REPORT

On contract research for

SAVANNAH ENVIRONMENTAL

ARC • LNR

SOIL IMPACT ASSESSMENT FOR THE PROPOSED NAMAS WIND FARM, NEAR KLEINSEE, NORTHERN CAPE

By

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May 2018

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DECLARATION

I have over 30 years’ experience in soil surveying, classification and interpretation. I have compiled over 150 soil survey reports, including numerous EIA and related studies. I have a PhD in soil science and am a member of the Soil Classification Working Group of South Africa.

I hereby declare that I am qualified to compile this report as a registered Natural Scientist (SACNASP Registration No. 400463/04) and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
May 2018

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1. INTRODUCTION

Genesis Namas Wind (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 20 km south-east of Kleinsee within the Nama Khoi Local Municipality and the Namakwa District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~5092ha has been identified by Genesis Namas Wind (Pty) Ltd as a technically suitable area for the development of the Namas Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 43 turbines. The entire project site is located within Focus Area 8 of the Renewable Energy Development Zones (REDZ), which is known as the Springbok REDZ. Due to the location of the project site within the REDZ, a Basic Assessment (BA) procedure will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following four farm portions:

» Portion 3 of the Farm Zonnekwa 328
» Portion 4 of the Farm Zonnekwa 328
» Remaining Extent of the Farm Rooivlei 327
» Portion 3 of the Farm Rooivlei 327

The Namas Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 140MW:

» Up to 43 wind turbines with a maximum hub height of up to 130m. The tip height of the turbines will be up to 205m;
» Concrete turbine foundations and turbine hardstands;
» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» An on-site substation of up to 100m x 100m (1ha) in extent to facilitate the connection between the wind farm and the electricity grid;
» Access roads to the site (with a width of up to 10m) and between project components (with a width of approximately 8m);
» A temporary concrete batching plant; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

The power generated from the project will be sold to Eskom and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa, as contemplated in the Integrated Resource Plan.

2. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Savannah Environmental to undertake a soil impact assessment near Kleinsee, in the Northern Cape Province. The purpose of the investigation is to contribute to the Impact Assessment process for the proposed Namas Wind Farm. The objectives of the study are;

- To obtain all existing soil and related information,
- To produce a soil map of the specified area, and
- To assess broad agricultural potential and impacts.

2.1 Legislative and Policy Framework

In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), any application for change of land use must be approved by the Minister of Agriculture, while under the Conservation of Agricultural Resources Act (Act 43 of 1983) no degradation of natural land is permitted.

The following section summarises South African Environmental Legislation with regard to soil and agricultural issues:

- The law on ***Conservation of Agricultural Resources*** (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. The Act also requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.

- The ***Bill of Rights*** states that environmental rights exist primarily to ensure good health and well-being, and secondarily to protect the environment through reasonable legislation, ensuring the prevention of the degradation of resources.

- The Environmental right is furthered in the ***National Environmental Management Act*** (No. 107 of 1998), which prescribes three principals, namely the precautionary principle, the "polluter pays" principle and the preventive principle. It is stated in the above-mentioned act that the individual/group responsible for the degradation/pollution of natural resources is required to rehabilitate the polluted source.

- Soils and land capability are protected under the ***National Environmental Management Act*** (Act 107 of 1998), the ***Environmental Conservation Act*** (Act 73 of 1989) and the ***Conservation of Agricultural Resources Act*** (Act 43 of 1983).

- The ***National Veld and Forest Fire Bill*** of 10 July 1998 and the ***Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act*** (Act 36 of 1947) can also be applicable in some cases.

- The ***National Environmental Management Act*** (Act 107 of 1998) requires that pollution and degradation of the environment be avoided, or, where they cannot be avoided, minimised and remedied.

2.2 Assumptions and limitations of study

The soil information obtained for this report is of a reconnaissance nature (1:250 000 scale). It is assumed that the information is of a high scientific standard, but the limitation of the scale, and the absence of any source of more detailed soil information, is stated. A Geotechnical report for the project was supplied, but it concentrates on the underlying material and not on the soil profile, or the associated agricultural potential.

3. SITE CHARACTERISTICS

3.1 Location

An area was investigated lying to the south of the town of Kleinsee on the following farms: Portion 3 of the farm Rooivlei 327, the Remaining Extent of the farm Rooivlei 327, Portion 4 of the farm Zonnekwa 328, and Portion 3 of the farm Zonnekwa 328.

The area lies on the coastal hinterland strip of the west coast (see Figure 1).

The area lies between 29° 49′ and 29° 52′ S and between 17° 08′ and 17° 18′ E. The position of the project site is shown by the orange area on Figure 1.

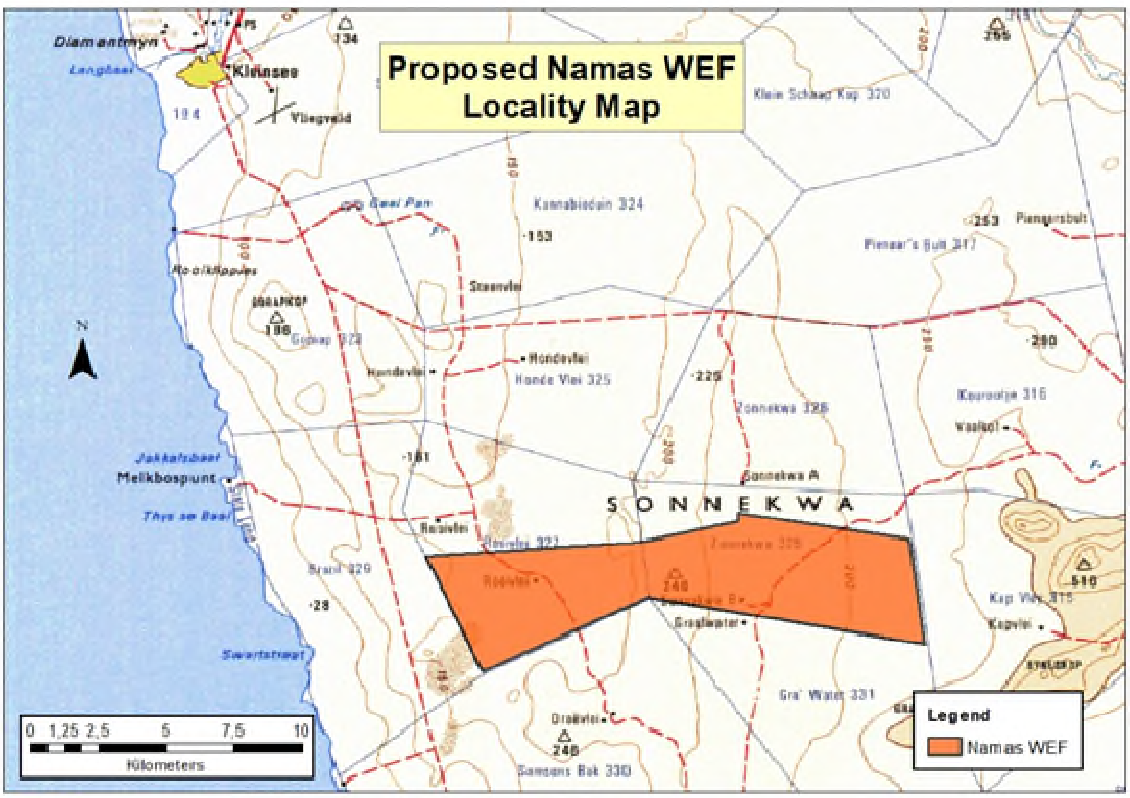

Figure 1 Namas Wind Farm project site Locality map

3.2 Terrain

The area (including the project site) consists of slightly undulating topography, with slopes of less than 5% over most of the area, and with an altitude above sea level of between 120 and 246 m.

The current land use of the project site is extensive grazing (specifically by sheep) and the site is dominated by natural vegetation. The site also includes a significant proportion of sand dunes.

3.3 Climate

The climate of the area has a mostly all year rainfall distribution, but the annual average is very low, at around 75 mm per year, although this might be slightly higher in the higher parts of the landscape (Koch *et al.*, 1987).

Temperatures will be warm to very hot in summer, but cool to cold in winter, with almost no occurrence of frost.

3.4 Parent Material

The area is underlain by Quaternary sediments, mostly sandy (Geological Survey, 1984).

4. METHODOLOGY (Land Type Survey)

Existing information was obtained from the map sheet 2916 Springbok (Schloms & Ellis, 1987) from the national Land Type Survey, published at a 1:250 000 scale. A ***land type*** is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

The project site under investigation is covered by three land types, as shown on the map in the Appendix, namely:

- **Ah38** (High base status, red and yellow soils)
- **Ai13** (High base status, yellow soils)
- **Hb80** (Grey sands and other soils)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur.

The site was not visited during the course of this study, and so the detailed soil composition of the specific land types within the project site has not been ground-truthed. However, this is not seen as a limiting factor for the intent of this study, due to the prevailing shallow soils and steep terrain which is restrictive in terms of agricultural activities. It can also be noted that the conclusions from other studies within the surrounding areas of the project site and in this area of the Northern Cape as a whole are in line with the findings of this report.

5. SOILS

A summary of the dominant soil characteristics of each land type is given in Table 1 below (the colours correspond to those used in the map in the Appendix A).

Column 6 shows the distribution of agricultural potential per soil class within each land type (see Section 5), with the dominant class shown in **bold**. These figures will always add up to 100%, so that the relative proportions of each potential class within every land type can be determined and easily compared with other land types.

5.1 Erodibility

The soils present in most of the project site are not considered susceptible to erosion by water. However, if the vegetation cover is disturbed (for example by overgrazing or construction activities) and considering the sandy nature of the topsoils, as well as the dry climate, there is a significant possibility of removal of some or all of the topsoil by wind action.

This can be mitigated by ensuring that the minimum area is disturbed, and that rehabilitation of surface vegetation is carried out as soon as possible.

Table 1 Land types present within the Namas Wind Farm project site (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Soil Potential* (%)
Ah38	Hutton & Clovelly 31/41 Vilafontes 11/31	400-1200 >1200	67% 20%	Red and yellow brown, sandy, structureless soils, sometimes calcareous Grey-brown, sandy, structureless soils	High: 0.0 **Mod:100.0** Low: 0.0
Ai13	Clovelly 31/34/41/44 Pinedene 31/34	600-1200 400-800	63% 13%	Yellow brown, sandy, structureless soils, sometimes calcareous Yellow brown, sandy, structureless soils, on gleyed clay	High: 0.0 **Mod: 92.7** Low: 7.3
Hb80	Fernwood 20/21 Pinedene/Kroonstad	>1200 400-800	36% 24%	Grey-brown, sandy, structureless soils Yellow brown and grey, sandy, structureless soils, on gleyed clay	High: 0.0 **Mod: 76.0** Low: 24.0

*__Note__ – this describes the **soil characteristics only**, and does not take into account any other limiting factors, such as climate.

6. AGRICULTURAL POTENTIAL

As can be seen from the information contained in Table 1, there are no high potential soils present within the project site and the soils are of moderate potential at best, due mainly to the sandy texture which will lead to rapid water infiltration and the soils drying out.

In addition, the low rainfall in the area (Section 3.3) means that there is little potential for rain-fed arable agriculture in the area in any case. Arable production would therefore be possible only by irrigation, and no indications of any irrigated areas, within and surrounding the project site, can be identified through Google Earth.

In general, the soils that do occur within the project site are suited for extensive grazing at best and furthermore the grazing capacity of the area is very low, at around 26-40 ha/large stock unit (ARC-ISCW, 2004).

6.1 Recommendations

The prevailing potential of the soils for rain-fed cultivation throughout most of the area, as well as the use of irrigation activities for cultivation, is low. Considering the land types and soils located within the project site and the current land-use activities, it is recommended that no further detailed soil investigation is required for the Namas Wind Farm.

7. IMPACTS

Two impacts have been identified to be associated with the development of the Namas Wind Farm from a soils perspective; these impacts include:

***Impact 1* (Table 2)**: In most environmental investigations, the major impact on the natural resources of the site would be the loss of potential agricultural land due to the construction of the turbines and associated infrastructure. However, in this instance, this impact would be of extremely limited significance and would be local in extent, if at all.

***Impact 2* (Table 3)**: In this area, the sandy soils, coupled with the dry climate, means that a possible impact would be the increased risk of wind erosion of the topsoil when vegetation cover is removed or disturbed. This would be especially relevant for the construction of access roads, turbines and other associated infrastructure.

The significance of the impacts can be summarized as follows:

Table 2 Loss of agricultural land

Nature: Loss of potentially productive agricultural land *(both construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance (E+D+M)x P	**Low (27)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: The main mitigation measures would be: • To avoid any cultivated land (if present) • To minimize the footprint of construction as much as possible.		
Cumulative impacts: likely to be low, as all soil-related aspects will be confined to the site, and the prevailing agricultural potential in the area is low.		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation during and after the life of the project.		

Table 3: Soil erosion

Nature: Increased soil erosion hazard by wind *(construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Medium (3)	Low (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance (E+D+M) x P	**High (64)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Very possible	No
Can impacts be mitigated?	Yes	Yes
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-		

vegetated as soon as possible. • Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure).
Cumulative impacts: likely to be high, as wind erosion can carry soil particles for a considerable distance, depending on wind strength and direction, as well as soil texture.
Residual Risks: if mitigation is not carried out, long-term wind erosion, with results such as loss of valuable topsoil, may occur.

The main impact would be for the excavation for the wind turbines and connecting infrastructure (roads, buildings, cables etc).

7.1 Cumulative Impacts

The likelihood of cumulative impacts for wind erosion is large, if not mitigated. This is because other wind farm developments are proposed close to the Namas Wind Farm project site; this is summarised in Table 4 below. **Figure 2** illustrates the other wind farms planned within the surrounding area of the Namas Wind Farm project site.

As identified above, the most significant cumulative impact from a soils perspective will be the effects of wind erosion. Within the surrounding areas of the project site only three other facilities are proposed. These facilities are located to the north, south, east and west of the project site. When considering the impact of wind erosion solely within the Namas Wind Farm project site (as per Table 3 above) the impact is identified as having a medium extent with a permanent duration without the implementation of appropriate mitigation measures. With the implementation of the appropriate mitigation measures at the Namas Wind Farm project site, the impact will have a low extent with a short-term duration.

When considering the other wind farm developments within the surrounding area, it is assumed that the impact of erosion and appropriate mitigation measures at a site-specific level for each of the facilities have been considered and the mitigation measures recommended are sufficient for the management and mitigation of erosion. Therefore, considering that the impact of erosion at each facility will be low in extent, subject to the implementation of the recommended mitigation measures, and managed for each facility separately, the cumulative impact for erosion is considered to be low. Under these circumstances, the loss associated with erosion is therefore considered to be acceptable loss, without detrimental consequences.

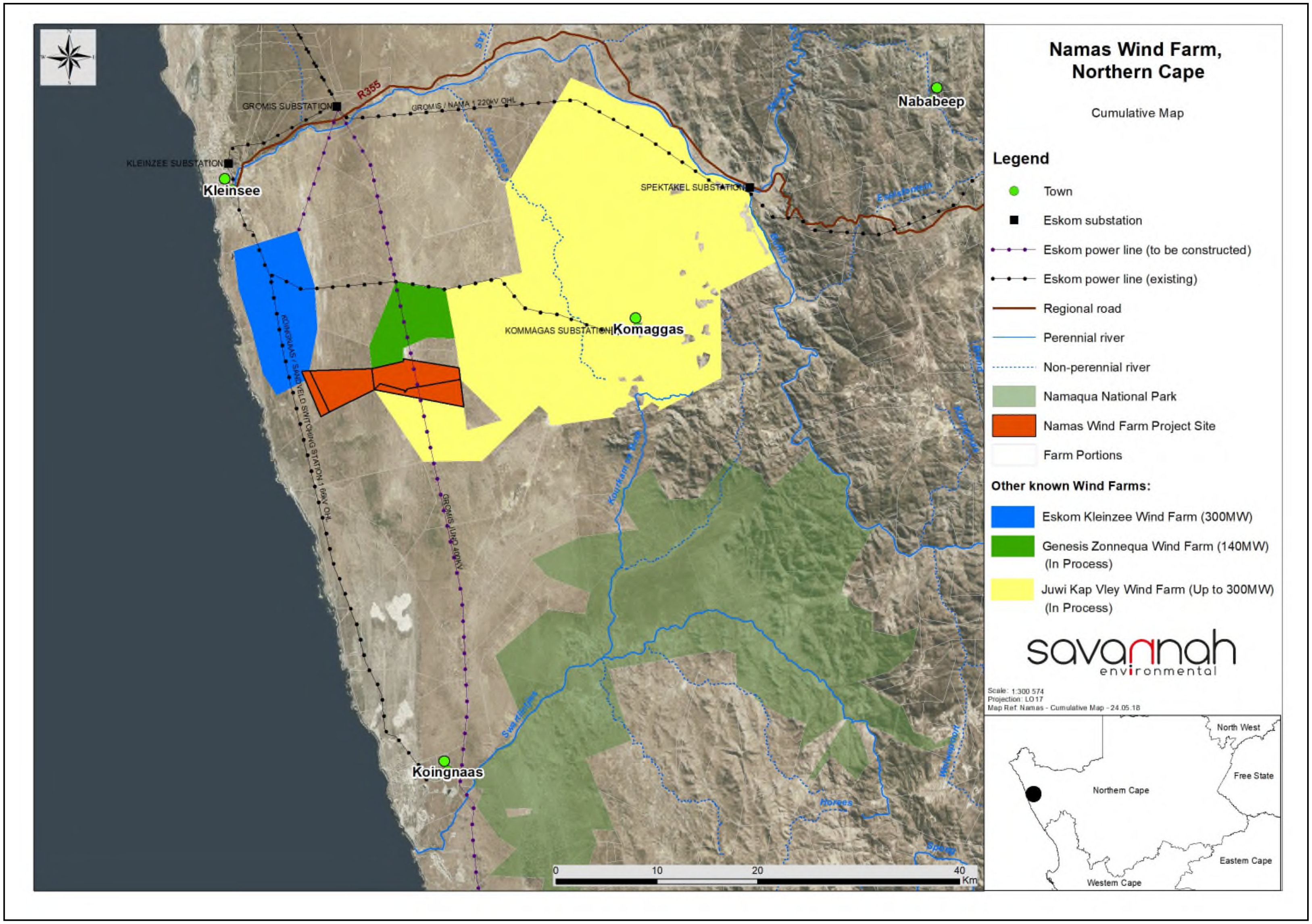

Figure 2: Namas Wind Farm Cumulative Map

Here, the Namas study area is shown in red, with other proposed developments on all four sides. The Eskom Kleinsee project has received authorisation, while the other applications are in process. However, if there is large scale development of wind energy facilities in the area, any failure to prevent wind erosion of topsoil on one project could lead to that material being deposited on any or all neighbouring properties.

The cumulative impacts are summarized in Table 4 below.

Table 4 Cumulative Impact

<table>
<tr><td colspan="3">Nature: Cumulative impact of the Proposed Development in terms of wind erosion</td></tr>
<tr><td></td><td>Overall impact of the proposed project considered in isolation[1]</td><td>Cumulative impact of the project and other projects in the area[2]</td></tr>
<tr><td>Extent</td><td>Low (1)</td><td>Low (2)</td></tr>
<tr><td>Duration</td><td>Short-term (2)</td><td>Short-term (2)</td></tr>
<tr><td>Magnitude</td><td>Minor (2)</td><td>Minor (2)</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>Improbable (2)</td></tr>
<tr><td>Significance (E+D+M)x P</td><td>Low (10)</td><td>Low (12)</td></tr>
<tr><td>Status (positive/negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>High</td><td>High</td></tr>
<tr><td>Loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="3">Confidence in findings:
High.</td></tr>
<tr><td colspan="3">Mitigation: The main mitigation measures would be:
• To minimise the footprint of construction as much as possible.
• Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-vegetated as soon as possible.
• Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure).
• Ensure that equal responsibility and co-operation is accepted if more than one facility will be using the same access road, or if the possibility exists of sediment transfer (by wind or water) from one site to another</td></tr>
<tr><td colspan="3">Residual Risks:
Significant risk of accelerated soil erosion by wind if mitigation measures of each facility are not applied correctly.</td></tr>
</table>

[1] It is assumed that the appropriate mitigation measures have been implemented.

[2] It is assumed that the appropriate mitigation measures have been implemented.

8 CONCLUSION AND RECOMMENDATIONS

The main recommendation is that care should be taken within all aspects of the construction phase to ensure that erosion is managed and mitigated appropriately. The project site is a dry area, with fragile vegetation and sandy topsoils and will be susceptible to uncontrolled topsoil removal by wind. The long-term effects of ignoring this aspect could be severe, both for the project and for the surrounding environment.

8.1 Measures for inclusion in the draft Environmental Management Programme

OBJECTIVE: Conservation, as far as possible, of the existing soil resource, both on site and in adjoining areas.

Project component/s	Construction of all infrastructure where topsoil will be disturbed
Potential Impact	Loss of topsoil leading to wind erosion
Activity/risk source	Construction activities
Mitigation: Target/Objective	To retain all topsoil with a stable soil surface

Mitigation: Action/control	Responsibility	Timeframe
• Storage of all topsoil that is disturbed (maximum height 2 m; maximum length of time before re-use 18 months)	Construction Engineer	Construction
• Immediate replacement of topsoil after the undertaking of construction activities within an area	Construction Engineer	Construction
• Soil conservation measures must be put in place to ensure soil stabilisation	Construction Engineer	Post-Construction

Performance Indicator	No indications of visible topsoil loss
Monitoring	Visual inspection every 6 months (minimum) of all areas where disturbance has taken place (for the duration of the project) If soil loss is suspected, acceleration of soil conservation and rehabilitation measures must be implemented (as specified above)

Considering the findings of the report and the current soils environment within which the Namas Wind Farm is proposed, it is the opinion of the specialist that the proposed activities should be authorised, subject to the implementation of the recommended mitigation measures. The activities proposed are considered to be acceptable from a soils perspectives considering the characteristics and potential of the soils present within the project site.

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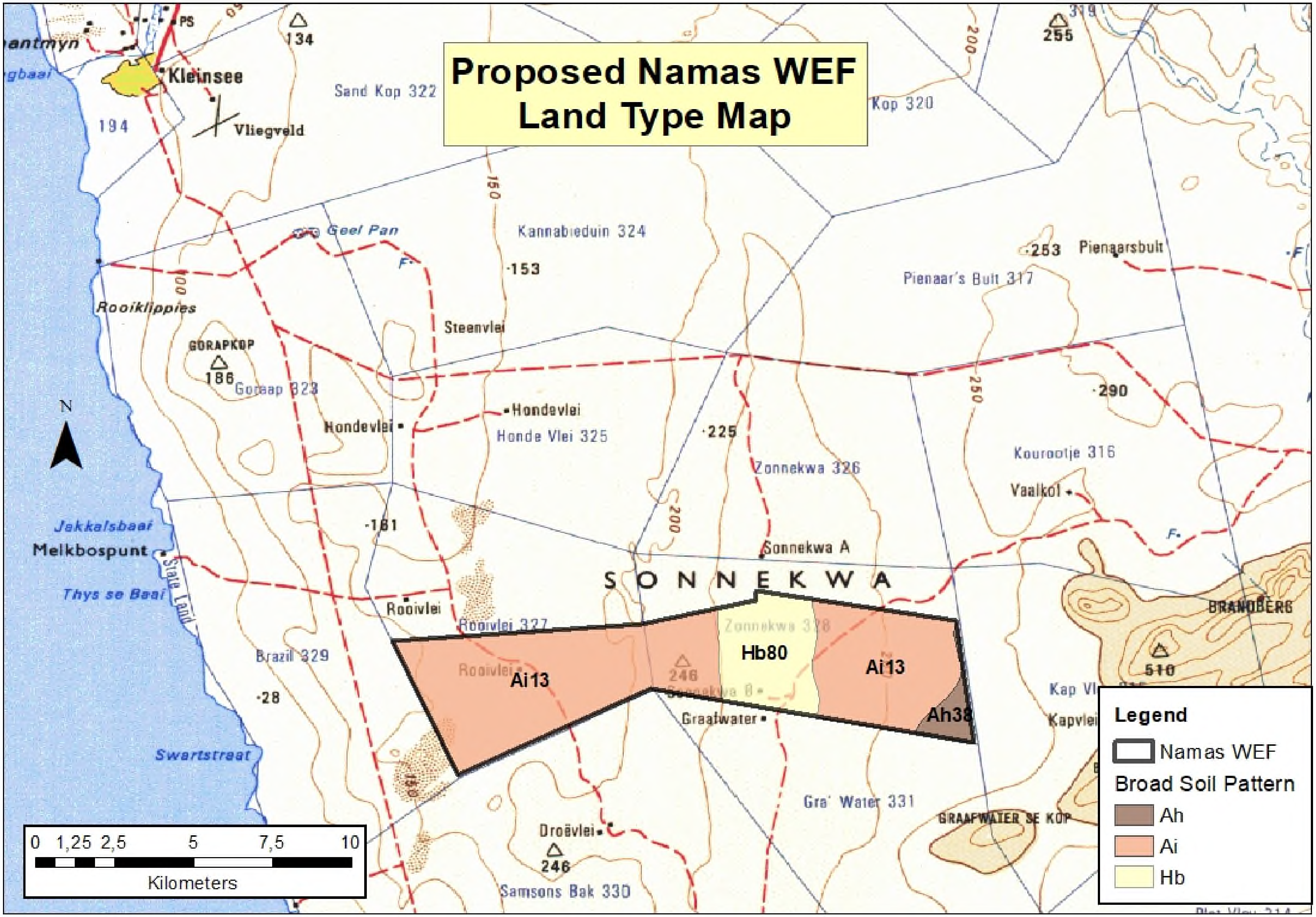
APPENDIX

MAP OF LAND TYPES


Proposed Namas WEF
Land Type Map
Legend
Namas WEF
Broad Soil Pattern
Ah
Ai
Hb
Ai13
Hb80
Ai13
Ah38
0 1,25 2,5 5 7,5 10
Kilometers
N
S O N N E K W A
Kleinsee
Vliegveld
Sand Kop 322
Kop 320
Kannabieduin 324
Geel Pan
Pienaarsbult
Pienaar's Bult 317
Rooiklippies
GORAPKOP
Goraap 323
Steenvlei
Hondevlei
Honde Vlei 325
Zonnekwa 326
Kourootjie 316
Vaalkol
Sonnekwa A
Jakkalsbaai
Melkbospunt
Thys se Baai
State Land
Rooivlei
Rooivlei 327
Zonnekwa 328
BRANDBERG
Brazil 329
Graafwater
Gra' Water 331
GRAAFWATER SE KOP
Swartstraat
Droëvlei
Samsons Bak 330