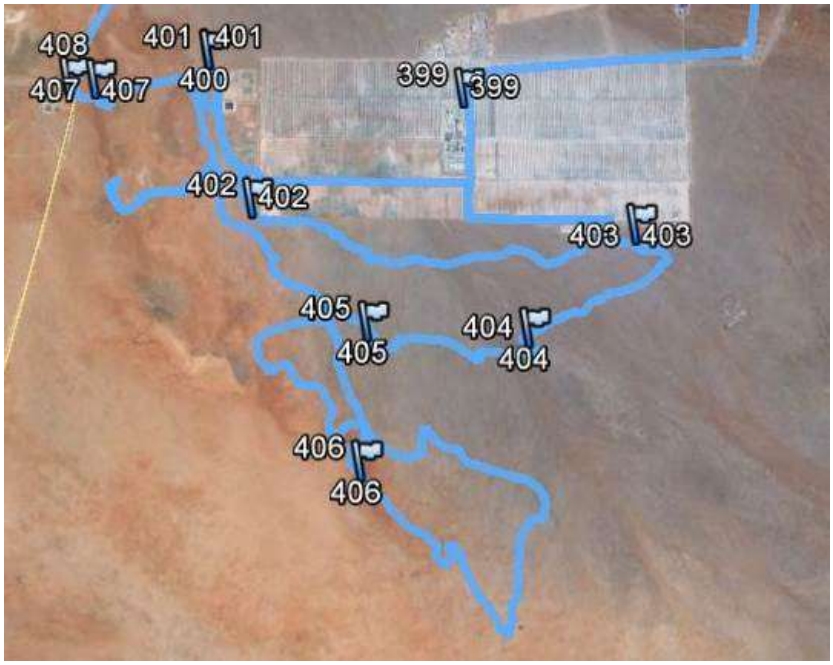
The environment in question is arid, comprising relatively flat drainage plains with mountainous features at the north western and north eastern regions of the identified site. The landscape is sparsely vegetated, therefore making any surface archaeological traces highly visible.

There are several outcropping rocky features in the north west and north east of the plain, but the only feature of note on the site of the proposed ~~Xina~~XiNa facility is a sand dune running down the south-western boundary.

Google Earth image of the overall terrain (north at top) in which physical landscape features mentioned are clearly visible.



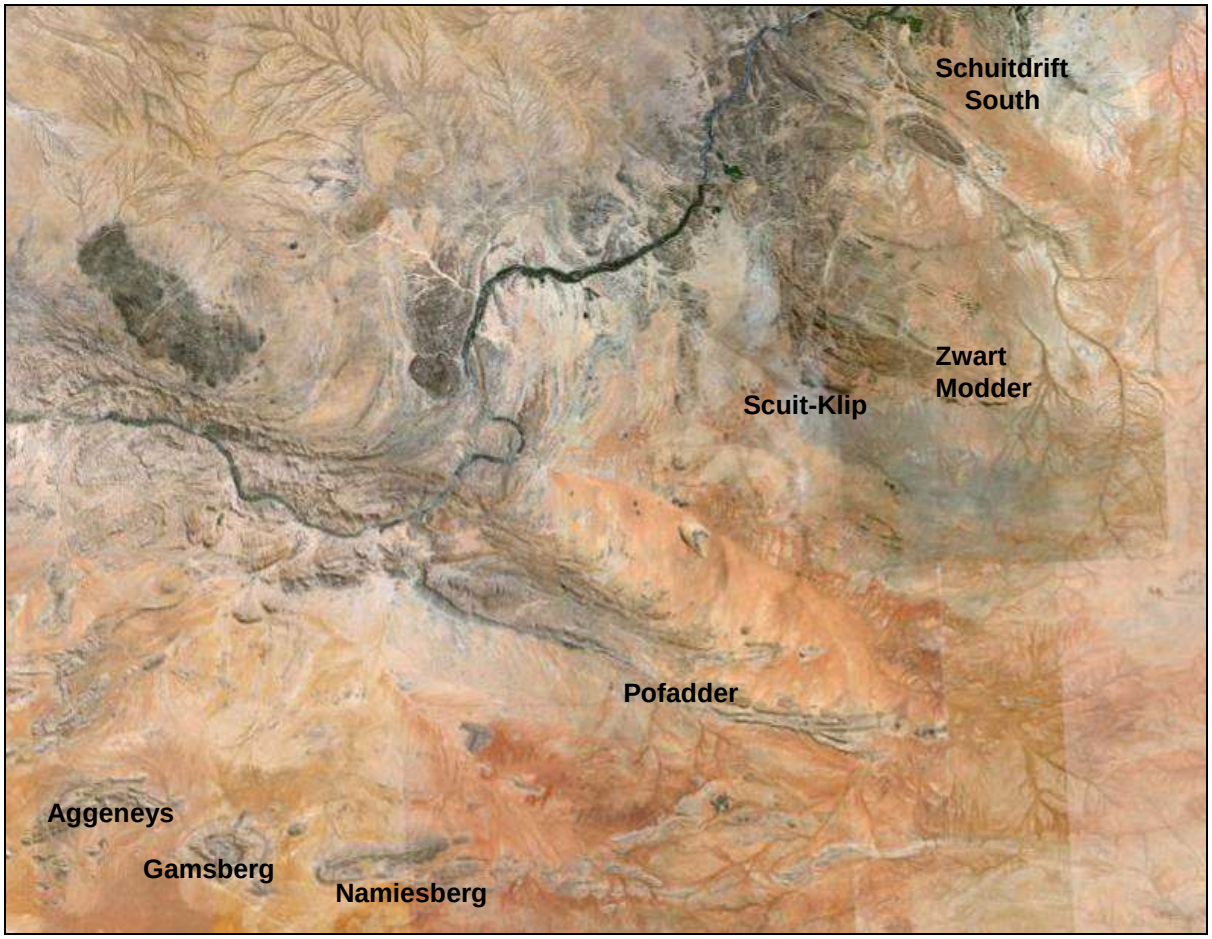
Area to be investigated (yellow outline, above) for the final ~~Xina~~XiNa solar field and ancillary infrastructure – with survey GPS track (below).



2.1 Description of heritage features of the region

2.1.1 Colonial frontier

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 now emerging concerning the history of genocide against the Bushmen in this area (Anthing 1863), with certain mountainous areas (like Gamsberg near Aggeneys) being likely massacre sites, referred to by Dunn in 1872 (Robinson 1978) and, more obliquely, by Anthing (1863; Jose Manuel de Prada-Samper pers. comm. 2009). Dunn refers to conflict at Zwart Modder, the farm adjoining Scuit-Klip, where he recorded an isolated grave of a member of the Northern Border Police, which has yet to be relocated. Immediately below the Ysterberg ridge, located on the Farm Scuit-Klip, there is a road-side twentieth century grave (Morris 1999a).



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 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 ~~which~~ provided clean sand for sleeping, or around the seasonal pans (Beaumont *el 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. Dunn, in 1872, refers to a place at Schuit Klip (i.e. Scuit-Klip) where water collected following rains and was still available after a year of no rain in the vicinity (Robinson 1978:60-61). At such times competition between groups over resources and stress within an already marginalised hunter-gatherer society, must have intensified.

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 or at the bases of hills. There is a roadside grave along one of the roads in the vicinity; however the area has not been investigated in its entirety.

2.2 Description and evaluation of environmental issues and potential impacts identified in the scoping phase

Heritage resources including archaeological sites are in each instance unique and non-renewable resources. Area and linear 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 are possible in the case of the ~~Xina~~XiNa Solar Thermal Plant itself; the proposed substation; the power lines, water supply lines and access roads would represent linear impacts. Potentially associated with roads are borrow pits (although none is indicated) which – in the event of their use – could have a major impact if heritage resources are present.

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.

With respect to the magnitude and extent of potential impacts, it has been noted that the erection of power lines would have a relatively small impact on Stone Age sites, in light of Sampson's (1985) observations during surveys beneath power lines

in the Karoo (actual modification of the landscape tends to be limited to the footprint of each pylon), whereas a road or a water supply pipeline would tend to be far more destructive (modification of the landscape surface would be within a continuous strip), albeit relatively limited in spatial extent, i.e. width (Sampson compares such destruction to the pulling out of a thread from an ancient tapestry). A water pipeline, if sourcing water at the river, could traverse more sensitive terrain, i.e. impacting a potentially greater density of archaeological sites.

3. METHODOLOGY

A site visit was necessary to inspect various parts of the terrain on foot, focusing on areas of expected impact (construction of plant, sub-station, and secondary infrastructure such as roads, pipelines and power lines). Heritage traces would be evaluated in terms of their archaeological significance (see tables below). A set of Scoping phase predictions were made which the study would test with observations made in the field.

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.

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.

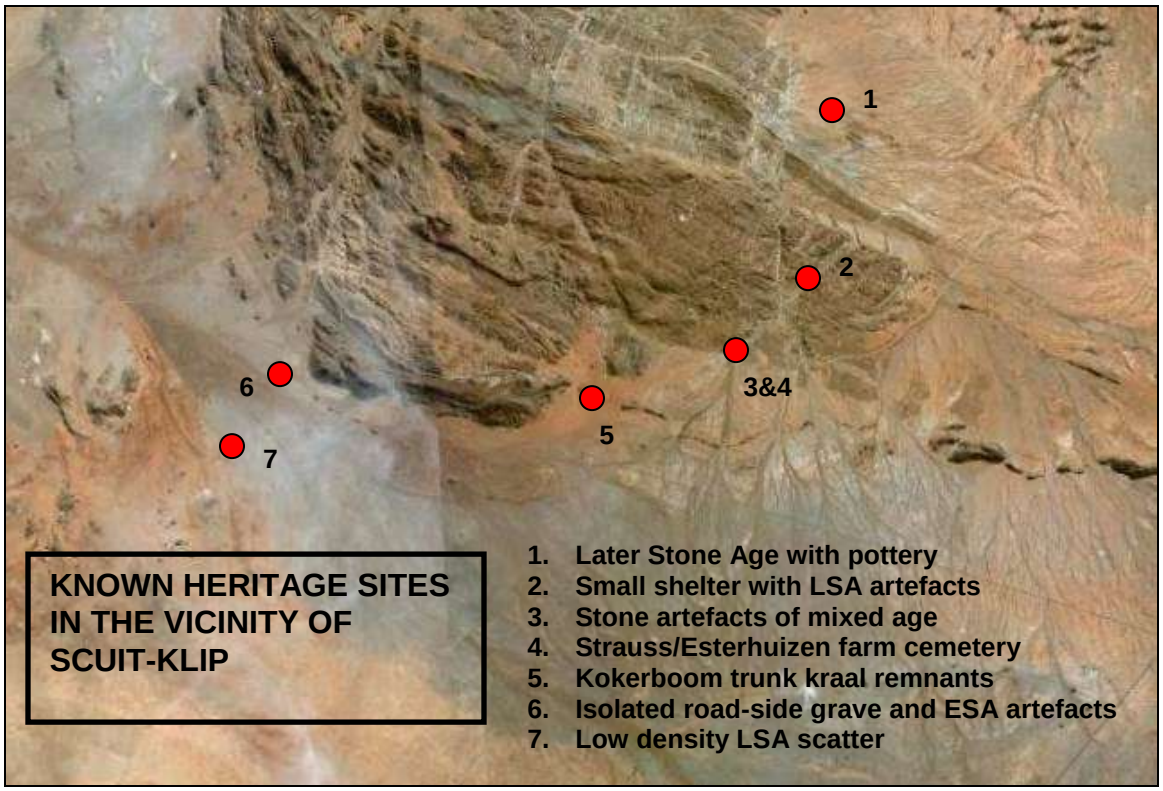
3.2 Scoping phase predictions

Previous findings in the area have indicated that terrain close to hills or rocky features, particularly sandy spots near sheltering rocks, may tend to have traces of precolonial Stone Age occupation/activity, while places in the open plains have been

found to have sparsely scattered artefacts (such as at Konkonsies near the Paulputs Substation site – Morris 1999a). An exception to this is where rocky outcrops at the surface on the plains provide places where water pools exist after rains, attracting people in the past who left traces such as artificial grinding grooves in the bedrock and other evidence such as stone artefacts and pottery.

The sand dunes along the south western part of the area may also have been a focus for past human occupation.

Colonial era sites or features in the surrounding area include road-side graves, a farm cemetery and farm homestead/kraal ruins. None were known in the study area.



» Based on previous experience in the area, the study area is likely *not* to be rich in archaeological traces of major significance.
» There appear to be none of the features such as hills or rocky features which in other parts of this landscape provide shelters with traces of precolonial Stone Age occupation/activity, though some material may occur on the dunes running along the south-western boundary.

» Nineteenth- and twentieth-century cultural history/farming infrastructure is not known to occur within the specific development footprint area; intangible heritage values attached to places at ~~I~~ the study area would be difficult to recover owing to the sparse population. It is not thought likely that any significant intangible heritage values would be attached to the particular terrain in question.

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 the Northern Cape Heritage Resources 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: of a road, a pipeline, erection of a pylon, or preparation of a site for a sub-station, or plant, or building, or any other *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.

Some of the activities indicated here have a generally lower impact than others. For example, Sampson (1985) has shown that powerlines tend to be less destructive on Stone Age sites than roads since access along the route of the line during construction and maintenance tends to be by way of a 'twee-spoor' temporary roadway (not scraped, the surface not significantly modified). Individual tower positions might be of high archaeological significance (e.g. a grave, or an engraving). The impact of a 'twee-spoor' could be far greater on Iron Age sites in other parts of South Africa, where stone walling might need to be breached.

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

Class	Landform	Type 1	Type 2	Type 3
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.

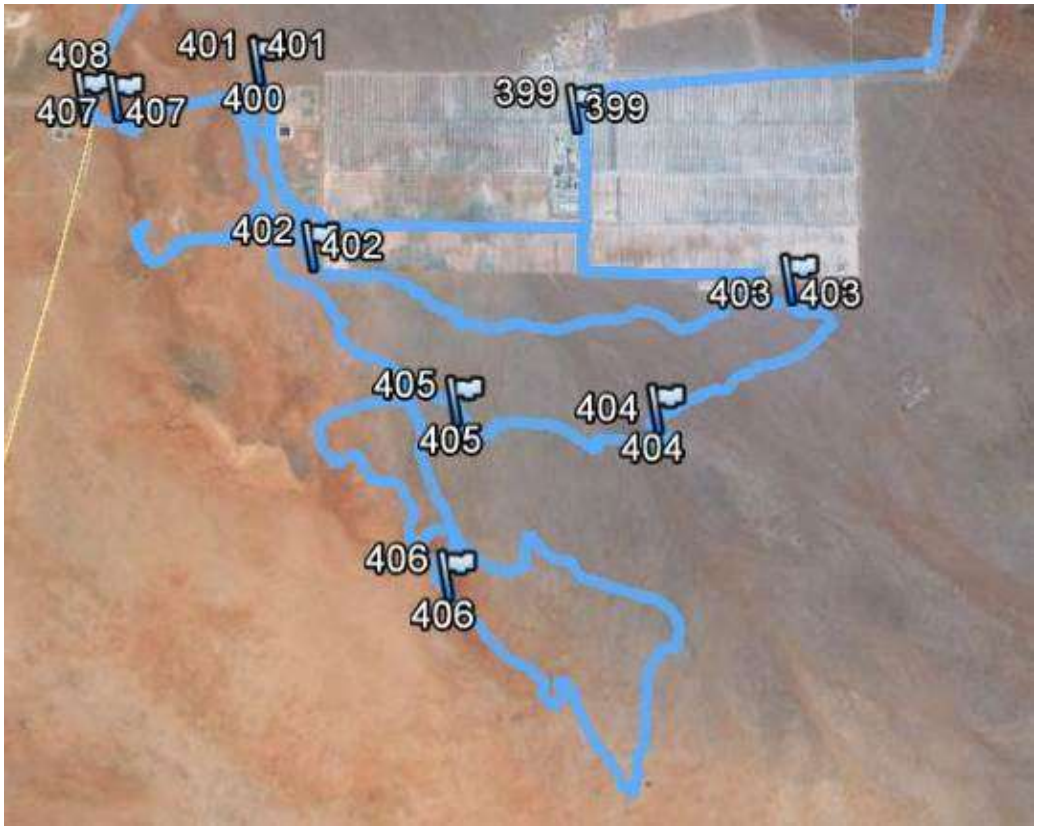
4.1 Fieldwork observations

The proposed development footprint area and ancillary infrastructure locales were visited on 14 February 2014. In summary the findings can be reported in relation to predictions made in the scoping report (see 3.2 above):

4.1.1 Richness of archaeological traces:

» *That the development footprint is likely not to be rich in archaeological traces of major significance, but that some material may occur on the dunes running along the south-western boundary.*

This was found to be the case. In fact almost all of the primary development footprint site was found to be entirely bereft of archaeological traces of any kind. Logged GPS survey points merely indicate where photographs of the landscape were taken rather than reflecting any positive archaeological observations.



The single exception (GPS point 407 in the above figure) was the location (28.87819°S 19.56782°E) of very sparse fragments of ostrich eggshell pieces taken to relate to Later Stone Age activity at the northern end of the sand

dune running along the western boundary of the development site. No stone artefacts were found.

Isolated fragments of ostrich eggshell (above) found on the dune (below) at 28.87819°S 19.56782°E

The following set of images indicate the landscape that was investigated, found to be singularly bereft of any archaeological traces along the survey path.

Terrain south of the KaXu development

View northwards towards the KaXu facility

View northwards from the southern-most extent of the proposed ~~Xina~~XiNa development

View from the dune eastwards across the proposed ~~Xina~~XiNa site.

4.1.2 Colonial era traces

» *That nineteenth- and twentieth-century cultural history/farming infrastructure is not known to occur within the specific development footprint area; and that significant intangible heritage values are not expected to be attached to the particular terrain in question.*

No colonial era heritage features were found.

4.1.3 Water Pipeline extension

In addition to the ancillary infrastructure development within the ~~Xina~~XiNa footprint, the route of the water pipeline from an extraction point at Onseepkans was investigated. It was found that the water pipeline had been installed within the road reserve between Paulputs and Onseepkans, in all instances within already disturbed terrain, where it is unlikely that any impact on in situ heritage traces if and where present would have occurred.

Pipeline route within the road servitude, subject to prior disturbance in road construction.

4.2 Characterising the archaeological significance (Refer to 3.4 above)

In terms of the significance matrices in Tables 1 and 2 under 3.4 above, all of the archaeological observations fall under Landforms L1 and L3 Type 1. In terms of archaeological traces they all fall under Class A3 Type 1. All of these ascriptions (Table 1) reflect poor contexts and likely low significance for these criteria.

For site attribute and value assessment (Table 2), all of the observations noted fall under Type 1 for Classes 1-7, again reflecting low significance, low potential and absence of contextual and key types of evidence.

On archaeological grounds the impacts would be of low significance.

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 (Jodas 2010):

- 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).

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

At the main development footprint of the proposed ~~Xina~~XiNa Solar Thermal Plant with ancillary infrastructure.

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	1
Duration	5	1
Magnitude	8	4

Probability	2	1
Significance	**28**	**6**
Status (positive or negative)		
Reversibility	No	No
Irreplaceable loss of resources?	Yes, if and where present – but occurrence is between zero and extremely low density, no or low significance.	Not regarded as necessary
Can impacts be mitigated?	Not considered necessary.	Not regarded as necessary
Mitigation: Mitigation Measures: Artefact densities are zero to extremely low over the development footprint and along the pipeline route. 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: -		

5. MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

OBJECTIVE: Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility.

Project component/s	Any road construction over and above what is necessary and any extension of other components addressed in this EIA.
Potential Impact	The potential impact if this objective is not met is that wider areas or extended linear developments may result in further destruction, damage, excavation, alteration, removal or collection of heritage objects from their current context on the site.
Activity/risk source	Activities which could impact on achieving this objective include deviation from the planned lay-out of road/s and infrastructure without taking heritage impacts into consideration.
Mitigation: Target/Objective	A facility environmental management plan that takes cognizance of heritage resources in the event of any future extensions of roads or other infrastructure. It is not regarded as necessary that any mitigation should take place for the areas identified for development.

Mitigation: Action/control	**Responsibility**	**Timeframe**

Provision for on-going heritage monitoring in a facility environmental management plan which also provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of development or operation. No Phase 2 (mitigation) regarded as necessary in terms of present development layout.	Environmental management provider with on-going monitoring role set up by the developer. -	Environmental management plan to be in place before commencement of development. -

Performance Indicator	Inclusion of further heritage impact consideration in any future extension of infrastructural elements. Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
Monitoring	Officials from relevant heritage authorities (National and Provincial) to be permitted to inspect the operation at any time in relation to the heritage component of the management plan.

6. CONCLUSIONS

Zero to very sparse heritage traces were found in the development footprint areas.

From an archaeological perspective the observed heritage resources either fall well outside of the proposed development footprint or are of no or low significance. Criteria used here for impact significance assessment rate the impacts as Low (even taking into consideration the fact that for heritage traces, unlike biological processes, impacts tend to be irreversible, of permanent duration and high magnitude).

No further assessment or mitigation for archaeological and cultural heritage traces is necessary for the study area surveyed.

References

Anthing, L. 1863. Letter to the Cape Parliament. Cape Blue Book.

Beaumont, P. B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Deacon, J. nd. Archaeological Impact Assessment - specialist input to planning and design. Unpublished notes compiled for the National Monuments Council.

Dunn, E. J. 1931. The Bushmen. London: Charles Griffin & Co.

Morris, D. 1999a. Archaeological impact assessment, 'Southern Option', powerline 'Schuitdrift' to 'Paulputs', Pofadder District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 1999b. Archaeological impact assessment, Skuitklipkop Microwave Tower, Kenhardt District, Northern Cape. Unpublished Report to Eskom.

Morris, D. 2000a. Gamsberg Zinc Project environmental impact assessment specialist report: archaeology.

Morris, D. 2000b. Archaeological impact assessment, Black Mountain Mine, Aggeneys, Northern Cape. Unpublished report to Walmsley Environmental Consultants.

Morris, D. 2000c. Archaeological specialist report: desktop assessment of possible archaeological resources along the proposed route, Helios to Aggeneis, Northern Cape. Appendix G in Eyethu Engineers CC: Scoping report: environmental impact assessment for the proposed Aggeneis to Helios 400 kV transmission line. Eskom Transmission Group.

Morris, D. 2001. Gamsberg Zinc: supplementary report on archaeological resources at Gamsberg. Unpublished report for Gamsberg Zinc Project.

Morris, D. 2010. Cultural Heritage Assessment: Gamsberg. Supplementary observations to a previous specialist report on archaeological resources. Unpublished report to SRK Consulting.

Morris, D. 2012. Pofadder Solar Thermal Facility KaXu Solar One: Specialist Input for the Environmental Impact Assessment Phase and Environmental Management Plan: Archaeology.

Morris, D. & Beaumont, P.B. 1991. !Nawabdanas: archaeological sites at Renosterkop, Kakamas District, Northern Cape. South African Archaeological Bulletin 46:115-124.

Penn, N. 2005. The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century. Athens, Ohio and Cape Town: Ohio University Press and Double Storey Books.

Prinsloo, H.P. 1998. Argeologiese omgewingsverslag: Pofadder en Aggeneys omgewing. For Klopfer Environmental Consultants.

Robinson, A.M.L. (ed) 1978. Selected articles from the Cape Monthly Magazine NS, 1870-1876. Cape Town: Van Riebeeck Series Second Series No 9.

Sampson, C. G. 1974. The Stone Age archaeology of South Africa. New York: Academic Press.

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Thompson, G. 1827. Travels and adventures in Southern Africa. Reprint, Cape Town: Africana Connoisseurs Press, 1962.

Whitelaw, G. 1997. Archaeological monuments in KwaZulu-Natal: a procedure for the identification of value. Natal Museum Journal of Humanities. 9:99-109.