

**Heritage scoping assessment for
THE PROPOSEDARIES-HELIOS 765KV TRANSMISSION POWER LINE AND
SUBSTATIONS UPGRADE, NORTHERN CAPE PROVINCE**

**HERITAGE SCOPING ASSESSMENT FOR THE PROPOSED ARIES-
HELIOS 765KV TRANSMISSION POWER LINE AND SUBSTATIONS UPGRADE,
NORTHERN CAPE PROVINCE**

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Declaration:

I, J.A. van Schalkwyk, declare that I do not have any financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services.



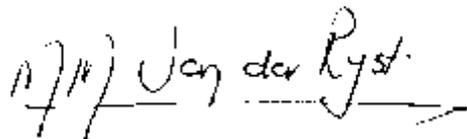
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EXECUTIVE SUMMARY

HERITAGE SCOPING ASSESSMENT FOR THE PROPOSED ARIES-HELIOS 765KV TRANSMISSION POWER LINE AND SUBSTATIONS UPGRADE, NORTHERN CAPE PROVINCE

Eskom Holding SOC Limited proposes to construct a 765kV transmission power line for the "Proposed Northern Alignment 765kV Power Line Project". A section of this line is to run from the existing Aries Substation southwest of the town of Kenhardt to the Helios Substation north of the town of Loeriesfontein in the Northern Cape Province. The total length of the power line would be approximately 165km. For this purpose three alternative alignments have been identified, one of which will be selected as the most viable proposition.

Power lines on the scale required for a project such as this put particular constraints on heritage resources. It is anticipated that overall the impact of the development would largely be indirect, as it might only pass over or in close proximity of a heritage site or feature. The impact therefore would largely be visual. In other cases the impact will be direct as it would focus on a particular node, i.e. tower positions or access/ inspection roads. This would give rise to the physical disturbance of the material and its context.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by **Mokgope Consulting** on behalf of the applicant, Eskom, to conduct a Heritage Scoping Assessment to determine if there are any fatal flaws that would prevent the proposed development from taking place in any of the three corridors where it is proposed to develop the electricity transmission line.

The cultural landscape qualities of the region essentially consist of a two components. The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age) occupation and a much later colonial (farmer) component. This rural landscape has always been sparsely populated. The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less.

The following heritage sites were identified in the larger region:

- Pre-colonial archaeological sites dating to the Stone Age have been identified to occur in the region of study area. In most known cases the impact of the development would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.
- Colonial period or historic period heritage manifest in a wide variety – farmsteads, infrastructure and cemeteries. As the power line is to cross a rural landscape for the most part, the impact would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.

As an initial evaluation of the three route alternatives, it can be concluded that the impact of the proposed development on sites, features or objects of cultural heritage would be low. The reason is that cultural heritage sites are distributed sparsely in the region. Secondly, power lines usually have less of an impact than for example mining developments.

It is our opinion that from a heritage point of view there are no fatal flaws that would prevent the proposed development from taking place in any of the corridors. However, having said that, it must be remembered that heritage sites are not only fixed features in the environment, occurring within specific spatial confines, but they are also finite in number. Avoiding of impacts on sites is therefore the preferred form of mitigation. In areas where a high density of sites occurs, if at all possible, exclusion zones where no development is to take place, should be set aside. If that is not possible, mitigation can only be achieved through archaeological investigation.

As the exact coordinates for the power line and the individual tower structures are not yet available, it is difficult to determine what the final impact of the proposed development would be. Therefore, for the project to continue, we propose the following:

- Mitigation should be based on avoiding of sites rather than anything else. In order to achieve this, a full “walk down” of the selected corridor must be done prior to construction taking place, to document all sites, features and objects, in order to propose adjustments to the routes and thereby to avoid as many impacts as possible.
- In addition, the management measures, as set out in Section 7 of this report should be implemented prior to construction taking place.
- No impact on heritage sites, features or objects can be allowed without a valid permit from SAHRA.



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Heritage Consultant
June 2013

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GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Study area: Refers to the entire study area as indicated by the client in the accompanying Fig. 1 & 2.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 000 000 - 150 000 Before Present
Middle Stone Age	150 000 - 30 000 BP
Late Stone Age	30 000 - until c. AD 200

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Late Iron Age	AD 1300 - AD 1830

Historical Period: Since the arrival of the white settlers - c. AD 1840 - in this part of the country

ABBREVIATIONS

ADRC	Archaeological Data Recording Centre
ASAPA	Association of Southern African Professional Archaeologists
BP	Before Present
CS-G	Chief Surveyor-General
EIA	Early Iron Age
ESA	Early Stone Age
LIA	Late Iron Age
LSA	Later Stone Age
HIA	Heritage Impact Assessment
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency

HERITAGE SCOPING ASSESSMENT FOR THE PROPOSED ARIES-HELIOS 765KV TRANSMISSION POWER LINE AND SUBSTATIONS UPGRADE, NORTHERN CAPE PROVINCE

1. INTRODUCTION

Eskom Holding SOC Limited proposes to construct a 765kV transmission power line for the "Proposed Northern Alignment 765kV Power Line Project". A section of this line is to run from the existing Aries Substation southwest of the town of Kenhardt to the Helios Substation north of the town of Loeriesfontein in the Northern Cape Province. The total length of the power line would be approximately 165km. For this purpose three alternative alignments have been identified, one of which will be selected as the most viable proposition.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such sites.

Power lines on the scale required for a project such as this put particular constraints on heritage resources. It is anticipated that overall the impact of the development would largely be indirect, as it might only pass over or in close proximity of a heritage site or feature. The impact therefore would largely be visual. In other cases the impact will be direct as it would focus on a particular node, i.e. tower positions or access/ inspection roads. This would give rise to the physical disturbance of the material and its context.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by **Mokgope Consulting** on behalf of the applicant, Eskom, to conduct a Heritage Scoping Assessment to determine if there are any fatal flaws that would prevent the proposed development from taking place in any of the three corridors where it is proposed to develop the electricity transmission line.

2. TERMS OF REFERENCE

2.1 Scope of work

The aim of this scoping assessment, broadly speaking, is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where it is planned to develop the transmission line that could be considered as a fatal flaw which would lead to a specific alternative to be eliminated from further investigation.

The scope of work for this study consisted of:

- Conducting of a desk-top investigation of the area, in which available literature, reports, databases and maps were studied.
- A visit to the proposed development area.

The objectives were to

- Identify possible archaeological, cultural and historic sites within the proposed development area;

- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.

2.2 Limitations

The investigation has been influenced by the following factors:

- Large sections of the study area have not yet been subjected to systematic archaeological surveys, creating huge gaps in available knowledge. Furthermore, most information that was generated in specific areas is based on impact assessments done for the purpose of development projects of some sort. It therefore covered these regions only selectively.
- During the field survey, access to the various properties was not possible.
- During the field survey the coordinates for the individual pole structures were not available.
- In some cases the proposed power line will have a visual impact, i.e. an indirect impact, on heritage sites. This is not addressed in this report as a separate report will be dealing with visual impacts.
- The unpredictability of buried archaeological remains.

3. HERITAGE RESOURCES

3.1 The National Estate

The NHRA (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
 - ancestral graves;
 - royal graves and graves of traditional leaders;
 - graves of victims of conflict;
 - graves of individuals designated by the Minister by notice in the Gazette;
 - historical graves and cemeteries; and
 - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
 - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - objects to which oral traditions are attached or which are associated with living heritage;
 - ethnographic art and objects;
 - military objects;

- objects of decorative or fine art;
- objects of scientific or technological interest; and
- books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that “cultural significance” means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

- its importance in the community, or pattern of South Africa’s history;
- its possession of uncommon, rare or endangered aspects of South Africa’s natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa’s natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix was developed whereby the above criteria were applied for the determination of the significance of each identified site (see Appendix 1). This allowed some form of control over the application of similar values for similar sites.

4. STUDY APPROACH AND METHODOLOGY

4.1 Extent of the Study

This survey and impact assessment covers the area as presented in Section 5 and as illustrated in Figures 1 & 2.

4.2 Methodology

4.2.1 Preliminary investigation

4.2.1.1 Survey of the literature

A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological, historical sources and heritage impact assessment reports were consulted – see list of reference below.

- Information on events, sites and features in the larger region were obtained from these sources.

4.2.1.2 Data bases

The *Heritage Atlas Database*, the *Environmental Potential Atlas*, the *Chief Surveyor General (CS-G)* and the *National Archives of South Africa (NASA)* were consulted.

- Database surveys produced a number of sites located in the larger region of the proposed development.

4.2.1.3 Other sources

Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature was obtained from these sources.

4.2.2 Field survey

The site visit involved only a cursory overview of the region by accessing the proposed alternative routes by means of existing roads. This took place over a period of five days in May 2013.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 Site location and description

Eskom proposes to construct a 765kV transmission power line for the "Proposed Northern Alignment 765kV Power Line Project". A section of this line is to run from the existing Aries Substation southwest of the town of Kenhardt to the Helios Substation north of the town of Loeriesfontein in the Northern Cape Province. The total length of the power line would be approximately 165km. For this purpose three alternative alignments have been identified, one of which will be selected as the most viable proposition.

The geology of the region is largely sedimentary in nature, being made up of sand, limestone, clay, dune sand, calcrete and silcrete, except in the southern part where it is mostly shale with some dolerite intrusions.

The region is very arid, although the ample rain of the past season shows that could have been a very attractive area for human settlement for shorter periods in the past. This is for example confirmed by the presence of threshing floors identified at some farmsteads, indicating the production of grain. Almost all the open water is located in pans, most of which is salty and therefore unusable to humans as well as animals.

The corridors pass through three vegetation zones: Bushmanland Sandy Grassland, Bushmanland Arid Grassland and Bushmanland Basin Shrubland.

The topography is classified as flat to gently rolling plains. As a result of the above environmental factors the following aspects can be seen to dominate in the environment

- Plains which make up the largest section of the study area. Water sources and potential shelter is limited.
- Some areas are covered with red dunes, probably aeolian in origin. Pans occur in between the dunes, making occupation possible

- Small hills and outcrops of dolerite occur in the southern section of the study area. These hills afford some potential for shelter.
- Pans and vleis occur sporadically all over. If water is fresh, occupation is possible.

This is a rural landscape where sheep farming dominates. For large sections of the region even this is not a permanent type of settlement, as many farmers move their live-stock to different regions (Loeriesfontein) for a couple of months (July to December) every year. It was only with the drilling of bore holes that the possibility of permanent settlement became a reality.

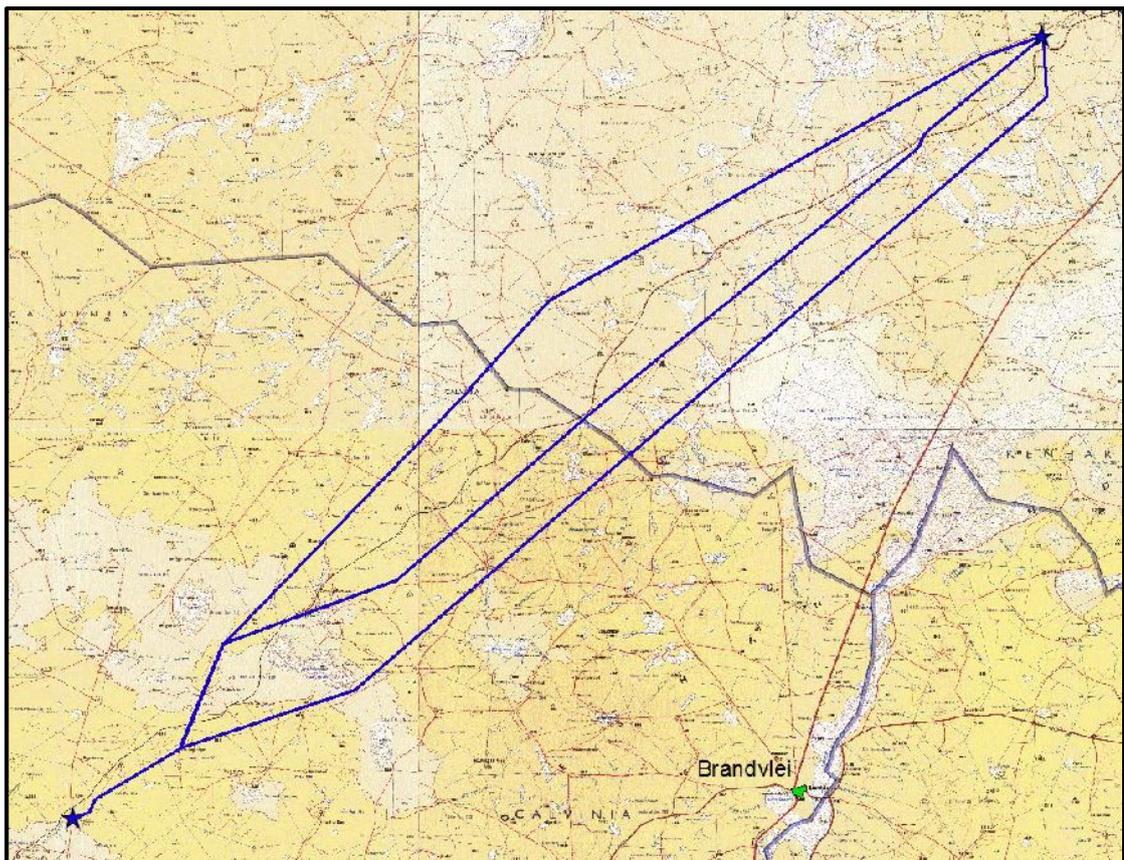


Fig. 1. Location of the study area in regional context.
(Topocadastral maps: Chief Surveyor-General)

5.2 Regional overview

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representivity – see Section 3.2 and Appendix 1 for more information.

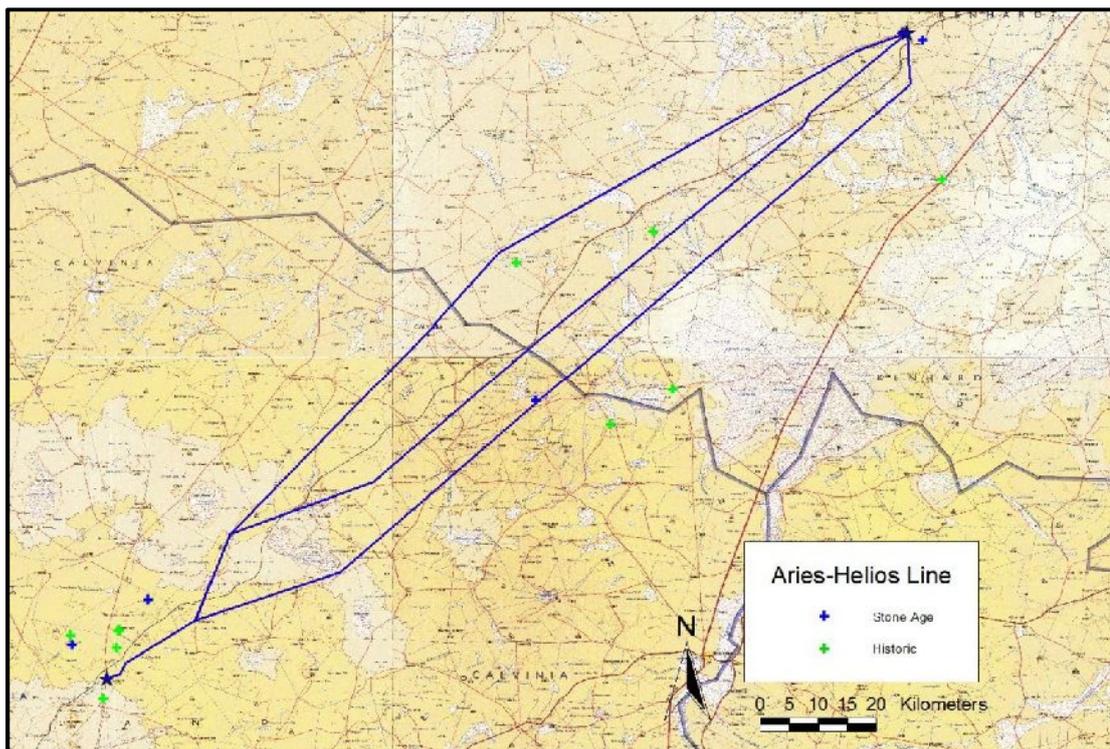


Fig. 2. Map showing the location of identified heritage site in the study area. (Corridor 1 = bottom; corridor 2 = middle; corridor 3 = top)

Archaeological context for the Stone Age of the Northern Cape, Bushmanland and Namaqualand

The Northern Cape and Namaqualand, that includes the area known as Bushmanland, are arid regions with limited sources of surface water (Mitchell 2002). The territory occupied by Bushmanland broadly lies south of the Orange/Gariep River stretching to the west of Kenhard and east of Springbok in Namaqualand. A widespread presence of hunting-gathering and herder groups within these regions has been documented by early travellers with the data often applied to identify historical territorial ranges (Burchell 1812; Campbell 1815, 1822; Stow 1872, 1910; Bleek & Lloyd 1911; Mossop 1935; Engelbrecht 1936; Arbousset & Daumas 1968; Lye 1975; Dunn 1978; Deacon 1996).

A remarkably large number of archaeological sites have been recorded, researched and published through archaeological impact (AIA) and heritage assessments undertaken in the Northern Cape and Namaqualand regions. Earlier (ESA) and Middle Stone Age (MSA) lithics occur over most of the surface area with a more recent presence of Later Stone Age (LSA) occupations (Beaumont et al. 1995). The region in general contains very numerous small shallow pans, also known as dolines, of 100 to 200 m in diameter but also many larger pans. Areas around pan environments tend to display higher densities of lithics (Morris 2005b; van der Ryst & Küsel 2011, 2012).

Stone circles have also been recorded in this area. These features may represent residential structures being the bases of huts or windbreaks, storage structures, stock enclosures or hunting blinds (Kinahan 1986; Noli & Avery 1987; Parsons 2004; Jacobson 2005; Veldman 2008; Orton 2012a-c). Stone circles in Namibia date to the last 800 years (Veldman 2008). These low structures are not well studied but some research has been undertaken further east along the Orange River (Sampson 1968), in the Seacow Valley in the eastern Karoo (Sampson 1986), at Bloubos northwest of Upington (Parsons 2004) and in Namibia

(Veldman 2008). Stone circles have recently also been discovered at De Aar in the central Karoo (Orton 2011c).

Parsons (2003, 2004, 2007, 2008; Lombard & Parsons 2008) used lithic raw material, tool types and non-lithic material culture to assign assemblages from late-Holocene open-air and several shelter sites in the Northern Cape to hunting-gathering or pastoral herding groups. The distinction is, however, not so clear-cut (Orton 2002/3; Sadr 2003; Mitchell & Whitelaw 2005). The hunter-gatherer assemblages termed Swartkop contain grass-tempered ceramics (Beaumont & Vogel 1989; Parsons 2007) and are dominated by hornfels, but with the use of quartz for some lithics. Blades are said to be integral to the Swartkop, with high frequencies of backed blades (Parsons 2007, 2008). Two earlier pulses of occupation are associated with the Springbokoog Industry. Earlier assemblages have proportionally more blades and fewer potsherds (Beaumont & Vogel 1989; Parsons 2007). Nearby sites with engravings such as at Jagt Pan and neighbouring engraved localities are often situated close to water sources. The Doornfontein herder sites are marked by ceramics (sometimes with lugs and spouts). Differences in the geographical spread indicate a preference for the pastoral Doornfontein sites along rivers while Swartkop sites are usually found further from the river (Fauvelle-Aymar 2004; Orton 2012a). This apparent patterning for hunter-gatherer versus herder localities is substantiated by Beaumont et al. (1995). They noted that most of the recorded LSA localities in Bushmanland were ephemeral occupations by small groups 'in the hinterland on both sides of the [Orange] river' (1995:263 as quoted by Morris 2013a).

Pastoralist communities that herded sheep, goat and cattle and speaking Khoe languages were well-established in these regions (Mitchell & Whitelaw 2005). Substantial herder encampments occur along the Orange River floodplain (Morris 2013a). Hendrik Jacob Wikar during his travels in 1778 recorded the names of the Cape-Gariep herder groups who had settlements on both sides of the river (Mossop 1935). Morris and Beaumont (1991) excavated sites at Renosterkop east of Augrabies where they found a herder signature in the more recent occupation levels. Wikar on his visit in 1778/9 gave an account of an island across Renosterkop known as !Nawabdanas, also shown on his map, that was occupied by the †Nam-//neikwa or Karos-wearers (Mossop 1935: 122-123, 227; Morris & Beaumont (1991). Robert Jacob Gordon on his travels also visited this locality in 1779 (Cullinan 1992). Based on linguistic evidence Ehret (2008) estimates the spread of early Khoekhoe populations east into northern South Africa and south to the Gariep-Vaal confluence at around 2000 years ago or somewhat earlier. Four styles are recognized in the distinctive herder ceramics, and these also serve as rough chronological markers (Sampson 2010). Differences in herder ceramics and the fibre-temper bowls of hunter-herders assist in the identification of a herder or hunting-gathering presence at late Holocene archaeological localities.

One of the best-known sites in the region is the Wonderwerk Cave in the Kuruman Hills. The cave extends horizontally for 139 m and was formed by an ancient solution cavity in the dolomite formation (Beaumont 1990c). The lithic succession at Wonderwerk serves as a benchmark for the Stone Age sequence of the Northern Cape. It comprises an uppermost LSA sequence that contains Ceramic LSA, Wilton and Oakhurst (Humphreys & Thackeray 1983). Some of the cave deposit has been removed by guano diggers, which destroyed several important archaeological levels. The MSA levels that were still intact yielded blades and unifacial MSA points. The ESA sequence contains the usual large cutting tools and includes a transitional Fauresmith assemblage with blades, large scrapers and radially-prepared cores.

Excavations since the 1940s, which became more focussed as from 1976 to 1993, revealed a stratified series of deposits that accumulated up to a depth of about seven metres and are divided into nine Major Units (Beaumont & Vogel 2006). The application of a range of dating methods points to a complex cultural succession. Dates for the following cultural stages have been established at Wonderwerk: an LSA at 1-12.5 kyr (kyr = thousand years ago), the MSA at around ~70 to >220 kyr, the Fauresmith to ~270-500 kyr and an ephemeral Acheulean at >0.78 myr BP (Beaumont & Vogel 2006). An interdisciplinary project initiated in 2004 aims at dating the ESA deposits in particular, using a range of radiometric techniques, and will also focus on analysing the lithic faunal and botanical remains recovered from these strata

(Chazan et al. 2008). The Wonderwerk deposits also contain portable stone slabs with anthropogenic markings (Chazan & Horwitz 2010; Jacobson et al. 2012; Beaumont & Bednarik 2013).

The paintings at Wonderwerk are in a poor state of preservation. While the region has some good painted sites, the Northern Cape is particularly known for its wealth of open-air rock engraving sites (Morris 1988, 2002, 2012a). The landscape settings of the engraved sites include the glaciated andesite pavements at Driekopseiland and also koppies and rock outcroppings surrounded by extensive plains, often in close proximity to pans or springs such as Wildebeest Kuil, Driekopseiland and Rooipoort (Morris 1988, 1990, 2002, 2012) and the remarkable nested geometrics at Rooipoort/Klipfontein where thousands of engravings are clustered around a major spring (Morris 1990; Dowson 1992; Mitchell 2002). Differences in style are attributed to different time periods. Incised finelines are the oldest, while pecked and scraped engravings occur within the last 2000 years (Morris 1988). Scraped engravings occur between Kenhardt, Beaufort West and De Aar (Orton 2012a). The engraved locality Springbokoog constitutes a significant landscape where three stone circles cluster among the >80 boulders with fineline engravings (Deacon 1986, 1988, 1996). Other major engraved sites in the area are Keurfontein at Vosburg to the east of Springbok Oog (Morris 1990). The testimonies of the /Xam from Bushmanland underlie much of our interpretation of the beliefs and customs as expressed in the rock art of the Bushmen (Bleek & Lloyd 1911).

The Kathu sites contain significant ESA Acheulean and Fauresmith assemblages, and also a well-represented MSA (Beaumont 1990b, 2004; Chazan et al. 2012; Wilkins & Chazan 2012). Kathu Pan is formed by a shallow depression with an internal drainage and a high water table. Archaeological and palaeoenvironmental data from Kathu Pan and Kathu Townlands were used to reconstruct changes over time in the prehistoric environment (Beaumont 2004). Biostratigraphy or faunal correlation is often used to date the southern African sites and gives some indication of the approximate age of some of the associated assemblages. Associated faunal remains with some of the Acheulean include *Elephas recki recki*. These animals disappeared at sites in East Africa such as at Olorgesailie, Kenya, at around 600 000/800 000 years ago (Beaumont 2004; McNabb et al. 2004). The transitional Fauresmith at Kathu Pan has been dated to ca. 500 000 BP (Porat et al. 2010). A current research project at Kathu Pan 1 established a date of 500 000 years for a Fauresmith blade assemblage where blades were systematically removed from prepared cores (Porat et al. 2010; Wilkins & Chazan 2012).

The LCT's from this area often contain very fine handaxes with some superb symmetrical examples produced on banded ironstone in c. 0.8–1.3-Ma-old stratum 4b at Kathu Pan 1 (Beaumont & Bednarik 2013). Lithics in some of the Acheulean deposits, but also in MSA levels, display a shiny silica skin. At Kathu Townlands an outcropping of banded ironstone that covers a large area of around 25 km contains enormous quantities of flaked items. This phenomenon is ascribed to the use of the high-grade bedrock jasper and ironstone as a source for raw materials and is supported by the high incidence of handaxe roughouts (Beaumont 2004). The prepared core technique was used to produce the spectacular small handaxes, long blades, convergent flakes/points and scrapers found in Fauresmith collections. MSA tools were also recovered from the Kathu localities (Beaumont 2004). Surface sites around Kathu exhibit a palimpsest of prehistoric utilization and may contain lithics from all periods in the Stone Age succession.

North-east of Kathu newly-found ESA sites with LCT's and an associated range of tools occur in sand quarries and on a hilltop at Uitkoms Farm and the Bestwood locality (Chazan et al. 2012). The new residential and commercial developments at Bestwood demonstrate the importance of Phase 2 heritage studies in the Kathu region.

Cave and shelter sites are not abundant in the region. An early MSA occupation and a more recent LSA utilization were recorded at Zoovoorbij Cave close to the Orange River 64 km east of Augrabies (Kaplan 2012a; Orton & Webley 2013). Rock shelters along the escarpment mostly contain LSA and herder occupation deposits (Humphreys & Thackeray 1983; Herries et al. 2007). The LSA of the Northern Cape is well researched (Humphreys & Thackeray 1983; Herries et al. 2007). A few of the small rock shelters with occupations dating to the

Holocene along the Ghaap Escarpment have been excavated, including Burchell's Shelter (Humphreys 1975) and Dikbosch I and II (Humphreys & Thackeray 1983).

Burchell's Shelter has been occupied during historic times and travellers such as Burchell himself observed some of the Bushmen then present within this region (Humphreys 1975). Burchell, in describing their dress, wrote that they wore sandals and that their skin karosses were reddened with ochre (Humphreys 1975). It is evident from the archaeological investigations at Burchell's Shelter that only small groups occupied this locality and the artefacts and food remains demonstrate that they exploited a wide range of animals and collected plant foods, snakes and lizards, ostrich eggshell (OES) eggs and harvested termite eggs. Empty ostrich eggs were used as containers for substances such as ochre and specularite, but in particular as water flasks. In the Northern Cape OES flasks are sometimes found with mastic-attached spouts (Morris 2005a; Humphreys 2006).

The shelters of Dikbosch I and the smaller locality of II are located on the edge of the Ghaap escarpment (Humphreys & Thackeray 1983). To the north of Dikbosch I is a stream bed below a waterfall that would have represented a good water source during prehistoric times. The occupational sequence at the bigger shelter shows a regular use of this locality throughout the major part of the Holocene. The preservation of organic materials is good and the artefactual remains demonstrate a range of hunting and gathering and also probably ritual activities. The excavations at Dikbosch II suggest intermittent and ephemeral occupations (Humphreys & Thackeray 1983). Excavations at two shelters at Limerock on the Ghaap Plateau uncovered deposits with LSA occupation materials including lithics, numerous decorated OES fragments and other decorative pieces as well as ceramics (Humphreys & Thackeray 1983).

In addition to the well-known Taung localities some important fossiliferous and lithic-bearing breccias have recently been found on the Ghaap Plateau (Johnson et al. 1997; Herries et al. 2007). A multi-disciplinary project involving Australian, British and South African researchers has been initiated to investigate the palaeoanthropological potential of the Ghaap escarpment (Herries et al. 2007; Curnoe 2012).

The use of earth pigments, and in particular ochre and specular haematite, is universal (Watts 2002). Pigments and the exceptional pieces of engraved and ground incised pieces of ochre from MSA contexts at sites such as Wonderwerk attest to the time-depth of such practices (Mitchell 2002). Soft red haematite manuports were found in association with an Acheulean ESA assemblage At Kathu Pan I in deposits that have been dated to ~540 ka ago (Beaumont 1990b, 2004; Porat et al. 2010; Beaumont & Bednarik 2013). At Wonderwerk, Kathu Pan and Canteen Koppie unmodified specularite and ochre lumps have been found in levels with transitional ESA/MSA Fauresmith lithics (Beaumont & Bednarik 2013).

Quarrying of ore bodies often destroy earlier evidence for the utilization of the resource. Extensive mining of specular haematite by at least 40 000 BP has been documented at for example Ngwenya Mines, Swaziland (Nkambula 2011; Beaumont & Bednarik 2013). Investigations at Tsantsabane/Blinkklipkop established a date of AD 800 for the utilization of this particular rich source (Thackeray et al. 1983; Beaumont & Morris 1990). The specularite mines at Tsantsabane/Blinkklipkop and Doornfontein 1 near Postmasburg were rich and well-known ore sources that were quarried extensively over a long period of time (Beaumont & Thackeray 1981; Beaumont & Morris 1990; Mitchell 2002; Morris 2004). Dunn (1931:110) was told that 'it was from here that the Bushmen and other natives for hundreds of miles obtained their supplies of specular iron ore, which becomes red when burnt'. The pigment was bartered and exchanged for goods such as iron knives, assegais, axes, tobacco, copper and iron, and copper ornaments and beads (Campbell 1822 (Vol II); Burchell 1967; Arbousset & Dumas 1968). The mainly late Holocene lithic sequences at the mining localities are characterised by informal tool types with low frequencies of formal tools. Some of these were most likely to have been used in the mining and processing of pigments. Ceramics and items of European origin have also been recovered (Morris 1990; Couzens & Sadr 2010).

Namaqualand, a winter rainfall area, occupies the north-western corner of South Africa between the Olifants and Gariep rivers and extends along the Atlantic coast. The territory occupied by Bushmanland includes parts of Namaqualand east of Springbok. It is an open undulating landscape with isolated koppies (inselbergs) and several generally low mountain ranges. The Knersvlakte is a large open plain to the north of the Olifants River and the uplands of Matsikammaberg and to the west of the Bokkeveld Escarpment (Mackay et al. 2010). Quartz gravelly patches and heuweltjies occur over large parts of the Knersvlakte. Heuweltjies are circular mounds associated with hardpan that show different vegetation patterns than the surrounding soils. They are a characteristic feature of the Succulent Karoo biome of Namaqualand. Heuweltjies are most likely old termitaria of the harvester termite *Microhodotermes viator* (Francis et al. 2012; Halkett 2012; Kunza et al. 2012). Lithics are often found at heuweltjies but this phenomenon has not yet been researched in enough detail.

The arid landscape with sparse vegetation ensures that heritage remains are highly visible. The archaeology of Namaqualand is dominated by millions of stone tools that derived from the utilization of the resources of the region by hunter-gatherers and herders until the recent past. The west coast is particularly important for the study of pastoralism as it is one of the proposed routes of entry for herder groups into southern Africa (Orton et al. 2011). Early dates of more than 2000 years ago for sheep were acquired from directly-dated sheep bone from Spoeg River Cave in this region (Webley 1992). Some 1500 LSA, 90 MSA (that include both sealed and open living sites as well as quarries) and 50 ESA localities have been documented in Namaqualand (Dewar & Stewart 2012). Some of these represent important MSA and LSA open and shelter sites on the Knersvlakte in the southern part of Namaqualand that have been the focus of current research.

The ESA is usually represented by isolated examples of handaxes in Namaqualand. The MSA in sealed shelter sites has received particular attention (Dewar & Stewart 2012). Conversely, there is a lack of detail on open-air and surface MSA sites in Namaqualand (van der Ryst & Küsel 2012, 2013b). This is beginning to change with the publication of current research projects aimed at the collection of MSA material in both the northern and southern regions of Namaqualand (Mackay et al. 2010; Dewar & Stewart 2012). This period is of particular significance as the origins of modern culture and language are associated with the emergence of anatomically modern humans, *Homo sapiens*, during the MSA. The upland savannas of southern Africa are seen as a focal region of biological and cultural evolution during this time (Beaumont & Vogel 2006).

A recent project that is focussed on human adaptations in low-productivity environments known as Adaptations to Marginal Environments in the MSA (AMEMSA) aims to investigate the economics, technologies and social organization that populations in Namaqualand developed to cope with the stress of marginal environments (Dewar & Stewart 2012). The research project aims to test the hypothesis that pre-modern humans exhibit a pattern of mosaic settlement that is directly related to favourable climatic periods. According to these premises physical and cultural modernity were required to cope with the demands of marginal ecozones to enable *Homo sapiens* populations to maintain settlement in harsh environments on a more constant basis (Dewar & Stewart 2012). Subsistence resources are unpredictable and patchy in marginal environments so that flexible social and technological strategies with innovative behaviour were required to successfully cope with environmental constraints (van der Ryst & Küsel 2012, 2013b).

Research at Spitzkloof A (28°51.79' S; 17°04.65'E) in the Richtersveld documented deep MSA deposits, while LSA lithics were recorded on the talus slopes of the shelters (Dewar & Stewart 2012). Current research includes investigations at Spitzkloof B. Investigations at the inland locality of Swartkop Hill near Garies recorded extensive raw material extraction at a quarry site during the MSA (Webley, L & Halkett 2010; van der Ryst & Küsel 2012, 2013b). Morris (2013a) also found a MSA extraction quarry near Gamsberg.

During the LSA the resources of the region were more intensively utilized. Both terrestrial and marine resources were actively sourced and shell middens are conspicuous along the Namaqualand coast line (Orton et al. 2005; Orton 2007). The more recent occupations of the

region are also better documented and understood as a great many shell middens, deflated open-air localities and some rock shelters sites have been recorded through research projects but in particular on account of the numerous AIA's undertaken prior to mining activities. The many AIA's since undertaken in the region by archaeologists such as Lita Webley, Genevieve Dewar, Tim Hart, Jason Orton and Dave Halkett documented deep stratified cave deposits and open-air sites for the MSA. The data show a particular strong presence for San hunter-gatherers during the Holocene, and Khoekhoe pastoralists (ancestor of Nama-speakers) for >2000 years, along shores but also at inland open and shelter sites.

Hart (2006) in his review of the Vredendal region also notes that abundant and important heritage resources have been recorded over the last decade. An assessment undertaken in 1991 by Parkington and Poggenpoel in the Brandsebaai area established intensive utilization of coastal resources within the last 2000 years. This is demonstrated by the ubiquitous Holocene shell middens on rocky shoreline areas. They also found much rarer MSA shell middens at Brandsebaai, Liebenbergsbaai and Boegoeberg (Hart 2006). Numerous sites dating to the last 2000 have been recorded in the Richtersveld. Recent excavations at Jakkalsberg on the bank of the Orange River in the north-western Richtersveld, where fish was a key resource, yielded dates from the mid- to late Holocene (Orton & Halkett 2010).

Surveyed areas in Bushmanland exhibited a markedly low incidence of artefactual material. Morris (2011a-c) points out the reduced archaeological visibility away from landscape features such as hills and rock outcrops. Morris (2011b) noted a general background noise of lithic elements but few sites. According to Morris (1999, 2000a-c, 2001, 2010b, 2011a-c) late Holocene lithics constitute the most common archaeological occurrences within the Aggeneys-Pofadder region. LSA lithics often occur in association with ceramics and OES fragments. OES containers served as water flasks and fragments from broken flasks were used to make beads.

Beaumont et al. (1995), as discussed above, found differences in the geographical distribution of LSA hunter-gatherer localities and the herder sites of pastoral groups. Beaumont et al. (1995) were of the opinion that increasing pressure brought about by the presence of herders in the Orange/Gariep River Basin resulted in the displacement of hunters to marginal areas such as Bushmanland. This came about largely in the last millennium when the archaeological remains of hunting and gathering settlements are commonly found near water sources (Morris 2011c). Notwithstanding, it is clear that there was also a herder presence in this region is suggested by ceramics near Aggeneys and, east of Pofadder, at Schuifdrift South (Morris 1999), grinding hollows on rock outcrops in the Aggeneys/Gamsberg area (Morris 2011a) and attested by herder rock paintings present on a boulder alongside the Aggeneys/Black Mountain aggregate quarry (Morris 2011a).

Such rock art sites are uncommon in some parts of Bushmanland. Janette Deacon documented finger paintings on a boulder next to the Aggregate Quarry at Black Mountain Mine, Aggeneys (29°15'26" S; 18°48'12"E) (Morris 2011a, 2011c, 2013b). The rock art site comprises a boulder with a finger-painted star motif as well as an image of an indented oval shape. Morris (2013a: 38) also refers to a description by Dunn (1931) in his book, *The Bushman*. Dunn (1931: 46) wrote that 'near N'Ghaums [Gams], I saw an engraving of a hippopotamus being dragged across the dry veldt by several Bushman people by means of a rope attached to its nose.' Rock art research demonstrated that images of large mammals were metaphors for rain animals. The location of the engraving has not yet been established.

The MSA is widespread across Bushmanland but usually in low densities (Beaumont et al. 1995; Morris 2013a). An extensive MSA workshop was recorded at Gamsberg (GI 1) where the raw material, gossan, was extensively sourced (Morris 2013a). The site has been afforded a high rating of significance. A project near Garies in Namaqualand (Van der Ryst & Küsel 2012, 2013b) found a similar focus on a preferred source of quality toolstone at a MSA quarry site.

ESA Acheulean workshop locales (Gamsberg Sites GI 4 and 5) with handaxes and Victoria West cores were recorded at raw material sources on the western side of the Gamsberg

basin. They represent some of the rare known ESA Acheulean sites that have been recorded in Bushmanland, and are therefore of regional significance (Morris 2013a).

1:50 000 Topocadastral Map Survey

- **2919DD Soutdwaggas:** No data found
- **2920CC Skansklip:** No data found
- **2920CB Boomriver:** No data found
- **2920CD Dagab:** No data found
- **2920DA Drieboomlaagte:** No data found
- **2920DC Gous Se Kolk:** No data found
- **2920BD Grootriet:** No data found

- **2920DB Sonderhuis:**

According to Pelser (2011) the Olyvenkolk contains fairly large numbers of ESA and MSA tools over a large area with some concentrations of medium to high significance, e.g. GPS Location: S 29 29 38.1; E 20 47 20.6. Mitigation measures suggested in the 2011 report for sites that would be impacted upon by the development were undertaken during February 2012 during a Phase 2 (Lombard & Pelser 2012). Pelser (2012) subsequently assessed another part of the farm, Klein Zwart Bast 188. According to Pelser (2012: 17) *'[t]The assessment of the new expanded area for the Photo-Voltaic Solar Power Generation Plant on Klein Zwart Bast revealed that the whole area covered by the dwyka tillite material can be viewed as one Stone Age landscape, and that the area is generally homogenous in this sense. Individual sites cannot really be discerned, and it is clear that the area was utilized from the Early right through to Later Stone Age periods'*.

Halkett and Orton (2011a) found several weathered bifaces at Olyvenkolk whereas most of the other lithic occurrences were MSA. Morris noted in 2006 that the Dwyka tillites near Olyvenkolk and Klein Zwart Bast were sources of raw materials for ESA tools (Webley & Halkett 2012a). Whereas some weathered ESA tools on hornfels were recorded by Webley and Halkett (2012a), most of the lithics are from the MSA. Flaked products included flakes and blades (some with retouch), chunks and cores, were made on quartzite, banded ironstone and CCS. Morris (2013a) also mentions MSA sites from Olyvenkolk, southwest of Kenhardt and Maans Pannen, east of Gamoep. The ESA lithics at these localities are weathered Victoria West cores on dolerite, long blades and a very low numbers of handaxes and cleavers.

- **3019BC Boegoefontein**

Van Schalkwyk (2011c) concurs with Morris (2000c) that ESA lithics are not abundant in this region. The author recorded low density MSA occurrences mostly at the foot of hills or outcrops of suitable toolstone material in the southern section of the study area. LSA lithics are more abundant. Lithics should be more abundant close to water sources as at Dirks-Kop where lithics and OES fragments are said to occur around a pan (Van Schalkwyk 2011c). According to the palaeontological report this locality and also 3019DA Stinkputs are underlain with important fossil-bearing deposits (Almond 2011b).

- **3019DA Stinkputs:** No data found
- **3019BB Granaatboskol:** No data found

- **3019BD Commissioner's Pan:** No data found
It is suggested that an investigation should be made at Commissioner's Salt Pan, Bitterputs se Pan and Kammassoutpan in view of the landscape utilization of LSA groups.
- **3020AA Halfweg:** No data found
- **3020AB Verdorskolk:** No data found

General data that may relate to this trajectory

The following is a direct quote from Webley and Halkett (2010b: 6-7) in their report on the Aries-Helios and associated loop in and loop out lines, west of Brandvlei in the Northern Cape:

'In a desktop review of the archaeological literature, Webley (2009) summarised the re-discovery of the Bleek and Lloyd records relating to the /Xam Bushman. The /Xam were traditionally hunter-gatherers who roamed across the plains of Bushmanland but by the mid-nineteenth century they were subsisting on Trekboer farms around Kenhardt, Van Wyksvlei and Brandvlei. The stories and folklore of the /Xam have been instrumental in assisting with the interpretation of the rock art of southern Africa. Using a map provided by /Xam informants, archaeologists have been able to trace their territories and their last camp sites. The Grass Bushmen are reported to have lived around the Katkop Hills, very close to the location of substation 3d. While a camp site of the Flat Bushmen has been excavated by archaeologists on the farm Bitterpits, it has proved more difficult to find appropriate sites to excavate around the Katkop Hills. Since the area around the Katkop Hills has not been subjected to an intensive survey by archaeologists, Webley (2009) recommended that a survey be undertaken prior to the development of the new substation, to ensure that it would not impact negatively on the archaeological heritage of the area.'

The report on the proposed sub-station between Aries and Helios situated to the west of the R27 and of Brandvlei, in Bushmanland ephemeral scatters of weathered possibly MSA lithics, in all four alternative areas proposed for the substation below (Webley & Halkett 2010b: 10).

- Archaeological sites

NHRA Category	Archaeological and palaeontological sites
Protection status	General Protection - Section 35: Archaeology, palaeontology and meteorites
Significance	High on a regional level – Grade III



Fig. 3. Stone tool typology and flake dating to the Middle Stone Age identified in the region. The stone tools (on the left) are not from the region and are only used to illustrate the difference between Early (left), Middle (middle) and Later Stone Age (right) technology.

Historic period

Early explorers such as Colonel Robert Jacob Gordon, who journeyed through the region in the late 1770s reported a very low density of farmers of white origin living in the region. However, by the early 19th century some Dutch speaking trekboers moved into the region, grazing their stock. As they depended on water for their live-stock, these farmers would have stuck close to available water sources and it was only during the wetter parts of the rain season that they might have accessed other areas for short periods of time. Even today, people migrate with their stock on a seasonal basis, moving between winter and summer grazing. In the past this was done by following the sheep by means of wagons and donkey carts, but in recent times this is done by means of trucks.

An investigation of the Title Deeds of some of the farms under consideration indicated that they were surveyed during the latter part of the nineteenth century, implying that they would have been occupied since then.

Due to the sparse population, infrastructural development in this part of the world has always been low. The roads are gravel and graded occasionally. As there are no major rivers, river crossings remained informal.

The one industrial activity that is practised in the region on a commercial basis is the extraction of salt from the various pans in the region. The manner in which the salt is extracted requires a low level technology, with the result that even if it has taken place over a long period of time at any given place, few structures or features are associated with it.

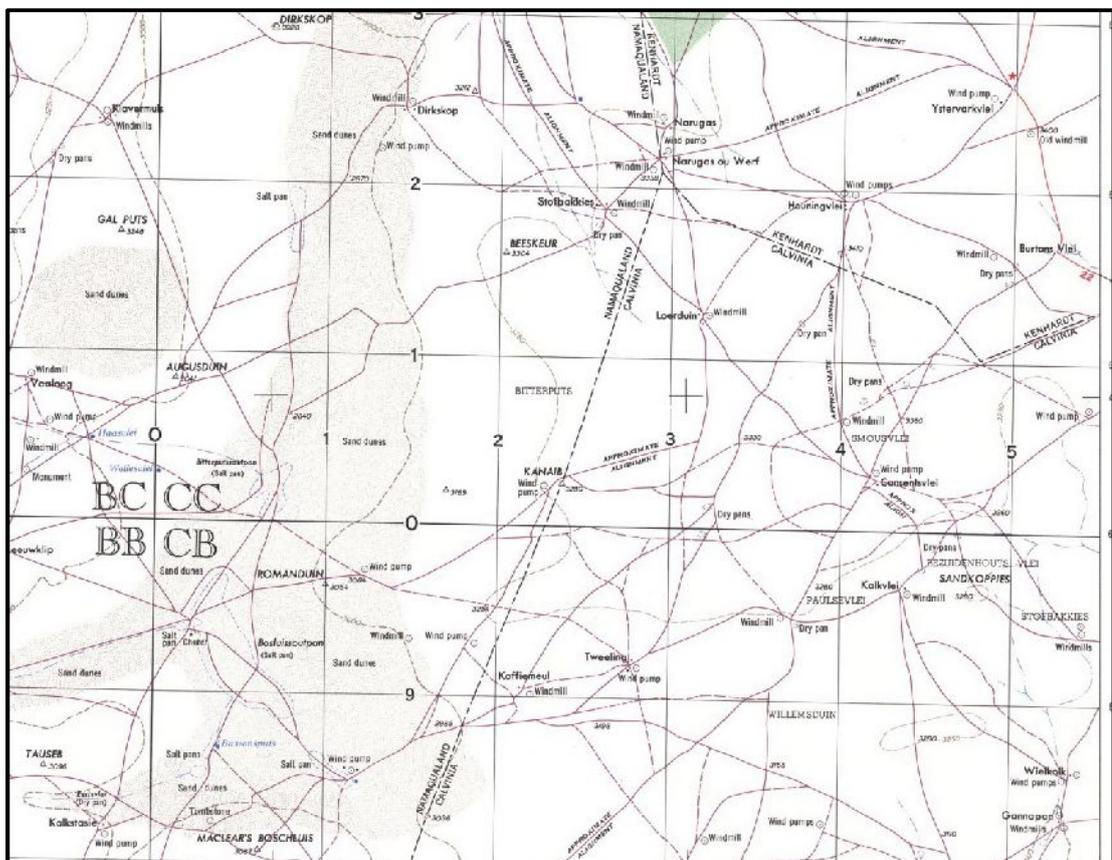


Fig. 4. Section of the 1950 1:250 000 cadastral map.

It is probable that the salt pans were exploited in pre-colonial times for obtaining of salt, but this would have been on a very low level of activity. It was only with the more permanent settlement of farmers in the region since the early twentieth century that the salt was exploited on a commercial basis.

The map in Fig. 4, based on information dating to the early 1940s, indicate the occurrence of features such as farmsteads, windmills, mining areas and roads. The implication is that as this map is older than 60 years the indicated features are also older than 60 years, meaning that they enjoy general protection under the heritage act. Although it is not certain what the qualities of each particular feature is, it is expected that at least some of it would have unique vernacular characteristics.

- Farmsteads

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	General Protection - Section 34: Structures older than 60 years

Significance	High on a regional level – Grade III
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Fig. 5. Examples of farmsteads and farming related features identified in the region.

- Cemeteries

Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important 'documents' linking people directly by name to the land.

NHRA Category	Graves, cemeteries and burial grounds
Protection status	General Protection - Section 36: Graves or burial grounds

Significance	High on a local level – Grade III
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- Public monuments

Although most of these usually occur in urban areas, some also occur in rural areas where some event of significance took place.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
	General Protection - Section 37: Public Monuments and Memorials

Significance	Medium on a regional level – Grade III
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- Infrastructure and industrial heritage

In many cases this aspect of heritage is left out of surveys, largely due to the fact that it is taken for granted. However, the land and its resources could not be accessed and exploited without the development of features such as roads, bridges, railway lines, electricity lines and telephone lines, as well as industries that exploit locally available resources.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
	General Protection - Section 34: Structures older than 60 years

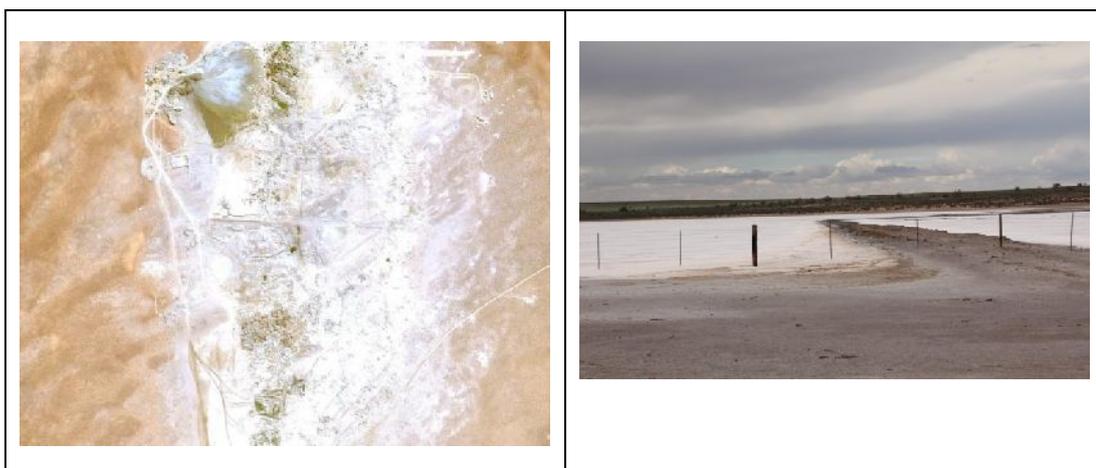


Fig. 6. Extensive salt works on Galputs.
(Photo: Google Earth)

6. SITE SIGNIFICANCE AND ASSESSMENT

6.1 Heritage assessment criteria and grading

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- **Grade I:** Heritage resources with qualities so exceptional that they are of special national significance;

- **Grade II:** Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III:** Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable of mitigation measures would allow the development activities to continue.

6.2 Statement of significance

A matrix was developed whereby the above criteria, as set out in Sections 3(3) and 7 of the NHRA, No. 25 of 1999, were applied for each identified site (see Appendix 1). This allowed some form of control over the application of similar values for similar sites. Three categories of significance are recognized: low, medium and high.

Table 2. Summary of identified heritage resources in the study area.

Identified heritage resources	
<i>Category, according to NHRA</i>	<i>Identification/Description</i>
Formal protections (NHRA)	
National heritage site (Section 27)	None
Provincial heritage site (Section 27)	Yes
Provisional protection (Section 29)	Yes
Place listed in heritage register (Section 30)	None
General protections (NHRA)	
structures older than 60 years (Section 34)	Yes
archaeological site or material (Section 35)	Yes
palaeontological site or material (Section 35)	None
graves or burial grounds (Section 36)	Yes
public monuments or memorials (Section 37)	Yes
Other	
Any other heritage resources (describe)	None

In terms of Section 7 of the NHRA, the sites currently known or which are expected to occur in the study area are evaluated to have the following significance:

- Stone Age sites are viewed to have medium significance on a regional level and have Grade III significance;
- Rock art sites (Stone Age) are viewed to have high significance on a regional level and have Grade II significance;
- Farmsteads are viewed to have medium significance on a regional level and have Grade III significance;

- Graves and cemeteries are viewed to have high significance on a local level and have Grade III significance;
- Industrial and infrastructural heritage sites are viewed to have medium significance on a regional level and have Grade III significance.

6.3 Impact assessment

Impact analysis of cultural heritage resources under threat of the proposed development, are based on the present understanding of the development.

Environmental Parameter	Pre-colonial: Stone Age sites
Issue/Impact/Environmental Effect/Nature	Many sites are still unknown. Their potential and significance therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. tower positions or access/ inspection roads
Extent	Local
Probability	Can occur
Reversibility	Irreversible
Magnitude	High
Duration	Permanent
Significance Rating	Sites have a medium significance on a region level – viewed as NHRA Grade III sites. Distinguish from find spots, which have low significance. Rock art sites are viewed to have high significance on a regional level – viewed as NHRA Grade II sites.
Mitigation measures	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. Sites that cannot be avoided should be excavated in full by an archaeologist qualified in Stone Age archaeology.

Environmental Parameter	Colonial Period - farmsteads
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole
Extent	Local
Probability	Unusual but possible
Reversibility	Reversible with human intervention
Magnitude	Moderate
Duration	Medium term
Significance Rating	Sites have a medium significance on a region level – viewed as NHRA Grade III sites.
Mitigation measures	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

Environmental Parameter	Colonial Period - cemeteries
Issue/Impact/Environmental Effect/Nature	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole
Extent	Local
Probability	Unusual but possible
Reversibility	Reversible with human intervention
Magnitude	Low
Duration	Medium term
Significance Rating	Sites have a medium significance on a region level – viewed as NHRA Grade III sites.
Mitigation measures	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

Environmental Parameter	Colonial Period – industrial heritage
Issue/Impact/Environmental Effect/Nature	Different features are subject to damage. Some might be unique – no alternatives or second examples. Easy to identify and therefore easy to avoid
Extent	Site
Probability	Unusual but possible
Reversibility	Reversible with human intervention
Magnitude	Marginal loss of resources
Duration	Medium term
Significance Rating	Sites have a medium significance on a region level – viewed as NHRA Grade III sites.
Mitigation measures	All of these sites should be avoided as far as possible. Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed, but only as last case scenario.

Significance assessments for the three alternative routes are presented in the table below – see Appendix 3 for the methodology used.

At present there are no grounds, based on heritage resources, for deciding between the alternative routes. From this it is deduced that all three of the alternative routes would be equally suitable for development of the power line.

Scoring Without Mitigation = (NM)

Scoring With Mitigation = (WM)

Analysis of the Significance of Potential Heritage Impacts (Aries - Helios – for all three route corridors)

Environmental Parameter	Nature of Impact	Magnitude	Reversibility	Extent	Duration	Probability of occurrence	Ranking	Significance	
								Without Mitigation	With Mitigation
Pre Colonial Stone Age Sites	Many sites are still unknown. Their potential and significance therefore unknown. The impact will be the physical disturbance of the material and its context. Impact will be focused on a particular node, i.e. tower positions or access/ inspection roads	3 2	3 3	2 2	5 5	3 3	39 36	High	High
Colonial Period - farmsteads	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole	3 3	3 3	2 2	3 3	2 2	22 22	Moderate	Moderate
Colonial Period - cemeteries	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole	2 2	3 3	3 3	3 3	2 2	22 22	Moderate	Moderate
Colonial Period –	The various features are subject to damage. Easier to identify and therefore	3 3	3 3	1 1	4 4	2 2	22 22	Moderate	Moderate

industrial heritage	easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole								
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7. RECOMMENDED MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

7.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

7.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

8. CONCLUSIONS

The aim of the survey was to evaluate potential heritage resources that would occur within the boundaries of a proposed electricity transmission corridor and to determine if there are any

fatal flaws that would prevent the proposed development from taking place in any of the three corridors where it is proposed to develop the electricity transmission line.

The cultural landscape qualities of the region essentially consist of a two components. The first is a rural area in which the human occupation is made up of a pre-colonial (Stone Age) occupation and a much later colonial (farmer) component. This rural landscape has always been sparsely populated. The second component is an urban one consisting of a number of smaller towns, most of which developed during the last 150 years or less.

The following heritage sites were identified in the larger region:

- Pre-colonial archaeological sites dating to the Stone Age have been identified to occur in the region of study area. In most known cases the impact of the development would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.
- Colonial period or historic period heritage manifest in a wide variety – farmsteads, infrastructure and cemeteries. As the power line is to cross a rural landscape for the most part, the impact would only be indirect, e.g. the power line crossing some distance from the site, thereby having only a visual impact. However, when more detailed information is available, e.g. the exact position of the different towers and access/inspection roads, which will give rise to physical disturbance of the material and its context, it might be determined that specific development aspects might have a direct disturbance, which would result in irreplaceable loss of heritage resources.

As an initial evaluation of the three route alternatives, it can be concluded that the impact of the proposed development on sites, features or objects of cultural heritage would be low. The reason is that cultural heritage sites are distribute sparsely in the region. Secondly, power lines usually have less of an impact than for example mining developments.

It is our opinion that from a heritage point of view there are no fatal flaws that would prevent the proposed development from taking place in any of the corridors. However, having said that, it must be remembered that heritage sites are not only fixed features in the environment, occurring within specific spatial confines, but they are also finite in number. Avoiding of impacts on sites is therefore the preferred form of mitigation. In areas where a high density of sites occurs, if at all possible, exclusion zones where no development is to take place, should be set aside. If that is not possible, mitigation can only be achieved through archaeological investigation.

As the exact coordinates for the power line and the individual tower structures are not yet available, it is difficult to determine what the final impact of the proposed development would be. Therefore, for the project to continue, we propose the following:

- Mitigation should be based on avoiding of sites rather than anything else. In order to achieve this, a full “walk down” of the selected corridor must be done prior to construction taking place, to document all sites, features and objects, in order to propose adjustments to the routes and thereby to avoid as many impacts as possible.
- In addition, the management measures, as set out in Section 7 of this report should be implemented prior to construction taking place.
- No impact on heritage sites, features or objects can be allowed without a valid permit from SAHRA.

9. REFERENCES

9.1 Data bases

Chief Surveyor General
Environmental Potential Atlas, Department of Environmental Affairs and Tourism.
Heritage Atlas Database, Pretoria.
National Archives of South Africa
SAHRA Archaeology and Palaeontology Report Mapping Project (2009)

9.2 Literature

Acocks, J.P.H. 1975. *Veld Types of South Africa*. Memoirs of the Botanical Survey of South Africa, No. 40. Pretoria: Botanical Research Institute.

AGES 2013. *Proposed establishment of a renewable energy facility on the Remainder Portion of the Farm Klipdrift 20, Letsemeng Local Municipality, Xhariep District Municipality, Free State Province*.

Almond, JE. 2010. *Palaeontological impact assessment: desktop study proposed photovoltaic power station adjacent to Greefspan Substation near Douglas, Northern Cape Province*. Cape Town.

Almond, JE. 2011a. *Proposed mainstream wind farm near Prieska, Pixley ka Seme District Municipality, Northern Cape Province*.

Almond, JE. 2011b. *Proposed mainstream wind farm near Loeriesfontein, Namaqua District Municipality, Northern Cape Province*.

Arbousset, T & Daumas, F. 1968. *Narrative of an exploratory tour to the Cape of Good Hope*. Facsimile reprint. Cape Town: Struik.

Beaumont, PB. 1990a. Canteen Kopie (Klipdrif). In PB Beaumont & D Morris (Eds) *Guide to archaeological sites in the Northern Cape*: 14-16. Kimberley: McGregor Museum.

Beaumont, PB. 1990b. Kathu. In PB Beaumont & D Morris (Eds) *Guide to archaeological sites in the Northern Cape*: 75-100. Kimberley: McGregor Museum.

Beaumont, PB. 1990c. Wonderwerk Cave. In PB Beaumont & D Morris (Eds) *Guide to archaeological sites in the Northern Cape*: 101-134. Kimberley: McGregor Museum.

Beaumont, P. 2004. Kathu Pan and Kathu Townlands/Uitkoms. In PB Beaumont & D Morris (Eds) *Archaeology in the Northern Cape: some key sites*: 50-53. Kimberley: McGregor Museum.

Beaumont, PB. 2007. *Phase 1 Heritage Impact Assessment report on the remainder of portion 9 (Wouterspan), portion 14 (Stofdraai) and portion 16 (a portion of portion 9) of the farm Lanyon Vale 376, on the Orange River downstream of Douglas, Karoo District Municipality, Northern Cape Province*. Unpublished report for Rockwell Diamonds.

Beaumont, P. 2013. *Phase 1 Archaeological Impact Assessment Report on a 6.4 ha area on the remaining extent of farm Middelpaas 140, situated ~45 Km ENE of Daniëlskuil, Barkly West Magisterial District, Northern Cape Province*.

Beaumont, PB & Bednarik, RG. 2013. Tracing the emergence of palaeoart in sub-Saharan Africa. *Rock Art Research* 30(1): 1-22.

- Beaumont, PB, Smith, AB & Vogel, JC. 1995. Before the Einiqua: the archaeology of the frontier zone. In Smith, AB (ed.) *Einiqualand: studies of the Orange River frontier*:236-264. Cape Town: University of Cape Town Press.
- Beaumont, PB & Vogel, JC. 1989. Patterns in the age and context of rock art in the Northern Cape. *South African Archaeological Bulletin* 44: 73-81.
- Beaumont, PB & Vogel, JC. 2006. On a timescale for the past million years of human history in central South Africa. *South African Journal of Science* 102: 217–28.
- Becker, E.2011. *Archaeological Impact Assessment Technical Report prepared for !Xun and Khwe Solar Project, Platfontein and Wildebeestkuil, Kimberley, Northern Cape*. Unpublished report to Afri-Devo Energy.
- Becker, E. 2013. *Transnet Capital Projects Ngqura 16 Mtpa Manganese Rail Phase 1 Heritage Impact Assessment Rail Kimberley to De Aar*.
- Bleek, WHI & Lloyd, LC. 1911. *Specimens of Bushman folklore*. Collected by the late WHI Bleek PhD and LC Lloyd edited by the latter. London: George Allen & Co.
- Burchell, W.1967 [1822-24]. *Travels in the interior of southern Africa*. Vol 2. Cape Town: Struik.
- Campbell, J. 1815. *Travels in South Africa*. 3rd ed. London: Black, Parry & Co. Facsimile reprint 2004. Cape Town: Struik.
- Campbell, J. 1822. *Travels in South Africa*. Volume I and II. London: Francis Westley. Facsimile reprint 2004. Elibron Classics Series.
- Chazan, M, Hagai, R, Matmon, A, Porat, N, Goldberg, P, Yates R, Avery, M, Sumner, A & Horwitz, LK. 2008. Radiometric dating of the Earlier Stone Age sequence in Excavation I at Wonderwerk Cave, South Africa: preliminary results. *Journal of Human Evolution* 55(1): 1-11.
- Chazan, M & Horwitz, LK. 2010. Milestones in the development of symbolic behaviour: a case study from Wonderwerk Cave, South Africa. *World Archaeology* 41(4): 521-539.
- Chazan, C, Wilkins, J, Morris, D & Berna, F. 2012. Bestwood 1: a newly discovered Earlier Stone Age living surface near Kathu, Northern Cape Province, South Africa. *Antiquity* 86(331). Antiquity Gallery.
- Cullinan, P. 1992. *Robert Jacob Gordon 1743-1795*. Cape Town: Struik.
- Curnoe, D. 2005. Beyond Taung: Palaeoanthropological research at Groot Kloof, Ghaap Escarpment, Northern Cape Province, South Africa. *NYAME AKUMA* 64: 58-56.
- Couzens, R, & Sadr, K. Rippled ware at Blinkklipkop, Northern Cape. *South African Archaeological Bulletin* 65: 196-203.
- Deacon, J. 1986. "My place is the Bitterpits": the home and territory of Bleek and Lloyd's /Xam San informants. *African Studies* 45: 135-155.
- Deacon, J. 1988. The power of a place in understanding southern San rock engravings. *World Archaeology* 20: 129-140.
- Deacon, J. 1996. Archaeology of the Flat and Grass Bushmen. In Deacon, J & Dowson, TA (eds) *Voices from the past: /Xam bushmen and the Bleek and Lloyd collection*: 245-270. Johannesburg: Witwatersrand University Press.

- Dewar, G, and Stewart, BA. 2012. Preliminary results of excavations at Spitzkloof Rockshelter, Richtersveld, South Africa. *Quaternary International* 270: 30-39.
- Dunn, EJ. 1978. Through Bushmanland. In AM Lewin Robinson (ed.) *Selected articles from the Cape Monthly Magazine, 1870-1876*: 31-42. Cape Town: Van Riebeeck Series Second Series. Cape Town: Van Riebeeck Society 6.
- Dunn, EJ. 1931. *The Bushman*. London: Griffin.
- Dowson, A. 1992. *Rock engravings of southern Africa*. Johannesburg: Witwatersrand University Press.
- Ehret, C. 2008. The early livestock-raisers of southern Africa. *Southern African Humanities* 20: 7-35.
- Engelbrecht, JH. 1936. *The Korana*. Cape Town: Maskew Miller.
- Fagan, G. 2008. *Brakdak: platdakke in die Karoo*. Kaapstad: Breestraat Publikasies.
- Fauvelle-Aymar, F-X. 2004. Between the first herders and the last herders: are the Khoekhoe descendants of the Neolithic 'hunters-with sheep'? *Before Farming* [online version] 2004/4, article 5: 1-11.
- Francis, ML, Ellis, F, Lambrechts, JJN & Poch, RM. 2012. A micromorphological view through Namaqualand termitaria (Heuweltjie, a Mima-like mound). *Catena* 10: 57-73.
- Gaigher, S. 2012. EIA Process. *Draft Scoping Report: Proposed Prieska solar energy facility & associated infrastructure*. Unpublished report for Savannah Environmental.
- Halkett, D. 2012. *Heritage Impact Assessment proposed upgrade to National Route 7, Section 4 from Trawal to Vanrhynsdorp, Western Cape*. Prepared for Sivest Environmental Division.
- Halkett, D & Orton, J. 2011. *Heritage Impact Assessment (Archaeology And Palaeontology): Proposed Olyven Kolk solar power plant, Northern Cape Province*. Anex. H.
- Hart, T. 2006. *Initial Heritage Scoping Assessment of a proposed Eskom Transmission Line Route from Gariep River to Vredendal (Eskom Kudu Integration Project)*. Unpublished report prepared for SEF.
- Herries, AIR. 2011. A chronological perspective on the Acheulian and its transition to the Middle Stone Age in Southern Africa: The question of the Fauresmith. *International Journal of Evolutionary Biology*. Article ID 961401, 2012: 1-25. doi:10.4061/2011/961401.
- Herries, H, Curnoe, D, Brink, J, Henderson, Z, Morris, D, Van Reyneveld, K & Hodge, E. 2007. Landscape evolution, palaeoclimate and Later Stone Age occupation of the Ghaap Plateau escarpment, Northern Cape Province, South Africa. *Antiquity* 81(313), no page numbering.
- Humphreys, AJB. 1974. Note on a date for a burial from the Riet River. *South African Journal of Science* 70: 271.
- Humphreys, AJB. 1975. Burchell's Shelter: the history and archaeology of a Northern Cape rock shelter. *South African Archaeological Bulletin* 30: 3-18.
- Humphreys, AJB. 1982. Cultural material from burials on the farm St. Clair, Douglas area, Northern Cape. *South African Archaeological Bulletin* 37: 68-70.

Humphreys, AJB. 2006. More on spouted ostrich eggshell containers from the Northern Cape, with a note on the history of anthropology and archaeology at the McGregor Museum, Kimberley. *South African Archaeological Bulletin* 61: 208.

Humphreys, AJB. 2007. More on pots in burials from the Douglas Area, Northern Cape. *South African Archaeological Bulletin* 62: 68-70.

Humphreys, AJB and Thackeray, AI. 1983. *Ghaap and Gariiep: Later Stone Age studies in the northern Cape*. South African Archaeological Society Monograph Series 2. Cape Town.

Hutten, M. 2013a. *HIA for the proposed Pulida Park solar south-east of Kimberley, Free State Province*. Unpublished report for Ages (Pty) Ltd.

Hutten, M. 2013b. *Heritage impact assessment for the proposed Carodex Solar Park south of Kimberley, Northern Cape Province*.

Jacobson, L. 2005. Comments on stone circles in the Bloubos landscape, Northern Cape. *Southern African Humanities* 17: 153-154.

Johnson, BJ, Miller, GH, Fogel, ML & Beaumont, PB. 1997. The determination of late Quaternary paleoenvironments at Equus Cave, South Africa, using stable isotopes and amino acid racemization in ostrich eggshell. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 136: 121-37.

Kaplan, J. 2002. *Archaeological Impact Assessment Lutzville West, Vredendal. Unpublished report prepared for EnviroAfrica*.

Kaplan, J. 2008a. *Phase 1 Archaeological Impact Assessment proposed shopping centre development (Erf 3853) Vredendal, Western Cape Province*. Unpublished report prepared for EnviroAfrica.

Kaplan, J. 2008b. *Phase 1 Archaeological Impact Assessment proposed development Remainder Portion of Erf 3853 Vredendal, Western Cape Province*. Unpublished report prepared for EnviroAfrica.

Kaplan, J. 2009. *Archaeological Impact assessment of the proposed upgrading of the Vredendal North Waste Water Treatment Works (Portion 386 of the Farm Vredendal No. 292)*. Unpublished report prepared for EnviroAfrica.

Kaplan, J. 2010. *Archaeological scoping study and impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape*. Unpublished report prepared for DJ Environmental Consultants.

Kaplan, J. 2011. *Phase 1 archaeological impact assessment proposed development portion 116 of Farm 292 Vredendal Western Cape*. Unpublished report prepared for EnviroAfrica.

Kaplan, J & Wiltshire, N. 2011. *Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba Municipality, Northern Cape*. Unpublished report for Aurecon South Africa (Pty) Ltd.

Kiberd, P. 2006. Bundu Farm: a report on archaeological and palaeoenvironmental assemblages from a pan site in Bushmanland, Northern Cape, South Africa. *South African Archaeological Bulletin* 61: 189-201.

Kinahan, J. 1986. The archaeological structure of pastoral production in the Central Namib Desert. *South African Archaeological Society Goodwin Series* 5: 69-82.

- Kunza, NF, Hoffman, MT & Webera, B. 2012. Effects of heuweltjies and utilization on vegetation patterns in the Succulent Karoo, South Africa. *Journal of Arid Environments* 87: 198-205.
- Lombard, M & Parsons, I. 2008. *Blade and bladelet function and variability in risk management during the last 2000 years in the Northern Cape*. *South African Archaeological Bulletin* 63: 18-23.
- Lombard, M & Pelsner, AJ. 2012. *Final report on the Archaeological Phase 2 mitigation of an open-air Stone Age site to be impacted on by the Aries Solar Energy Plant on Portion 1 of the farm Klein Zwart Bast 188 Kenhardt District, Northern Cape*. Unpublished Report Archaeos cc AE01216P. For Sevenstones 159 (Pty) Ltd.
- Lye, WF. (ed.) (1975). *Andrew Smith's journal of his expedition into the interior of South Africa 1834-36*. Cape Town: Balkema.
- Mackay, A, Orton, J, Schwartz, S & Steele, T. 2010. Soutfontein (SFT)-001: preliminary report on an open-air site rich in bifacial points, southern Namaqualand, South Africa. *South African Archaeological Bulletin* 65: 84-95.
- McNabb, J, Binyon, F & Hazelwood, L. 2004. The large cutting tools from the South African Acheulean and the question of social traditions. *Current Anthropology* 45(5): 653-677.
- Mitchell, PJ. 2002. *The archaeology of southern Africa*. Cambridge: Cambridge University Press.
- Mitchell, P & Whitelaw, G. 2005. The archaeology of southernmost Africa from c 2000 BP to the early 1800s: a review of recent research. *Journal of African History* 46(2): 209-241.
- Morris, D. 1988. Engraved in place and time: a review of variability in the rock art of the Northern Cape and Karoo. *South African Archaeological Bulletin* 43: 109-121.
- Morris, D. 1990. Klipfontein: Bushman's Fountain rock engraving site. In Beaumont, P & Morris, D (eds) *Guide to archaeological sites in the northern Cape*: 1-3. Kimberley: McGregor Museum.
- Morris, D. 1996. *An Archaeological Impact Assessment at Flamink, Waterkuil, Calvinia District*. Unpublished report for Gypsum Industries.
- Morris, D. 1999. *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*. McGregor Museum Kimberley.
- 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 Aggeneys, Northern Cape*. Appendix G in Eyethu Engineers CC: Scoping report: environmental impact assessment for the proposed Aggeneys 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. McGregor Museum Kimberley.
- Morris, D. 2002. *Driekopseiland and 'the rain's magic power': history and landscape in a new interpretation of a Northern Cape rock engraving site*. MA diss., University of the Western Cape, Cape Town.

- Morris, D. 2003. *AIA for the farm Koodoosberg 141*. Unpublished report McGregor Museum.
- Morris, D. 2005a. Further evidence of spouts on ostrich eggshell containers from the Northern Cape, with a note on the history of anthropology and archaeology at the McGregor Museum, Kimberley. *South African Archaeological Bulletin* 60: 112-114.
- Morris, D. 2005b. *Report on a Phase 1 Archaeological Impact Assessment of proposed mining areas on the farms Ploegfontein, Klipbankfontein, Welgevonden, Leeuwfontein, Wolhaarkop and Kapstevél, west of Postmasburg, Northern Cape*.
- Morris, D. 2005c. *Archaeological Impact Assessment of Abrahamoos Fontein near Plooyburg, Northern Cape*.
- Morris, D. 2007a. *Mokala National Park: a first report on heritage resources*. Kimberley:McGregor Museum.
- Morris, D. 2007b. *Archaeological specialist input with respect to upgrading railway infrastructure on the Sishen-Saldanha Ore Line: Borrow pits at Loop 8*.
- Morris, D. 2010/2011. *Archaeological Impact Assessment Phase 1: Proposed development of PV Power Station at Greefspan, near Douglas, Northern Cape*. McGregor Museum, Kimberley, and Morris, D. 2011. *Archaeological Impact Assessment Phase 1 (upgraded)*.
- Morris, D. January 2011a. *A Phase 1 Heritage Impact Assessment for the proposed Aggeneis – Paulputs 220KV Transmission Line*.
- Morris, D. 2011b. *Sato Energy Holdings Zuurwater photovoltaic energy generation facility development near Aggeneys, Northern Cape*. Heritage Impact Assessment.
- Morris, D. 2011c. *Black Mountain concentrated solar power facility development at Aggeneys, Northern Cape*. McGregor Museum Kimberley.
- Morris, DRNM. 2012a. *Rock art in the Northern Cape: the implications of variability in engravings and paintings relative to issues of social context and change in the precolonial past*. PhD diss., University of the Western Cape.
- Morris, D. 2012b. *Desktop Heritage Impact Assessment: Proposed 1.5 ha extension of gravel mine, portion 2 of the farm Aroams 57, Near Aggeneys, Northern Cape Province*. Unpublished report for Greenmined Environmental.
- Morris, D. 2013a. *Khobab Wind Energy Facility: power line route options, access road and substation positions specialist input for the environmental basic assessment and environmental management programme for proposed power line options for the Loeriesfontein 1 wind & Loeriesfontein 3 solar energy facility at Sous and Aan De Karee Doorn Pan, north of Loeriesfontein, Northern Cape Province*. Unpublished report for Savannah Environmental.
- Morris, D. 2013b. *Archaeological and Cultural Heritage Investigation for the Environmental and Social Impact Assessment (ESIA) for the Gamsberg Zinc Mine and associated infrastructure in Northern Cape, South Africa*.
- Morris, D & Beaumont, P. 1991. !Nawabdanas: Archaeological Sites at Renosterkop Kakamas District, Northern Cape. *South African Archaeological Bulletin* 46: 115-124.
- Morris, D, Steyn, M & Ribot, I. 2006. A burial from Driekopseiland, Northern Cape. *The South African Archaeological Bulletin* 61(184): 133-141.
- Morris, D & Seliane, M. 2005/2007. *Archaeological Impact Assessment at Taaibosch Fontein near Plooyburg, Northern Cape*. McGregor Museum, Kimberley.

- Mossop, EE. 1935. *The journal of Hendrik Jacob Wikar (1779)*: 1-201 and Engelbrecht, JA *The tribes of Wikar's Journal*: 222-237. The Van Riebeeck Society 15: Cape Town.
- Nel, J. 2008. Archaic. Final report heritage resources survey and preliminary assessment, Transnet freightline EIA, Eastern Cape and Northern Cape.
- Nkambule, DT. 2011. *The Ngwenya mines: a historical overview and assessment with recommendations for the management of the archaeological and other heritage resources*. Hons diss. Unisa.
- Noli, D & Avery, G. 1987. Stone circles in the Cape Fria area, northern Namibia. *South African Archaeological Bulletin* 42: 59-63.
- Orton, J. 2002/2003. Superficial comparisons and reality: a reassessment of Dunefield Midden and the Swartkop Industry. *Southern African Field Archaeology* 11 & 12: 64-67.
- Orton, J. 2007. The sampling of ephemeral shell scatters in Namaqualand, South Africa. *The South African Archaeological Bulletin* 62(185): 74-78.
- Orton, J. 2011a. *Heritage impact assessment for the proposed Koekenaap wind energy facility, Vredendal Magisterial District, Western Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd.
- Orton, J. 2011b. *Heritage impact assessment for the proposed Matzikamma solar park, Vredendal Magisterial District, Western Cape*. Unpublished report prepared for DJ Environmental Consultants.
- Orton, J. 2011c. *Heritage impact assessment for three solar energy facilities at De Aar, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd. St James: ACO Associates.
- Orton, J. 2012a. *Heritage impact assessment for a proposed photovoltaic energy plant on the farm Vogelstruisbult near Klipgatspan, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd.
- Orton, J. 2012b. *Heritage impact assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd.
- Orton, J. 2012c. *Heritage impact assessment for a proposed photovoltaic energy plant on the farm Klipgat Pan near Copperton, Northern Cape*. Unpublished report prepared for Aurecon South Africa (Pty) Ltd.
- Orton, J. 2012d. *Heritage impact assessment for a proposed Rare Earth separation plant in Vredendal, Western Cape*. Unpublished report prepared for Savanna Environmental (Pty) Ltd.
- Orton, J. 2012e. Tortoise burials in Namaqualand: uncovering ritual behaviour on South Africa's west coast. *Azania: Archaeological Research in Africa* 47: 99-114.
- Orton, J. 2013. *Rareco Rare Earth Separation Plant, Vredendal, Western Cape Province*. Prepared for Savannah Environmental (Pty) Ltd.
- Orton, J & Halkett, D. 2010. Stone tools, beads and a river: two Holocene microlithic sites at Jakkalsberg in the northwestern richtersveld, Northern Cape, South Africa. *South African Archaeological Bulletin* 65: 13-25.
- Orton, J, Hart, T & Halkett, D. 2005. Shell middens in Namaqualand: two hunter-gatherer sites at Rooiwalbaai, Northern Cape Province, South Africa. *South African Archaeological Bulletin* 60: 24-32.

- Orton, J, Klein, RG, Mackay, A, Schwartz, S & Steele, T. 2011. Two Holocene rock shelter deposits from the Knersvlakte, southern Namaqualand, South Africa. *Southern African Humanities* 23: 109–50.
- Orton, J & Webley, L. 2013. *Heritage Impact Assessment for proposed granite prospecting near Pofadder, Northern Cape*. Unpublished report prepared for Sizisa Ukhanyo Trading 830 cc.
- Parsons, I. 2003. Lithic expressions of Later Stone Age lifeways in the Northern Cape. *South African Archaeological Bulletin* 58: 33-37.
- Parsons, I. 2004. Stone circles in the Bloubos landscape, Northern Cape. *Southern African Humanities* 16: 59-69.
- Parsons, I. 2007. Hunter-gatherers or herders? Reconsidering the Swartkop and Doornfontein Industries, Northern Cape Province, South Africa. *Before Farming* 4: Article 3.
- Parson, I. 2008. Five Later Stone Age artefact assemblages from the interior Northern Cape Province. *South African Archaeological Bulletin* 63: 51-60.
- Pelser, AJ. 2011. *A report on an archaeological impact assessment (AIA) for the proposed solar energy plant on Klein Zwart Bast 188, Kenhardt District, Northern Cape*. Unpublished report AE1104 prepared for Robert De Jong & Associates. Archaeos.
- Pelser, AJ. 2012. *A report on a Heritage Impact Assessment (HIA) for a proposed photovoltaic solar power generation plant on Klein Zwart Bast 188, Kenhardt District, Northern Cape*. For Escience Associates (Pty) Ltd.
- Porat, N, Chazan, M, Grün, R, Aubert, M, Eisenmann, V & Horwitz, LK. 2010. New radiometric ages for the Fauresmith industry from Kathu Pan, southern Africa: implications for the Earlier to Middle Stone Age transition. *Journal of Archaeological Science* 37: 269–283.
- Sadr, K. 2003. The Neolithic of southern Africa. *Journal of African History* 44: 195-209.
- Sampson, CG. 1968. The Middle Stone Age industries of the Orange River scheme area. *National Museum Bloemfontein Memoir* 4: 1–111.
- Sampson, CG. 1984. A prehistoric pastoralist frontier in the Upper Zeekoe Valley, South Africa. In Hall, M, Avery, G, Avery, DM, Wilson, ML & Humphreys, AJB (eds) *Frontiers: southern African archaeology today*: 96–110. Oxford: British Archaeological Reports International series 207.
- Sampson, CG. 1985. Atlas of Stone Age settlement in the central and upper Seacow Valley. *National Museum Bloemfontein Memoir* 20: 1-116.
- Sampson, CG. 1986. Model of a prehistoric herder-hunter contact zone: a first approximation. *South African Archaeological Society Goodwin Series* 5: 50-56.
- Sampson, CG. 2010. Chronology and dynamics of Later Stone Age herders in the Seacow River valley, South Africa. *Journal of Arid Environments* 74: 842-848.
- Steele, T, Mackay, A, Orton, J & Schwartz, S. 2012. Varsche Rivier 003. A new Middle Stone Age site in southern Namaqualand, South Africa. *South African Archaeological Bulletin* 67: 108-119.
- Stow, GW. 1872. Griqualand West. *Cape Monthly Magazine* 5: 65-78.
- Stow, GW. 1910. *The native races of South Africa* (Edited by G.M. Theal). London: Swan Sonnenschein & Co.

- Thackeray, AI, Thackeray, JF & Beaumont, PB. 1983. Excavations at the Blinkklipkop specularite mine near Postmasburg, Northern Cape. *South African Archaeological Bulletin* 38:17-25.
- Van der Ryst, MM. 2006. *Seeking shelter: hunter-gatherer-fishers of Olieboomspoot, Limpopo, South Africa*. Unpublished PhD: University of the Witwatersrand.
- Van der Ryst, MM & Küsel, SU. 2011. *Specialist report on the Stone Age and other heritage resources at Kolomela, Postmasburg, Northern Cape*. Commissioned by African Heritage Consultants.
- Van der Ryst, M & Küsel, S. 2012. *Phase 2 mitigation and specialist study of Middle Stone Age localities on the farm Zandkopsdrift 357, Garies District, Northern Cape Province*. Commissioned by Sedex and AGES (Gauteng) (Pty) Ltd.
- Van der Ryst, MM & Küsel, SU. 2013a. *Phase 2 specialist study of affected Stone Age locality at site SA02, a demarcated surface area, on the farm Nooitgedacht 469 (Woon 469)*. Commissioned by Sishen Iron Ore Mine and AGES (Pty) Ltd.
- Van der Ryst, MM & Küsel, SU. 2013b. Middle Stone Age technological organisation: lithic extraction at Swartkop Hill in the interior of Namaqualand, Northern Cape, South Africa. *Azania: Archaeological Research in Africa*. (In press).
- Van der Walt, J. 2012. *Archaeological Impact Assessment for the proposed Hantam PV solar energy facility on the farm Naronsies 228, Loeriesfontein, Northern Cape*. Unpublished report to Savannah Environmental.
- Van der Walt, J. 2013. *Archaeological Impact Assessment for the Garob to Kronos Power Line, near Copperton in the Northern Cape Province*. Unpublished report to Savannah Environmental.
- Van Jaarsveld, A. 2006. 31 March 2006. *Hydra-Perseus and Beta-Perseus 765kv transmission power lines Environmental Impact Assessment*.
- Van Ryneveld, K. 2005a. *Cultural Resources Management Impact Assessment: portion 1 of Roode Pan 146, Kimberley District, Northern Cape, South Africa*. McGregor Museum.
- Van Ryneveld, K. 2005b. *Cultural Resources Management Impact Assessment: (Portion of Uitdraai 33, Prieska District, Northern Cape, South Africa)*. Report to Digby Wells & Associates Environmental Solutions Provider.
- Van Ryneveld, K. 2006. *Vogelstruis Bult 104, Prieska District, Northern Cape, South Africa*.
- Van Ryneveld, K. 2007. *Portions of Erf 1, Douglas, Phase 1 Archaeological Impact Assessment*.
- Van Ryneveld, K. 2012. *!Xun and Khwe solar project Platfontein 68, Solplaatjie Municipality, Northern Cape, South Africa*.
- Van Schalkwyk, J. 2008. *Heritage impact survey report for the development of visitor facilities in the Mokala National Park, Northern Cape Province*.
- Van Schalkwyk, J. 2011a. *Heritage impact assessment report for the proposed establishment of a PV solar facility by mainstream renewable power in the Prieska region, Northern Cape Province*.
- Van Schalkwyk, J. 2011b. *Heritage Impact Assessment for the proposed establishment of a wind farm and PV facility by mainstream renewable power in the Loeriesfontein region, Northern Cape*. Unpublished report for SiVest Environmental Division.

Van Schalkwyk, J. March 2011c. *Heritage impact assessment for the proposed Eskom 400kv electricity transmission line, Aggeneys to Helios Substations, Northern Cape Province.*

Veldman, A. 2008. *Living on the edge: Damara herders in the landscape.* Hons diss. Unisa.

Webley, LE. 1992. Early evidence for sheep from Spoeg River Cave, Namaqualand. *Southern African Field Archaeology* 1: 3–13.

Webley, L. 2009. *An Archaeological Desktop Study (Report 3): Proposed construction of a substation between Aries-Helios and associated loop in and loop out lines, Northern Cape.*

Webley, L & Halkett, D. 2010a. *An archaeological Impact Assessment (Report 2): Proposed construction of a substation between Helios-Juno and associated loop in and loop out lines, north of Nieuwoudtville, Northern Cape.* Unpublished report for Nzumbululo Heritage Solutions.

Webley, L & Halkett, D. 2010b. *An Archaeological Impact Assessment (Report 3): Proposed construction of a substation between Aries-Helios and associated loop in and loop out lines, west of Brandvlei in the Northern Cape.* Unpublished report for Nzumbululo Heritage Solutions.

Webley, L & Halkett, D. 2010c. *An Archaeological Impact Assessment (Report 4): Proposed construction of a substation between Aries-Garona and associated loop in and loop out lines, north-west of Kenhardt in the Northern Cape.* Unpublished report for Nzumbululo Heritage Solutions.

Webley, L & Halkett, D. 2010d. *Archaeological (Incl Heritage) Impact Assessment: Proposed Prospecting on Portion 2 and Remainder Portion of the farm Zandkopsdrift 537, Garies, Northern Cape.* The Archaeology Contracts Office: Department of Archaeology University of Cape Town.

Webley, L & Halkett, D. 2012a. *Heritage Impact Assessment: proposed Kenhardt photovoltaic solar power plant on remainder of the farm Klein Zwart Bast 188, Northern Cape Province.*

Webley, L & Halkett, D. 2012b. *Heritage Impact Assessment: proposed Loeriesfontein photovoltaic solar power plant on portion 5 of the farm Klein Rooiberg 227, Northern Cape Province.*

Webley, L & Orton, J. 2012. *Heritage impact assessment: proposed construction of the Graspan photovoltaic power facility, Pixley Ka Seme district municipality, Northern Cape Province.*

Wilkins, J and Chazan, M. 2012. Blade production ~500 thousand years ago at Kathu Pan 1, South Africa: support for a multiple origins hypothesis for early Middle Pleistocene blade technologies. *Journal of Archaeological Science* 39(6): 1883-1900.

Xhariep District Municipality Capacity Building Programme Integrated Environmental Programme Final Draft October 2004.

9.3 Maps and aerial photographs

1: 50 000 Topocadastral maps
Google Earth

APPENDIX 1: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE RESOURCES

Significance

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by its aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. Historic value				
Is it important in the community, or pattern of history				
Does it have strong or special association with the life or work of a person, group or organisation of importance in history				
Does it have significance relating to the history of slavery				
2. Aesthetic value				
It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group				
3. Scientific value				
Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage				
Is it important in demonstrating a high degree of creative or technical achievement at a particular period				
4. Social value				
Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons				
5. Rarity				
Does it possess uncommon, rare or endangered aspects of natural or cultural heritage				
6. Representivity				
Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects				
Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class				
Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.				
7. Sphere of Significance		High	Medium	Low
International				
National				
Provincial				
Regional				
Local				
Specific community				
8. Significance rating of feature				
1.	Low			
2.	Medium			
3.	High			

APPENDIX 2. RELEVANT LEGISLATION

All archaeological and palaeontological sites, and meteorites are protected by the National Heritage Resources Act (Act no 25 of 1999) as stated in Section 35:

(1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority-

- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite;
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

In terms of cemeteries and graves the following (Section 36):

(1) Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit.

(2) SAHRA must identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with the grave referred to in subsection (1), and must maintain such memorials.

(3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority-

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- (c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

APPENDIX 3. METHODOLOGY FOR THE ASSESSMENT OF POTENTIAL IMPACTS

All impacts identified during Scoping and EIA stages of the study will be classified in terms of their significance. The broad significance categories are as follows:

- The **Nature** of the impact: This will describe the cause and the effect, what will be affected and how it will be affected.
- **Mitigation level:** The degree at which the impact can be mitigated.
- The **Extent** of the impact: This will be categorised as local, regional or national.
- The **Magnitude** of the impact: This will be quantified as:
 - Low: Will cause a low impact on the environment;
 - Moderate: Will result in the process continuing but in a controllable manner;
 - High: Will alter processes to the extent that they temporarily cease; and
 - Very High: Will result in complete destruction and permanent cessation of processes.
- The **Probability:** which shall describe the likelihood of impact occurring and will be rated as follows:
 - Extremely remote: Which indicates that the impact will probably not happen;
 - Can Occur: there is a possibility of occurrence;
 - Unusual but Possible: Distinct possibility of occurrence;
 - Almost Certain: Most likely to occur; and
 - Certain/ Inevitable: Impact will occur despite any preventative measures put in place.
- **The duration (Exposure):** wherein it will be indicated whether:
 - The impact will be of a immediate;
 - The impact will be of a short tem (between 0-5 years);
 - The impact will be of medium term (between 5-15 years);
 - The impact will be long term (15 and more years); and
 - The impact will be permanent.
- **Reversibility/ Replaceability:** The degree at which the impact can be **reversible or the lost resource can be replaced.**

To determine the significance ranking, the following ranking (or similar) will be applied to each impact identified:

The Significance of the impact is calculated as follows:

$$\text{Significance} = \text{Consequence (Magnitude+ Duration+ Extent + Reversibility)} \times \text{Probability}$$

Table 1: Significance ranking (Savahanna Environmental, 2008)

RANKING	MAGNITUDE	REVERSIBILITY	EXTENT	DURATION	PROBABILITY
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact	Almost certain

				ceases after operational life of asset)	
3	Moderate	Reversibility with human intervention	Provincial	Medium term	Can occur
2	Low		Local	Short term	Unusual but possible
1	Minor	Completely reversible	Site bound	Immediate	Extremely remote
0	None		None		None

RANKING	100-65	64-36	35-16	15-5	4-1
SIGNIFICANCE	Very High	High	Moderate	Low	Minor