REPORT

On contract research for

ARCUS CONSULTING

SOIL INFORMATION FOR PROPOSED SAN KRAAL WIND ENERGY FACILITY, NEAR NOUPOORT, NORTHERN CAPE

By

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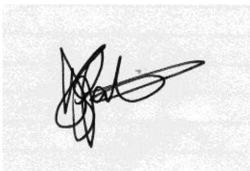
DECLARATION

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.



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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Arcus Consulting to undertake a soil investigation near Noupoort, in the Northern Cape Province. The purpose of the investigation is to contribute to the Environmental Impact assessment (EIA) process for the proposed San Kraal Wind Energy Facility. The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area, as well as

- To assess broad agricultural potential.

1.1 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 ***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, minimized and remedied.

- The ***Conservation of Agriculture Resources Act*** (Act 43 of 1983) 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.

2. SITE CHARACTERISTICS

2.1 Location

An area was investigated lying to the south-west of the town of Noupoort on portions of the farms Farm No. 181 (RE 181), Tweefontein (1/11), Farm No. 13 (RE/13), Farm No. 182 (15/182), Farm No. 182 (3/182), Farm No. 14 (14), Farm No. 182 (46/182). The area lies on an undulating plateau landscape between the Renosterberg and Kikvorsberg mountain ranges (see Figure 1). The provincial border with the Eastern Cape Province cuts through the south of the study area.

The area lies between 31° 11′ and 31° 19′ S and between 24° 58′ and 25° 08′ E.

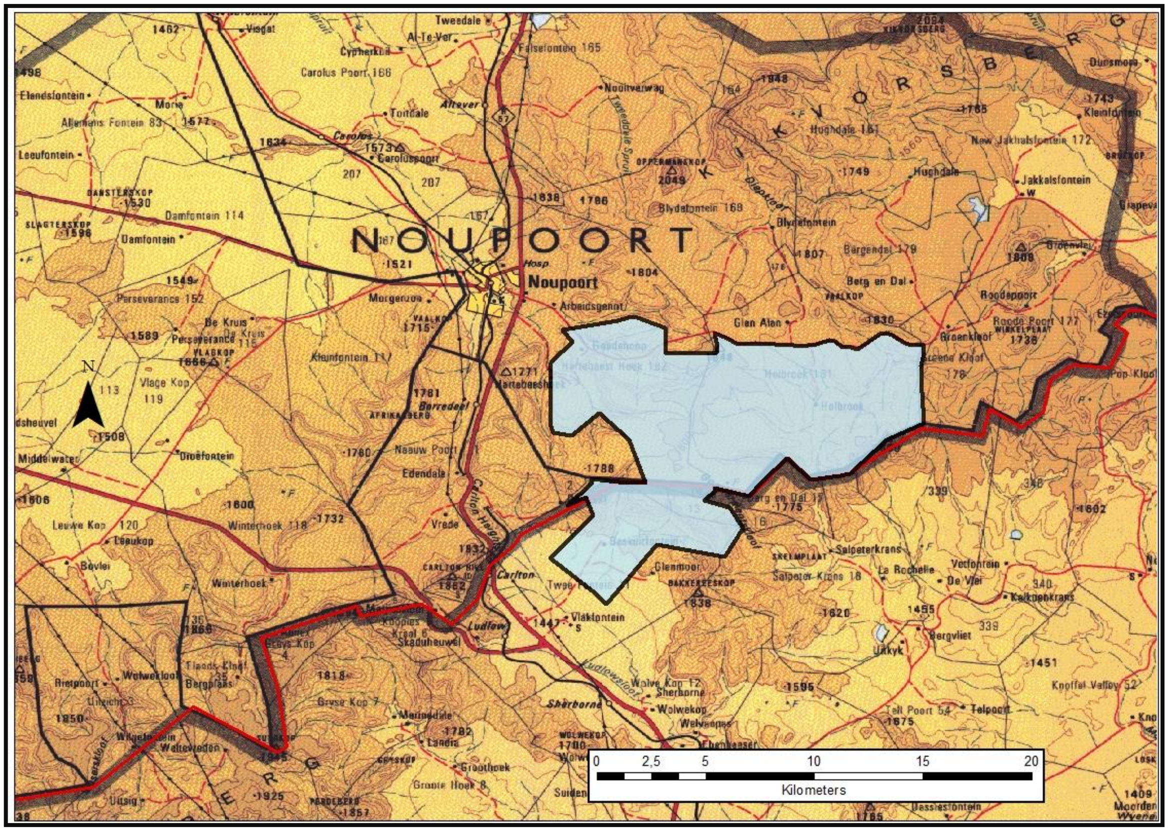

Figure 1 Locality map (with project site indicated in the blue polygon).

2.2 Terrain

The area consists of slightly undulating to steeply sloping topography, with slopes of less than 10% over much of the area, but becoming as steep as 80-100% on the escarpment zones of the upper mountain slopes. The altitude of the area is between 1 600 and 1 700 metres in most of the area, but the highest parts are at over 1 850 metres. Current land use is dominantly natural vegetation (presumably used for extensive grazing), with a significant proportion of exposed rock.

2.3 Climate

The climate of the area has a mostly summer rainfall distribution, but the annual average is low, at around 345 mm per year, although this might be slightly higher in the higher parts of the landscape (Koch, 2012).

Temperatures will be cool to cold in winter, with frequent frost, often heavy, between May and September.

2.4 Parent Material

The area is underlain by mudstone of the Beaufort and Tarkastad Groups, Karoo Sequence, along with small areas of dolerite intrusions (Geological Survey, 1983), as shown in Figure 2.

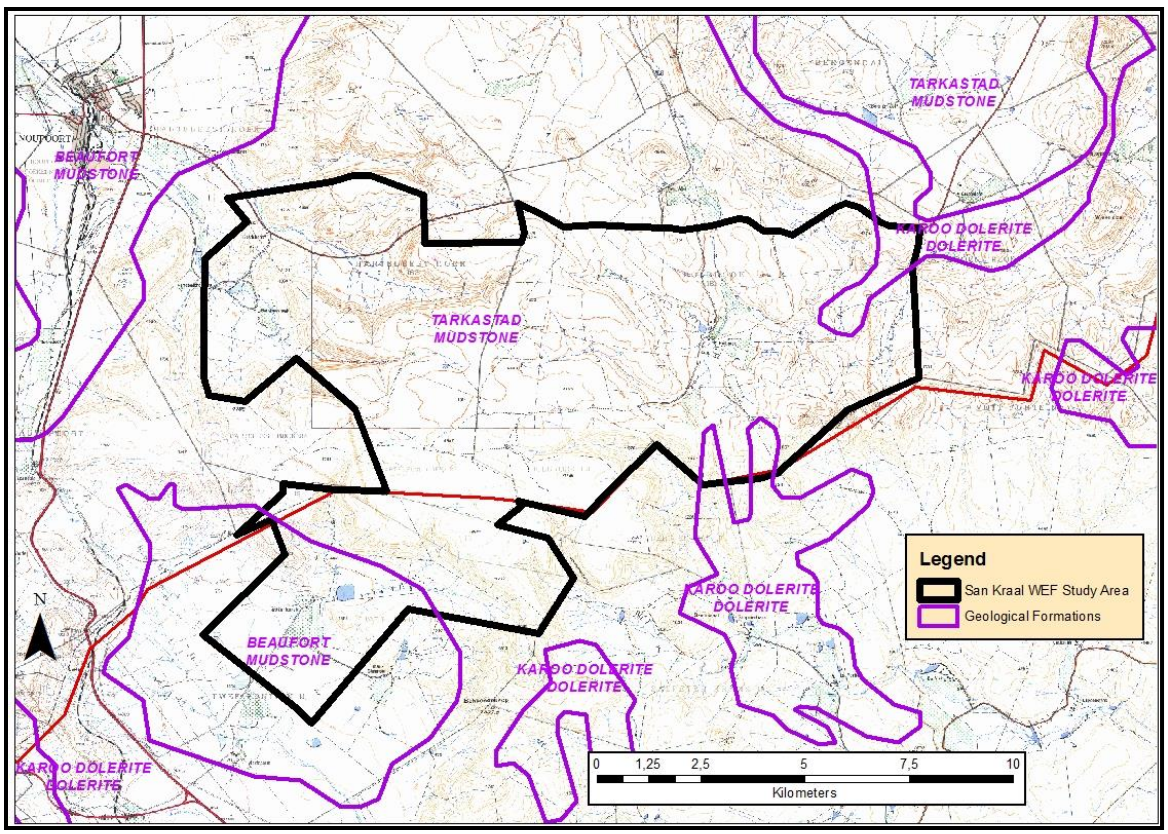

Figure 2 Geological formations, San Kraal WEF.

3. METHODOLOGY

Existing information was obtained from the map sheet 3124 Middelburg (Geers & Eloff, 1992) from the national Land Type Survey, published at 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 area under investigation is covered by six land types, as shown on the map in the Appendix, namely:

Da77 (Duplex soils*, mostly red)
Fb174, Fb259, Fb372, Fb373 (Shallow soils, occasionally calcareous)
Ib316 (Shallow soils with much rock)

**Soils with a relatively sandy topsoil horizon abruptly overlying a structured, clayey subsoil horizon*

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 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 restricting regarding agricultural activities.

4. 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).

Column 6 shows the distribution of ***<u>dryland</u>*** agricultural potential 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.

Table 1 Land types occurring (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Da77	Swartland 10/11 + Valsrivier 21/41 Lithosols + rock	200-800 50-150	30% 22%	Red-brown, sandy topsoils on structured, sandy clay loam to sandy clay subsoils on weathering rock Grey-brown, sandy/loamy topsoils on hard rock, with rock outcrops	High: 0.0 Mod: 12.2 **Low: 87.8**
Fb174	Mispah 10/20 Glenrosa 13/16	20-100 50-150	30% 23%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 12.3 **Low: 87.7**
Fb259	Mispah 10/22 Glenrosa 13/16	50-150 200-300	30% 20%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 12.0 **Low: 88.0**
Fb372	Mispah 10/20 Glenrosa 13/16	50-100 200-300	46% 18%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 13.1 **Low: 86.9**
Fb373	Mispah 10/22 Swartland 11/12 + Valsrivier 21/41	50-150 200-900	27% 16%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Red-brown, sandy topsoils on structured, sandy clay loam to sandy clay subsoils on weathering rock	High: 0.0 Mod: 7.1 **Low: 92.9**
Ib316	Rock Mispah 10	- 50-100	62% 18%	Surface rock outcrops Grey-brown, sandy/loamy topsoils on hard rock	High: 0.0 Mod: 3.4 **Low: 96.6**

5. AGRICULTURAL POTENTIAL

As can be seen from the information contained in Table 1, there are virtually no high potential soils in the study area and very few medium potential soils. Every land type is dominated by either (in the west) structured, clayey duplex soils (Swartland and Valsrivier forms) or rock and shallow lithosols (Mispah and Glenrosa soil forms), which have low to very low arable potential.

In addition, the low rainfall in the area (Section 2.3) means that there is little potential for rain-fed arable agriculture in the area. Arable production would therefore be very problematic without irrigation. Currently, only a few small cultivated lands can be identified through Google Earth, and these occur in the west of the area on the farms Hartebeeshoek and Beskuitfontein (land type **Da77**).

In general, the soils are suited for extensive grazing at best and the grazing capacity of the area is relatively low, at around 18-25 ha/large stock unit (ARC-ISCW, 2004).

5.1 Recommendations

The prevailing potential of the soils for rain-fed cultivation throughout most of the area is low to very low. It is thus very unlikely that any further, more detailed investigation will be required.

6. IMPACTS

Impact 1: In most environmental investigations, the major impact on the natural resources of the study area would be the loss of potentially agricultural land due to the construction of the turbines and associated infrastructure. However, this impact would be of extremely limited significance and would be local in extent.

Impact 2: In this area, the steep topography in many parts, coupled with the shallow soils, relatively sandy topsoil and dry climate, means that a possible impact would be the increased danger of erosion of the topsoil when vegetation cover is removed. This would be especially relevant for the construction of access roads, turbine sites and other associated infrastructure.

The impacts can be summarized as follows:

Table 1 Impact significance

Impact Phase (Construction and Operation)							
<u>Possible</u> Impact or Risk: **Impact 1. Loss of agricultural land**							
ANTICIPATED SCOPING IMPACTS TO BE SCOPED OUT OR INVESTIGATED FURTHER							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**L**	**L**	**L-**	**negative**	**M**	**High**	**High**
With Mitigation	**L**	**L**	**L-**	**neutral**	**M**	**High**	**High**
Can the impact be reversed?	**YES** – very little land will be affected and soil can be replaced						
Will impact cause irreplaceable loss or resources?			**NO** – soil potential in vicinity is low, so no agricultural soils will be affected				
Can impact be avoided, managed or mitigated?	**YES**						
Mitigation measures to reduce residual risk or enhance opportunities: 1) Avoid any areas under cultivation (if any)							
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	**NO** – considered to be insignificant due to very restricted occurrence of agricultural soils						

Table 2 Impact significance

Impact Phase (Construction and Operation)							
Possible Impact or Risk: **Impact 2. Increased soil erosion hazard**							
ANTICIPATED SCOPING IMPACTS TO BE SCOPED OUT OR INVESTIGATED FURTHER							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	**L**	**M**	**M-**	**negative**	**M**	**High**	**High**
With Mitigation	**L**	**L**	**L-**	**neutral**	**M**	**High**	**High**
Can the impact be reversed?	**YES** – topsoil coverage can be replaced and affected sites re-vegetated and stabilized						
Will impact cause irreplaceable loss or resources?		**NO** – soil potential in vicinity is low, so no agricultural soils will be affected					
Can impact be avoided, managed or mitigated?	**YES** – soil conservation measures should be implemented						
Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimize vegetation removal to smallest possible footprint 2) Control possible runoff by using soil conservation and soil retention measures, especially on steep slopes 3) Store any removed topsoil for later use (contains indigenous seeds etc) and re-vegetate as soon as possible 4) Once specific infrastructure sites are known, site-specific measures can be devised for implementation and any potentially high risk sites can be identified.							
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	**NO**						

1.2 Cumulative Impacts

The likelihood of cumulative impacts is small. Only if other developments (whether wind farms or not) were to occur, using the same access roads and thereby increasing potential soil erosion aspects, would cumulative impacts need to be considered.

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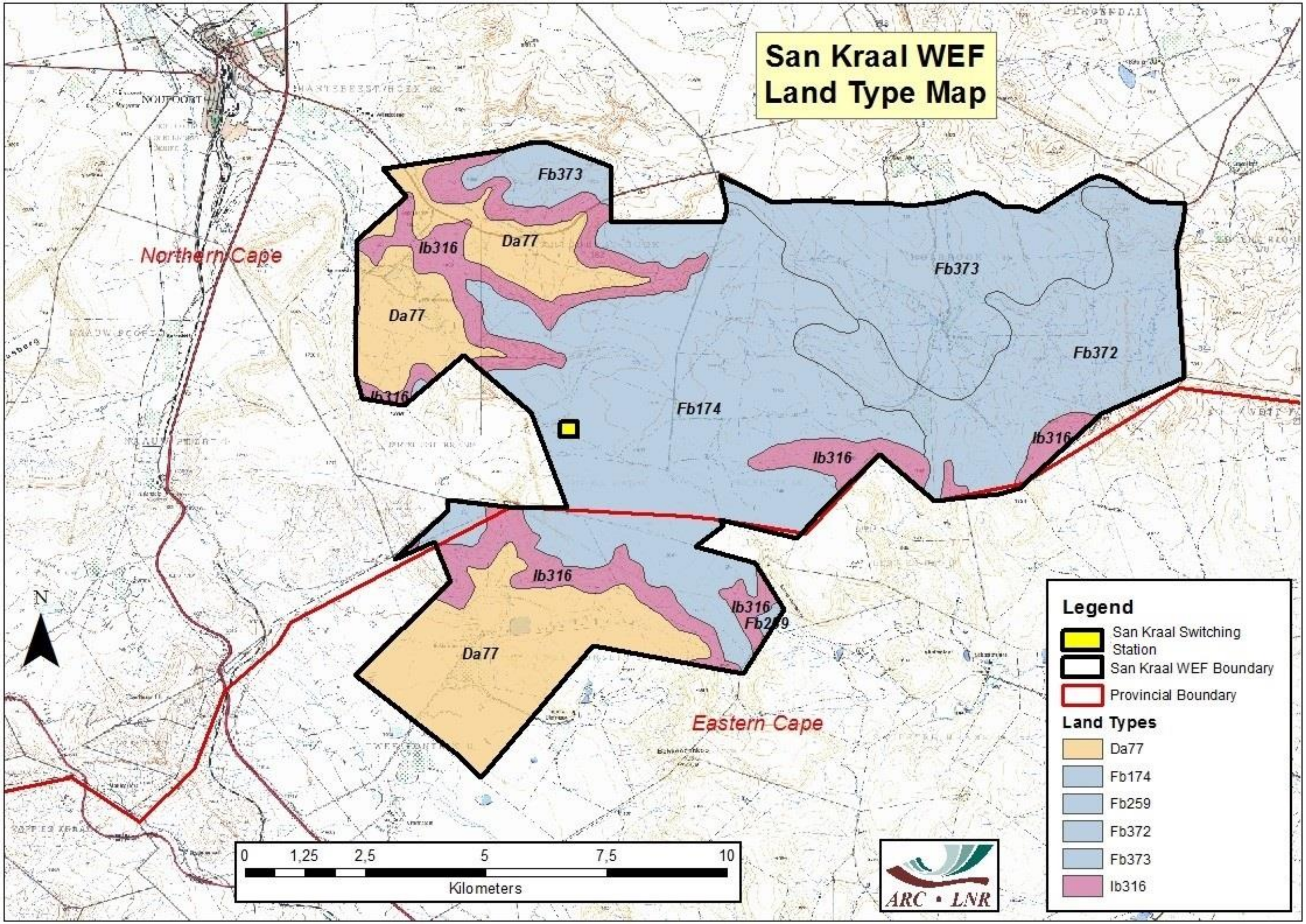
APPENDIX

MAP OF LAND TYPES


San Kraal WEF
Land Type Map
Northern Cape
Eastern Cape
Fb373
Da77
Ib316
Fb174
Fb372
Fb259
N
0
1,25
2,5
5
7,5
10
Kilometers
ARC • LNR
Legend
San Kraal Switching Station
San Kraal WEF Boundary
Provincial Boundary
Land Types
Da77
Fb174
Fb259
Fb372
Fb373
Ib316