SPECIALIST INPUT

FOR THE

ENVIRONMENTAL IMPACT ASSESSMENT
AND ENVIRONMENTAL MANAGEMENT PLAN
FOR THE PROPOSED WIND ENERGY FACILITY
AND ASSOCIATED INFRASTRUCTURE
AT A SITE IN THE WESTERN CAPE PROVINCE:

FINAL GEOLOGICAL AND EROSION POTENTIAL REPORT

PREPARED BY

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PREPARED FOR:

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Abbreviations and Definitions

Study area	Portion 5 of the Farm Gravewaterkop No 158 Portion 620 of the Farm Olifants River Settlement Portion 617 of the Farm Olifants River Settlement
DEADP	Department of Environmental Affairs and Development Planning
EIA	Environmental Impact Assessment
I&AP	Interested and Affected Party
NEMA	National Environmental Management Act, No 107 of 1998
PPP	Public Participation Process
ROD	Record of Decision
TOR	Terms of Reference

1 INTRODUCTION

1.1 Background

The study area is situated in the West Coast of the Western Cape Province in the Matzikama Local Municipality. This area covers about 35 km² and includes three properties, namely Portion 5 of the Farm Gravewaterkop No 158, Portion 620 of the Farm Olifants Rivier Nedersetting and Portion 617 of the Farm Olifants Rivier Nedersetting.

A commercial wind farm facility and associated infrastructure is planned by Eskom in the study area. This proposal will include up to 100 turbines that would be spaced over a footprint of about 25 km². Each tower will stand about 78 m tall and will be founded on a concrete foundation of 15 m x 15 m.

An access road to the site will be constructed linking in to the existing main road in the area. Internal access roads will be established within the site to each wind turbine. These internal roads will be approximately 4 to 6 m wide with a turning circle radius of about 25 m.

An electricity substation will be established within the study area. Overhead 132 kV powerlines will feed into the distribution network at the Koekenaap or Juno Substation. A small office structure and visitors centre may also be constructed at the entrance to the wind energy facility.

1.2 The Environmental Process

It is understood that authorisation is required from DEAT (with comments from the DEADP) in terms of the NEMA (Act 107 of 1998) EIA Regulations as read with Government Notices R.385 and R.386 of 21 June 2006. In terms of the above legislation the establishment of the proposed new wind energy facility requires authorisation in terms of the Scoping and EIA process. This geological and soil erosion specialist report forms one of the specialist study requirements for the Scoping and EIA phases of the project.

The author is registered as a Geological Scientist (registration number 400118/96) with the South African Council for Scientific and Natural Scientific Professions (SACNASP) with about 13 years experience. He is the sole member of Geological and Environmental Services (GES) who have been appointed by Savannah Environmental (Pty) Ltd to conduct the above geological and soil erosion specialist report. GES is a Port Elizabeth based consultancy of three years that specialises in engineering geological and environmental geological disciplines.

1.3 Terms of Reference

Specialist input is required for the Scoping Phase of the EIA studies. This geological and soils specialist report has been requested by Savannah Environmental (Pty) Ltd to address the following concerns:

- The prevailing geological conditions in the area

- The weathered geological (soil) environment in the study area
- Broad engineering geological conditions in the study area
- The erosion potential in the area

Comment on the above physical environments with reference to the (a) turbines, (b) access roads and (c) substation sites associated with this project have been broadly addressed in this specialist report. It should, however, be noted that this report merely outlines numerous issues of concern that should be brought to the attention of the proponent during project planning. This report should not be used as an engineering geological report for planning purposes as no site-specific information has been collected and analysed at the time of report compilation. The proponent should undertake a specialist engineering geological investigation to address the issues raised in this report prior to project implementation.

The scoping report should include the following information in terms of the geological and soil erosion regimes:

Description of the environment that may be affected by the wind energy facility:

- Identification, description and evaluation of environmental issues and potential impacts
- Evaluation of direct, indirect and cumulative impacts in terms of (a) nature and (b) extent of such impacts
- Statement of significance of identified issues based on above evaluation
- Red flag any sensitive issues that may influence the turbine footprints
- Identification of significant impacts to be assessed during EIA

1.4 Limitations

The information provided in this final specialist report has been based on information provided by Eskom Holdings Limited, Savannah Environmental (Pty) Ltd and the published literature. On site observations and photographs of the study area were also made available by Dr Pete Illgner. The desk-top study approach to this report has obvious limitations and should be confirmed by on-site observations during the EIA phase of the investigation.

The information provided in this report is, however, is deemed adequate for the scoping evaluation as required by the NEMA Regulations.

2 PHYSICAL ENVIRONMENT

This section provides for an overview of the project's earth-science related physical environment. The role of this chapter is to provide a context for the evaluation of the physical environments forming part of the TOR for this report. This baseline information has relevance when (a) attempting to assess and describe the condition of the receiving environment and (b) predicting potential aspects of this environment that may be affected/ impacted by the proposed wind energy facility.

The physical environment in the study area has been described from numerous published sources published on a fairly coarse, regional scale. The region of interest in terms of standard published maps and associated description brochures covers the 1:250 000 scale 3118 Calvinia sheet, which extends from Doring Bay on the West Coast to east of Calvinia in the Karoo. The physiography of this region changes from a sandy, slightly undulating coastal belt to mountainous country near Nieuwoudtville and eventually to a hilly Karoo landscape. The study area occupies the western part of the above 1:250 000 scale sheet, where the landscape to the south-east is drained by the perennial Olifants River system and the coastline to the north-west is drained by small, poorly developed ephemeral streams.

2.1 Topographical Environment

2.1.1 Regional Topography

The major topographical feature in the southern part of geological sheet 3118 Calvinia includes a 20 km wide coastal flat between the Atlantic seaboard and the northern Cedarberg Ranges. The Cedarberg Ranges have deeply incised valleys sometimes exposing basement rocks, which underlie the sandstone lithologies of the mountainous terrain. Around Vredendal, to the east/ south-east of the study area, the marine peneplain widens appreciably into the Knersvlakte, which is bordered to the east by Bokkeveldsberge.

North of the Olifants River, in a coastal strip that includes the study area, the coastal plain narrows as a result of hill country built by the underlying granite and metamorphic lithologies. The topography to the north part of the study area is controlled by a semi-arid to arid climate, whilst the southern region (including the mountainous terrain) experiences an annual precipitation rate of between 75 and 300 mm. The variable rainfall in the region is further borne out by the considerable botanical diversity, ranging from coastal sandveld to the xerophytic Knersvlakte and protea-dominated inland terrain dominated by mountainous topography. The climatic conditions in the study area, therefore, should be considered transitional between the semi-arid to arid northern conditions and the sub-tropical southern region. The variable climatic conditions will influence weathering rates and ultimately the topographical landscape in the region.

2.1.2 Coastal Topography

The Namaqualand coastal topography is not well studied, although diamond prospecting operations have revealed up to 11 overlapping Pleistocene (3 million to 8 000 years ago) marine terraces to a maximum elevation of up to about +90 m above mean sea-level. These terraces were formed as a result of local upwarping with local transgressions marked by wave cut benches within bedrock. Troughs in the 6 to 8 m terrace are frequently filled with organic sands. The coastal complex attains thicknesses of between 40 and 50 m and is mantled by cobbles and boulders, calcareous and siliceous cement and loose cover sands with occasional clay bands.

The calcified horizon may attain thicknesses of up to 10 m thick and generally disappears downslope of the 11 to 18 m contour level. The calcareous material and cover sands are thought to be of Pleistocene age and are mapped as part of the Quagga's Kop Formation.

2.1.3 Study Area Topography

The published information shows a high-ground of about 100 m above mean sea-level in the north-eastern part of the study area north of the Baai Vals/ Kaapvlei access road. The 100 m contour level occurs sub-parallel with the coastline at distances of between 6 and 10 km inland of the coastline.

This high-ground slopes towards the coastal environment towards the 50 m contour level that bisects the study area footprint in the north-west (near the Weskus Mynbou landing strip) and south (west of the Nooitgedacht farmstead). Between the above two localities the 50 m contour level has been mapped against the coastline, south-west of the study area boundary.

The numerous small embayments to the west of the study area near Duiwegat (Geelwal Karoo 262) is a function of coastal geology dominated by an isolated outcrop of calcareous and gypsofilous soil underlain by medium-grained gneiss (Landplaas Gneiss) and an undifferentiated complex of limestone, dolomite, marble, greywacke, quartzite and phyllite (Widow Formation).

Photographic information provided by Dr Pete Illgner reveals numerous disturbed footprints tens of metres wide throughout the central party of the study area. These disturbed footprints appear to be formed by small animals (maybe suricate habitat or even termite colonies) and look sub-surface borrows and cavities from the images that have affected the topography in isolated areas on the metre-scale. These biological landforms should be assessed during specialist engineering geological investigations to establish potential impacts on future development footprints.

2.1.4 Recommendations

The site-specific topographical environment is poorly mapped (i.e. the published data is too coarse) and needs to be established/ confirmed during an on-site field investigation where recent coastal processes can be more accurately determined. It is important to identify and understand the various marine terrace levels occurring in the study area so that the platforms upon which the proposed wind energy infrastructure is earmarked can be properly understood and that correct planning decisions are made with regards the underlying geological/ engineering geological environment.

The bioturbation (borrows and cavities) footprints indicated on the photographs needs to be confirmed by an appropriate terrestrial zoologist/ entomologist to establish the normal extent of such habitats with a view to determining the potential impacts that these structures would have on the proposed wind energy facility. The above specialist components should be undertaken by the proponent during detailed engineering geological investigation once the EIA studies have been completed.

2.2 Hydrological Environment

2.2.1 Drainage

The closest significant regional drainage system to that of the proposed wind energy facility is the perennial Olifants River, which flows in a south-westerly directly into the sea about 25 km south-east of the study area. No drainage channels occur in the study area according to the published information.

A few minor (poorly developed) ephemeral drainage channels do, however, occur to the west of the study area (north of Geelwal) and north-west of the study area (north of Baai Vals). These ephemeral drainage channels have no influence on the surface drainage in the study area, but do show an interesting straight-line pattern generally orientated perpendicular with the coastline. Such fluvial channel orientations frequently suggest rapid upliftment or lowering of sea-levels, which concurs with the numerous marine terrace levels within the near coastal zone.

2.2.2 Recommendations

The drainage environment within the study area cannot be described in great detail without input of a site-specific nature. The coarse scale of the published information is, nevertheless, sufficient to comment on the natural drainage conditions occurring in the study area for scoping phase purposes. Site specific detail should be assessed as part of a thorough engineering geological study once the EIA investigation has been completed.

Drainage mechanisms within the study area are crucial during stormwater planning and design as the unconsolidated cover sands may ensure that most run-off permeates into the sub-soil environment.
The surface run-off conditions would be exacerbated along roadway servitudes where such linear structures would behave as a conduit for stormwater run-off after periods of heavy or prolonged precipitation. The underlying calcareous material may also become saturated after wet periods and result in sub-surface karstic weathering phenomena (e.g. sinkhole development).

2.3 Geological Environment

2.3.1 Geomorphology

According to the 1:250 000 Geological map (3118 CALVINIA) published by the Council for Geosciences the study area comprises numerous young cover deposits of mostly marine origin underlain by metamorphic bedrock of the Namaqualand Metamorphic Province. Generally the wide range of Tertiary 65 to 2 million years old) to Recent (Holocene from the end of the Pleistocene (8 000 years ago to present time) deposits covering the coastal plain includes thin cover sands where underlying bedrock is difficult to deduce to limited outcrop and exposure. Raised beaches along the coast are related to marine transgression linked to Tertiary and Pleistocene sea-floor spreading, glaciations and crustal warping.

Marine terrace deposits (raised beaches) are common along the coastline and occur at various elevations that correspond to Miocene, Pliocene and Quaternary transgressions. These deposits overlie wave-cut benches and are frequently abutted against a landward cliff in bedrock topography. These deposits are frequently diamondiferous and are unlikely to occur within the footprint earmarked for the proposed wind energy facility.

Isolated and patchy calcrete material is mapped in the south-eastern part of the study area, west of the Skilpadvlei farmstead. These calcrete deposits are related to dorbank (indurated hard rock pedogenic material) of the surrounding calcareous soils and represent advanced calcretisation of the red sand, clay, gravel and scree that occurs in the area. The calcrete is usually about 1 m thick but can reach thicknesses if up to 6 m in places.

Isolated duricrusts of silcrete and ferricrete also occur in the Schaap Vlei area and appear to be related to the sub-surface palaeo (ancient) drainage system along which enhanced ground water movement took place. This layer frequently crops out at between the 65 and 70 m contour levels. The duricrust formation is described as being related to three main mechanisms of enhanced groundwater circulation:

- Palaeo land surfaces or permeable terrace gravels
- Palaeo drainage systems
- Major fault structures

Calcareous and gypsoferous soils are mapped in the extreme southern (north of Cliff Point) and north-western (south of the Weskus Mynbou landing strip and Skaapvlei) part of the study area. These surficial deposits generally comprise hard red calcareous soil known as dorbank. These materials have been interpreted as remnants of the overlying terrace deposits of the Quagga's Kop Formation, which frequently exhibit similar degrees of calcretisation.

Fine-grained, red-coloured aeolian (formed by wind) sands cover the coastal plain throughout the region, including large parts of the study area. These wind-blown sands frequently form low-relief, mobile bedforms that are blown over underlying harder calcareous soils. The dunes are able to form up and down the slopes of hills and valleys to reveal micro "climbing falling" dune morphologies.

Patches of the dune sand overlie various other bedrock and surficial deposits and stretch right up to the coast where they spill over the sea cliff onto white beach and dune sand. The red colour of the dune sand is a function of oxidising arid conditions. The sand bedforms are generally blown inland by the prevailing southerly and south-westerly winds and it is suggested that the red aeolian sand was derived from the palaeo Olifants River mouth, which would have occurred south-east of its present location during Palaeogene/ Neogene regression.

2.3.2 Geology

Based on bedrock outcrop along the coastline seawards of the study area it is reasonable to assume that the study area is underlain by Landplaas Gneiss of the Little Namaqualand Suite (Namaqua Metamorphic Suite) in the Geelwal Karoo area (north-western part of the wind energy facility footprint) and various lithologies of the Gariep Supergroup, Gifberg Group throughout the remainder of the study area.

Landplaas Gneiss

The Landplaas Gneiss outcrops along the coast west of Skaapvlei and in an isolated outcrop between the Skaapvlei homestead and the coastline, on the property Klipvley Karoo Kop 153. Although both of these outcrops occur outside the study area boundaries, it is reasonable to assume that the material would occur beneath the cover material in at least the northern part of the study area.

The Landplaas Gneiss generally comprises pink-weathering medium to coarse-grained quartz-feldspar-biotite gneiss. The origin of these gneisses is controversial and range from either sedimentary or igneous origins. The Landplaas Gneiss rocks are predominantly granitoids and have been included in the Little Namaqualand Suite because they display the penetrative foliation that characterises the main deformational and metamorphic event that affected the Namaqua rocks. The Landplaas Gneiss lithologies are deemed to be about 1 200 million years old and represent part of the basement rocks in the region.

Gariep Supergroup

The Gifberg Group of the Gariep Supergroup unconformably overlies the basal gneiss lithologies along the coastal zone west of the study area. Lithologies of the Widouw Formation of the Gifberg Group outcrop along the coastal zone south of Duiwegat and west of the Nooitgedag farmstead. South of these outcrops, the coastal zone has been mapped as lithologies of the Aties Formation, also of the Gifberg Group.
None of the rocks of the Gariep Supergroup have been mapped in the study area, but their occurrence at depth cannot be ignored based on isolated outcrop to the east and west of the proposed wind energy facility.

The Widouw Formation generally comprises undifferentiated limestone, dolomite, marble with minor greywacke, quartzite and phyllite of unknown thicknesses. Along the coastline to the west of the study area the marbles are generally white and massive, whilst the dolomite is blue-grey, black and white.

The Aties Formation is generally characterised by black graphitic schist but also contains sericite schist, phyllite, greywacke, quartzite and impure dolomite, limestone and marble. Along the coastal zone west of the study area the various lithologies of the Aties Formation have been overthrusted by the older Widouw Formation revealing a highly folded and crenulated rock mass.

The above basal rocks form the more erosion-resistant bedrock exposed along the marine terrace within the coastal platform environment. The Cenozoic younger cover materials, as outlined in the geomorphological section of this report overlie these basement rocks throughout the study area.

2.3.3 Economic Resources

Numerous mining activities are indicated on the published geological map as occurring in the region. Heavy mineral sand (dune sand material) is mined to the north of the study area (Schaap Vley), west of the study area at Geelwal and south of the study area north of Cliff Point.

Diamonds are mined along the coastal zone at Baai Vals, south of Geelwal and north of Cliff Point.

Limestone is mined along the coast between Geelwal and Cliff Point and north of Geelwal.

Lignite is mined north of Schaap Vley, north of the study area.

Kaolin is mined west of Skaapvlei, north-west of the study area.

No commercial mining activity takes place within the study area, but the possibility of commercially exploitable material occurring within the study area cannot be excluded from a geological perspective. This scenario is, however, considered unlikely as economically viable mineral deposits within the study area would most likely have been identified during previous exploration programmes. Resources of value to the construction industry, however, should be assessed during more detailed engineering geological investigation upon completion of the EIA investigations associated with this project.

2.3.4 Fossils

The ancient basement rocks underlying the study area at depth do not contain fossiliferous material due to their age and metamorphic influence that would have erased all valuable primary structures. The cover material, however, especially beach deposit remnants would in all likelihood be dominated by marine bivalves and crustacean debris, indicative of the higher than present palaeo marine depositionary environment.

2.3.5 Recommendations

The undifferentiated published geological data and highly variable lithologies reported to occur in the area could be of concern to planners where very thin cover sands overlie the bedrock environment. Such shallow cover sands would expose the highly variable metamorphic bedrock at shallow depth with various engineering geological implications to the proposed infrastructure (turbines, roads and powerline infrastructure) associated with this project.

More detailed site investigation assessments are recommended to ensure that the published geological information is correct and that isolated outcrops of various rock types have not been missed that may be of interest to project planners and developers of the proposed new wind energy facility. Such specialist input should be addressed during an invasive engineering geological investigation that should be commissioned by the proponent upon completion of the EIA investigation.

3 ENGINEERING GEOLOGICAL OVERVIEW

The study area generally comprises weathered metamorphic rocks of the Namaqualand Metamorphic Province at depth. The published literature suggests that outcrops of these highly variable and ancient lithologies within the proposed wind energy facility footprint are considered unlikely. These bedrock conditions are overlain by unconsolidated aeolian sand with variable pedogenic influences dominated by calcareous material with minor amounts of ferruginous and siliceous material in places. The calcareous material ranges from competent dorbank (hardpan) grading to more friable glaebular calcrete and calcretised sand, whilst the ferricrete and silcrete tends to grade into one another and are composed of sand, grit, talus and conglomerate.

Engineering geological constraints that could be of concern from a planning and engineering perspective with regards the proposed new wind energy facility and associated infrastructure include the following:

- Where clayey material occurs close to surface this material may be expansive and should be tested to determine any heave characteristics. Heaving clays will result in structural damage to foundations during fluctuating moisture conditions if not taken into account by the project engineers during foundation design.
- The unconsolidated aeolian sand would be erodible by both wind and water. These cover sands should, therefore, be protected by vegetation cover and excavation gradients of not steeper than 1:3 should be created to facilitate such growth.
- Where cover sands are exposed to flowing water and high wind speeds the risk of soil erosion could be considered high.
- The sands in the study area may contain a collapsible fabric and should be tested to ascertain any inherent collapse potential. This implies structural damage to foundations where such soil movements have not been allowed for in the foundation design.
- Differential settlement concerns should be borne in mind where structures are founded on material of variable consistency such as very loose aeolian sand and well cemented calcareous dorbank (hardpan). Ground conditions in such environments should be checked by project engineers during construction to ensure risks such as these are eliminated/ reduced.
- Compressible soil and associated reduced bearing pressures within the aeolian environment. Engineers will, therefore, have to engineer improved ground conditions to ensure adequate bearing pressures are created to facilitate construction of all infrastructure associated with this project.
- Compressible soil when wet and associated reduced bearing capacities of clayey material after wet periods. Where such clayey conditions occur adequate stormwater drainage will need to be installed to encourage water away from the area of interest.
- Shallow well-cemented dorbank (considered highly likely) and less weathered bedrock (considered highly unlikely) with associated excavation concerns where deeper foundations/ trenches are required. Where such excavation concerns are encountered stronger excavation equipment and even blasting may be required to facilitate deep trench excavation.

- Shallow perched water tables in flatter areas especially after periods of heavy or prolonged precipitation. Adequate stormwater planning will be required to ensure that such flooding scenario's are reduced/ eliminated during the design stage of the project.
- Poor surface drainage and damp conditions where flat grades prevail.
- Unstable excavation sidewalls where excavation trenches are opened where (a) shallow perched water tables prevail or (b) where deep excavations are opened within unconsolidated aeolian sand.
- Karst topography and sinkholes cannot be excluded where thicker accumulations of calcareous material occur. Karstic weathering phenomena are well documented where groundwater ingress occurs into thick calcareous deposits such as occurring in the study area (considered unlikely in the study area due to low rainfall values).

Many of the above criteria should be proven during invasive field investigation techniques, including disturbed soil sample analysis. The suitability of material for construction applications such as turbine foundations and pavement layerworks should also be established during such detailed engineering geological investigation. Additional tests that should be carried out during the specialist investigation include the establishment of the erosion potential of the material occurring across the site (i.e. dispersiveness), the suitability of the material for construction applications, in situ bearing capacities and the chemical potential of the groundwater (perched) occurring across the site to impact negatively on reinforced concrete structures.

The above requirements should be conducted as a specialist engineering geological investigation by the proponent once the EIA investigation has been competed. This engineering geological investigation is vital to ensure long term integrity of the proposed wind energy facility within this dynamic coastal environment.

Engineering geological test procedures that should be undertaken during the above specialist investigation should include the following:

- Foundation Indicator for turbine and substation foundations (including hydrometer test)
- Road Indicator for road pavement layerworks
- MOD CBR for both foundation and pavement design
- SCS Double Hydrometer to establish dispersive potential of the soil
- Corrosive test of groundwater (if encountered) to establish impact on reinforced concrete

Should surfaced roads be proposed as part of the construction phase of the wind energy facility then suitable construction material for paved road surfaces would have to be explored in the region. This level of information should be addressed in the detailed engineering geological investigation, which would be conducted out by the proponent upon completion of the EIA process.

3.1 Recommendations

Very broad engineering geological issues have been raised as very little site-specific information was encountered in the published literature. Coastal environments are, however, notoriously variable and irrespective of the amount of published information available, any development in such environments should be subjected to a detailed engineering geological investigation.

Such an investigation should be invasive and include the excavation of a number of deep trial pits within footprints of proposed infrastructure. Various soil testing procedures should also be carried out to ensure adequate information is made available to assist project planners and engineers with the design and planning stages of the project. It is, therefore, recommended that the proponent conduct such an engineering geological investigation upon completion of the EIA process.

4 SOIL EROSION OVERVIEW

The study area is considered to fall within an arid zone where the Weinert Number (N number) is greater than 5. The published literature indicates that the Namaqualand coastal zone has an N value in excess of 50, which implies that mechanical weathering is more prominent than chemical weathering in the region. The Weinert N number is a value calculated from climatic data that is used by engineers to establish the link associated with the variation in the performance of weathered rocks used in road construction when related to climatic conditions.

The N value is broadly split into areas where the N value is more or less than 5. The humid region of southern Africa is associated with areas where N is less than 5, whilst the more arid region occurs where N is greater than 5.

The above arid landscapes generally tend to be characterised by shallow soil conditions, which impact on weathering potential in the region. However, in the study area the above bedrock and weathering environments have been covered by reworked aeolian sands, which in turn have been modified by pedogenic (calcrete, ferricrete and silcrete) processes.

The published Erodibility Index for South Africa (published on the DEAT website) suggests that the Namaqualand coastline be considered low to moderate risk in terms of erosion potential (i.e. 11 to 15 out of a maximum of 19). Despite the above published data, Dr Pete Illgner noted during a site inspection earlier in 2007 that significant erosion has occurred along unsurfaced tracks in the coastal zone, which is a broad geomorphological term extending from the coastline to the escarpment inland.

4.1 Recommendations

Site specific information is required to establish the various on-site parameters associated with soil erosion in the study area. Data of interest in this regard includes the mechanisms of erosion taking place, the various soil environments within which the erosion takes place, the significance of erosion should it continue unabated and whether such erosion is natural or a function of anthropogenic disturbance.

Where possible, remedial actions should be established to ensure that existing erosion concerns are addressed with a strategy towards long-term rehabilitation. Likewise, all development associated with the proposed new wind energy facility should be constructed with due cognisance of erosion risk to ensure that new erosion scars are not formed as a consequence of new development footprints.

The above soil erosion recommendations should be addressed during the invasive engineering geological investigation, which should be commissioned by the proponent upon completion of the EIA process.

5 CONCLUSION

The specialist report covering the geological and soil environment occurring within the study area has been compiled based on published literature and personal observations made by Dr Pete Illgner during a brief site assessment during the first quarter of 2007. The numerous recommendations made in this report should be confirmed during more detailed engineering geological investigations, which should be commissioned by the proponent upon completion of the EIA process.

None of the issues raised during this earth-science base review are insurmountable, however, but should be borne in mind by planners and engineers to ensure the structural integrity of the proposed new wind energy facility.

The geological environment and soil erosion concerns raised in this report that could potentially impact on the proposed wind energy facility (and associated infrastructure) have been broadly identified in this report. These constraints would need to be confirmed during detailed engineering geological investigation upon completion of the EIA process. None of the constraints are overtly significant and would all be surmountable pending suitable engineering counter measures, which imply additional construction costs.

No geological or soil erosion concerns occur at this site that could be considered fatal flaws with regards the establishment of the proposed wind energy facility and associated infrastructure.

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AUTHOR CREDENTIALS AND INDEPENDENCE

The author of this report, Mark Rynhoud of Geological and Environmental Services (GES) is an independent environmental practitioner and declares that he does not have any financial interest in the undertaking of the activity, other than remuneration for work performed in the compilation of this specialist report, in accordance with the NEMA EIA regulations. GES have no vested interest in the proposed activity and will not engage in conflicting interties associated with the project.

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