HERITAGE IMPACT ASSESSMENT (SCOPING) FOR THE PROPOSED SAN KRAAL WIND POWER (PTY) LTD WIND ENERGY FACILITY TO BE SITUATED IN THE NORTHERN CAPE.

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

Prepared for
Arcus Consulting

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April 2016

ACO Associates cc
Archaeology and Heritage Specialists

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Summary

ACO Associates CC has been appointed by Arcus Consulting Pty Ltd to contribute a specialist heritage report into the scoping phase of an EIA process for the proposed San Kraal Wind Energy Facility. The project area lies in the Great Karoo in the Northern Cape Province just 6 km south east of Noupoort. This is an arid area situated on the escarpment of an area locally known as the Kikvorsberge. The area is quite sparsely populated and rural in nature. This report explores issues with respect to the broad discipline of heritage which includes palaeontology, archaeology, historic structures, history, places and landscape quality. Previous work in the area has revealed a long history of human occupation, several periods of conflict and numbers of archaeological sites. The palaeontology of the Karoo and escarpment is internationally significant.

The impact assessment phase of the project will need to address the following issues:

- Archaeology. The physical remnants of human activity need to be identified and assessed through physical site inspection, mapped and assigned field grades. This is a field intensive process as there are no databases in existence that have enough detailed information that will allow the assessment to take place at a desktop level. Much of the South African landscape has never been surveyed.
- Palaeontology. The area is paleontologically sensitive. The SAHRIS palaeontological sensitivity mapping project has made a big contribution to preliminary desktop research in terms of the identification of potentially sensitive geology, however the detailed work has to be done through physical field assessment which will involve physical inspection of rock exposures. This will need to be done during the EIA process.
- Landscape and setting. The assessment of the landscape as a heritage resource will require the integration of findings of the visual impact assessment as well as consideration of the methods of landscape characterisation and grading to produce an integrated statement of impact for purposes of the EIA.
- The Northern Cape Heritage authority is responsible for the heritage issues in the Northern Cape. All reports will be uploaded to SAHRIS for their attention.

Details of the specialist

This study has been undertaken by Tim Hart BA Hons, MA (ASAPA, APHP) of ACO Associates CC, archaeologists and heritage consultants.

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CURRICULUM VITAE

Name: Timothy James Graham Hart

Profession: Archaeologist

Date of Birth: 20/07/60

Parent Firm: ACO Associates

Position in Firm: Director

Years with Firm: 9

Years experience: 30 years

Nationality: South African

HDI Status: n/a

Education: Matriculated Rondebosch Boys High, awarded degrees BA (UCT) BA Hons (UCT) MA (UCT).

Professional Qualifications: Principal Investigator ASAPA, member of Association of Heritage Professionals (APHP)

Languages: Fully literate in English, good writing skills. Conversation in Afrikaans, mediocre writing skills, good reading skills. Some knowledge of Latin.

PROPOSED POSITION ON TEAM: Overall project co-director, task leader on field projects.

KEY QUALIFICATIONS

- Bachelor of Arts in Archaeology and Psychology
- BA Honours in archaeology
- MA in Archaeology
- Recipient of Frank Schwietzer Memorial Prize (UCT) for student excellence
- Professional member (no 50) Association of Southern African Professional Archaeologists (ASAPA)
- Principal Investigator, cultural resources management section (ASAPA)
- Professional member in specialist and generalist categories Association of Heritage Professionals (APHP)
- Committee Member Heritage Western Cape, Committee Member SAHRA
- Awarded Department of Arts and Culture and Sport award for best heritage study in 2014,

Relevant recent Project Experience with respect to large projects:

- Specialist Specialist consultant – Eskom's Kudu Integration project (identifying transmission line routes across Namaqualand)
- Specialist consultant – Eskom's Atantis Open Cycle Gas Turbine project, upgrade and power lines
- Specilaist consultant – Eskom's Mossel Bay Open Cycle Gas Turbine project, substations and power lines
- Specialist consultant – Eskoms proposed Omega sub-station
- Specialist consultant – Eskoms Nuclear 1 programme
- Specialist consultant – Eskoms PBMR programme
- Specialist consultant – Department of Water Affairs raising of Clanwilliam Dam project
- Specialist consultant to De Beers Namaqualand Mines (multiple projects since 1995)
- Specialist consultant – Saldanha Ore Handling Facility phase 2 upgrade
- Three years of involvement in Late Stone Age projects in the Central Great Karoo
- Wind Energy systems: Koekenaap, Hopefield, Darling, Vredendal, Bedford, Sutherland, Caledon
- Specialist consultant – Eskom nuclear 1
- Bantamsklip Nuclear 1 TX lines
- Koeberg Nuclear 1 TX lines
- Karoo uranium prospecting various sites
- HIA Houses of Parliament
- Proposed Ibhubesi gas project, West Coast of South Africa.

Experience

After graduating from UCT with my honours degree I joined the Southern Methodist University (SMU Dallas Texas) team undertaking Stone Age research in the Great Karoo. After working in the field for a year I registered for a Masters degree in pre-colonial archaeology at UCT with support from SMU. On completion of this degree in 1987 I commenced working for the ACO when it was based at UCT. This was the first unit of its kind in RSA.

In 1991 I took over management of the unit with David Halkett. We nursed the office through new legislation and were involved in setting up the professional association and assisting SAHRA with compiling regulations. The office developed a reputation for excellence in field skills with the result that ACO was contracted to provide field services for a number of research organisations, both local and international. Since 1987 in professional practise I have has been involved in a wide range of heritage related projects ranging from excavation of fossil and Stone Age sites to the conservation of historic buildings, places and industrial structures. To date the ACO Associates CC (of which I am co-director) has completed more than 1500 projects throughout the country ranging from minor assessments to participating as a specialist in a number of substantial EIA's as well as international research projects. Some of these projects are of more than 4 years duration

Together with my colleague Dave Halkett I have been involved in heritage policy development, development of the CRM profession, the establishment of 2 professional bodies and development of professional practice standards. Notable projects I have been involved with are the development of a heritage management plan and ongoing annual mitigation for the De Beers Namaqualand Mines Division, heritage management for Namakwa Sands and other west coast and Northern Cape mining firms. Locally, I was responsible for the discovery of the "Battery Chavonnes" at the V&A Waterfront (now a conserved as a museum – venue for Da Vinci exhibition), the discovery of a massive paupers burial ground in Green Point (now with museum and memorial), the fossil deposit which is now the subject of a public display at the West Coast Fossil Park National Heritage Site as well as participating in the development of the Robben Island Museum World Heritage Site. I have teaching experience within a university setting and have given many public lectures on archaeology and general heritage related matters. I am presently running a NLF funded project to research the historic burial grounds of Green Point.

Academic Publications

Hart, T.J.G. 1987. Porterville survey. In Parkington, J & Hall, M.J. eds. Papers in the Prehistory of the Western Cape, South Africa. Oxford: BAR International Series 332.

Sampson, C.G., Hart, T.J.G., Wallsmith, D.L. & Blagg, J.D. 1988. The Ceramic sequence in the upper Sea Cow Valley: Problems and implications. South African Archaeological Bulletin 149: 3-16.

Plug, I. Bollong, C.A., Hart, T.J.G. & Sampson, C.G. 1994. Context and direct dating of pre-European livestock in the Upper Seacow River Valley. Annals of the South African Museum, Cape Town.

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Hart, T. & Halkett, D. 1994. The end of a legend? Crossmend, HARG. University of Cape Town.

Hart, T 2000. The Chavonnes Battery. Aquapolis. Quarterly of the International Center for Cities on Water. 3-4 2000.

Hine, P, Sealy, J, Halkett, D and Hart, T. 2010. Antiquity of stone walled fish traps on the Cape Coast of South Africa. The South African Archaeological Bulletin. Vol. 65, No. 191 (JUNE 2010), pp. 35-44

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Klein, R.G., Cruz-Uribe, K., Halkett, D., Hart, T., Parkington, J.E. 1999. Paleoenvironmental and human behavioral implications of the Boegoeberg 1 late Pleistocene hyena den, northern Cape province, South Africa. Quaternary Research 52, 393-403.

Smith, A., Halkett, D., Hart, T. & Mütti, B. 2001. Spatial patterning, cultural identity and site integrity on open sites: evidence from Bloeddrift 23, a pre-colonial herder camp in the Richtersveld, Northern Cape Province, South Africa. South African Archaeological Bulletin 56 (173&174): 23-33.

Smith, A., Halkett, D., Hart, T. & Mütti, B. 2001. Spatial patterning, cultural identity and site integrity on open sites: evidence from Bloeddrift 23, a pre-colonial herder camp in the Richtersveld, Northern Cape Province, South Africa. South African Archaeological Bulletin 56 (173&174): 23-33.

Halkett, D., Hart, T., Yates, R., Volman, T.P., Parkington, J.E., Klein, R.J., Cruz-Uribe, K. & Avery, G. 2003. First excavation of intact Middle Stone Age layers at Ysterfontein, western Cape province, South Africa: implications for Middle Stone Age ecology. Journal of Archaeological Science

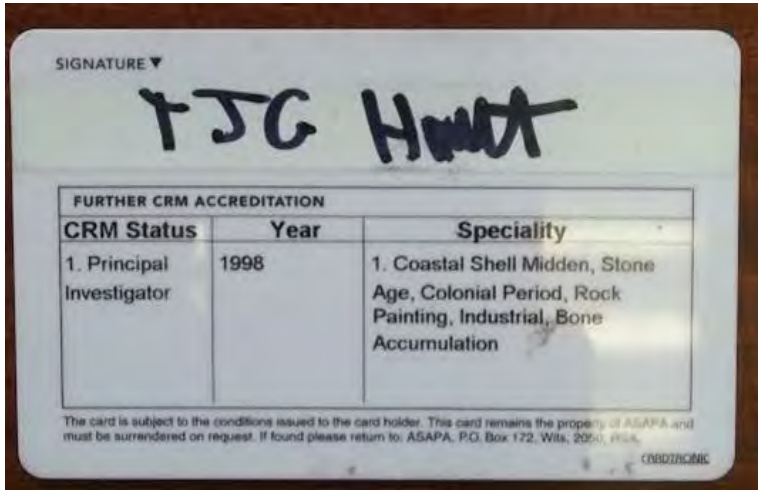
Cruz-Uribe, K., Klein, R.G., Avery, G., Avery, D.M., Halkett, D., Hart, T., Milo, R.G., Sampson, C.G. & Volman, T.P. 2003. Excavation of buried late Acheulean (mid-quaternary) land surfaces at Duinefontein 2, western Cape province, South Africa. Journal of Archaeological Science 30.

Parkington, JE. Poggenpoel, C. Halkett, D. & Hart, T.2004 Initial observations from the Middle Stone Age coastal settlement in the Western Cape In Conard, N. Eds. Settlement dynamics of the Middle Paleolithic and Middle Stone Age. Tubingen: Kerns Verlag.

Orton, J. Hart, T. Halkett, D. 2005. Shell middens in Namaqualand: two later Stone Age sites at Rooiwalbaai, Northern Cape Province, South Africa. South African Archaeological Bulletin. Volume 60 No 181

G Dewar, D Halkett, T Hart, J Orton, J Sealy, 2006. Implications of a mass kill site of springbok (Antidorcas marsupialis) in South Africa: hunting practices, gender relations, and sharing in the Later Stone Age .Journal of Archaeological Science 33 (9), 1266-127

Finnegan, E. Hart, T and Halkett, D. 2011. The informal burial ground at Prestwich Street, Cape Town: Cultural and chronological indicators for the informal Cape underclass. The South African Archaeological Bulletin Vol. 66, No. 194 (DECEMBER 2011), pp. 136-148



SIGNATURE ▼

TJG Hart

FURTHER CRM ACCREDITATION

CRM Status	Year	Speciality
1. Principal Investigator	1998	1. Coastal Shell Midden, Stone Age, Colonial Period, Rock Painting, Industrial, Bone Accumulation

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<<archaeologists

THE ASSOCIATION OF SOUTHERN AFRICAN PROFESSIONAL ARCHAEOLOGISTS

ACCREDITED PROFESSIONAL ARCHAEOLOGIST FOR THE SADC REGION

TG Hart

050

Professional Member

EXP. 31/07/2016

Declaration of independence

PROJECT: Proposed San Kraal (Pty) Ltd Wind Energy Facility at Noupoort.

I, Tim Hart, as the appointed independent specialist hereby declare that I acted as the independent specialist in this application; and that I

- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and

- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;

- have and will not have no vested interest in the proposed activity proceeding;

- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;

- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;

- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;

- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;

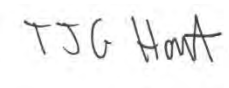
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;

- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and

- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.

Signature of the specialist:



Name of company:
ACO Associates cc

Date: 15 April 2016

GLOSSARY

Archaeology: *Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.*

Calcrete: *A soft sandy calcium carbonate rock related to limestone which often forms in arid areas*.

Cultural landscape: *The combined works of people and natural processes as manifested in the form of a landscape*

Early Stone Age: *The archaeology of the Stone Age between 700 000 and 2500 000 years ago***.**

Fossil: *Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.*

Heritage: *That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999.*

Holocene: *The most recent geological time period which commenced 10 000 years ago.*

Late Stone Age: *The archaeology of the last 20 000 years associated with fully modern people.*

Middle Stone Age: *The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.*

Midden: *A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.*

National Estate: *The collective heritage assets of the Nation*

Palaeontology: *Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.*

Pan: *A shallow depression in the landscape that accumulates water from time to time.*

Palaeosole: *An ancient land surface.*

Pleistocene: *A geological time period (of 3 million – 20 000 years ago).*

Pliocene: *A geological time period (of 5 million – 3 million years ago).*

Miocene: *A geological time period (of 23 million - 5 million years ago).*

SAHRA: *South African Heritage Resources Agency – the compliance authority which protects national heritage.*

Structure (historic:) *Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.*

Acronyms

DEAT	Department of Environmental Affairs and Tourism
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
LSA	Late Stone Age
MSA	Middle Stone Age
NHRA	National Heritage Resources Act
SAHRA	South African Heritage Resources Agency
WEF	Wind Energy Facility
PV	Photo-voltaic (solar) array

Contents

1 Introduction

The proposed San Kraal Wind Energy Facility is to be situated just 6 km south east of the town of Noupoort in the Great Karoo. The proposed facility will built on the high lying ground at the edge of the Kikvorsberge Escarpment. Here the escarpment breaks up into a series of flat topped ridges and hills which provide expanses of flat elevated areas suitable for wind energy development. The N9 between Noupoort and Middelberg and the railway system lie a short distance (5 km) to the west of the project area. This is rugged country characterised by often arid conditions, large dolerite sills, ridges and outcrops and deep valleys. It is sparsely populated and generally rural, with razing of sheep and cattle being the primary occupation of local famers.

The proposed 390 MW San Kraal WEF would consist of the following infrastructural components:

- Up to 78 turbines with a generation capacity between 3 – 5 MW and a rotor diameter of up to 150 m, a hub height of up to 150 m and blade length of up to 75 m;
- Foundations (up to 25 x 25 m) and hardstands associated with the wind turbines;
- Internal access roads of between 8 m (during operation) and 14 m (during construction) wide to each turbine;
- 33kV underground electrical cables will be laid to transmit electricity generated by the wind turbines to the onsite switching station;
- Overhead medium voltage cables between turbine rows where necessary;
- An on-site switching-station complex (15 000 m^2) to facilitate stepping up the voltage from medium to high voltage (132 kV) to enable the connection of the WEF to the proposed Umsobomvu WEF 400kV Substation, and the generated power will be fed into the national grid;
- A 25 km 132 kV high voltage overhead power line from the on-site switching station to the proposed 400 kV Umsobomvu substation to the national grid;
- A 7500 m^2 operations and services workshop area/office building for control, maintenance and storage;
- Temporary infrastructure including a site camp; and
- A laydown area approximately 7500 m^2 in extent, per turbine.

The total size of the land portions within which the proposed development will be located is 10 511.51 hectares. The footprint of the proposed development is estimated to be less than 1% of this area.

Description	**Dimensions**		
	Length (m)	**Breadth (m)**	**Area (sqm)**
Eskom 400kV Umsobomvu substation	150	150	22500
San Kraal 132/33 kV switching station	150	100	15000

OMS Area	150	50	7500
Construction compound	50	40	2000
Container storage area	50	40	2000

1.1 Time and season

In the arid Karoo areas the season in which the work is done will not influence the outcome of the study as visibility is good all year round.

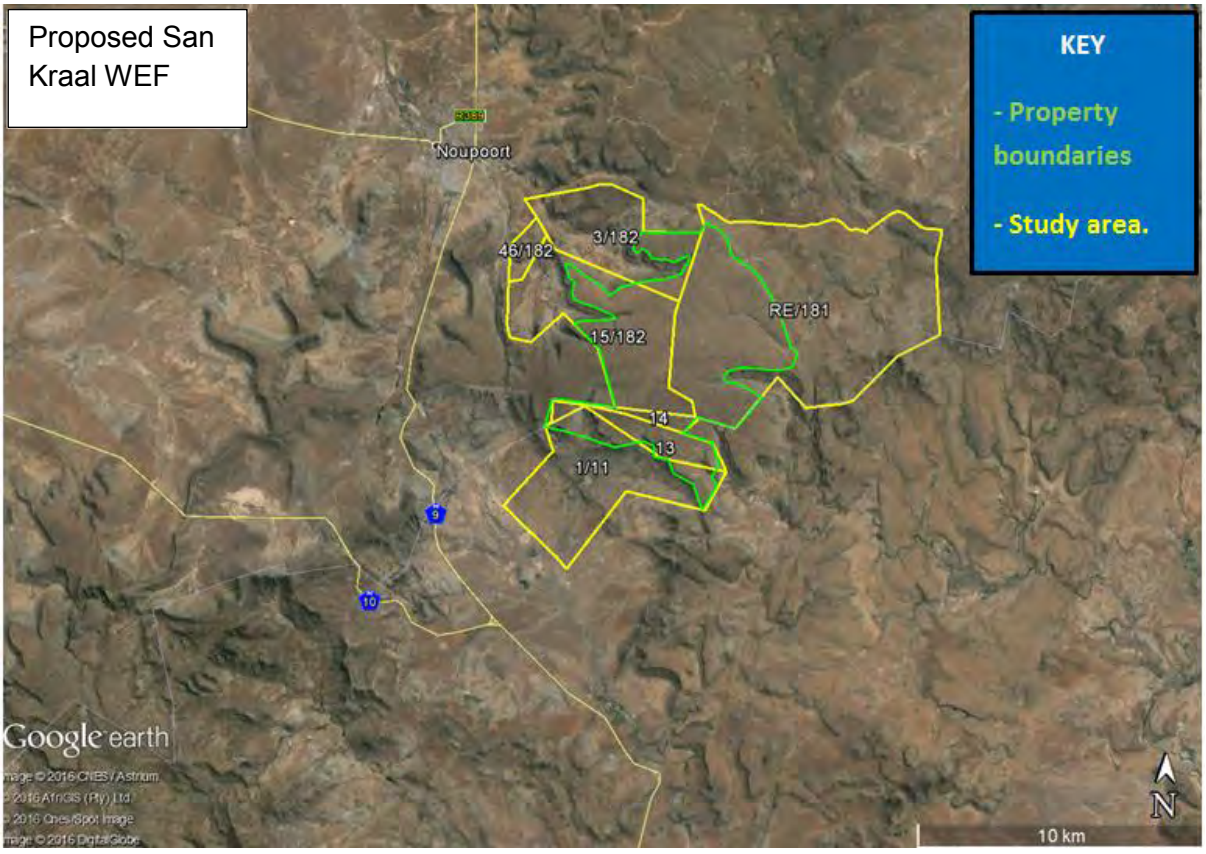


Figure 1 Location of the proposed San Kraal WEF.

2 Methodology

This study is a desktop assessment that has not involved any field work. The study area is known to the author of this report as he has completed a number other studies nearby including being a staff member of the Zeekoe Valley Archaeological project and a co-excavator with Prof Brit Bousman (Bousman 1988) at Blydefontein in the nearby Kikvorsberge. The heritage character of the area can therefore be reasonably anticipated.

In terms of written sources, a number of heritage studies have taken place in the region as well as the Zeekoei Valley Archaeological Survey which has generated numerous scientific publications on Karoo archaeology.

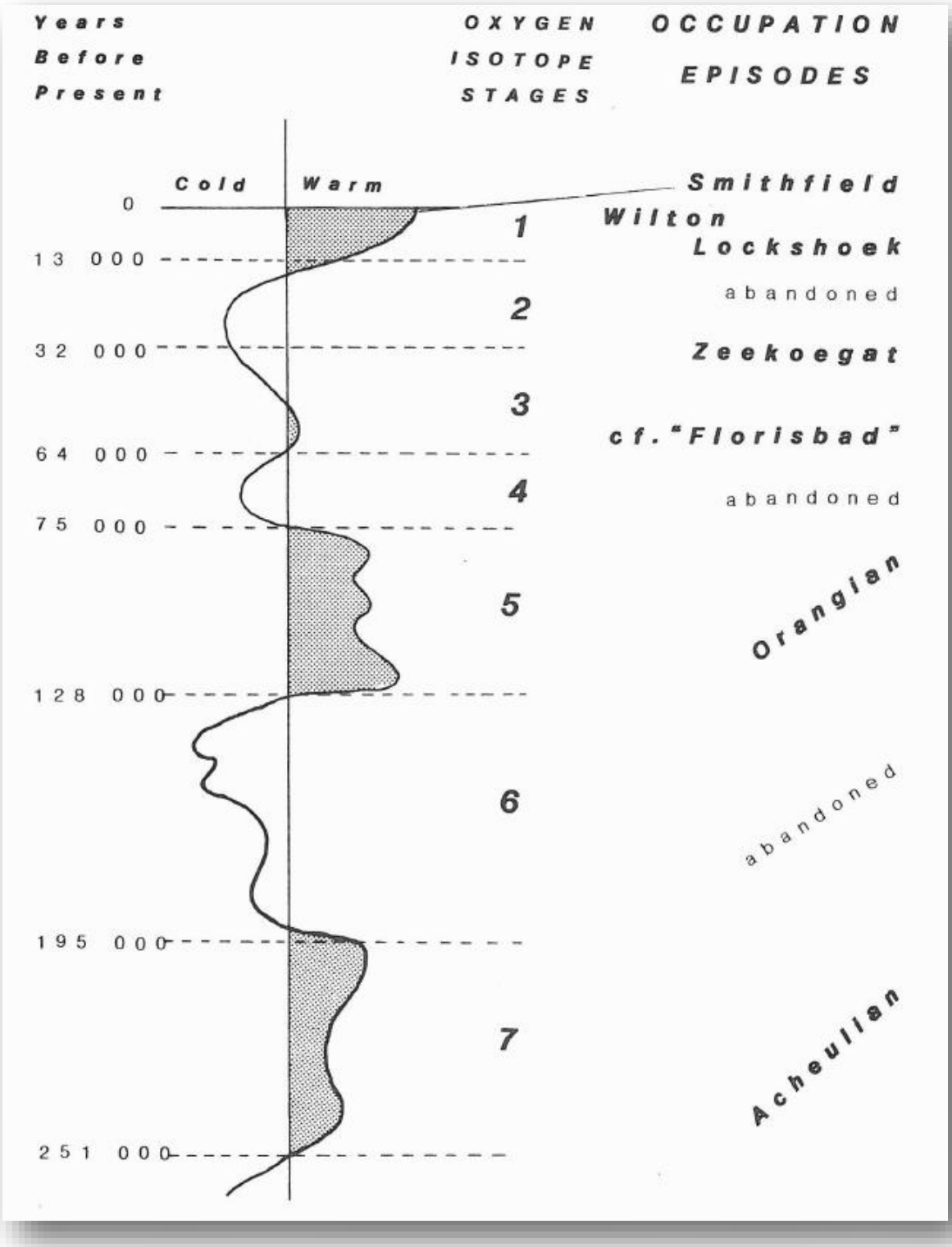


Figure 2 The sequence of occupation of the Karoo by humans as proposed by Sampson 1985 (after Sampson 1985)

3 Heritage indicators within the receiving environment

This study has focused on the notion of the project area as a series of layered cultural landscapes which form the main heritage indicators assessed in this study. The study area is a typical slice of this eastern central Karoo landscape.

3.1 The Karoo as a cultural landscape

The central Karoo is almost entirely given over to sheep, some cattle and game farming. Overgrazing since the advent of formal farming in the 19th century has caused some changes to the landscape in terms of the composition of vegetation. Acocks (1953) has claimed that pure grass veld gave way to Karoo scrub only after livestock was introduced; however it is apparent that rainfall fluctuation does cause seasonal and even cyclical oscillations with respect to prevalence of Karoo scrub versus grasslands.

Overall, the damage caused by modern surface development has been slight. To all intents and purposes the project area has the qualities of an intact natural area, which on a world scale is fast becoming a rare resource. In areas where transformation has taken place – sheet erosion and donga formation has had an impact. The settlements and farms represent a comparatively ephemeral imposition of the landscape of colonial settlement. The flood zones of major water courses have been transformed by agriculture. Aside from these comparatively moderate interventions the Karoo remains dominated by its wilderness qualities. Indications are that this situation is changing: there are numerous proposals for the establishments of renewable energy facilities which will have a significant impact in terms of industrialisation of the landscape, there is a possibility of *fracking* and uranium mining taking place, as well as the construction of the Square Kilometer Array, will accumulatively add a significant 21st century development layer that will significantly impact the status-quo and probably irreversibly.

The heritage of the Karoo is essentially a series of layers of events (or landscapes) that has become superimposed on the land surface. The earliest of these is the Karoo palaeontology – an ancient landscape that was deposited as a result of a vast inland sea. The shores and swamps of this landscape abounded with ancient species of fish, plants, invertebrates and early mammal-like reptiles. After the breakup of Gondwanaland the Karoo took on the geology that has resulted in its particular character. Millions of years later it was home to successions of early human occupation. Stone Age occupations of the Early, Middle and Later Stone age left half a million years of human made debris on the land surface. Superimposed on the Karoo landscape one more is the history of European colonisation and the wars that went with it.

3.1.1 The Palaeontological Landscape

The Karoo is to all intents and purposes is a massive palaeontological landscape consisting of multiple layers of sediments that contain a vast array of fossils ranging from fish, early

vertebrates, plant remains and trace fossils. It is considered to be one of the most complete fossil repositories on the planet. Generally the Karoo fossils predate the age of the life forms popularly known as *dinosaurs* by some scores of millions of years. The vertebrates of these times are known as early mammal-like reptiles which were ancestral to dinosaurs, hence the Karoo palaeontological sequence has contributed on a world scale to understanding the development of life forms on the planet. The project area lies in a mosaic of highly fossiliferous areas within the Karoo.

The geology and paleontology of the region has been a subject of research since the early 20th century. The flat plains of the Nama Karoo are underlain by a series of shale and mudstone strata which represent some 400 million years of depositional events (Visser 1986). The basal rocks of the Karoo sequence are known as the Dwyka formation which was deposited by a wet based glacier during the Permo-Carboniferous glaciation. This was followed by the deposition of the Ecca formation which is made up of sediments deposited in a shallow lake that covered what is now the interior of Southern Africa. Ecca shales form many of the large flat plains of the Northern Karoo (Truswell 1977; Tankard et al 1982; Visser 1986). The best known depositional event of the Karoo sequence is the laying down of the Beaufort shales about 230 million years ago. These shales are rich in a stratified sequence of fish, reptilian and amphibian remains that lie fossilized in Permian and Triassic period swamp deposits (Truswell 1977; Visser 1986; Oelofsen and Loock 1987). At the end of the Triassic period a series of geological upheavals took place with the fragmentation of the Gondwanaland continent. These were largely responsible for giving the Karoo its characteristic landscape (Figure 3). Triassic period volcanic activity took place over an extended period of time beginning at 187 million years ago (Truswell 1977). During this time the horizontal volcanics of the Drakensberg were laid down and the shales of the Karoo were penetrated by dolerite intrusions and extrusions in the form of vertical dykes and horizontal sills following the bedding planes of the shales. These geological structures give rise to a very characteristic topography with general occurrences of mesas, hillocks and sharp ridges (Visser 1986).In the study area extruding dolerite dykes and hillocks exposed through differential erosion are dominant features of the landscape giving rise to the vast flat plains of mudstones dolerite outcrops and hills that are so characteristic of this area (Figure 3). These igneous events resulted in the formation of Hornfels a fine grained black rock with a conchoidal fracture. Hornfels is formed when a dolerite intrusion takes place and bakes the surrounding mudstone to a metamorphic form (Visser 1987). Millions of years later prehistoric peoples enthusiastically exploited hornfels exposures for raw material for making artefacts – a staple resource in the Karoo for hundreds of thousands of years.

3.1.2 The pre-colonial cultural landscape

Sampson (1985) stated that one of the many reasons for him choosing to undertake archaeological research in to the Karoo was that it was that the heritage was intact and untouched by ploughing and recent intervention. The pre-colonial archaeology of the Karoo was not only visible, but also prolific and in exceptionally good condition. A comprehensive survey of a 5000 square kilometre catchment area (the Valley of the Zeekoei River from the

Sneeuberg Mountains to the Gariep River Valley) which lies immediately west of the project area revealed the presence of some 10 000 archaeological sites representing a history of human occupation that dates back at least 250 000 years (or more). Of the 10 000 sites recorded and identified to industry (phases), some 6000 were attributable to the Late Stone Age. Sampson identified some 7 industries (phases) of human history within his study area – each of which are legible on the landscape today, and each of which represent a pre-colonial layer of the human history of the Karoo. A deep discussion of technicalities of Karoo archaeology is not warranted in this report as it is complex and pre-supposes knowledge of archaeology that most members of the general public don't have. Figure 2 depicts the phasing of the human occupation of the Karoo (directly applicable to Northern Cape and Free State). It would be inappropriate to discuss the details of the specific occupation phases in this report, other than to mention that each one the phases of human occupation described by Sampson (1985) represents a pulse of human occupation of the central Karoo – the population of people at any given time reflecting variations in climate and the degrees of aridity and temperature that dictate the viability of the landscape as a place suitable for people to live. Each phase of occupation has left its archaeological signature on the landscape which is identifiable by the kinds of stone artefacts that have been left behind. The different phases are broadly termed the Early Stone Age and Middle Stone Age. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region.

The latest phase of occupation of the Great Karoo is a period known as the Late Stone Age. It is a very important layer on the landscape as this represents the heritage of the Khoekhoen (historically known as "Hottentot" by early writers) and San (popularly known as Bushman) people of South Africa. The direct descendants of these groups make up a significant proportion of the population today. This heritage is represented by two industries (phases). These are the Interior Wilton which is characterised by a microlithic stone artefact industry characterised by lightly patinated hornfels (indurated shale stone) and the later Smithfield industry characterised by specific classes of stone artefacts and the presence of grass tempered ceramics.

The scarcity of natural caves and shelters in the Karoo landscape has resulted in the majority of archaeological sites being open occurrences of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved in open contexts. The most recent archaeological remains relating to the San have been historically described as the "Smithfield Industry", and are found from the Free State to the Northern and Eastern Cape. The Smithfield typically contains flaked lithics (on unpatinated blue-black hornfels), grinding equipment, bored stones, and potsherds (typically relating to bowl-shaped pots with stamp impressed decoration). Formal stone tools include end scrapers. Sampson also recognized a

Khoekhoen ceramic tradition and he speculates on the chronological ordering of the settlement in the valley (1988, 2010). Also associated with the Late Stone age of the Karoo are rare rock paintings which occur in the few caves and shelters to be found in the dolerites, however more plentiful are engraved rocks and stones and stone surfaces.

After 1000 years BP (before present) people who were herding sheep/goats and possibly cattle, made an incursion into Karoo and established a new economic order based on transhumant pastoralism (Hart 1989, Sampson, Hart, Wallsmith and Blagg 1989, Sampson 2010). The presence of herding people is represented by stone walled structures that occur throughout the Karoo. They have been recorded within the Zeekoei River Valley, between De Aar and Victoria West (within this project study area) and even in the inhospitable high Karoo near Sutherland (Hart 2005) and on the West Coast (Sadr 2007).

The spatial distribution of Late Stone Archaeological sites in the Karoo is quite patterned. People needed to be close to water so rivers, pans and springs played an important role in influencing where people lived. The climate of the Karoo also played a key role. The winters can be extremely cold with temperatures dropping well below zero, made worse by freezing winds. The summers in contrast are harsh, hot and rainfall is unreliable. Sampson has observed that almost all Late Stone Age sites are situated at the bottom of the breaks of dolerite dykes, in sheltered areas on the crests of dolerite dykes, as well as in dolerite mazes and outcrops. So too, are the stone circles and circle complexes built by Khoekhoen groups after 1000 AD which are almost always built on the edges of low ridges and dykes. The higher ridges provided a view, some security, loose stones with which to build kraals and screens and allowed people to be elevated above the frost levels in winter. Definable sites of the Late Stone Age are sparse on the vast flat shale plains as these areas offered little protection from the wind and collect frost in winter. Similarly sites tend to be rare on exposed hilltops and very high ridges hence natural features such as rock outcrops and dolerite dykes played a significant role for Late Stone Age people.

The archaeology of the Karoo is so intact that Sampson (1988) was able to gather enough observations to postulate the existence on the landscape the territorial boundaries of different groups of people based on the variations on the decorative motifs on pottery. Recent evidence (Sampson 2010) indicates that once herding groups settle in the Karoo, their presence was continuous until the incursion of European *trekboere* in the 1700's.

Earlier archaeological sites (ESA and MSA) may also be found associated with natural foci, however indications are that the location of this kind of material is more widely broadcast. Distinct foci are few and in places scatters of dispersed and eroded material may be found over vast expanses of landscape.

3.1.3 The landscape of colonial settlement

The indigenous people of Karoo waged a bitter war against colonial expansion as they

gradually lost control of their traditional land. Penn (2005) notes the most determined indigenous resistance to *trekboer* expansion occurred when they entered the harsh environment of the escarpment of the interior plateau (namely Hantam, Roggeveld and Nieuweveld and Sneeuberg Mountains). Similarly *trekboer* settlers find their progress onto the upper escarpment halted at the Sneeuberg close to the project area. The San people launched an almost successful campaign to drive them out. Numerous place names throughout the Karoo such as Oorlogspoort and Oorlogskloof are testimony the skirmishes of the late 18th century. The situation became so desperate that the colonists fought back by establishing the "Kommando" system – the "hunting" of San was officially sanctioned in 1777 (Dooling 2007) and in some instances bounties were obtainable from the local landrost (on presentation of body parts). The Drostdy of Graaff Reinet (the northernmost regional center of the time) played a significant role in this long and bitter war which eventually saw the almost complete destruction of the Karoo San People.

The advent of the early European Settlers into the Great Karoo is one which is largely un-documented. These European pastoralists were highly mobile; trekking between winter and summer grazing on and off the escarpment. Land ownership was informal, and only became regulated after the implementation of the quitrent system of the 19th century used by the Government to control the lives and activities of the farmers.

The Europeans moved onto land associated with water sources or perennial fountains (Westbury and Sampson 1993). Many of the early settlers first attempted to cultivate wheat, and to all accounts were successful at first. Almost all historic ruins of farm houses have associated *trapvloere* – floors where wheat was winnowed in all likelihood for domestic use. The San resisted the presence of the Europeans vigorously – life on the frontiers of the Cape was no easy matter for all parties involved. The San saw their traditional territories and hunting areas diminishing, the vast game herds of the Karoo dwindled. The San used every opportunity to impede the progress of the Europeans by raiding lonely farms, murdering the occupants and stealing stock. The Europeans were allowed by law to shoot San males on sight and take women and children into servitude. By 1770 the Karoo was the furthest frontier of the Cape Colony. By 1820 after the suppression of the San the Karoo was quickly divided into quitrent or loan farms, the process of land seizure from the indigenous inhabitants was formalized through a government regulated process of formal land grants. Even in the early 19th century there were tracts of landscape simply known as "crown land" – much of this was marginal being away from rivers and fountains. It was on these patches of crown land that the last surviving groups of San eked out a meager existence. As the land parcels that were available to them diminished, they found themselves with little option other than to work as herdsmen and servants for the colonists (Sampson, Sampson and Neville 1994; Penn 2004).

The two major regional centers in the area, Beaufort West and Graaff Reinet were established as administrative centers to exert hegemony over the activities of the *Trekboere* who were prone to behave as free agents without governance. Of the two centers, Graaff Reinet, is the

oldest being establish under the Dutch rule at the Cape as a legal and administrative center. The town has an extraordinarily colourful history, as being so remote from Cape Town; its citizens were inclined to exert independence to the point that Graaff Reinet was the seat of several rebellions, and for a period a self-proclaimed republic. The appointment of the a firm-handed administrator, Andries Stockenstroom saw the dissent quelled, and ongoing problems for farmers caused by the Karoo San brought to an end by force of arms (Franzen 2006). Noupoort was established in the 1870's as a railway junction when the Union Railway Company established the railway system. It was a railway village until 1942 when it gained a formal municipality (Raper, Undated). It continues to play an important role in the functioning of the railway system but is not a tourist destination of consequence.

3.1.4 History of the farms

Indications are that most of the farms in the study area would have started as loan farms.
A loan farm was given out after a person petitioned the government for permission to use a piece of land. They paid tithes to the government for the use but it was not generally recorded in title deeds with surveyor's diagrams. Many of these loan farms were circular in shape because of a custom that allowed the farmer to take a measurement from a central spot, such as a homestead, spring or rock formation. The walking-off distance was regarded as about 750 roods (2.8km), amounting to an area of around 3000 morgen (2570 hectares). Weak springs are at the centres of most of loan farms indicates the importance of even the most meagre water resources on this landscape. The formal granting of title deeds only took place in the early 19th century, however judging by the kinds of artefacts and structures found on the landscape, many of the farms were established informally long before land was formally granted or loaned.

4 Identified sensitivities

4.1 Palaeontology

Any form of bedrock excavation has the potential to affect continental sediments of the Beaufort Group. These sediments underlie the great much of the study area and are renowned for their rich fossil heritage of terrestrial vertebrates (most notably mammal-like reptiles or therapsids), as well as fish, amphibians, molluscs, trace fossils (e.g. trackways) and plants (e.g. petrified wood). Butler (2014) has identified a number of fossils close to the project area that relate to the underlying Balfour formation (part of the Beaufort Group) and has indicated that a minimum of site monitoring is required in this general area.

Excavations and other construction work undertaken into Beaufort Group bedrock in order to install the wind turbines and associated infrastructure are likely to expose, disturb, destroy or seal-in valuable fossil heritage. Although the direct impact will be local, these fossils are of importance to national as well as international research projects on the fossil biota of the ancient Karoo and the Permian mass extinction events. Consequently, the impact from disturbance and/or destruction of valuable fossil heritage of the Beaufort Group bedrock is of high significance, at both local and regional levels" (Almond 2010). Unfortunately at scoping level it is very difficult to predict sensitivity as fossil finds are usually associated with specific

rock strata, and even within strata form areas of varying density and significance, the detailed nature of which can only be established through physical survey and identification.

4.2 Archaeological heritage

The pre-colonial heritage sensitivities of the site are likely to be typical of what has been found in the area before. Rock paintings are known to exist in the area while Orton (2014) located evidence of numerous Late Stone Age archaeological sites, stone features, graves and historic ruins in the Blydefontein area.

It can be reasonably assumed that the entire spectrum of Stone Age archaeology can be expected to be present in varying quantities depending on local erosional and depositional contexts, however the locations of such material do need to be field verified.

Experience throughout the Karoo has shown that high ridges seldom attracted any form of prehistoric occupation. Ridge tops tend to be dry, windswept and very cold in winter. Unless there was a large rock shelter, source of water or a raw material, it is not expected that the system of ridges with the study area are likely to be sensitive in terms of archaeology. The turbine sites which are normally situated on high ground are likely to be relatively insensitive.

Valley bottoms were rather more favoured by pre-colonial people for occupancy. Here there are normally sources of water, shelter from the prevailing winds as well as the potential for grazing small stock on or close to the sandy river beds. Also important were low ridges on or adjacent to flat plains. Khoikhoi kraals were almost always built adjacent to or against low ridges and cliffs. Anywhere where there is a cluster of rock that provided shelter from the wind or a shallow cave inevitably has archaeological material associated with it.

4.3 Landscape and setting

Aesthetic impacts along the escarpment of the Kikvorsberge are a concern. The escarpment while not dramatic, is a scenic area, while the N9 is a scenic Karoo route. It has strong wilderness qualities, typical Karoo vistas and a sense of isolation. The combined effect of wind energy facilities will impact the aesthetic qualities of the region which will diminish the value of the landscape as an aesthetic resource.

Figure 3 View of the Kikvorsberge escarpment. Turbines will be situated on the high areas.

5 Assumptions and uncertainties

The most significant assumption that has been made for this particular study is that what is known from adjacent areas and studies is applicable to the San Kraal scenario. While this is a relevant assumption to make, the way that people have used the landscape throughout history is not necessarily uniform or particularly predictable.

At the time of writing this report the site has not been physically inspected, proposed positions of infrastructure are preliminary. While the terms of reference for this study require the assessment of potential impacts, there is not enough knowledge available at scoping level about the site to achieve this with a good degree of confidence. However the history of the region is well researched and adequate for compilation of a scoping report.

6 Legislation and policies

The basis for all Heritage Impact Assessments (HIA) is the National Heritage Resources Act, No 25 of 1999 (NHRA), which in turn prescribes the manner in which heritage is assessed and managed. The NHRA has defined certain kinds of heritage as being worthy of protection, by either specific or general protection mechanisms. In South Africa the law is directed towards the protection of human made heritage, although places and objects of scientific importance are covered. The National Heritage Resources Act also protects intangible heritage such as traditional activities, oral histories and places where significant events happened. Generally protected heritage, which must be considered in any heritage assessment, includes:

- Any place of cultural significance (described below)
- Buildings and structures (greater than 60 years of age)
- Archaeological sites (greater than 100 years of age)
- Palaeontological sites and specimens
- Shipwrecks and aircraft wrecks
- Graves and grave yards.

Section 38 of the NHRA stipulates that HIAs are required for certain kinds of development such as rezoning of land greater than 10 000 m2 in extent or exceeding 3 or more sub-divisions, linear developments in excess of 300 m or for any activity that will alter the character or landscape of a site greater than 5000 m2. Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:

a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

b) the construction of a bridge or similar structure exceeding 50 m in length;

c) any development or other activity which will change the character of a site--

i) exceeding 5 000 m^2 in extent; or

ii) involving three or more existing erven or subdivisions thereof; or

iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Section 3(3) of the National Heritage Resources Act (NHRA), No 25 of 1999 defines the cultural significance of a place or objects with regard to the following criteria:

(a) its importance in the community or pattern of South Africa's history;
(b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

(c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
(d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
(e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
(f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;
(g) its strong or special association with a particular community or cultural group for social cultural or spiritual reasons;
(h) 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
(i) sites of significance relating to the history of slavery in South Africa.

6.1 Scenic Routes

While not specifically mentioned in the NHRA, No 25 of 1999, Scenic Routes are recognised as a category of heritage resources which requires grading as the Act protects area of aesthetic significance (see clause "e" above). Baumann & Winter (2005) comment that the visual intrusion of development on a scenic route should be considered a heritage issue.

6.2 Heritage Grading

A key tool in the assessment of heritage resources is the heritage grading system which uses standard criteria. In the context of an EIA process, heritage resources are graded following the system established by Winter & Baumann (2005) in the guidelines for involving heritage practitioners in EIA's (Table 1). The system is also used internally within Heritage Authorities around the country for making decisions about the future of heritage places, buildings and artefacts.[1] Presently Heritage Western Cape has a good guide to grading which is nationally applicable, on their website (http://www.westerncape.gov.za/public-entity/heritage-western-cape). The grading system was designed with structures in mind but has been applied to archaeological sites, streetscapes, objects. The call has been made by the heritage authority to apply the system to landscapes although this is variably applied in South Africa. The decision making process that we have used in this report is based on a simple 3-phase process.

1) Decide what kind of landscape is involved (rural, natural wilderness, historical townscape or historical agricultural area) – establish its dominant characteristics taking cognisance of UNESCO guidelines and previous work.
2) Establish the value of the landscape in terms of its history, its aesthetic value and its value to a given community (in this case its tourism value).
3) Consider the intactness of the landscape – has it been recently intruded on by new development (we have taken 60 years as a marker as this is generally used as a historic cut-off), and using the grading system as a guide suggest a field grading.

[1] http://www.westerncape.gov.za/other/2012/9/grading_guide_&_policy_version_5_app_30_may_2012.pdf

The system is in its early days of development and still needs to be refined further.

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

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

Heritage specialists use the grading system to express the relative significance of a heritage resource. This is known as a field grading or a recommended grading. Official grading is done by a special committee of the relevant heritage authority; however heritage authorities rely extensively on field grading in terms of decision making. It must be noted that the subdivision of grades 3A-3C is merely a guidance tool and not legally applicable.

7 Need and desirability of the project

The need for renewable energy is essentially two-fold. Firstly the planet is facing an unprecedented environmental crisis brought on historical dependence on fossil fuels which have contributed to global warming and climate change. Wind turbines represent renewable energy that is not dependent on the use of fossil fuels (apart from during construction). During operation they produce no emissions. Secondly, South Africa which is heavily reliant on fossil fuels is having its own energy crisis as there is not enough generating capacity to sustain base-load supply. A diversity of supplementary sources is needed to contribute to the national grid.

The negative side of renewable energy facilities is that they are large industrial developments that are more often than not situated outside of the urban edge. Hence the impacts on the aesthetic and heritage qualities of large tracts of the South African Landscape can be high.

8 Accumulative impacts

Accumulative impacts in the Great Karoo are a concern. There are at least 5 proposals for renewable energy facilities within a 35 km radius (Figure 5), however it must considered that not all of these will be approved. The combined effect of wind energy facilities will impact the aesthetic qualities of the region which will diminish the value of the landscape as an aesthetic resource and potentially affect its future in terms of conservation related enterprises which in recent years have blossomed throughout the central Karoo.

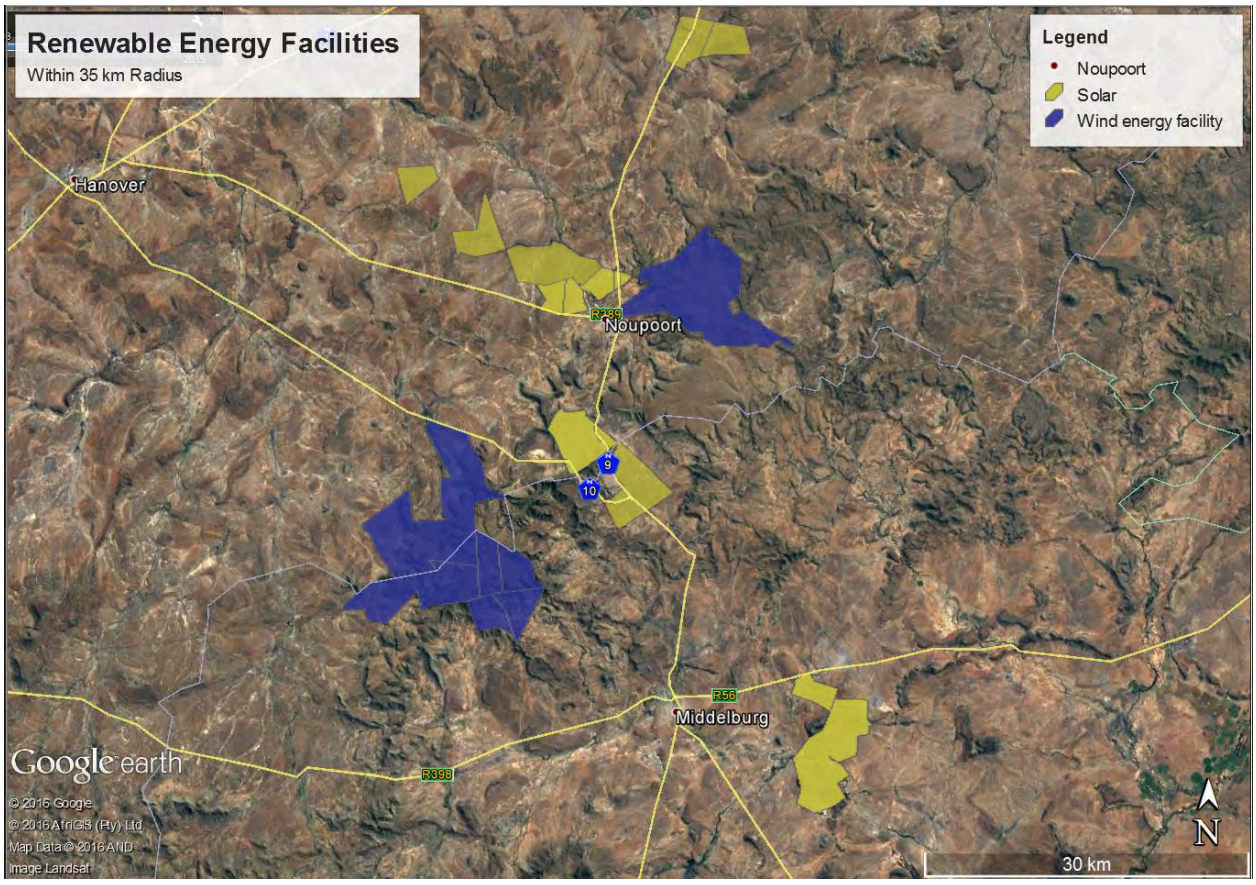


Figure 5. The map of renewable energy proposals shows the potential for accumulative impacts between De Aar, Noupoort and Middelburg.

9 Alternatives

An alternative turbine layout for the San Kraal WEF will be produced based on the results of the Scoping phase results and assessed in the EIA phase. Alternatives for grid connections have been proposed.

10 Methodology

10.1 Assessing heritage in the context of wind energy developments

Wind energy facilities have increased exponentially throughout the world in response to the international energy crisis and climate change. Initially communities enthusiastically accepted the presence of wind energy facilities, however web-based research of international experience has indicated that they are not without controversy. The impacts of clusters of massive wind turbines on cultural landscape can be severe, both in physical terms and with respect to the intangible and aesthetic qualities of a given locality. In terms of landscapes and heritage in South Africa, there are no pro-active detailed local regional studies that can be consulted which make objective and standardised assessment of impacts quite difficult. It is generally recognised that severe impacts can occur, however the heritage authorities generally recognise the desirability of clean energy and the need to build clean energy facilities in landscape that can tolerate them. Heritage sites are contextually sensitive to any form of development – this is particularly the case with a heritage site or place that is well known, well used and publically celebrated.

Wind energy facilities are often big developments. Turbines (some facilities with several hundred turbines are proposed in parts of RSA) can be more than 100 m high with blades greater than 50 m in radius. The structure has to be counterweighted by a concrete block sunk deep into the ground. Each turbine site needs road access that can be negotiated by a heavy lift crane which means that in undulating topography deep cuttings and numerous roads may be made into a landscape to create workable gradients.

The point at which a wind turbine may be perceived as being “intrusive” in terms of the aesthetics of an area is a subjective judgment which is value laden depending on individual backgrounds, perceptions and values. However it can be anticipated that the presence of such facilities close to wilderness and heritage areas will destroy many of the intangible and aesthetic qualities for which an area is valued, or could be potentially valued in the future. Yet the circumstances are variable as in certain landscape forms, the graceful shapes of the turbines and the sculptured twist of the rotors are perceived to be aesthetically pleasing. In essence, the perception of whether a wind turbine is an acceptable presence in a landscape depends greatly on context, setting, landscape character and an individual’s aesthetic values.

The degree of physical landscape disturbance caused during the construction of turbines is such that the destruction of archaeological and palaeontological heritage can be a high likelihood. Hence, in the assessment of impacts of wind energy proposals it is necessary to assess both physical damage to heritage caused by the establishment of infrastructure, as well as focus on the way that such a facility can change the aesthetic and intangible values of the cultural landscapes in which the physical heritage resources exist.

10.2 Landscape and setting

Landscapes are heritage resources of national or regional or local importance in terms of rarity and representativeness

The UNESCO Operational Guidelines for the World Heritage Convention (1995) identified three main types of cultural landscapes derived from the following characteristics:

a. The **clearly defined landscape** designed and created intentionally. This embraces garden and parkland landscapes constructed for aesthetic reasons
b. The **organically evolved landscape.** This results from an initial social, economic, administrative, and/or religious imperative and has developed its present form by association with and in response to its natural environment. Such landscapes reflect that process of evolution in their form and component features. They fall into two sub-categories:
c. A **relict (or fossil) landscape** is one in which an evolutionary process came to an end at some time in the past, either abruptly or over a period. Its significant distinguishing features are, however, still visible in material form.
d. A **continuing landscape** is one which retains an active social role in contemporary society closely associated with the traditional way of life, and in which the evolutionary process is still in progress. At the same time it exhibits significant material evidence of its evolution over time.
e. The **associative cultural landscape** included by virtue of the powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence which may be insignificant or even absent (Extract from paragraph 39 of the Landscape *Operational Guidelines for the Implementation of the World Heritage Convention)*

Also criteria that have been considered (Baumann, Winter, Aikman 2005) locally are:

- Design quality
  The landscape should represent a particular artistic or creative achievement or represent a particular approach to landscape design

- Scenic quality
  The landscape should be of high scenic quality, with pleasing, dramatic or vivid patterns and combinations of landscape features, and important aesthetic or intangible qualities (vividness, intactness, unity)

- Unspoilt character/authenticity/integrity
  The landscape should be unspoilt, without visually intrusive urban, agricultural or industrial development or infrastructure. It should thus reveal a degree of integrity and intactness
- Sense of place

The landscape should have a distinctive and representative character, including topographic and visual unity and harmony

- Harmony with nature
  The landscape should demonstrate a good example of the harmonious interaction between people and nature, based on sustainable land use practices

- Cultural tradition
  The landscape should bear testimony to a cultural tradition which might have disappeared or which illustrates a significant stage in history or which is a good example of traditional human settlement or land use which is representative of a culture/s

- Living traditions
  The landscape should be directly and tangibly associated with events or living traditions with ideas or with beliefs, with artistic and literary works of high significance

The study area lies within a rural context. In terms of the UNESCO guidelines it is a natural evolving landscape. In terms of the assessment checklist published by Baumann, Winter, Aikman (2005) the landscape is largely intact as a natural landscape, intrusions within the last 60 years are moderate, therefore it may be considered reasonably authentic.

11 Impact Assessment

11.1 Potential Impacts associated with wind energy facilities.

Wind energy facilities are big developments that can produce a wide range of impacts that will affect the heritage qualities of an area. Each turbine site needs road access that can be negotiated by a heavy lift crane(s) which means that in undulating topography deep cuttings and contoured roads will have to be cut into the landscape to create workable gradients. During the construction phase each of the turbine sites will have to be leveled off to create a solid platform for cranes as well as a lay-down area for materials. This will involve earthmoving and road construction, followed by the bringing in of materials and plant. The actual construction of the turbines will involve excavation into the land surface over an area of some 25 x 25 m for the concrete base. The pre-fabricated steel tower is bolted on to the base and erected in segments. The nacelle containing the generator is finally attached followed by the rotors. The turbines are connected to underground cables that will connect to an onsite switching-station, where after the generated current will transported via 132 kV transmission powerlines to the proposed 400 kV Umsobomvu Substation to be located west of the facility, of which there after the generated electricity will be fed into the national grid via 400 kV transmission lines.

11.2 Impacts expected during the construction phase of the wind energy facility

During the construction phase the following physical impacts to the landscape and any heritage that lies on it can be expected:

- Construction of roads to turbines sites with a possibility of cut and fill operations in places:
- Upgrading of existing farm tracks;
- Creation of working and lay-down areas close to each turbine site;
- Excavation of foundations for each tower;
- Excavation of many kilometers of linear trenches for cables;
- Erection of a power line/s;
- Construction of electrical infra-structure in the form of one or more sub-stations.

In terms of impacts to heritage, archaeological sites which are highly context sensitive are most vulnerable to the alteration of the land surface. The best way to manage impacts to archaeological material is to avoid impacting them. This means micro-adjusting turbine positions where feasible, or routing access roads around sensitive areas. If primary avoidance of the heritage resource is not possible, then some degree of mitigation can be achieved by systematically removing the archaeological material form the landscape. This is generally considered a second best approach as the process that has to be used is exacting and time-consuming, and therefore expensive.

It is also during the construction phase that impacts to palaeontological heritage may be expected. Blasting and cutting of roads, digging of the turbine foundations are the areas where fossil bearing rock may be impacted and fossil material physically destroyed.

It is suggested that the following mitigation measures could be implemented.

- Existing farm tracks be re-used or upgraded to minimise the amount of change to un-transformed landscape;
- During the detailed planning phase, drawings of proposed road alignments, infrastructure and near-final turbine positions should be submitted to an archaeologist for review and field-proofing. Micro-adjustment of alignments and turbine positions is likely to be sufficient to achieve adequate mitigation.
- During the EIA phase the population of heritage sites in and around the study area must be sampled so that the findings can inform planning decisions.

11.3 Impacts expected during operation of the wind energy facility

In terms of Oberholzer's (2005) classification of development activities, construction of wind turbines is a major industrial activity and therefore a category 5 development. Category 5 developments in natural landscapes tend to have a very high visual impact. This implies that there would be a significant change to the sense of place and character of the site.

During the operational life of the wind farm, it is expected that physical impacts to heritage will diminish or cease. Impacts to intangible heritage are expected to occur. Such impacts relate to changes to the feel, atmosphere and identity of a place or landscape. Such changes are evoked by visual intrusion, noise, changes in land use and population density. In the case of

this project, impacts to remote and rural landscape and wilderness qualities are possibly of greatest concern. The point at which a wind turbine may be perceived as being “intrusive” from a given visual reference point is a subjective judgment, however it can be anticipated that the presence of such facilities close to (for example) wilderness and heritage areas will destroy many of the intangible and aesthetic qualities for which an area is valued. The fact that turbines are continuously revolving results in a visual impact that can be very disturbing and destructive to the sense of serenity of a place.

- Due to the size of the turbines the visual impacts are largely not easily mitigated (they are easily visible from 10 km) in virtually all landscapes.
- The fact that the turbines are in continuous motion creates a visual impact more severe than that caused by static objects and buildings;
- Shadow flicker – an impact particular to wind turbines, comprises very large moving shadows created by the giant blades when the sun is low on the horizon. Such shadows can extend considerable distances from the turbine. Continuous shadow flicker will have a serious impact on the sense of place of a heritage site;
- Visual impact of road cuttings into the sides of slopes will affect the cultural, natural and wilderness qualities of the area;
- Residual impacts can occur after the cessation of operations. The large concrete turbine bases will remain buried in the ground indefinitely. Bankruptcy or neglect by a wind energy company can result in turbines standing derelict for years creating a long term eyesore.

While it is not expected that physical impacts will result, changes to the way in which the area is used by people can result in impacts. If the intangible qualities of a place are affected in such a way that it becomes an undesirable place to visit or reside, the sustainable use of local tourism amenities may diminish. There is merit in making sure that no structures are affected by shadow flicker or noise which may result in them being uninhabitable.

12 Impacts of grid connection

The impact of the proposed San Kraal connections are of rather a lesser intensity than those associated with the wind energy facility. The footings for the towers are shallower and the service road is normally a simple track. It is possible that archaeological sites could be disturbed but the rather shallower excavations mean the palaeonotological impacts will be less. The lines will cause an aesthetic impact for up to a 5 km radius (depending on topography and weather) which means that there is potential for accumulative impacts close to regional substations where grid connections converge. The presence of a certain amount of infrastructure in the area such as the N9 and the electrical and linear infrastructure of the railway system are 20th century clutter which means that the presence of additional powerlines are unlikely to be out of place in the local environment.

Table 2 Summary of impacts – construction phase San Kraal

Impact Phase: Construction							
<u>Possible</u> Impact or Risk **Construction impacts on palaeo, human-made and landscape aspects associated with development of the WEFs.**							
ANTICIPATED SCOPING IMPACTS TO BE SCOPED OUT OR INVESTIGATED FURTHER							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local	Perm.	Medium	Neg	Medium	Possible	Medium
With Mitigation	Local	Perm.	Low	Neg/pos	Low (+)	Possible	Medium
Can the impact be reversed?			YES - If not mitigated, certain archaeological and palaeontological resources are not replaceable. Setting and landscape impacts are not replaceable.		NO - destruction of heritage material is not reversible as it can never be authentically replaced.		
Will impact cause irreplaceable loss or resources?			YES – archaeological sites can be avoided or subject to rescue excavation. Similar applies to palaeontological resources.		NO – Landscape impacts on this scale are difficult to mitigate, however the visual assessment will suggest adjustments that will help.		
Can impact be avoided, managed or mitigated?			YES – Archaeology and palaeontology and rock paintings must be assessed as well as buildings, ruins. Landscape must be graded.				
Mitigation measures to reduce residual risk or enhance opportunities: 1) Archaeological sensitivity must be identified in the EIA phase. Avoidance or rescue excavation may be required as well as monitoring during road cuttings and excavation of bases in any areas that are considered to be archaeologically sensitive. 2) Mitigation of large scale impacts to scenery and setting are marginally possible.							
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?							

Table 3 Summary of impacts – operational phase San Kraal

Impact Phase: Operation							
<u>Possible</u> Impact or Risk **Operation impacts on palaeo, human-made and landscape aspects associated with development of the WEFs.**							
ANTICIPATED SCOPING IMPACTS TO BE SCOPED OUT OR INVESTIGATED FURTHER							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Sub-regional	L. term	High	Neg	High	High	High
With Mitigation	Sub-regional	L. term	High	Neg	Medium	Medium	High
Can the impact be reversed?					NO – class 5 industrial developments in a wilderness landscape cannot be fully successfully mitigated, however careful siting of turbines could lower impacts.		
Will impact cause irreplaceable loss or resources?			YES – permanent impact to landscape quality.				
Can impact be avoided, managed or mitigated?					Moderately - turbines are generally too massive to mitigate landscape impacts. Careful positioning may offer moderate benefits in terms of visual impact, however landscape and setting impacts will be generally immitigable.		
Mitigation measures to reduce residual risk or enhance opportunities: VIA may indicate measure that can be applied that will decrease the visual impact.							
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?			YES – the landscape qualities of the site must be graded as this will help express the degree of impact in regional and local terms.				

Table 4 Summary of Impacts – operation and construction for San Kraal

Impact Phase: Construction and Operation

<u>Possible</u> Impact or Risk. Construction and operation impacts on palaeo, human-made and landscape aspects associated with development of the grid connections for the San Kraal WEF

ANTICIPATED SCOPING IMPACTS TO BE SCOPED OUT OR INVESTIGATED FURTHER

	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Sub-regional	L. term	High	Neg	High	High	High
With Mitigation	Sub-regional	L. term	Medium	Neg	Medium	Medium	High

Can the impact be reversed?		NO - destruction of heritage material is not reversible as it can never be authentically replaced.
Will impact cause irreplaceable loss or resources?	YES - If not mitigated, certain archaeological and palaeontological resources are not replaceable. Setting and landscape impacts are not replaceable.	
Can impact be avoided, managed or mitigated?	YES – archaeological sites can be avoided or subject to rescue excavation. Similar applies to palaeontological resources.	NO – Landscape impacts on this scale cannot be mitigated (class 5 industrial development)

Mitigation measures to reduce residual risk or enhance opportunities:

1) Archaeological sensitivity must be identified in the EIA phase. Avoidance or rescue excavation may be required if sensitive areas are affected.

2) Palaeontological sensitivity must be identified in the EIA phase. Avoidance or rescue excavation may be required as well as monitoring during road cuttings and excavation of bases,

3) Mitigation of large scale impacts to scenery and setting are not possible.

Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	YES – Archaeology and palaeontology must be assessed as well as buildings, ruins. Landscape must be graded.	

13 Positive and negative impacts on environment

In terms of human made heritage, that is archaeology and built environment the impact is likely to be neutral or negative. There are a few benefits that will accompany the project such as job creation for and around the community of Noupoort; also the project will have economic benefits for local businesses and service providers (e.g. accommodation for workers during construction); and as an addition, the project will have a small positive benefit in that the data that is collected during the assessment or mitigation thereafter contributes to the general pool of research data.

The landscape qualities of the site are likely to be negatively impacted as a result in the physical changes to the appearance and character of the area. It will lose its sense of isolation and much of its sense of wilderness which will affect its future amenity value in conservation and heritage terms.

The successful detection of fossiliferous material on site during and before construction can be of benefit to science as these areas have the potential to contribute new knowledge. In contrast the destruction of fossil material during excavation or blasting constitutes a permanent and irreversible negative impact, especially if rare or unique specimens are lost.

14 Conclusion

At scoping stage there are no indications that there are any red flag issues attached to the San Kraal proposed WEF site, however there will be scenic impacts from the N9 and railway. Noupoort is not known as a tourist town so impacts in heritage terms to local tourism will be moderate and potentially low if mitigation measures suggested by the specialists are implemented.

14.1 Key issues

- Archaeology. The physical remnants of human activity need to be identified and assessed through physical site inspection, mapped and assigned field grades. This is a field intensive process as there are no databases in existence that have enough detailed information that will allow the assessment to take place at desktop level. Much of the South African landscape has never been surveyed.
- Palaeontology. The area is paleontologically sensitive. The SAHRIS palaeontological sensitivity mapping project has made a big contribution to preliminary desktop research in terms of the identification of potentially sensitive geology, however the detailed work has to be done through physical field assessment which will involve physical inspection of rock exposures. This will need to be done during the EIA process.
- Landscape and setting. The assessment of the landscape as a heritage resource will require the integration of findings of the visual impact assessment as well as consideration of the methods of landscape characterisation and grading to produce an integrated statement of impact for purposes of the EIA.

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