McGregor Museum
Department of Archaeology

Heritage Impact Assessment of the proposed new power-line route south of the river to Kakamas, Northern Cape

David Morris
McGregor Museum, Kimberley
November 2011

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed hydropower station on the Orange River near Kakamas, Northern Cape

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4.2 The specialist appointed in terms of the Regulations_

I, **David Morris** , declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

[provided in PDF version: hard copy being posted]

Signature of the specialist:

McGregor Museum, Kimberley

Name of company (if applicable):

17 December 2010

Date:

Heritage Impact Assessment of the proposed new power-line route south of the river to Kakamas, Northern Cape

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November 2011

1. INTRODUCTION

Kakamas Hydro Electric Power (KHEP)1 (previously Mulilo Renewable Energy (Mulilo)) wishes to run a power-line to Kakamas running through terrain south of the river with two possible routes linking to the hydro-electric site at Neus island. (see **Figure 1**).

The McGregor Museum was approached by Aurecon South Africa (Ms Louise Corbett, tel 021-4812512, fax 0866673532, Louise.Corbett@af.aurecongroup.com) to conduct a heritage impact assessment which is provided in this report.

1.1. Focus and Content of Specialist Report: Heritage

The archaeology and heritage specialist study is focused along the route of the proposed power-line.

This specialist study is a stand-alone report (as per the National Heritage Resources Act) and incorporates the following information:

- Introduction, detailing the focus of the report and Terms of Reference (1.1-1.2) and introducing the author in terms of qualifications, accreditation and experience to undertake the study (1.3)
- Description of the affected environment (2) providing background to the development and its infrastructural components (2.1); background to the heritage features of the area (2.2); and defining environmental issues and potential impacts (2.3)
- Methodology (3) including an assessment of limitations (3.1); statement of expectations or predictions (3.2) and outline of EIA procedures including criteria for assessing archaeological significance (3.3).
- Observations and assessment of impacts (4), including field observations (4.1); characterizing archaeological significance (4.2); and characterizing the overall significance of impacts (4.3).
- Summary of Significance of Impacts is stated in tabular form (4.3.1).

[1] Note that KHEP has been established by Mulilo for this proposed project, hence the original application for the project was under the name of Mulilo.

- Measures for inclusion in a draft Environmental Management Plan for the development are set out in tabular form (5).
- Conclusions (6).

1.3 The author of this report

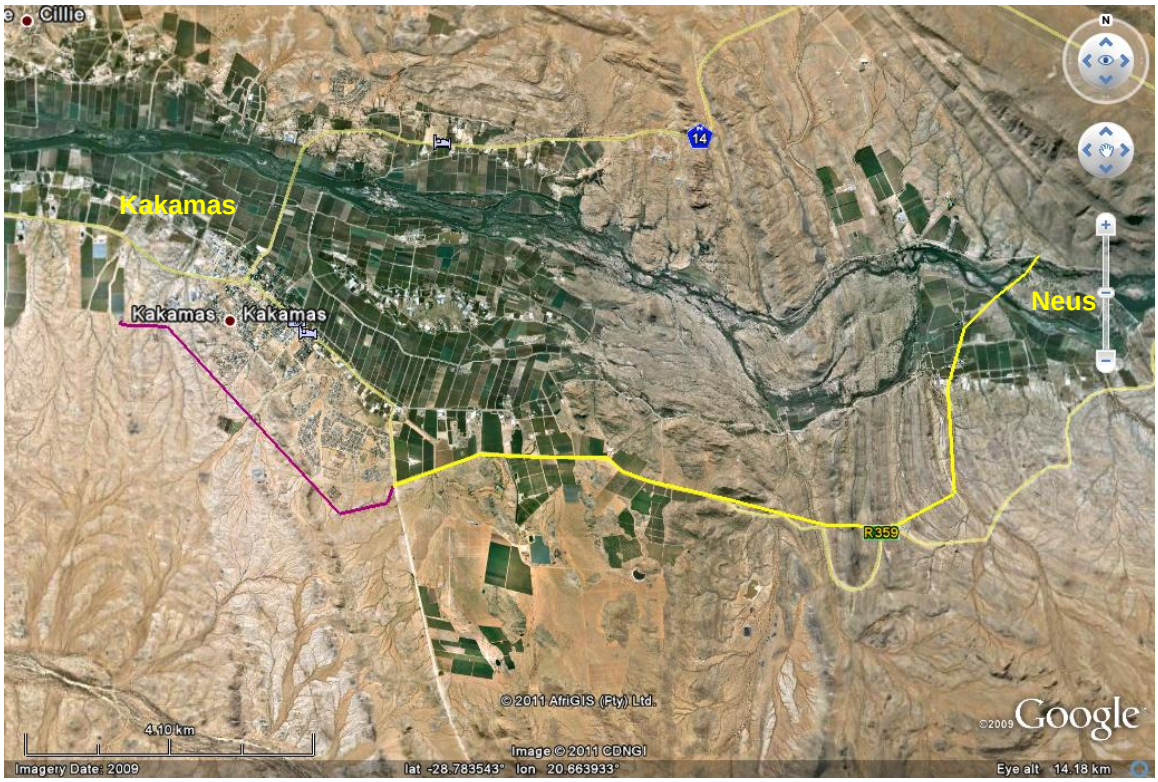
The author of this report is a qualified archaeologist (MA cum laude, PhD candidate, University of the Western Cape) accredited as a Principal Investigator by the Association of Southern African Professional Archaeologists. The author has worked as a museum archaeologist in the Northern Cape since 1985 and has since the late 1980s carried out surveys in the general area of Upington-Kakamas (Morris 2002, 2005, 2006; Morris & Beaumont 1991; Morris & Seliane 2006). In addition, the author has a comprehensive knowledge of Northern Cape history and built environment, and received recent UCT-accredited training at a workshop on Architectural and Urban Conservation: researching and assessing local (built) environments (S. Townsend, UCT). He is also Chairman of the Historical Society of Kimberley and the Northern Cape.

The author is independent of the organization commissioning this specialist input, and provides this Specialist Report 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 an intensively cultivated riverside setting alongside the Orange River south of Neus Island and mainly arid terrain to the south of the river between there and Kakamas to the west. The terrain away from the river is rocky with generally extremely sparse vegetation. Where archaeological materials might occur on the surface they would be highly visible. In a setting where erosion generally features much more strongly than deposition of sediment, there were very few places where it seemed possible that archaeological materials would occur below the surface.



The location of the proposed power-line route (maroon and yellow) between the Neus Island Hydropower Station site (east) and Kakamas (west).

2.1 Background to the development – description of proposed infrastructure

The proposed power-line would link the Neus Island hydropower station to the Eskom substation west of Kakamas.

Alternative connecting routes across the island and to the south bank of the river are proposed (figure 2), while the remainder of the line follows a single proposed route, mostly alongside an existing road to the vicinity of Kakamas, where it skirts along the southern and western fringes of the town.

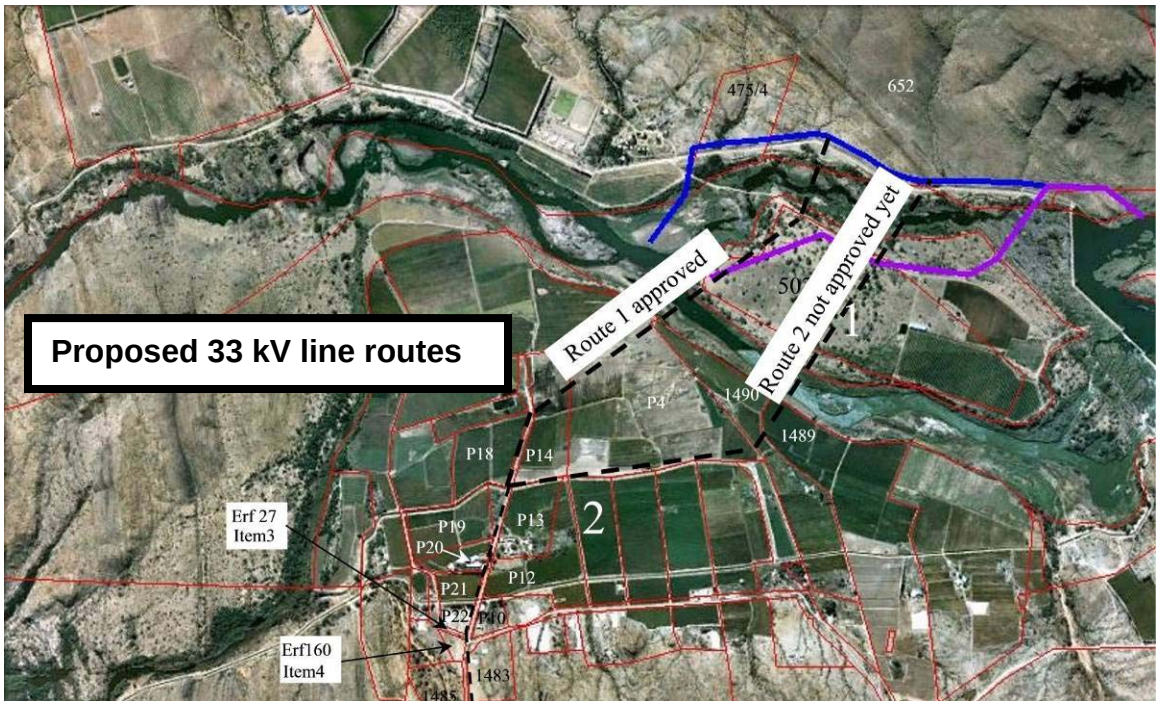


Figure 2. Alternative Routes 1 and 2 providing access south across and from the island at Neus.

2.2. Heritage features of the region

Apart from the survey carried out in 2010 for the Kakamas Hydroelectric project at Neus, no previous archaeological survey work had been carried out in the vicinity of Neus and westwards towards Kakamas. As in the 2010 report it can be suggested that:

2.2.1 Colonial frontier

The eighteenth- and nineteenth-century records for this region (Penn 2005) pertain mainly to the areas south of and along the Orange River. The travellers Wikar and Gordon followed the river as far as and beyond this region in the 1770s, describing communities living along the river (see Morris & Beaumont 1991 for a summary).

Gordon, in 1779, noted that the place was called *Garieb eib* (the Gariep ‘nose’). He noted the drop in gradient as the river flowed around the island. A group of Bushmen whose encampments were on the north bank of the river, some distance off according to his map, were known as *Khein eis* (= lean and thin people) (transcription of Gordon’s Journal by Fredi Pheiffer nd:41, cf, Mossop 1935). Where the river was rocky, these people would subsist by fishing. There is reference to trapping of hippos (presumably in pits) further downstream towards Kakamas. Gordon refers to the inhospitable terrain with hillocks strewn with irregular chunks of hard loose rocks and smaller sharp pieces so that “one walks

one's shoes through very quickly in this veld" (sharp bits of stone, enough to wear out shoes in no time (transcription of Gordon's Journal by Fredi Pheiffer nd:34).

Dunn and others describe the situation a century later (Robinson 1978). Frontiersmen such as the colourful Stephanos can be linked with particular places in the landscape – nearer to Keimoes (Morris 2002).

The region was caught up in the Koranna War of 1879-1880, while further military activity in the area included the risings of rebels during the Anglo-Boer War and again in January-February 1915 when there was also an incursion of German troops some of whom were killed in the area (Hopkins 1978:128-129).

One of the most significant historical watersheds for the particular vicinity under consideration was the establishment of the agricultural settlement at Kakamas in 1898. The irrigation scheme set up by this community included canal construction, beginning at the upper end of Neus Island (Hopkins 1978). The Kakamas settlement is also known for its pioneering development of a hydro-electric power generator, brought into operation in 1924 (Hopkins 1978). The building which housed the generator has been ear-marked as a museum.

2.2.2 Later Stone Age

Late Holocene Later Stone Age (LSA) sites are frequently noted in surveys south of and west of the region, including along the Orange River (e.g. Morris & Beaumont 1991; Beaumont et al. 1995). These are generally short-duration occupations by small groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003). In a range of hills north east of Keimoes, on Zovoorby, a rock shelter and specularite working (a sparkling mineral with known cosmetic and ritual use in the precolonial past) has been excavated (Smith 1995). LSA sites are usually focused on a particular feature in the landscape such as a hill or rocky outcrop and in relation to resources like water and associated habitats richer in animals and plant foods. Gordon's account of 1779 seems to suggest that particular locales were inhabited with inhospitable terrain separating such favoured spots.

2.2.3 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 glacial till. Similar occurrences have been noted north of Upington in situations where raw materials are abundant. Systematic collections of this material at Olyvenkolk south west of Kenhardt and Maans Pannen 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. 1995).

The ESA included Victoria West cores on dolerite and quartzite (a fine example has been found at Hondeblaf north of Upington), 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.

2.3 Description and evaluation of environmental issues and potential impacts

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 HIA would be to assess the sensitivity of such resources where present, to evaluate the significance of potential impacts on these resources and, if and where appropriate, to recommend no-go areas and measures to mitigate or manage said impacts.

In relation to the proposed power-line, linear impacts are expected.

2.3.1 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, particularly in the form of maintenance vehicles moving along the power-line. The Environmental Management Plan should seek to minimize the latter impacts as far as possible.

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). Power-line development could however have a more

substantial impact than suggested by Sampson for Stone Age sites if other kinds of heritage, e.g. structures, are present.

3. METHODOLOGY

A site visit was necessary to inspect various parts of the power-line route on foot, focusing on areas not previously impacted by intensive agriculture. Heritage traces would be evaluated in terms of their archaeological significance (see tables below). A set of 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 often 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).

Along most of the route of the proposed power-line erosion has been the predominant recent geological process, essentially leaving any archaeological traces at the surface and in poorly preserved contexts (in settings where deposits are sedimented, by contrast, archaeological material would tend to accumulate over time in separate strata, with greater chances for better preservation).

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, it is noted that local geology consists of unconsolidated Quaternary sediment overlying basement gneisses of the 1.1 billion year old Namaqualand Mobile Belt. Pending specialist input, it would seem unlikely that fossils would be preserved here.

3.2 Predictions

It may be predicted that:

The riverside/island environment may provide places where Stone Age settlement occurred, particularly in Later Stone Age times, but that deep river channels on either side may have rendered Neus Island less attractive. A survey along the river at Riemvasmaak suggested that river banks alongside deep channels may not have been as attractive as places with a shallower rocky river bed (opportunities for fording as well as activities such as fishing). Compare also

Gordon's 1779 remark that those living where the river is rocky, but not elsewhere, subsisted by fishing.

Away from the river between Neus and Kakamas the terrain is frequently inhospitable in terms of arid, rocky ground. Gordon encountered no encampments in these kinds of settings when moving through the area in October 1779.

3.3 Potentially significant impacts to be assessed in the HIA 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 Boŝwa 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: 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.

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 power-line 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. It has been noted with reference to Garth Sampson's (1985) finding that power-line construction generally has a low negative impact on Stone Age sites.

4.1 Fieldwork observations

The proposed power-line route was visited on 27-28 November 2011. In summary the findings can be reported in relation to predictions made in section 3.2 above:

4.1.1 Occurrence of Stone Age traces:

4.1.1.1 Findings on Neus Island

This feature site was surveyed in 2010, when not a single stone tool or other Stone Age trace was noted (as opposed to findings on the north bank). (See relevant report by Morris, 2010)

Gritty lag deposit horizons are exposed in a few places (above) – no artefacts present.

It was concluded that the island had not been an attractive locale for hunter-gatherer-fishers of the past. Parts of its circumference would not have been easy to access across deep high-energy river channels. Wikar refers to dangerous whirlpools in the vicinity (Mossop 1935:131).

It may yet be possible that some material could be encountered during construction and recommendations concerning accidental discovery should be adhered to (see section 5, below).

4.1.1.2 Findings on the north bank of the river

In striking contrast to the situation on the island, varying densities of stone artefacts were noted along the north bank of the river. These are described in a previous report. Some of the flakes have facetted butts suggesting a Middle Stone Age ascription for perhaps most of the material in question.

Parts of the north bank downstream from approximately where the causeway crosses the northern stream have been substantially transformed by agricultural activity and any erstwhile in situ heritage resources here are likely to have been disturbed long since.

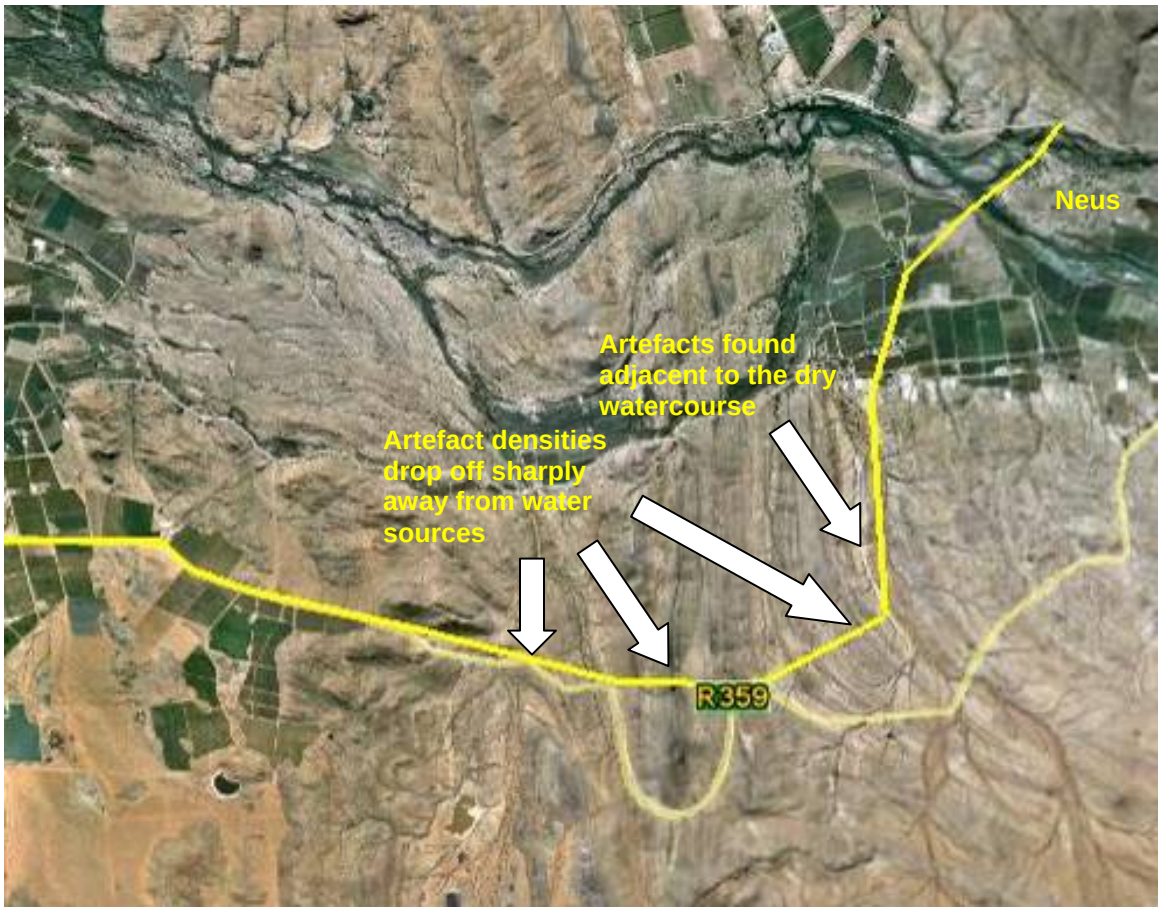
4.1.1.3 Findings on the south bank of the river

The south bank of the river here has been virtually entirely transformed by intensive agriculture, in vineyards and lands laid out on the broad plain and between canals which flow at different contours above the level of the river. Although Gordon referred to no settlement here, the plains may well have been a

focus for past human activity, the adjacent rocky terrain being a possible constraint. It is known that hippo hunting took place in such places along the river.

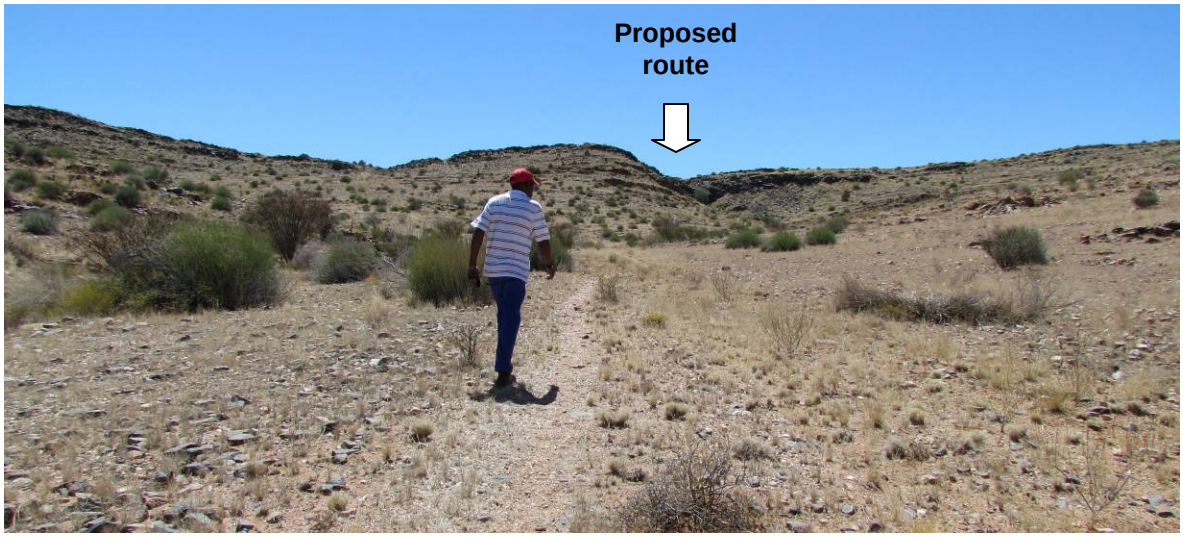
4.1.1.4 Findings along a dry watercourse.

About 1.5 km south west of the river crossing the route veers southwards up a dry watercourse which drains a local catchment before swinging westwards over hills towards Kakamas. Alongside the dry watercourse low densities of stone artefacts were noted, very similar to those observed on the north bank, i.e. predominantly Middle Stone Age, on jaspilite (banded ironstone), clearly made on cobbles sourced from the river gravels. Stone artefacts (photograph below) at 28.79607^{o} S, 20.71797^{o} E were present on the surface in poor depositional context, namely an erosion surface.



Westwards, between and over the hills artefact densities were found to drop off markedly.

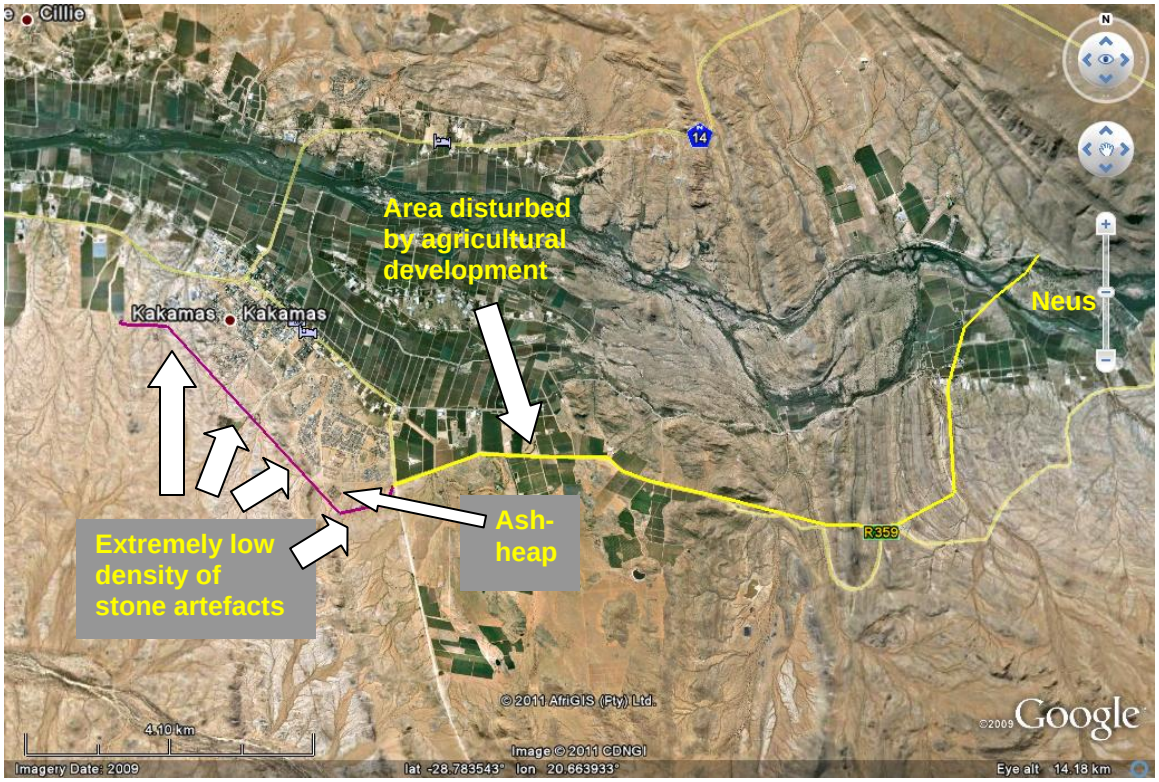
Up the slope and at the top of one of the higher ridges traversed by the proposed power-line (in the vicinity of 28.80043^{o} S, 20.70398^{o} E), virtually no stone tools were noted – save for a single jaspilite chunk flaked on one side (photo below).



Further westwards the line would run alongside the roadway and through cultivated lands. Disturbances in this section preclude in situ Stone Age material.

West of the Kakamas-Kenhardt road the line is planned to run briefly south-westwards, westwards to the south of the town of Kakamas, and finally north-westwards (to the west of the town) to the Eskom substation. Along this section of the proposed power-line the terrain is not as rocky as the hills nearer to De Neus, but it is generally lacking in unconsolidated top-soil and was found to have extremely low to zero occurrences of stone artefacts: where they do occur (e.g. at 28.79286^{o} S, 20.62141^{o} E, adjacent to a rocky feature – photo below) they are of the same type as those found near the eastern end of the line, probably all Middle Stone Age (facetted platforms) and mainly on jaspilite. A few flaked quartz pieces were found at this locale. The low archaeological visibility here, on an eroding surface, is taken to relate to a combination of inhospitable geological and arid climatic circumstances and proximity to the river which in the late 1770s, when Wikar and Gordon traveled through the area, was the main focus and conduit of human activity including hippo hunting and fishing.

Approach to the substation: stony, sparsely vegetated and extremely low to zero incidence of stone artefacts.



4.1.2 Colonial era traces

At no point along the proposed route of the power-line were any major features of the colonial era located. Old road alignments were noted through the hills and in one instance this is used as a contemporary footpath despite a rusted sign indicating “Geen toegang” – no entry.

No feature similar to the Noordvoor that was noted on the north bank of the river at De Neus was found in the path of the proposed power-line.

A twentieth century ash-heap was noted at 28.79741^{o} S, 20.62850^{o} E, associated with stock pens south west of the town of Kakamas, clear of the route of the line.

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, most of the archaeological observations fall under Landform L1, L2 or L3, mostly Type 1, i.e. of generally low or very low potential. In terms of archaeological traces they all fall under Class A3 Type 1. These ascriptions (Table 1) reflect low potential for these criteria.

For site attribute and value assessment (Table 2), the observations may be characterised as:

Stone Age remains – based on Table 2 above

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

On archaeological/heritage grounds, therefore, the Stone Age occurrences, extremely sparse, can be said to be (where they occur at all) of low significance, while for colonial era traces nothing noteworthy was found.

4.3 Characterising the significance of impacts

The criteria on which significance of impacts is based include **nature**, **extent**, **duration**, **magnitude** and **probability of occurrence**, with quantification of significance being grounded and calculated as follows:

- The **nature**, namely a description of what causes the effect, what will be affected, and how it will be affected.

- The **extent**, indicating the geographic distribution of the impact:
    - 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;
    - impact is regional – assigned a score of 3;
    - impact is national – assigned a score of 4; or
    - impact across international borders – assigned a score of 5.

- The **duration**, measuring the lifetime of the impact:
    - very short duration (0–1 years) – assigned a score of 1;
    - 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:
    - 0 is small and will have no affect on the environment;
    - 2 is minor and will not result in an impact on environmental processes;
    - 4 is low and will cause a slight impact on environmental processes;
    - 6 is moderate and will result in environmental processes continuing but in a modified way;
    - 8 is high (environmental 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 environmental processes.

- The **probability of occurrence**, indicating the likelihood of the impact actually occurring (scale of 1-5)
    - 1 is highly improbable (probably will not happen);
    - 2 is improbable (some possibility, but low likelihood);
    - 3 is probable (distinct possibility);

- 4 is highly probable (most likely); and
- 5 is definite (impact will occur regardless of any prevention measures).

- The **significance**, determined by a synthesis of the characteristics described above and expressed as low, medium or high. Significance is determined by the following formula:
  S= (E+D+M) P; where S = Significance weighting; E = Extent; D = Duration; M = Magnitude; P = Probability.

- The **status**, either positive, negative or neutral, reflecting:
  - 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 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 SUMMARY OF THE SIGNIFICANCE OF IMPACTS

The Table below indicates the Significance of Impacts, with and without mitigation – based on the worst case scenario.

This Table is for the site as a whole, i.e. development footprint of the proposed Hydropower Station together with ancillary infrastructure. A break-down of component impacts is indicated in the Table.

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 or other heritage material or object (what affected).

Anticipated impact of the distribution lines:
Generally, it is noted, power-line development has had a limited impact on

Stone Age sites – except where towers/poles are positioned on particular features such as burials.		
	Without mitigation	**With mitigation**
Extent	1	Not needed
Duration	5	Not needed
Magnitude	4	Not needed
Probability	2	Not needed
Significance	**20**	
Status (positive or negative)	WEAKLY NEGATIVE	
Reversibility	No	
Irreplaceable loss of resources?	Very low density and significance.	Loss of context but possible to mitigate.
Can impacts be mitigated?	Not needed	
Mitigation: Not needed.		
Cumulative impacts: Cumulative Impacts: where any archaeological contexts occur, direct impacts are once-off permanent destructive events. Secondary cumulative impacts may occur with the increase in development and operational activity associated with the life of the proposed hydropower station and the distribution line from it.		
Residual Impacts: -		

5. MEASURES FOR INCLUSION IN THE DRAFT ENVIRONMENTAL MANAGEMENT PLAN

The 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 is to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term operational life of the facility.

Project component/s	Any road or other infrastructure construction over and above what is outlined in respect of the proposed power-line route.
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 (minimal as they are) from their current context along the route.
Activity/risk source	Activities which could impact on achieving this objective include deviation from the planned route of the line 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 infrastructure. Mitigation based on present parameters is not considered to be necessary.

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.	Environmental management provider with on-going monitoring role set up by the developer for the line construction period primarily and for any instance of periodic or on-going land surface modification thereafter.	Environmental management plan to be in place before commencement of development.
Should unexpected finds be made (e.g. precolonial burials - not necessarily marked and potentially at some depth below the modern surface, e.g. near the river; ostrich eggshell container cache; or localised Stone Age sites with stone tools, pottery and possibly organic remains such as fish bones), the relevant Heritage Authority should be contacted.	Environmental Control Officer should become acquainted at a basic level with the kinds of heritage resources potentially occurring in the area and should report to the Heritage Authority as needed (see next column).	In the event of finding any of the features mentioned in column 1, reporting by the developer to relevant heritage authority should be immediate. Contact: SAHRA Ms C. Scheermeyer or Ms M. Galimberti, 021-4624502 or Bošwa ya Kapa Bokone Mr Andrew Timothy 053-8312537/8074700.

Performance	Inclusion of further heritage impact consideration in any future

Indicator	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

Precolonial/Stone Age material noted along the route of the proposed power-line was found to be of low significance, where present at all.

No significant colonial era structures were found along the specific route proposed.

Criteria used here for impact significance assessment rate the impacts as not worthy of further mitigation. The potential impacts on heritage material was considered to be acceptable, provided that relevant authorities are contacted immediately in the event that any additional feature is located during construction and operation phases.

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