

HERITAGE IMPACT ASSESSMENT

REVISED REPORT ON PHASE 1 OF THE ROGGEVELD WIND FARM

Remainder of Farm Appelsfontein 201
Remainder Farm Ekkraal 199
Portion 1 of Farm Ekkraal 199
Remainder of Farm Rietfontein 197
Remainder of Farm Bon Esperange 73
Portion 1 of Farm Bon Esperange 73
Remainder of Farm Aprils Kraal 105
Remainder of Farm Fortuin 74
Portion 3 of Farm Fortuin 74
Remainder of Farm Brandvalley75
Portion 1 of Farm Ou Mure 74
Remainder of Farm Nuwerus 284
Portion 2 of Farm Standvastigheid 210

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act as part of an EIA.)

Prepared for
SAVANNAH SA

On behalf of
Roggeveld Wind Power (Pty) Ltd .

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EXECUTIVE SUMMARY

ACO Associates CC have been appointed by Savannah Pty Ltd on behalf of the proponent, Roggeveld Wind Power (Pty) Ltd, to undertake a Heritage Impact Assessment, as part of the EIA process, for the establishment of a wind energy facility on a site some 40 km south west of Sutherland. The proposed facility lies in the Western and Northern Cape Provinces. This is a renewed application for a project that was first assessed in 2010-2011.

The fieldwork was conducted in two phases. The northern area (stage 1) was assessed in September October 2010 and the southern portion assessed in November- December 2010. The proposed layout has been revised which requires a revision of the EIA and specialist reports. The original fieldwork which was comprehensive, remains relevant (see Hart and Webley 2010). It involved a walk and drive survey of many of the turbine positions and a broad overview of the entire development site for all phases proposed at the time. In 2013 a revised layout was proposed for stage 1 for the study area which is now re-assessed in this document.

The findings of the heritage assessment have revealed that the study area is relatively austere in terms of both colonial and pre-colonial heritage. There are several distinct areas – distinguishable cultural landscapes that have been the focus of early colonial period settlement, in all likelihood by *trekboere*. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area. There are a number of existing farm houses that contain 19th century fabric, however very few of these have anything more than moderate heritage significance. Parts of the study area enjoy very high aesthetic qualities hence the significance of the study area lies mainly with its undeveloped wilderness qualities. Interestingly, pre-colonial or stone age heritage and archaeology is extremely scarce in the areas that were searched. No archaeological sites of these kinds were recorded despite the fact that 8 experienced archaeologists were involved in scouring the landscape.

The geology of the study area is palaeontologically sensitive, however if appropriate mitigation is carried out, this could result in positive scientific benefits.

In our opinion, no significant heritage limitations were encountered during the survey, however it will be necessary for an archaeologist to be involved in reviewing and walking down some of the proposed road alignments, especially through the valleys which are the most sensitive areas as part on the Environmental Management Plan. The area of greatest concern is the accumulative impact of a large amount of applications for wind energy development in the area which will impact the overall aesthetic qualities of the Roggeveld and plateaux.

Heritage Recommendations:

The Palaeontological Impact Assessment recommended:

- Field inspection of borrowpits, turbine footing excavations and cable tranches.
- Mitigation normally involves recording and/or collection of fossil material with a permit issued by SAHRA and/or Heritage Western Cape;
- It seems unlikely that any infrastructure will have to be repositioned;
- Selective monitoring of substantial excavations may be required.

The Pre-colonial and Colonial Archaeology:

- No recommendations are made with respect to pre-colonial heritage. The most important colonial archaeological sites in the study area are associated with Ekkraal which would have been impacted by the previous proposed layout. The current stage 1 proposal will not affect the Ekkraal heritage.

The Built Environment:

- Re-use of empty farm houses is encouraged as long as renovations carried out are subject to the approval of the relevant heritage compliance authority. It is suggested that the services of a conservation architect is sought if any farm houses are to be altered for re-use.

Graves:

- No known graves will be impacted by the proposal, however it is possible that unmarked graves may be encountered during trenching and excavations. In the event of this happening work in the immediate area should cease and the find reported to the heritage authority and an archaeologist. Human remains must not be removed from the find site, but the area cordoned off until a formal exhumation and investigation can be put in place.

Cultural Landscape:

- The proposed energy facility will not be visible from any major transport routes (N1) but there will be visibility from tertiary and regional roads in the area - especially the R354 between Matjiesfontein and Sutherland, a scenic tourism route. This will affect the sense of wilderness of a large chunk of the region. Conservation-worthy buildings or places of celebrated heritage significance are limited. The accumulated presence of existing 400 kV lines as well as further planned 765 kV transmission lines are destined to lead to further industrial clutter.
- The visual impact of the turbine positions will be assessed by a separate Visual Impact Assessment.

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LIST OF DEFINITIONS AND ABBREVIATIONS

Archaeology: *Remains resulting from human activity which is 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.*

Early Stone Age: *The archaeology of the Stone Age between ~700 000 and ~300 000 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 ~300 000 and ~20 000 years ago associated with early modern humans.*

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.*

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.*

Trapvloer A circular open flat floor area surrounded by upright stones that was used for hand-threshing wheat.

Acronyms

BP	Before the Present
DEA	Department of Environmental Affairs
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, No 25 of 1999
SAHRA	South African Heritage Resources Agency

1. INTRODUCTION

ACO Associates CC has been appointed by Savannah Environmental (PTY Ltd) on behalf of the proponent, Roggeveld Wind Power (Pty) Ltd (RWP) to conduct a Heritage Impact Assessment for Stage 1 of the proposed Roggeveld Wind Energy Facility. This study is a rejuvenation of a prior application for a larger facility proposed by RWP on the same site (submitted to Heritage Western Cape 2011). It is possible that further stages of the proposed activity will be subject to separate EIA processes in the future.

The closest towns are Sutherland (50 km to the north east), Matjiesfontein (south), Laingsburg (south east) and Merweville directly east. The proposed location may be described as remote. The R354, the regional road between Sutherland and Matjiesfontein runs along-side (3-1km) east of the study area (figure 1).

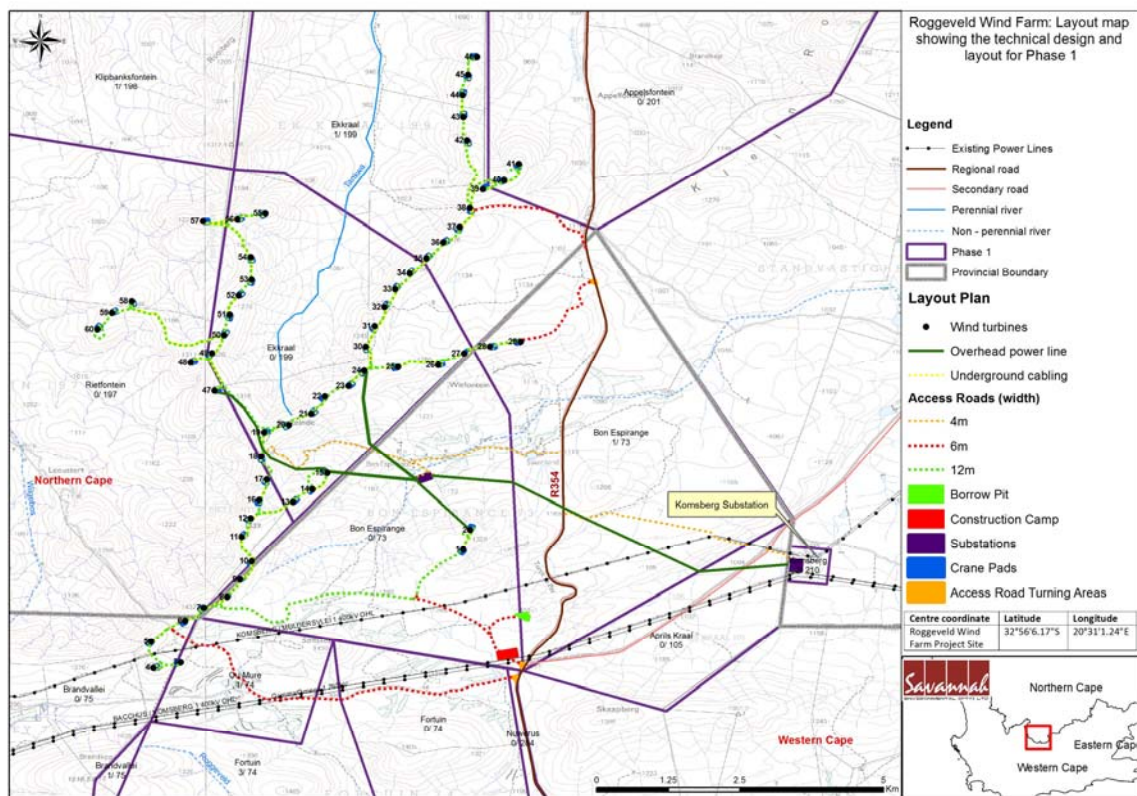


Figure 1 The proposed study area

Almost all of the proposed turbine positions are situated within the Northern Cape Province, while only 8 of the 66 proposed units are situated in the Western Cape. Site access roads, power line routes and substations are mostly situated within the Western Cape.

1.1 Development Proposal (see Table 1 for details).

- The renewed proposal for stage 1 involves some 60 turbines.
- each turbine has a 100m hub height and a maximum 117m rotor diameter
- each turbine has a foundation up to 20m x 20m underground and backfilled with a with maxim area of 4m diameter protruding above ground,
- adjacent to each turbine a crane pad or hard standing area of a maximum of 3000 m² to facilitate construction and maintenance.
- access roads up to 12m wide
- site layout (turbine locations, substation, access roads etc.) is provided with some certainty but may change subject to environmental, technical inputs and micrositing exercises.
- additional infrastructure (office and storage building, met masts, temporary laydown area, borrow pits).
- one main 200x200m substation next to existing Eskom Komsberg series capacitor station and one smaller substation closer to the turbines of 100x200m with smaller substations closer to the turbines collecting capacity from the turbines. The smaller substations would be connected to the main one via a 400kV overhead lines, but could be lower voltage (132kV) depending on technical specifications to be determined at a later stage.
- Approx. 10.6km of 33kV overhead lines and 5.8km of 400kV transmission lines
- Underground cabling between turbines.

Table 1 Description of Energy Facilities at the Roggeveld Site

Facility	Footprint	Height	Comments
Total area of site (Phase 1)	26529 ha	n/a	This is NOT the footprint of the site but rather the total area covered by all properties listed in the EIA application form.

Area covered by turbines	Circular underground foundation with a diameter of 20m + 3 m excavation buffer x 3m depth = 2.5 ha (excavation) Concrete protruding after backfill of 4m diameter (circular) = 0.075 ha	n/a	ONLY turbine foundation footprint
No. of wind turbines	60 x 2-3.3MW	n/a	±350m minimum spacing.
Size of wind turbine	N/a	Hub height 100m Rotor diameter 117m	Light grey/white painted steel tubular tower
Electrical turbine transformers	4m ² (2x2m) for each turbine One 100m ² (10x10m) and two 16m ² (4x4m) to collect underground cables and change to overhead 33kV lines, all right next to each turbine. total footprint = 0.036 ha	2.5m for most turbines but taller where overhead lines start.	Green painted steel mini container.
Hardstanding Areas / Crane pads	3000m ² (60x50m) per turbine total footprint = 18 ha for all turbines.	n/a	The hard-standing area is for each turbine and is made of highly compacted gravel surface, which is permanent.
Internal access roads	54 ha	n/a	12m wide, gravel surface + side drains

Electrical substation	One main 200x200m substation next to existing Eskom Komsberg series capacitor station and one smaller substation closer to the turbines of 100x200m. total footprint = 6 ha	Single storey buildings. Transformers variable height, gantries and other high voltage equipment max 10m, plus communication mast of 15m	Transformers next to substation buildings.
Underground power cabling from turbine to turbine	41.74km of cable trenches of 1m wide each, total footprint = 4.17ha	Approximately 1m deep	Trenches all run next to the access roads and usually don't have a permanent footprint as plants may grow on top
Electrical pylons of overhead power lines	Approx. 10.6km of 33kV overhead lines (~2m between conductors) and 5.8km of 400kV transmission lines (~8m between conductors).	33kV lines will be 15m tall (max) monopiles, 400kV lines will be 20m tall lattice pylons	Footprint is difficult to determine as actual permanently disturbed surface is limited to the small concrete foundations of each pylon
Operations and maintenance buildings (O&M building) with parking area	Included in smaller 100x200m substation footprint (see above)	Single storey	Plastered and painted masonry buildings. Steel portal frame structures and container storage included in the substation area.
Wind measuring mast	Up to 4 masts	100m	Painted steel lattice mast
Security fencing	n/a	2m	Galvanised weldmesh around substation and O&M buildings only.

Security Lighting Navigation lights	n/a	15m 100m	Painted steel lighting mast at both substations Flashing red light (to CAA requirements) fitted with reflectors to screen lights when seen from below, 2 lights for selected turbine nacelles as per final CAA approval (typically only for half of the turbines)
<i>Construction Phase:</i>			
Lay down area and construction camp	4.5 ha (150x300m)	Single storey but batching plant may be higher	Temporary gravel hard standing and prefab structures with construction equipment, spoil heaps, batching plant etc.
Borrow pit	2.19 ha	Up to 20m deep	

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The farms involved in the proposed project are:

Remainder of Farm Appelsfontein 201

Remainder Farm Ekkraal 199

Portion 1 of Farm Ekkraal 199

Remainder of Farm Rietfontein 197 Remainder of Farm Bon Esperange 73

Portion 1 of Farm Bon Esperange 73

Remainder of Farm Aprils Kraal 105

Remainder of Farm Fortuin 74

Portion 3 of Farm Fortuin 74

Remainder of Farm Brandvalley75Portion 1 of Farm Ou Mure 74

Remainder of Farm Nuwerus 284

Portion 2 of Farm Standvastigheid 210 (Komsberg)

1.2 The heritage team

Mr Tim Hart and Dr Lita Webley are independent specialist consultants who are in no way connected with the proponent, other than delivery of consulting services.

Lita Webley (PhD) is an archaeologist with 20 years of working experience in heritage consultancy. She is also accredited with Principal Investigator status with the Association of Professional Archaeologists of Southern Africa. Dr Webley serves on the Council of Heritage Western Cape, and Permit committees of the Eastern and Western Cape heritage

authorities.

Tim Hart (MA) is an archaeologist with 26 years of working experience in heritage consultancy. He is accredited with Principal Investigator status with the Association of Professional Archaeologists of Southern Africa. Mr Hart serves on the Impact Assessment Review committee of Heritage Western Cape and on the Permit committee of SAHRA.

Field assistance was provided by Postgraduate archaeology students of UCT and WITS

2. METHODOLOGY

This study has been commissioned as the heritage component of an EIA. It assesses the identified range of impacts in terms of accumulated knowledge of the area from previous field studies, published and unpublished material related to archaeological work and history of the region. A field survey of heritage resources has been conducted and heritage indicators (conservation-worthy buildings, archaeological sites and places celebrated as heritage) identified and mapped where appropriate. Definitions of heritage and criteria for assessment of heritage are indicated in the National Heritage Resources Act while the Provincial Guidelines for assessing heritage in the Western Cape applies. Both the NHRA and Provincial Guidelines require that cultural landscapes and areas of particular aesthetic and/or cultural heritage significance are considered in the assessment.

Independent Visual assessments form part of the EIA process.

2.1 Assessing heritage in the context of wind energy developments

Wind energy facilities have grown exponentially throughout the world in response to the international energy crisis and climate change. Wind energy is a new technology in South Africa but is well tested in other parts of the world. Such facilities are not without controversy – while supported by many as a source of renewable clean energy, it is also the impacts of clusters of massive wind turbines on cultural landscape can be serious, both in physical terms and with respect to the intangible and aesthetic qualities of a given locality. A pilot study commissioned by the Provincial Government of the Western Cape as part of its Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape and Report 6 in the series titled “Towards a Regional Methodology for Wind Energy Site Selection in the West Coast region” (CNdV 2006) considered landscape character rather than the cultural landscape concluded that wind energy facilities have an impact on the surrounding landscape in terms of the natural qualities of places. In terms of landscapes and heritage, there are no pro-active detailed local regional studies that can be consulted, however the pilot study recognises that impacts can occur and suggested a setback of 500 m for roads, communication towers, mountain catchments, private nature reserves, rivers wetlands and heritage sites to avoid physical impacts. The strategic environmental assessment by the CSIR (<http://www.csir.co.za/nationalwindsolaresea/>) considers areas in South Africa suitable for wind energy development in terms of optimal conditions but does not consider heritage or aesthetic issues. The study area lies within an identified optimal area.

Wind energy facilities are often large developments. Turbines can be up to 100m high with blades up to 50m in radius. The structure has to be counterweighted by a concrete block (up to 675 cubic meters) sunk deep into the ground. Each turbine location must be on an access road with gradients that can be negotiated by a heavy lift crane. Turbines can be visible from 10 km depending on the landscape. Indications are that they are perceived to be aesthetically more acceptable in agricultural or manicured landscapes than in natural environments (PGWC 2006).

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, but 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 those areas may be valued, or could be potentially be valued in the future. In some contexts however, the graceful shapes of the turbines and the sculptured twist of the rotors is perceived to be aesthetically pleasing.

The degree of physical landscape disturbance caused during the construction process of a wind energy facility means that the destruction of archaeological and palaeontological and historical heritage is a very likely. Impacts of wind energy facilities can therefore cause direct physical damage to heritage resources through the establishment of infrastructure, and by their presence can change the aesthetic and intangible values of the broader cultural landscapes in which the heritage resources exist.

2.2 The Site

The notional location of the proposed turbines and access roads were loaded onto handheld GPS receivers (set to the WGS84 datum) to facilitate the identification of the search area during field work component of the study that was undertaken in October and November-December 2010. During this time the major ridges in the stage 1 area and possible future expansions were covered. Walk and drive paths as well as site locations were recorded with GPS as were locations of heritage resources. Heritage resources were photographed and assessed.

The turbine positions provided by the proponent are indicative of the planned layout but may be subject to some adjustment in response to environmental considerations. These components will therefore be assessed during the EMP stage if necessary.

2.3 Limitations

There is little published archaeological information for the area. The remote location has meant that little development has occurred that required archaeological and heritage impact assessments, but additional proposals for other wind farms in the area has meant that some information has been accumulated. Dr Nigel Penn of Dept of History at UCT has published on the early colonial history of the area and the clashes that colonists had with local indigenous groups.

The fieldwork for the proposed stage 1 of development of the facility was simplified by the fact that a rough access road had already been cleared by a local contractor along much of the proposed turbine rows. This meant that many of the high ridges could be assessed. The vast size of the area has precluded a detailed survey, however the ACO team responded to these conditions by sampling areas close to water sources, assessing the historical built environment (which are very sensitive to visual impacts) and spot-checking the tops of high ridges (turbine sites) where they could be easily accessed.

3. REGULATORY AND LEGISLATIVE OVERVIEW

The basis for all heritage impact assessment is the National Heritage Resources Act 25 (NHRA) of 1999, which in turn prescribes the manner in which heritage is assessed and managed. The National Heritage Resources Act 25 of 1999 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:

Cultural landscapes (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 requires that Heritage Impact Assessments (HIA's) are required for certain kinds of development such as rezoning of land greater than 10 000 sq m in extent or exceeding 3 or more sub-divisions, or for any activity that will alter the character of a site greater than 5000 sq m.

3.1 Cultural Landscapes

Section 3(3) of the 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.

3.2 Scenic Routes

While not specifically mentioned in the NHRA (Act 25 of 1999), “scenic routes” are recognised by DEA&DP as a category of heritage resource. In the DEA&DP Guidelines for involving heritage specialists in the EIA process, Baumann & Winter (2005) comment that the visual intrusion of development on a scenic route should be considered a heritage issue. This is also given recognition in the Notice of Intent to Develop (NID) application which is used by Heritage Western Cape.

3.3 Heritage Grading

Heritage resources are graded following the system established by Winter and Baumann (2005) in the guidelines for involving heritage practitioners in EIA’s (Table 1).

Table 2: Grading of heritage resources (Source: Winter & Baumann 2005: Box 5).

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.

3.4 Wind Energy Guidelines and Heritage

Neither SAHRA nor HWC have developed policies with respect to heritage and renewable energy and therefore the issue of distance of wind turbines from heritage resources has not been resolved.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The study area is situated towards the southern margin of the Main Karoo basin almost immediately west of the Sutherland – Matjiesfontein road (R354). To the south, rocks of the Cape Supergroup make up the Cape Fold Belt mountains. Folding due to the tectonic forces which gave rise to the Cape Fold Belt is also present in the study area, but it is much more subdued. This has given rise to more or less parallel gentle anticlines (∩-shaped) and synclines (U-shaped), with their axes orientated approximately north-south. The entire area is underlain by rocks of the Karoo Supergroup rocks of the Abrahamskraal Formation and the Permian Beaufort Group. In the south there are scattered outcrops of the slightly older Waterford Formation of the Ecca Group, and also outcrops of the Tierberg and Fort Brown Formations in the extreme south (Theron, 1983). The Abrahamskraal Formation underlies all of the northern area and makes up the ridges on which the planned wind turbines are to be erected. The hilltops and hill slopes expose horizons of resistant channel-fill sandstones, with intervening layers of shales, representing former muddy flats and flood splays from broken river banks.

It is a semi-arid region with rainfall mainly in the form of summer thunderstorms in recent years, some snow and precipitation in winter. The vegetation is characteristic of the Succulent Karoo biome (figure 2). The northern parts of the “site” straddles the foot hills (Kleinroggeveldberge) below the great escarpment. This area is characterised by a series of very high and long ridges with valleys in-between (anticlines and synclines). These contain acacia thickets in places, a number of farm buildings and local roads. The high ridges (figure 3) are windswept, dry, inhospitable and un-developed (apart from dirt tracks). The southern portion which forms stage 2 of the proposal is slightly different – the linearity of the ridges is somewhat more varied and interspersed by vast flattish plains.

The area is sparsely populated being limited to a number of farms, most of which have absentee landlords. Farmers that were resident on site complained bitterly about unpredictable weather patterns, climate change and an increase in the number of predators which was making the main activity in the area (sheep farming) very difficult to sustain. Many farm buildings in that area contain elements greater than 60 years of age and fall with the general protection of the NHRA.

There are a number of farm tracks which cross the study area to service fenced stock camps and associated small dams and their accompanying wind pumps. Despite human intervention related to farming, the site remains predominantly natural and isolated.



Figure 2 Typical topography of the study area - valleys and ridges



Figure 3 The turbines are to be located on the high ridges, farming has historically taken place on the valley floors.

4.1 Palaeontological heritage of the area

A palaeontological impact assessment (PIA) of the site was commissioned and undertaken by Dr Duncan Miller with further comment kindly provided by Dr John Almond. The findings are integrated into this report. Recently Almond (2010) completed an assessment of the palaeontology of the area for *Mainstream* (a wind energy company) concluding that certain areas were of high palaeontological sensitivity. This area of the karoo is known for a variety of fossils of early mammal-like reptiles and trace fossils.

4.2 Pre-colonial Heritage of the area

Little was known of the archaeology of the study area until recently and in fact no heritage impact assessments are listed on the SAHRA database for this area (at least up to 2009). Despite the official record, there has been some limited research work around Sutherland (for example: Lloyd Evans et al. 1985; Hart 2005). Lloyd Evans et al. (1985) excavated a small rock shelter on the grounds of the South African Astronomical Observatory in Sutherland. It contained a Later Stone Age assemblage with a relatively high proportion of small convex scrapers and thin-walled potsherds of indigenous manufacture, ostrich eggshell and some *Nassarius kraussianus* (a type of marine shell) beads. They comment (1985: 108) that the presence of the shell beads points to cultural ties with people along the Cape coast while the small scrapers can be assigned to the Wilton industry, distinct from the large elongated scrapers typically associated with the interior sites along the Orange River as described by Sampson (et al. 1989).

Hart (2005) undertook a survey for a golf course to the south of the Sutherland urban edge. The most significant find was a complex of 13 stone enclosures which are typical of the *Khoekhoen kraals* that were mapped and described by the author in the eastern Karoo (Hart 1989, Sampson 2008). A single highly dispersed artefact scatter consisting of mainly waste material (flakes made from *hornfels* or indurated shale) was also found. Hart (2005) reported finding a dense artefact scatter associated with a shallow rock shelter outside the study area indicating that archaeological sites may be found in areas that were sheltered from the wind (an important consideration given Sutherland's extreme temperature ranges).

Recent work on another wind farm to the east, the so-called Zuurplaats WEF (Hart et al 2010) as well as archaeological specialist studies of the Gamma-Omega 765 kV powerline passing to the south of the escarpment (Patrick 2009) has overcome the information vacuum to a degree. The Zuurplaats project is of particular relevance given that it occupies a similar geographical position to the facility under discussion here, whereas the linearity of the powerline and its context make the archaeological observations moderately less useful.

Hart (et al's 2010:22-23) observations, included below:

Pre-colonial archaeological material: As expected includes Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) artefact scatters. Open sites are

extremely sparse on the upper plateau with only one MSA site being recorded – a scatter associated with a dry pan. The most common raw materials are hornfels, quartzite, chert, and also quartz and Karoo shale. Occasional flakes were noted randomly on the landscape lie scattered on the land surface which represents the “litter” of the Stone Age. On the upper plateau even incidental artefacts were scarce. In the southern portion of the study area a significant and well preserved Early Stone Age site containing complete and highly refined bifaces (hand axes) attributable to the Fauresmith industry was found on the farm Klipfontein.

Stone kraals: The most common form of pre-colonial site on the upper plateau were stone kraals or kraal clusters, which according to Sampson's (2008) figures from the Eastern Karoo, could be between 300 and just over 1000 years of age. The kraal complexes (which are distinctly different from colonial period stock kraals) tend to be found along the leeward slopes of low ridges (or where minimal wind affects the area). These typically consist of dry stone piled wall enclosures in a roughly circular configuration, sometimes interlocking but not more than half a meter high, and ranging from 3 - 4 meters to 9 m in diameter. In the past they are likely to have been associated with reed mat huts or brush shelter/s), probably erected a few meters away from the main 'kraal' where small stock such as fat tailed sheep and goats were kept. Often found in proximity to the larger 'kraals' are lammerkraals (lambs' kraals), which are much smaller (about 1m in diameter) and a bit higher (usually a few more layers of stones added to the wall) than the adjoining larger 'kraal'. These small kraals are known to have been used to keep new born lambs or goats separate from their mothers so that the milk could be used rather by the people (Webley 1986). It was noted that kraals are arranged in complexes of up to 13 interlocking enclosures with adjoining lammerkraals. Notable complexes were recorded in the area of Hartebeestfontein and at Vinkekuil. Also associated with these 'kraals' is artefactual material, fine thin red burnished pottery, and ostrich egg shell. At a site alongside the access road to Waterval there is a remarkable complex of 'kraals' below and on top of a ridge.

Below the escarpment in the southern section of the study area, another form of archaeological site was identified. These are what we interpret to be open Khoekhoen encampments situated among the Kameeldoring trees along the dry river beds in the bottom of valleys. The sites are typically quite large (60 – 80m in diameter), artefactually rich with very fine thin walled and burnished Cape Coastal pottery noted. There are numerous stone features, informal stone artefacts, grinding surfaces as well as a number of graves, some of which have broken grinding stones placed on top. Also evident were discreet ash middens and animal bone. On two of the sites there is evidence of European goods (19th century glass and ceramics) which may indicate some form of continuous use of the sites by Khoekhoen herders into the colonial period.

The 3 sites of this kind which were identified lie on the main track from Klipfontein to Modderfontein. Archaeological sites of this kind are very rare in the Western Cape, having been only previously recorded in the Richtersveld.

Halkett and Webley (2011) conducted a study just south of the Suurplaats site which revealed that the area had a rich and previously un-described heritage such as evidence

of proto-historic herder communities that were residing in the valley bottoms.

4.3 Colonial Heritage

Schoeman (1986) has described the early settlement of the Roggeveld and Sutherland area which commenced around 1750. The early farmers found the escarpment, which enjoys the highest rainfall, particularly suitable for small stock farming during the summer months but they moved down into the valleys and plains of the Karoo to escape the extreme winters. In addition, the escarpment seems to have been where most of the springs were found, and from where they were able to exploit the vegetation of both the *Onder Karoo* as well as the Sak River region in Bushmanland. Each *Trekboer* usually had in addition to a loan farm on the plateaux, a farm in the Karoo known as a *legplaats* (outpost). Initially, the population of the area remained small, because many of the early loan farms were merely “stock posts” and the owners lived elsewhere. Drought, poor grazing and attacks by the San caused many farms to be abandoned. Disputes over farm boundaries were intense. According to Penn (2005), in the 18th century there were numerous independent Khoekhoen kraals located amongst the *Trekboer* farms in the Roggeveld.

The first recorded loan farms in the Roggeveld date to 1743, and by 1750 there were 31 registrations (Penn 2005). Robert Jacob Gordon travelled through the Roggeveld in 1786 and he mentions farms belonging to the Van Wyks and the Louws (both are families who have lived in the area for generations) as well as a farm on the edge of the “Comsberg” (sic) that belonged to a Cloete (in Schoeman 1986). Many farmers seem to have had more than one loan farm.

Resistance to the *Trekboers* in the Roggeveld came initially from the San who resisted fiercely throughout the great Karoo, at times beating back the vanguard of *Trekboer* farmers. In 1754, attacks from the Khoisan are reported to have increased and flocks of sheep and herds of cattle belonging to the *Trekboers* were driven out of the area. This increased to the extent that it is described by Schoeman as a type of guerrilla warfare. Livestock was stolen, Khoisan herders and slaves killed, and *Trekboer* farms attacked. The colonists fought back by establishing the *Kommando* system – and leading to the officially sanctioned “hunting” of San was in 1777 (Adhikari 2011, Dooling 2007) In some instances, bounties were obtainable from the local *landdrost*. There was apparently a massacre of 186 San in the Roggeveld in 1765. The only confirmation of this is from the farm Oorlogskloof near Sutherland. There are a great many graves, some 30, laid out in three groups, with piles of rocks above them. There is also a separate gravestone with the date 1768. Both Penn and Schoeman refer to another mass grave on the farm Gunsfontein (to the west of Schietfontein (Scholtzenhof) - and now part of a private nature reserve), possibly dating to the rebellion of the 1770's. According to Penn (pers comm.), somewhere in the valleys of the escarpment is a large cave or shelter where some of the few surviving San made their last stand against the *kommando's*.

The Khoisan were gradually driven from the Roggeveld northward to the extent that by 1809 there is reported to have been only one settled “Bushmen” kraal left in the area.

Settlement became more permanent from the beginning of the 19th century. The farmers' main source of income was small stock, since wheat could only be grown with great difficulty in isolated and protected valleys when conditions permitted. There was very little grazing and standing water for cattle.

Schoeman (1986) notes that during the early years of settlement in the Roggeveld, many of the Trekboers lived in grass huts or *Matjieshuise* (mat covered houses), and in tents and some travellers found farmers living in *Matjieshuise* as late as 1839. Attempts at constructing more permanent structures were inhibited by the lack of suitable wood for roofs. The generic house comprised a "small oblong low hut" built of slabs of *leiklip* piled on top of each other, unplastered, with a reed roof. A single window was covered with white linen and a doorway covered with panel of reeds. The floor was of clay smeared with dung. Generally houses comprised two rooms, with an entrance into living room/kitchen and a second room serving as a communal sleeping/storeroom. Some had a free standing *kookhuis*. Associated farm buildings also included the houses of the workers.

There were also a number of kraals, with seven to eight not uncommon. A number of farm workers were slaves, brought by their owners from the Cape, but also included local Khoisan (Busmen and Khoekhoen) who for one reason or another were no longer pursuing their traditional lifestyles – some of these people were captured as children by Kommando units and enslaved as farm labour.

During the South African War, the threat of Boer incursions led British forces to build fortifications at a number of strategic passes through the Roggeveld. A stone redoubt was constructed on the farm Gunsfontein (adjoining the proposed wef) at the top of the Brandkloof and Maleishoek passes. With the Boer leader Manie Maritz active in the Calvinia District, many young men from the Roggeveld joined the Boer cause. One of the followers was Jan Fourie of Welgemoed (Schoeman 1986:98). There appears to have been some skirmishes in the vicinity of Skietfontein (Komsberg) in 1901. One of the stone structures located on Beerenvallei during the survey may relate to the Anglo Boer war. In a recent study Orton and Halkett (2011) identified a previously un-documented British complex of fortifications – redoubts and gun platforms situated on a farm 10 km south of Sutherland.

5. FINDINGS

5.1 Palaeontology

The full report is included in Appendix 2. The stratigraphy, lithology and palaeoenvironments of the rocks of the northern areas are summarised in the following table 3.

Table 3 Summary of stratigraphy and lithology.

AGE	GROUP	FORMATION	LITHOLOGY	PALAEOENVIRONMENT
PERMIAN	Beaufort	Abrahamskraal	sandstone channel + crevasse splay deposits, interbedded mudstones	subaerial upper delta plain, aerially exposed mudflats, backswamps,
PERMIAN	Ecca	Waterford	sandstone, greywacke, shale	shallow water, delta- front
PERMIAN	Ecca	Fort Brown	mudstone, minor sandstone	prodelta and delta-front
PERMIAN	Ecca	Tierberg	dark shale, mudstone	settling from suspension in deep water, shallowing towards the top

Table 4.1.1 Stratigraphy, Lithology and Palaeoenvironments of the Rocks Exposed in the Study Area (modified from Johnson *et al.*, 2006)

4.2 Palaeontology

The outcrops of the Waterford Formation in the south were not searched, but trace fossils in the form of burrows, trails and tubes are common in this formation, with rare bivalves and fragmentary fish remains (Thamm & Johnson, 2006; Johnson *et al.*, 2006). Plant fragments (*Glossopteris*) are also reported to be common and in places pieces of stem fragments of the tree genus *Dadoxylon* occur (Theron *et al.*, 1991).

The only fossils found in the rocks of the Abrahamskraal Formation were trace fossils in the form of sand-filled vertical burrows in sandstone (figure 5). These were in a loose block adjacent to a packed stone ruin in the Ekkraal valley) and may have been transported from elsewhere as building material (figure 4).



Figure 4 Trace Fossils Consisting of Sand-filled Vertical Burrows in Sandstone, from Ekkraal Farm (width of rock ca. 200 mm)

The Abrahamskraal Formation contains terrestrial vertebrate fossils, fish remains, non-marine molluscs and silicified wood (Johnson *et al.*, 2006). The lowest biozone of the Beaufort Group is the *Eodicynodon* Assemblage Zone, recently recognised in the southwestern part of the Karoo basin by Bruce Rubidge. This zone is characterised by fossils of *Eodicynodon*, a small primitive tetrapod reptile. Fossils of other primitive reptiles are also found in this biozone (MacRae, 1999). These are extremely important fossils documenting the rise of reptiles and evolution of mammal-like reptiles (therapsids), for which the Karoo is the pre-eminent locality.

The *Eodicynodon* Assemblage Zone is not recorded in this area and the Study Area lies within the *Tapinocephalus* Assemblage Zone. The zone is named after a therapsid (the mammal-like reptile *Tapinocephalus atherstonei*) restricted to this zone. Fossils of a wide variety of other tetrapods, both herbivores and carnivores, including early precursors to the line that gave rise to mammals, have been found in this zone (MacRae, 1999). There are very few records of vertebrate fossils in the part of the *Tapinocephalus* Assemblage Zone covered by the Study Area, and what has been found is sparse but diverse, so anything found would be of considerable significance (J. Almond pers. comm.).

5.2 Pre-colonial Archaeology

5.2.1 Stone age artefactual material

The actual turbine sites are situated on the tops of very high ridges where the wind

conditions are optimal. Within the study area the ridges are devoid of rock shelters, rock outcrops but are covered in stones and low shrubs (figure 5). They are extremely inhospitable in that they contain no foci where people could shelter from the elements. Rock shelters in this area are entirely absent, water sources are scarce. These harsh conditions were evidently experienced in the pre-colonial past as almost no evidence of any archaeological material at all was located. Even Middle Stone Age material which is normally ubiquitous throughout the karoo was almost entirely absent. These observations are not the function of a thin search pattern over a vast area, as half of the turbine sites were easily accessible by off-road vehicle. Very large tracts of the country were traversed. As has been demonstrated by other recent studies in the area, pre-colonial heritage tends to occur in the valley bottoms close to watercourses and springs which may explain why the high ridges of the study contains so little evidence for pre-colonial occupation.



Figure 5: Typical landscape of the study area – note the recently constructed access road over the tops of the ridges.

5.2.2 Other pre-colonial indicators

Co-ordinates and details of observations are presented in Appendix 1.

There are very few caves or shelters within the study area that could have supported occupation (few exhibited any form of sediment trap), and those that do exist, are generally formed in soft rock strata resulting in constant exfoliation. Two small rock shelters were inspected, however these contained no habitable floors or archaeological deposits.

5.3 Graves

A collection of stone piles were recorded in the Ekkraal Valley (figure 6). These do not appear to be associated with any other archaeological material which would assist in identifying them. They are provisionally described as graves as they could be culturally associated with pre-colonial occupation. It is not expected that the stone features will be impacted by the proposed activity.



Figure 6 Stone pile (possible grave) near Ekkraal.

5.4 Built Environment and colonial heritage

The built environment of the study area is limited to farms, farm houses, stone walls, walled kraals and secondary roads. Locations are indicated on figure 8. Given the remoteness of this area, even these are sparsely distributed. Virtually all farm infrastructure is situated in the low lying areas between the ridges. Most are several kilometres from proposed turbine locations which mean that direct impacts are not expected. Characteristically, locales of colonial settlement seem to be concentrated in three areas – namely the farm known as Ou Mure, the Ekkraal Valley and the Hartjieskraal-Barendskraal valley somewhat south of the study area..

5.5 Ekkraal Valley

The most significant collection of heritage resources in the entire area is confined to a single remote valley at the entrance to which lies the farm Ekkraal. The valley forms a

geographically delineable cultural landscape consisting of ruined 19th century farms, stone walled kraals, fragments of stone walling. The shallow Ekkraal valley lies between two of the large longitudinal ridges which form the main turbine rows. Along the gently sloping valley floor the team recorded some 16 occurrences of historical material, all evidently dating to the 19th century (figure 7). The rivulet which runs down the valley bottom was evidently a wetland which attracted *trekboer* agriculture. The presence of at least two *trapvloers* (threshing floors) and remnant of disturbed landscapes and ruined stone and mud-brick homesteads indicate that the area produced some harvests of wheat (figures 7-13). Today there is very little evidence of any fields in this essentially wilderness landscape.

The existing Ekkraal Farm (absentee owner) is a humble corrugated iron roofed building which dates from the 19th century. It is probably worthy of Grade IIIC status. The structure is not under threat and evidently well maintained (figures 7-13). The closest turbine are well in excess of 1 km distant which means that no direct impacts will result from the turbines themselves. Other elements of the built environment consist of dams, kraals and two out-buildings, one of which is built from stone and has a Dutch hearth. The existing vehicle track up the valley will be upgraded and widened to allow heavy vehicles to pass. Since many of the ruined features lie very close to this track, impacts could occur

The significance of Ekkraal valley lies in the intactness of the archaeological signature of early colonial occupation. The pattern of kraals, farm buildings, artefact scatters and walling remains highly legible. The area can be considered to be archaeologically sensitive and worthy of preserving in terms of its research potential. The heritage of the valley is not a tourism resource, and not well known to anyone other than the local populous. In these terms it does not constitute visually sensitive heritage. The revised layout for phase 1 is more sympathetic to the heritage qualities of the Ekraal Valley in terms of both visual impacts and physical impacts as the valley has been largely left free of infrastructure or access roads.



Figure 7 *Artefacts of the mid-late 19th century found associated with ruins near Ekkraal.*

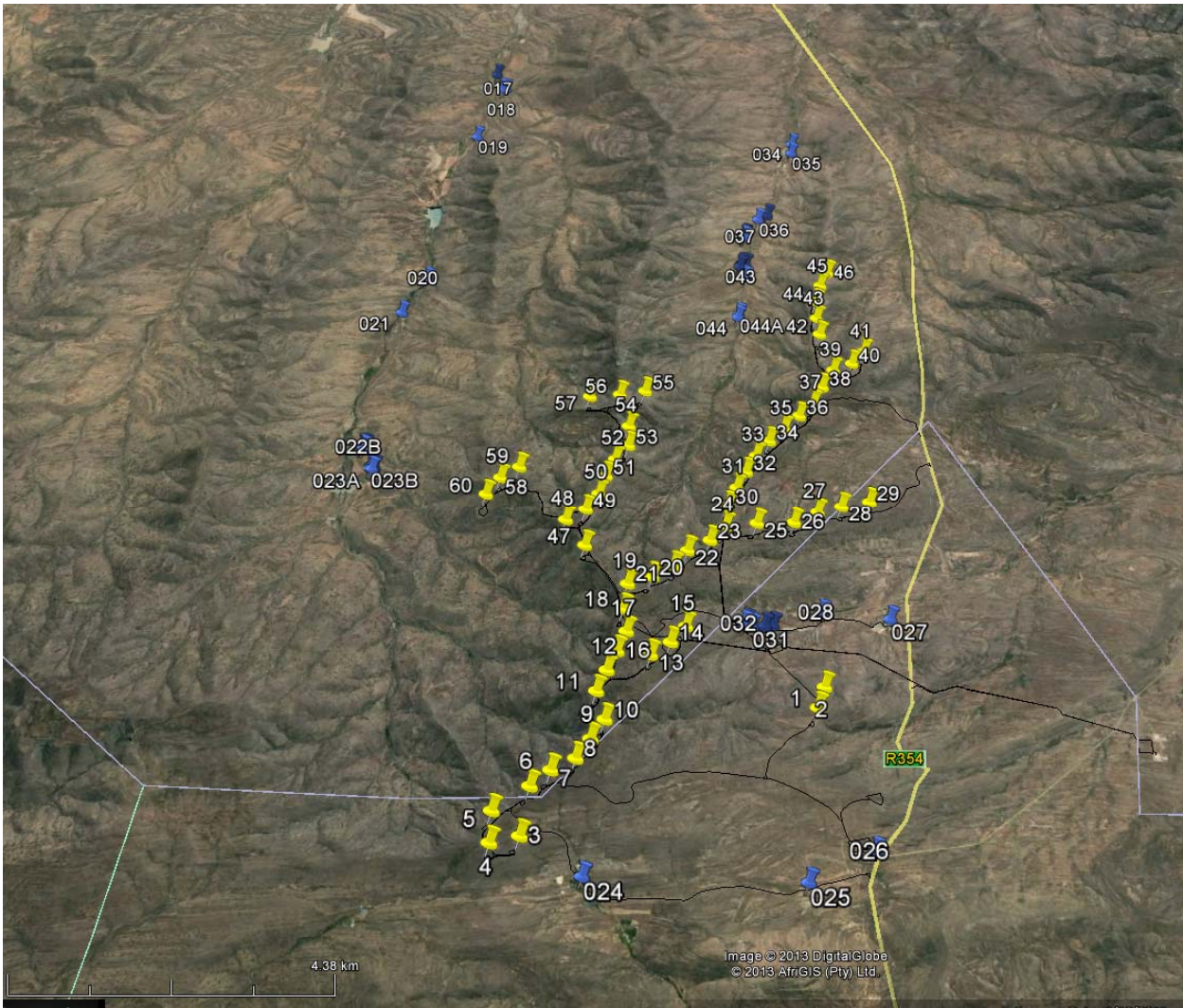


Figure 8 Distribution of recorded heritage sites (blue) vs proposed turbine layout for stage 1.



Figure 9 Large stone kraal, Ekkraal.



Figure 10 19th century ruins, Ekkraal



Figure 11 Remnants of a threshing floor (trapvloer) associated with ruins in **Figure 10**.



Figure 12 Existing structure, Ekkraal.



Figure 13 Existing Farm House, Ekkraal.

5.5.1 Ou Mure area

The farm known as Ou Mure is consists of a complex of structures, most noticeable of which is the late 19th century/early 20th century farmstead with its associated dry stone walled garden area and lands (figure 14 and 15). The house (double bayed with central veranda) appears to have originally been built of stone but has seen extensive changes in the early 20th century. While the farm and its surrounds are of heritage interest, the presence of 2 pairs of 400 kV Eskom transmission lines, and very large 765 kV lines under construction (some 380 m from the house) has negatively impacted the heritage and aesthetic qualities of the setting.

While it is not expected that Ou Mure will be directly impacted by the proposed activity, there will be periods in which the immediate surrounds of the farm we be subject to increased usage as a proposed access road into the turbine area could see upgrading of some of the roads around the farm.

The nearest proposed turbines to Ou Mure are to be constructed roughly 1km from the farm on surrounding ridges.



Figure 9 Farm house at Ou Mure.



Figure 10 Stone walled fields at Ou Mure.

5.6 Cultural Landscape

Within the study area there are a number of distinct cultural landscape areas that have been identified, and described previously – notable of these within the study area is the Ekkraal Valley. To the south and west of the study area is the Barendskraal-Hartjieskraal farm areas which contain collections of interesting heritage sites and buildings. The Ekkraal Valley is the most significant within the study area, however fortunately it is minimally impacted by the stage 1 proposal. Although this is a highly scenic area, it is very remote and not celebrated as a place with visual heritage qualities

In overall terms the study area represents a remote wilderness landscape, which even in prehistoric times appears to have been marginally inhabited. Colonial occupation of the area was also sparse being limited to valley bottoms. The predominant presence is that of open wilderness. While the area is highly scenic, within the project boundary there are no major tourism enterprises and is very seldom visited by persons other than those directly involved in farming.

Visual impacts, which are addressed in a separate independent report, are a concern as the proposed facility will be visible from the R354.

6. ASSESSMENT OF IMPACTS

The comment on the first proposal from Heritage Western Cape has a bearing on this project. Included below is a comment (figure 16) on the first proposal issued by Heritage Western Cape. The proposal was approved subject to no turbines being built on Tafelkop or Spitskop.

Our Ref: HM/CENTRAL KAROO/LAINGSBURG/MATJIESFONTEIN/ROGGEVELD WIND ENERGY FACILITY



Enquiries: Troy Smuts

Date: 23/01/2013

Tel: 021 483 9543

Case No: 111020JB18

Email: justin.bradfield@pgwc.gov.za

Auto IDs: 1232 - 2280

FINAL COMMENT
In terms of section 38(8) of the National Heritage Resources Act (Act 25 of 1999)
and the Western Cape Provincial Gazette 6061, Notice 298 of 2003

Attention: Ms Claire Alborough
ERM, Silverwood House, Block A
Steenberg Office Park
Steenberg
7945

CASE NUMBER: 111020JB18

HIA: PROPOSED ROGGEVELD WIND FARM, NORTHERN CAPE AND WESTERN CAPE.

The matter above has reference.

Heritage Western Cape is in receipt of your correspondence on the above matter, dated 16 January 2013 and the following was discussed:

1. Site located west of the R354, ~45 km south of Sutherland and 30 km north of Matjiesfontein, in both Western and Northern Cape Provinces.
2. Turbines: max 100m hub height, 117m rotor diameter (3 blades of 58.5m)
3. The Department of Environmental Affairs in December 2011 requested that some changes be effected to this the wind energy Farm.
4. The recommendations of Heritage Western Cape were that no turbines are to be located on Tafelkop or any other mountain ridgelines in the Western Cape.
5. The HIA notes that: Although this is a high scenic area, it is very remote and not celebrated as a place with visual heritage qualities.
6. The revised proposal is to have no turbines on Tafelkop or Spitskop.

Decision

1. Heritage Western Cape resolved to support the proposal as currently proposed without turbines on Tafelkop or on Spitskop.

www.capegateway.gov.za/culture_sport

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Figure 11 Record of comment on the first proposal issued by Heritage Western Cape.

The current proposal has responded to the requirement of Heritage Western Cape.

6.1 Turbines

The areas selected for the proposed construction of turbines are the tops of the large longitudinal ridges that are generally orientated north-south through the study area. These wind swept mountain tops are generally remote, exposed and inhospitable. During the course of this study many kilometres of ridge top landscape were traversed and found to be largely sterile of any form of human made heritage material.

The turbines rows will be highly visible from the R354 between Sutherland and Majiesfontein occupying some 14 linear km of landscape on the western side of the road. While the R354 is not a heritage resource as such, it does link two heritage rich communities which are strongly contextually linked with the Karoo experience, hence the proposed development could impact the sense of place associated with both towns. The degree to which this potential impact will be perceived by people depends on the perceptions and aesthetic inclinations of the user of the R354. The historic pass to Sutherland via Karoopoort lies about 18km to the east of the closest turbine row. The impact to this heritage resource and scenic route will be minimal as the turbines will only be marginally visible under the clearest of conditions.

The proponent has avoided locating turbines on high mountain tops within the Western Cape boundary, however high ridges with the Northern Cape boundary are utilised. The proponent has also indicated that they un-able to honour the 3 km buffer requested by SAHRA with respect to the regional road. 21 turbines are proposed within the 3km buffer (most of these are within the Northern Cape, and only 4 on the Western Cape side) while no turbines are proposed for within 1 km of the R354, although not a specific recommendation from the HWC for the Western Cape.

The study area has little amenity or intrinsic active tourism value at the present time (although it is highly scenic) which means that assigning a high degree of impact in terms of sense of place is unjustified. On the other hand, it is these very qualities that impart the area its wilderness value. It must be noted that the development proposal will potentially sterilise the area in terms of any future development of wild life experiences or outdoors orientated tourism, while the visual impact from the R354 will change the experience of people using the route to Sutherland, a locality that has become a popular tourist destination on account of SALT (South African Large Telescope).

There area is fossiliferous which means that palaeontological material may be impacted by excavation of footings for turbines. Provided that suitable mitigation is carried out, this is not necessarily a negative impact as gains in terms of contributions to scientific knowledge may result from any new observations made. If mitigation is not carried out, negative impacts will result as potentially significant scientific evidence will be lost.

6.2 Substations

Two substations will be required. One is within the Roggeveld wind farm, the other is

situated at Komsberg immediately adjacent to the large existing Eskom substation. The Komsberg site is well studied as it lies within the impact assessment study area for the proposed new Eskom 765 kV lines. The Roggeveld substation has been subject to assessment by ACO.

Impacts associated with the Komsberg site will be minimal – this is already an established local electrical infra-structure node therefore the character of the site will not change. The land is flat and away from foci that area of archaeological interest.

The Roggeveld on-site substation lies on land which has been subject to ploughing and is therefore disturbed in part. It lies some 300 m south of the Bon Esperance farm buildings which are of ungraded heritage significance.

Impacts associated with both proposed substations are of low significance, however a pre-construction inspection must be carried out

6.3 Connecting electrical lines

Transmission lines will be required to connect the on-site substations with the existing Eskom transmission lines (at Komsberg) that pass through the study area. Turbines in turn will need to be connected with substations by means of a network of underground cables. Impacts to person made heritage are not expected. Impacts to palaeo-heritage could result from the process of trench excavation. Provided that suitable mitigation is carried out, this is not necessarily a negative impact as gains in terms of contributions to scientific knowledge may result from any new observations made. If mitigation is not carried out, negative impacts will result as potentially significant scientific evidence will be lost.

Final layout for power lines have been drawn up and assessed. The proponent has gone to some effort to avoid placing these close to farm houses, with the result that the proposed routes are considered acceptable and will not result in significant negative impacts. It is important that a preconstruction walk-down is carried out.

6.4 Access Roads

A network of roads will be needed for construction and servicing of turbines. The proposal is to use as many existing farm roads as possible to limit damage to the veld. New roads will need to be constructed to gain access to the high ridges and turbine rows. Farm roads will need to be upgraded to a width of 12m in places. Cuttings in slopes may be needed to produce gradient that are negotiable for heavy vehicles and abnormal loads. The overall effect will be increased visibility of the road system on the landscape and scarring of hill slopes. Final road layouts must be assessed during the EMP.

The Ekkraal Valley where there is a concentration of historical archaeological sites will not be impacted in terms of the current proposed layout.

Table 4: The potential impact of construction of turbines, substation, access roads and

power line/s on the palaeontological heritage of the study area.

	Without Mitigation	With Mitigation
Nature/Type	Negative and direct	Neutral - positive
Extent	On-site	On-site
Duration	Permanent	Permanent
Probability/likelihood	Probable	Probable
Significance	High	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: Mitigation of palaeontological heritage can be achieved by ensuring that trenches and deep rock excavations are checked by a palaeontologist. The collection of new scientific information is a positive impact. The palaeontologist should comment on the possibility of surface palaeontological occurrences.		
Operational Phase: n/a		
Decommissioning Phase: n/a		
Cumulative impacts: n/a		

Table 5: The potential impact of the construction of the turbines, substations, access roads and power line/s on the pre-colonial and colonial archaeology of the study area.

	Without Mitigation	With Mitigation
Nature/Type	Negative & Direct	Neutral
Extent	On-site	On-site
Duration	Permanent	Permanent
Probability/likelihood	Possible	Unlikely
Significance	Moderate	Minor
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: Mitigation of the colonial archaeology should involve a final walk down of the proposed route of the road alignments and transmission lines. Heritage resources should be identified and flagged and avoided during construction activities.		
Substations should not be built in prominent positions or within sight of historic farms. These areas should be avoided for power line routes.		
It is unlikely that colonial or pre-colonial archaeology will be negatively impacted by the proposed turbine placements.		
Operational Phase: Unlikely		
Decommissioning Phase: Possible impacts during rehabilitation activities		
Cumulative impacts: Minor		

Table 6: The potential impact of the construction of the turbines, substation, access roads and power line/s on the built environment of the study area

	Without Mitigation	With Mitigation
Nature/Type	Negative & Direct	Neutral
Extent	On-site	On-site
Duration	Permanent	Short term
Probability/likelihood	Unlikely	Unlikely
Significance	Minor	Minor
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Mitigation of the built environment should involve micro siting turbine positions and associated infrastructure during the EMP to avoid placing turbines or infrastructure directly over built environment features and buildings or bisecting coherent settlement complexes. The sensitive reuse of vacant buildings is encouraged (as long as advice is sort on heritage sensitivities) as this will help sustain them.		
Operational Phase: Possible and potentially positive if old heritage buildings are sensitively treated.		
Decommissioning Phase: Possible during rehabilitation activities		
Cumulative impacts: Minor		

Table 7: The potential impact of the construction of the turbines, substation, access roads and power line/s on the Cultural Landscape of the Study Area.

	Without Mitigation	With Mitigation
Nature/Type	Negative & Direct	Negative & Direct
Extent	Local	Local
Duration	Long term	Long term
Probability/likelihood	Definite (temporary)	Definite (temporary)
Significance	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	No
Mitigation: No practical mitigation.		
Operational Phase: See above		
Decommissioning Phase: None		
Cumulative impacts: There are at least 6 applications for wind energy facilities in the Sutherland area. It is unclear which, if any will be constructed and so it is difficult to fully assess the cumulative impact. Logically though, the erosion of the cultural landscape would be progressive and possibly worsened by the clustering of facilities.		



Figure 12 Existing 400 kV transmission lines cross the landscape close to Ou mure

7. CONCLUSION AND RECOMMENDATIONS

7.1 Palaeontology

All the geological horizons in the Study Area are potentially fossiliferous. Consequently, all excavations, whether for road cuttings or foundations, may reveal fresh fossiliferous rock. There is a low but significant likelihood of important new discoveries in the Abrahamskraal Formation.

The likelihood of encountering Cenozoic fossils in valley fill sediments is considered to be low, but if excavations for infrastructure take place in the Ekkraal or Wilgebosrivier valleys, there is a possibility of fossil mammalian bones being encountered. In this case the South African Heritage Resources Agency will have to be notified immediately.

Road cuttings, particularly into hill slopes for access roads to the ridge tops where wind turbines would be located, should be investigated by a suitably qualified and experienced Karoo palaeontologist. Any substantial excavation exposing fresh bedrock, like borrow pits, similarly should be investigated palaeontologically.

If fossil material is encountered, the palaeontologist must be given sufficient time, access and resources to recover a scientifically representative sample for further study. If it cannot be studied immediately, the costs of housing the material should be borne by the developers. If this recommendation is followed, then from a palaeontological point of view, the development of the proposed Roggeveld wind farm will constitute a positive intervention, providing greater insight into the palaeontological heritage of South Africa.

7.2 Archaeology

The pre-colonial heritage of the area as manifested by archaeological traces is extremely sparse. Very little material was identified and no particular mitigation is suggested.

The colonial archaeological heritage of the study area is also sparse, but forms two distinct clusters. As a general comment, areas along river banks, and valleys appear to have been the focus of settlement during the last two centuries (see Appendix 1). Within the study area is the Ekkraal Valley which will not be directly be affected by the proposed activity.

If plans change and the Ekkraal Valley is to be impacted, then this area to be thoroughly surveyed and all heritage sites recorded and mapped on the landscape. Sensitive areas must be flagged so that these can be protected from construction related activities.

7.3 Graves

Graves tend to be located close to settlements. In addition to the identified ones with typical surface identifiers such as cairns and/or head stones, there are likely to be others that never had any, or which have been lost over time. The single identified formal

cemetery will not be affected by the proposed activity.

If human remains/burials are uncovered during the construction phase, work in the specific location should cease, and HWC/SAHRA should be notified. They would in all likelihood request an archaeologist to investigate and implement mitigation, in the form of exhumation. The mitigation of human remains from the colonial period requires a permit to be issued by the SAHRA Burials Unit.

7.4 Buildings

It is acceptable to utilise farm buildings for the project, however if renovation or changes to structures is envisaged, a heritage professional with experience in historical structures should be consulted to assist with sensitive re-adaptation or restoration. Kraals, walls, stone features and ruins must be left in-tact on the landscape.

7.5 Landscape and built environment

The built environment of the study area is limited and sparse. Although virtually every farm has generally protected material in its confines, none of these have anything beyond moderate local heritage significance. Direct impacts to any structures are expected to be very limited (the best example of a karoo historical house lies well outside the study area some 5 km to the south).

The greatest impact, which is not a heritage impact but a landscape impact has been identified in the independent visual baseline assessment by Oberholzer and Lawson. This is the industrialisation of a very large expanse of natural landscape adjacent to the R534 which is considered a scenic route. Combined with the impact of up to 5 other similar facilities planned in the general area, the natural amenity qualities of the region will be negatively impacted.

On purely heritage alone, there is no justifiable reason for not supporting the proposal.

Project component/s	<ul style="list-style-type: none"> • The renewed proposal for stage 1 involves some 60 turbines. • each turbine has a 100m hub height and a maximum 117m rotor diameter • each turbine has a foundation up to 20m x 20m underground and backfilled with a with maxim area of 4m diameter protruding above ground, • adjacent to each turbine a crane pad or hard standing area of a maximum of 3000 m² to facilitate construction and maintenance.. • access roads up to 12m wide • site layout (turbine locations, substation, access roads etc.) is indicative • additional infrastructure (office and storage building, met masts, temporary laydown area, borrow pits). • one main 200x200m substation next to existing Eskom Komsberg series capacitor station and one smaller substation closer to the turbines of 100x200m with smaller substations closer to the turbines collecting capacity from the turbines. The smaller substations would be connected to the main one via 400kV overhead lines. • Approx. 10.6km of 33kV overhead lines and 5.8km of 400kV transmission lines • Underground cabling between turbines.
Potential Impact	Physical destruction of both palaeontological and human made heritage.
Activity/risk source	Construction of roads, turbines bases, transmission lines and substations, intentional/unintentional neglect of historic buildings
Mitigation: Target/Objective	The conservation of human made heritage, the collection of palaeontological samples from excavation sites, conservation of protected buildings, retention of landscape qualities.

Mitigation: Action/control	Responsibility	Timeframe
Final walk-down of turbine sites as needed, checking of substation sites and power line routes, roads.	Contracted archaeologist.	Prior to construction as part of EMP.
Paleontological monitoring of cuttings into bedrock, foundations,	Contracted Palaeontologist	Prior to and during construction.

Performance Indicator	Retain archaeological sites in un-impacted condition, heritage buildings and farms cared for and re-used, scientific contribution through palaeontological research.
Monitoring	Periodic site inspection during and after construction, photographic recording of impacts, much can be done by a well-trained ECO.

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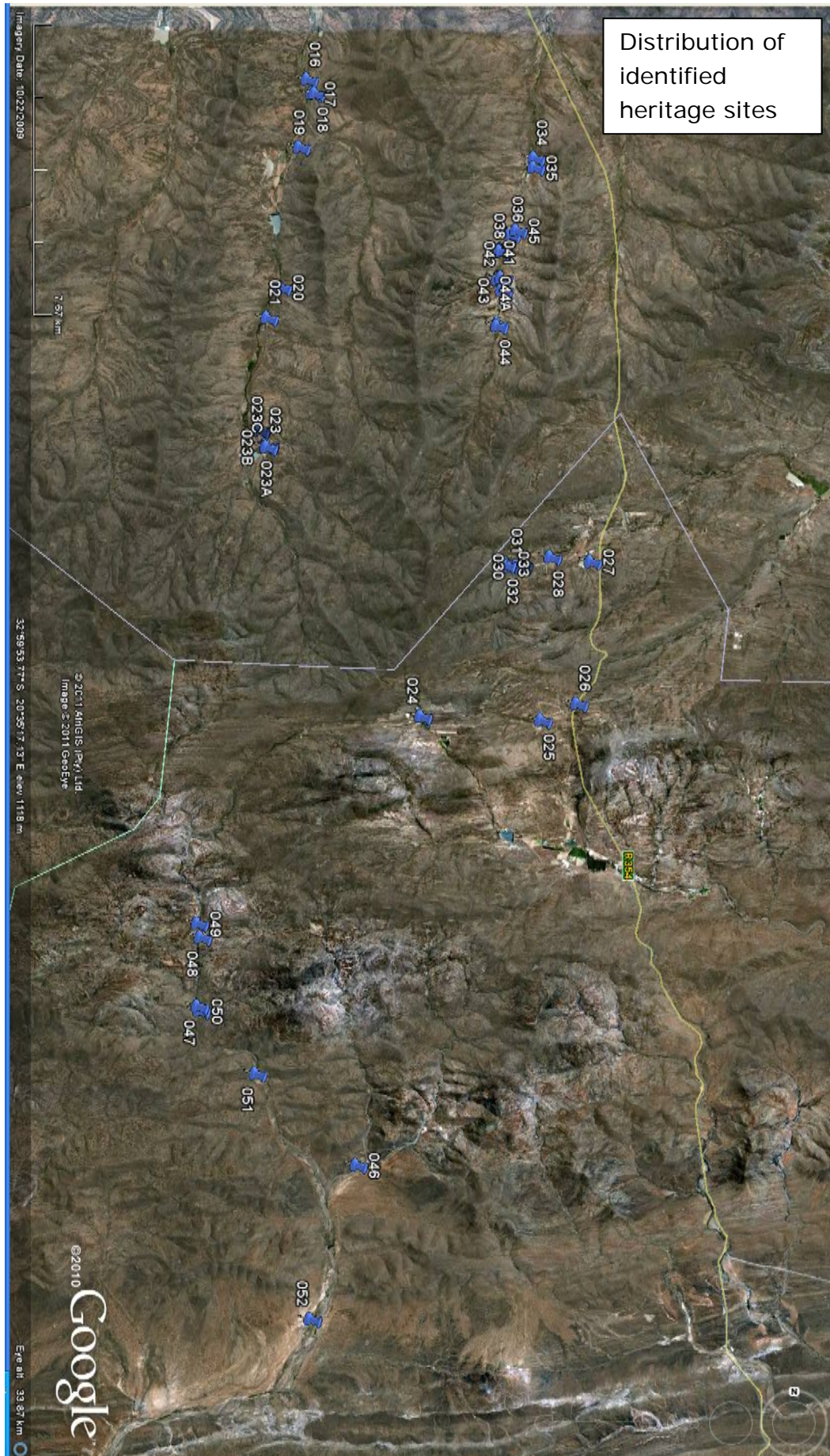
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APPENDIX 1: HERITAGE SITES RECORDED DURING THE 2010 SURVEY



Site No.	Location	Character	Description
16	S32 48 09.0 E20 28 20.7	Historical	Scatter of historical ceramics, glass, metal, rubber. A few other bits also scatter for some 50m to the south.
17	S32 48 21.3 E20 28 26.0	Historical	Scatter of historical ceramics, glass, metal, rubber, leather. More present under tree to the east.
18	S32 48 21.1 E20 28 28.7	Ruin	Stone enclosures and ruined cottage with dumps, artefacts etc. Also a small stone circle (?oven) of ~1m diameter. Bucket toilet in wooden shelter to the east. Coke and Fanta bottle fragments. Probably occupied quite recently, ?less than 100 years ago?
18A	as above	Ruin	Small ruin and <i>trapvloer</i> of c.10 m diameter, also a feeding trough. This site lies just south of 18 and is part of same 'complex'.
19	S32 49 07.4 E20 28 13.9	Ruin	Small house ruin.
20	S32 51 07.1 E20 27 57.0	House	House.
21	S32 51 33.3 E20 27 43.8	Ruin	Two ruins, one on either side of road. Mud brick ruin has stone foundations and platforms reaching within 1.5m of road edge. Ruin is 3 x 6 m. Platforms on at least 2 sides. Some historical artefacts lying around. Also a hand plough. Other ruin is mostly stone but with portions in mud bricks. It is about 6 x 12 m and seems built in phases. Various stone ?alignments around the area and many historical artefacts around.
22	S32 53 08.5 E20 27 35.6	?graves	6 piles of rocks on east side of road. Not in any order but one group of three and other three more widely spread. Two gps points for the ends (E+W).
	S32 53 08.3 E20 27 38.0		
	S32 53 09.4 E20 27 37.1		
23	S32 53 22.3 E20 27 46.3	Cairns	Many stone piles with mostly small cobbles, perhaps 30 - 40 of them. Spread around a large area. Cairns on hard ground surface with nothing
	S32 53 23.3 E20 27 45.3		

	S32 53 23.0 E20 27 44.0		beneath them. 4 gps points delimit area.
	S32 53 21.6 E20 27 44.0		
24	S32 57 09.5 E20 30 23.9	Farm	Ou Mure farm complex.
25	S32 57 11.3 E20 32 23.8	Building	Small white building south of the road.
26	S32 56 57.1 E20 32 59.5	Ruin	Stone ruin and kraal just off main tar road.
27	S32 54 57.3 E20 33 12.0	Farm	Bon Esperance farm complex.
28	S32 54 54.0 E20 32 31.5	Kraal	Stone kraal 30m north of road. Two enclosures, smaller may not be for stock?
29	S32 55 01.5 E20 32 02.4	<i>Trapvloer</i>	Trapvloer 15 m from road.
30	S32 55 02.0 E20 31 57.6	House	Farmhouse. Original part (running east-west) was built in 1929 but the addition is newer.
31	S32 55 02.3 E20 31 50.1	Kraal	Stone kraal.
32	S32 55 01.1 E20 31 45.7	Kraal	Stone kraal.
33	S32 54 59.9 E20 31 46.8	Ruin	Stone house with probable external hearth. About 4 x 12 m. Many historical artefacts and bones lying around outside.
34	S32 49 14.6 E20 32 10.8	Kraal	Stone kraal 100m west of road.
35	S32 49 22.7 E20 32 10.6	Kraal	Stone kraal next to cottage.
36	S32 50 20.3 E20 31 47.3	Kraal	Stone kraal alongside river.
37	S32 50 35.3 E20 31 38.1	Leiwat	Small double skin and rubble fill dam/leiwat to catch water and lead out of stream bed to wheat fields.
37B	S32 50 34.1 E20 31 38.2	"	More of above
37C	S32 50 33.2 E20 31 38.3	"	End of visible stone alignment.

38	S32 50 34.8 E20 31 37.1	Ruin	Long house with very large hearth. Double skin and rubble fill. Also small round feature outside to southeast. 14 m long with 2m deep hearth on end. Original part (10 m long) had north and south room with hearth on north end and a small stoep on east side of south room. A third room (4m long) was added to the south end. Ceramics found next to house
39	S32 50 57.8 E20 31 36.3	Ruin	Stone and mud-brick house ruin and outbuilding with a small brick feature (?oven) on east side of road.
40	S32 50 57.1 E20 31 36.4	?graves	Two mounds of rocks, biggish ones. Also a stone line along the very edge of the road.
41	S32 50 57.3 E20 31 39.2	Trapvloer	<i>Trapvloer</i> of 9m diameter with two small circles inside it. Various glass and ceramic frags around about including some fanta bottle fragments.
42	S32 50 58.9 E20 31 35.3	Dam	Small earthen dam of 4 m x 12 m, very shallow, just behind house at 039.
43	S32 51 07.9 E20 31 39.7	?	Stone feature in eroding area.
44	S32 51 38.5 E20 31 35.4	Ruin	Very long stone walling above river. L-shape with foot at 90 degrees to river about 6m long. GPS at both ends.
44A	S32 51 36.4 E20 31 35.8		
45	S32 50 16.8 E20 31 53.6	Dam	Earthen dam with stone lining in river, breached.
46	S33 03 29.2 E20 29 24.7	Farm	Hartjies Kraal Farm Complex.
47	S33 01 16.0 E20 26 43.3	Ruin	Stone ruin 0.5m from road and a few metres from river.
48	S33 00 17.5 E20 26 46.0	Kraal	Stone kraal. A second one occurs 200m east and a third 250m northwest.
49	S33 00 05.9 E20 26 42.9	Graveyard (Barendskraal)	Graveyard in two halves with elaborate graves to south and others to north. Graves bear names Groenewald and Marais . One grave has lots of marine shell on it (argenvillei, oculus, granatina, 1 exotic shell). Less formal graves may be workers graves – these are recently celebrated, covered with decorations, flowers, shells in jars, etc. One has a wooden sign on it with K. Maritz.
50	S33 01 19.8 E20 26 45.1	<i>Trapvloer</i>	<i>Trapvloer</i> 8m diameter with 1.5x2m 'room' on one side.

51	S33 02 12.7 E20 27 42.3	Farm	De Libanon. Interesting farm house with early 20th C additions. .
52	S33 05 41.1 E20 28 40.2	Farm	Volstruisfontein farm complex.

ROGGEVELD WIND FARM

PALAEONTOLOGY STUDY

Duncan Miller

1. Introduction

G7 Renewable Energies (Pty) proposes to establish a wind energy facility between Matjiesfontein and Sutherland in the Western and Northern Cape. The proposed project will straddle the provincial boundary, although most of the planned infrastructure is on the Northern Cape farms. The site is located to the west of the R354, approximately 40 km south of Sutherland and approximately 20 km north of Matjiesfontein. Environmental Resources Management (ERM) has commissioned a heritage assessment of this area from the Archaeology Contracts Office, University of Cape Town, for whom this palaeontological assessment has been done by Dr Duncan Miller.

Dr Miller is a research scientist with PhDs in both Materials Engineering and Archaeological Science. He has published over 50 peer-reviewed scientific papers on various topics, including the palaeontology of elevated beach deposits on the West Coast of South Africa, as well as producing numerous technical reports.

2. Methodology

The study commenced with the collection of literature, including the 1:250 000 Geological Map (Sheet 3220 Sutherland). Given the very limited timeframe for its generation, this report relies on general reference works. The geological formations and strata underlying the study area were identified and a field trip was conducted to the study area, with two days spent inspecting road cuttings, borrow pits, and erosional exposures for fossils. This was undertaken in conjunction with the archaeological heritage survey of the northern area, and details of the tracks covered are available in the relevant archaeological report. The southern area was not visited for the purposes of this palaeontological report, which for this area relies on published sources.

3. Regulatory and Legislative Overview

In terms of the National Heritage Resources Act No. 25 of 1999, all palaeontological material is protected. In terms of the Act, "*palaeontological* means 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". The Act stipulates that:

"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; or

(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”.

Control over palaeontological resources resides with the relevant provincial heritage authority, where such exists, otherwise with the national South African Heritage Resources Agency. Both Heritage Western Cape and the South African Heritage Resources Agency are responsible heritage authorities for this project. The provisions of the Act are complex, and the Act should be referred to directly for details about applications to collect or destroy palaeontological material.

4. Description of the Affected Environment

4.1 Local Geology

The Study Area is situated towards the southern margin of the Main Karoo basin. To the south, rocks of the Cape Supergroup make up the Cape Fold Belt mountains. Folding due to the tectonic forces which gave rise to the Cape Fold Belt is also present in the Study Area, but it is much more subdued. This has given rise to more or less parallel gentle anticlines (∩-shaped) and synclines (U-shaped), with their axes orientated approximately SSW-NNE, over most of the Study Area. The entire area is underlain by rocks of the Karoo Supergroup. Most of the area is underlain by rocks of the Abrahamskraal Formation of the Permian Beaufort Group (*Figure 4.1.1*). The hilltops and hill slopes expose horizons of resistant channel-fill sandstones, with intervening layers of shales, representing former muddy flats and flood splays from broken river banks (*Figure 4.1.2*). In the south there are scattered outcrops of the slightly older Waterford Formation of the Ecca Group, and also outcrops of the Tierberg and Fort Brown Formations in the extreme south (Theron, 1983).

Bedrock exposures are few, except on the crests of hills and a few marginal cliffs. Erosion gullies reveal that scree and valley fill deposits tend to be very thin, typically less than 1 metre, except in the central Wilgebosrivier valley in the north. Here the valley fill deposits, including river gravels exposed in the river bed in places, are of unknown thickness.

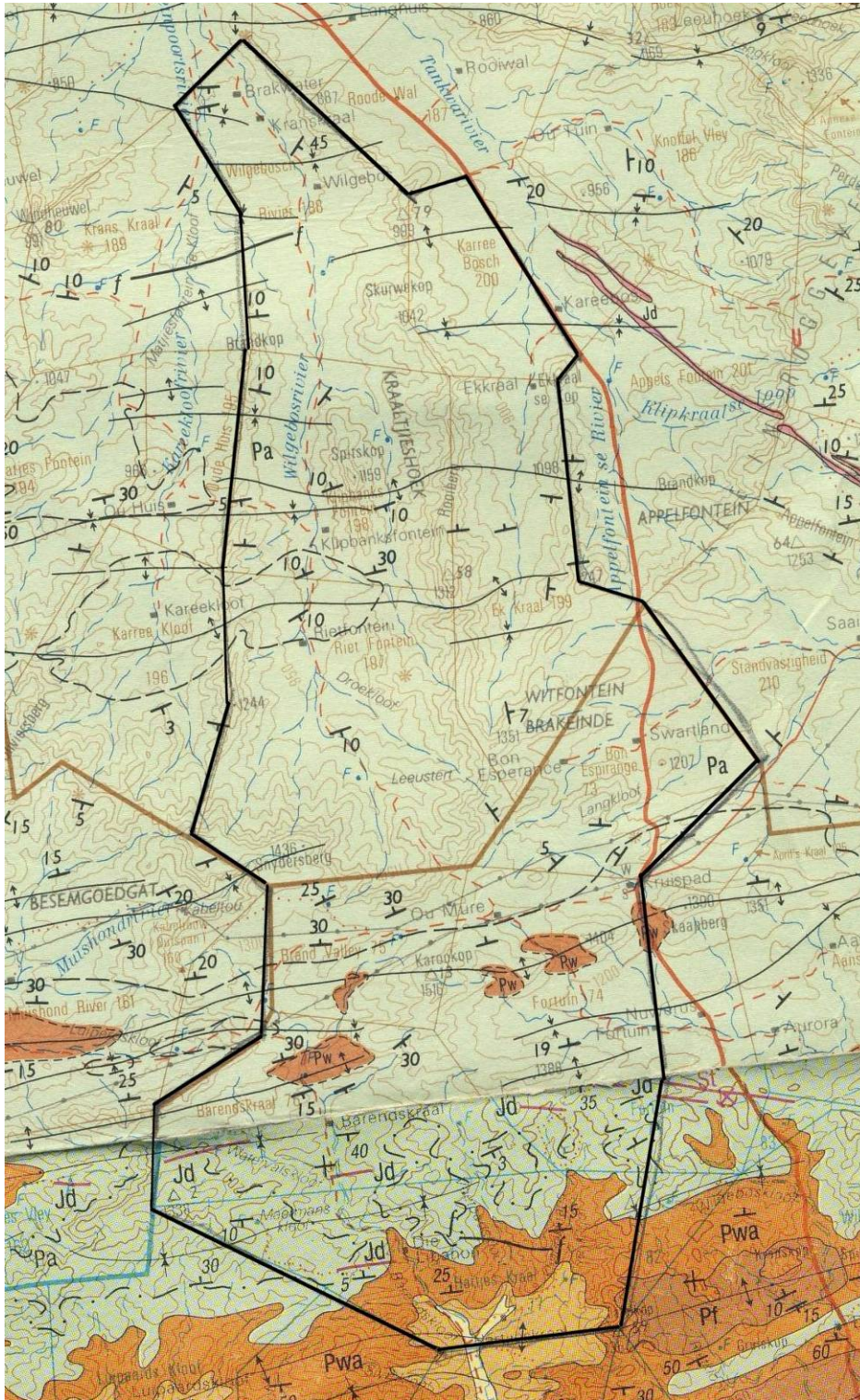


Figure 4.1.1 Geological Map of the Farms Enclosing the Proposed Wind Farm Area (from Sheet 3220 Sutherland and 3320 Ladismith) Pa = Abramskraal Formation; Pwa & Pw = Waterford Formation; Pt (yellow, unlabelled) = Tierberg Fm; Pf = Fort Brown Fm; Jd = dolerite



Figure 4.1.2 Typical Landscape of the Northern Area, Showing Ridges Supported by Resistant Sandstone Layers in the Abrahamskraal Formation (Looking North, Ekkraal Valley to the Right). Note the low bedrock exposure on the hillslopes.

The stratigraphy, lithology and palaeoenvironments of the rocks of the northern areas are summarised in the following table.

AGE	GROUP	FORMATION	LITHOLOGY	PALAEOENVIRONMENT
Permian	Beaufort	Abrahamskraal	sandstone channel + crevasse splay deposits, interbedded mudstones	subaerial upper delta plain, aerially exposed mudflats, backswamps,
Permian	Ecca	Waterford	sandstone, greywacke, shale	shallow water, delta-front
Permian	Ecca	Fort Brown	mudstone, minor sandstone	prodelta and delta-front
Permian	Ecca	Tierberg	dark shale, mudstone	settling from suspension in deep water, shallowing towards the top

Table 4.1.1 Stratigraphy, Lithology and Palaeoenvironments of the Rocks Exposed in

the Study Area (modified from Johnson *et al.*, 2006)

4.2 Palaeontology

The outcrops of the Waterford Formation in the south were not searched, but trace fossils in the form of burrows, trails and tubes are common in this formation, with rare bivalves and fragmentary fish remains (Thamm & Johnson, 2006; Johnson *et al.*, 2006). Plant fragments (*Glossopteris*) are also reported to be common and in places pieces of stem fragments of the tree genus *Dadoxylon* occur (Theron *et al.*, 1991).

The only fossils found in the rocks of the Abrahamskraal Formation were trace fossils in the form of sand-filled vertical burrows in sandstone (*Figure 4.2.1*). These were in a loose block adjacent to a packed stone ruin in the Ekkraal valley (Tim, please provide coordinates – it was at the ruin with the long wall adjacent to the river and the possible aqueduct/dam), and may have been transported from elsewhere as building material.



Figure 4.2.1 Trace Fossils Consisting of Sand-filled Vertical Burrows in Sandstone, from Ekkraal Farm (width of rock ca. 200 mm)

The Abrahamskraal Formation contains terrestrial vertebrate fossils, fish remains, non-marine molluscs and silicified wood (Johnson *et al.*, 2006). The lowest biozone of the Beaufort Group is the *Eodicynodon* Assemblage Zone, recently recognised in the southwestern part of the Karoo basin by Bruce Rubidge. This zone is characterised by fossils of *Eodicynodon*, a small primitive tetrapod reptile. Fossils of other primitive reptiles are also found in this biozone (MacRae, 1999). These are extremely important fossils documenting the rise of reptiles and evolution of mammal-like reptiles (therapsids), for which the Karoo is the pre-eminent locality.

The *Eodicynodon* Assemblage Zone is not recorded in the Study Area and this area lies within the *Tapinocephalus* Assemblage Zone. The zone is named after a therapsid (the mammal-like reptile *Tapinocephalus atherstonei*) restricted to this zone. Fossils of a wide variety of other tetrapods, both herbivores and carnivores, including early precursors to the line that gave rise to mammals, have been found in this zone (MacRae, 1999). There are very few records of vertebrate fossils in the part of the *Tapinocephalus* Assemblage Zone covered by the Study Area, and what has been found is sparse but diverse, so anything found would be of great interest (J. Almond pers. comm.).

5. Impact Identification and Assessment

Infrastructure development, particularly new road cuttings and excavations for foundations, provides a positive opportunity for palaeontology by exposing fresh rock. This constitutes a positive, direct impact if the proposals for mitigation are followed.

5.1 Waterford, Tierberg and Fort Brown Formations (Ecca Group)

The Waterford Formation crops out only in a hilly area in the south. Excavations into these sandstones and shales may expose fresh slabs with trace fossils and plant remains. The magnitude of the impact is expected to be low as these characteristic fossils are plentiful elsewhere in this formation. This is true also for more the more spatially limited outcrops of the Tierberg and Fort Brown Formations even further south. The overall significance for these formations is thus expected to be **minor to negligible**.

5.2 Abrahamskraal Formation (Beaufort Group)

The Abrahamskraal Formation underlies most of the Study Area. New road cuttings and any excavations for foundations or road metal will produce fresh rock, any of which may contain important fossils, particularly terrestrial vertebrates. It is not possible to predict the locations of such fossils, which to date have been few (Theron, 1983). Some localities at which vertebrate fossils have been found are marked on the 1:250 000 Geological Map (Sheet 3220 Sutherland), but these are north east of the Study Area. Given that the base of the Beaufort Group has been redefined relatively recently (MacRae, 1999), the lower horizons of the Abrahamskraal Formation are a potential source of scientifically very important fossils. This gives rise to a paradoxical situation in which the likelihood of finding fossils appears to be low, but the importance if they are found through specialist mitigation would be **high to very high**.

6. Mitigation of Potential Impacts

All the geological horizons in the Study Area are potentially fossiliferous. Consequently, all excavations, whether for road cuttings or foundations, may reveal fresh fossiliferous rock. There is a low but significant likelihood of important new discoveries in the Abrahamskraal Formation. Road cuttings, particularly into hill slopes for access roads to the hill tops where wind turbines would be located, should be investigated by a suitably qualified and experienced Karoo palaeontologist. Any substantial excavation exposing

fresh bedrock, like borrow pits, similarly should be investigated palaeontologically.

The likelihood of encountering Cenozoic fossils in valley fill sediments is considered to be low, but if excavations for infrastructure take place in the Ekkraal or Wilgebosrivier valleys, there is a possibility of fossil mammalian bones being encountered. In this case the South African Heritage Resources Agency will have to be notified immediately. The developers, site managers, and any operators of excavation equipment, need to be alerted to this possibility.

If any fossil material is encountered, the palaeontologist must be given sufficient time and access to resources to recover at least a scientifically representative sample for further study. If it cannot be studied immediately, the costs of housing the material should be borne by the developers.

7. Conclusion and Recommendations

All the geological horizons in the Study Area are potentially fossiliferous, and hence ideally all excavations for whatever purpose should be checked by a suitably qualified palaeontologist. If this is unfeasible, then at least all road cuttings and borrow pits should be investigated for fossil material. If fossil material is encountered, the palaeontologist must be given sufficient time and access to resources to recover a scientifically representative sample for further study. If this recommendation is followed, then from a palaeontological point of view, the development of the proposed Roggeveld wind farm will constitute a positive intervention, providing greater insight into the palaeontological heritage of South Africa.

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