REPORT

On contract research for

MOKGOPE CONSULTING

SOIL INFORMATION FOR PROPOSED AGGENEIS-PAULPUTS 400 kV TRANSMISSION LINE, NORTHERN CAPE

(DEA REF: 14/12/16/3/3/2/1012)

By

D.G. Paterson (Pr. Sci. Nat. 400463/04)

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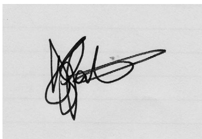
ARC-Institute for Soil, Climate and Water,
Private Bag X79,
Pretoria 0001, South Africa

Tel: (012) 310 2500 Fax: (012) 323 1157

DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist 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 Mokgope Consulting to undertake a soil investigation in the Northern Cape Province. The purpose of the investigation is to contribute to the Environmental Impact Assessment (EIA) process for a proposed 400 kV transmission line from Paulputs substation passing Pofadder to Aggeneis substation, in the Namaqualand area of the Northern Cape. 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.

2. SITE CHARACTERISTICS

2.1 Location

The study area lies in the extreme north-western corner of the Northern Cape Province, as shown in Figure 1. Three alternatives are proposed, namely **Route 1** (parallel to the existing 220 kV line), **Route 2** (which follows the N14 road before linking up with Alternative 1) and **Route 3** (running to the south of Alternatives 1 and 2). A shorter deviation from Route 3, named Deviation 3A, is also included.

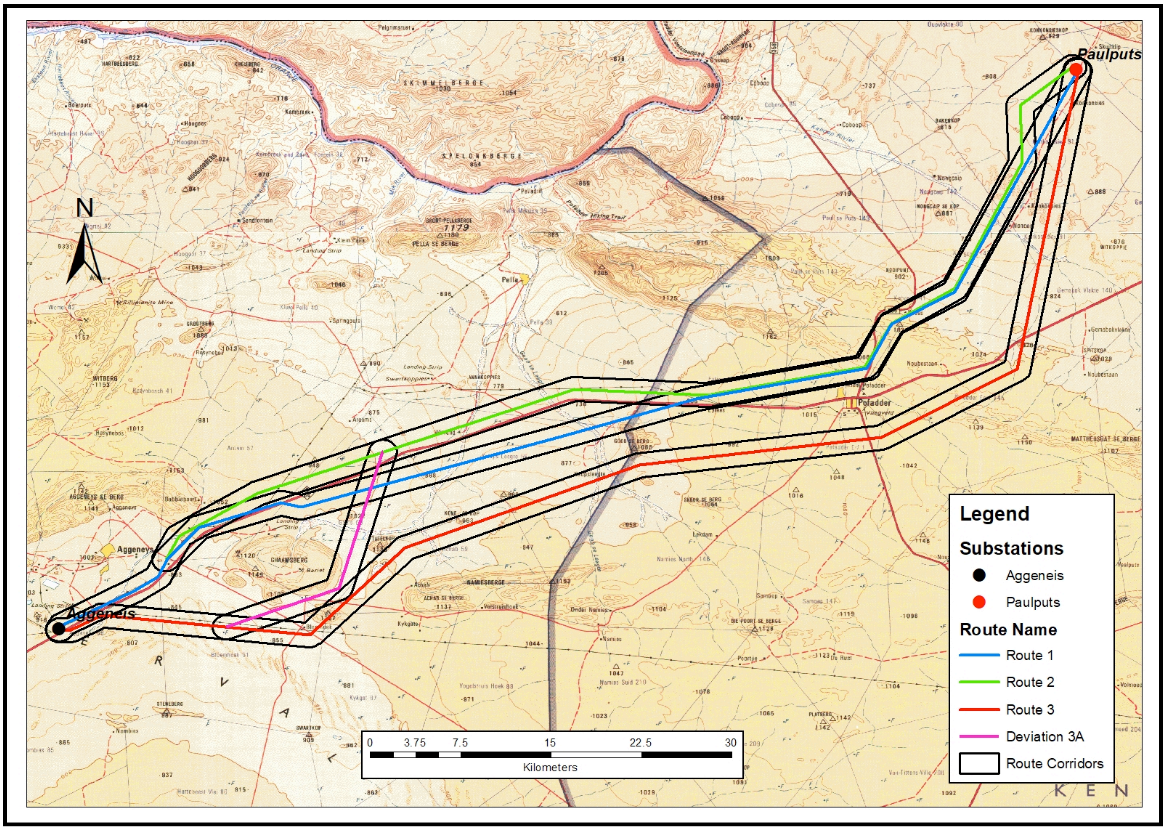

Figure 1 Locality map

2.2 Terrain

The route is generally gently undulating and lies at a height of approximately 800-1 000 metres above sea level for most part, although there is an area of more steeply undulating topography (up to 1 100 m in places), just to the north of Pofadder.

2.3 Climate

The climate of the area (ARC-ISCW, 2008) was derived from the closest station, namely Pofadder. The climate can be regarded as typical of the Karoo interior, with a low, generally all-year round rainfall distribution (although the rainfall closer to the coast is likely to be even lower than the figure given for Pofadder), warm summers and cold to very cold winters. The main climatic indicators (monthly averages) are given in Table 1 below.

Table 1 Climate Data

Month	Rainfall (mm)	Min. Temp (°C)	Max. Temp (°C)
Jan	8.2	16.6	33.0
Feb	19.1	16.7	31.3
Mar	22.8	15.5	29.9
Apr	19.1	12.1	24.6
May	5.9	8.2	20.6
Jun	6.9	5.4	17.3
Jul	5.5	5.2	18.0
Aug	2.6	6.1	19.7
Sep	4.5	8.7	23.7
Oct	4.6	11.1	26.6
Nov	4.1	14.1	30.1
Dec	9.2	15.6	32.0
Year	**112.6 mm**	**18.4°C (Average)**	

Very warm temperatures (>40°C) may be experienced in summer, while frost in winter is not common, but may occur occasionally.

2.4 Parent Material

The geology of the area (Figure 2) comprises mainly recent alluvial and aeolian deposits, with the hill areas comprising igneous and metamorphic rocks such as gneiss and schist of the Namaqualand Sequence (Geological Survey, 1984).

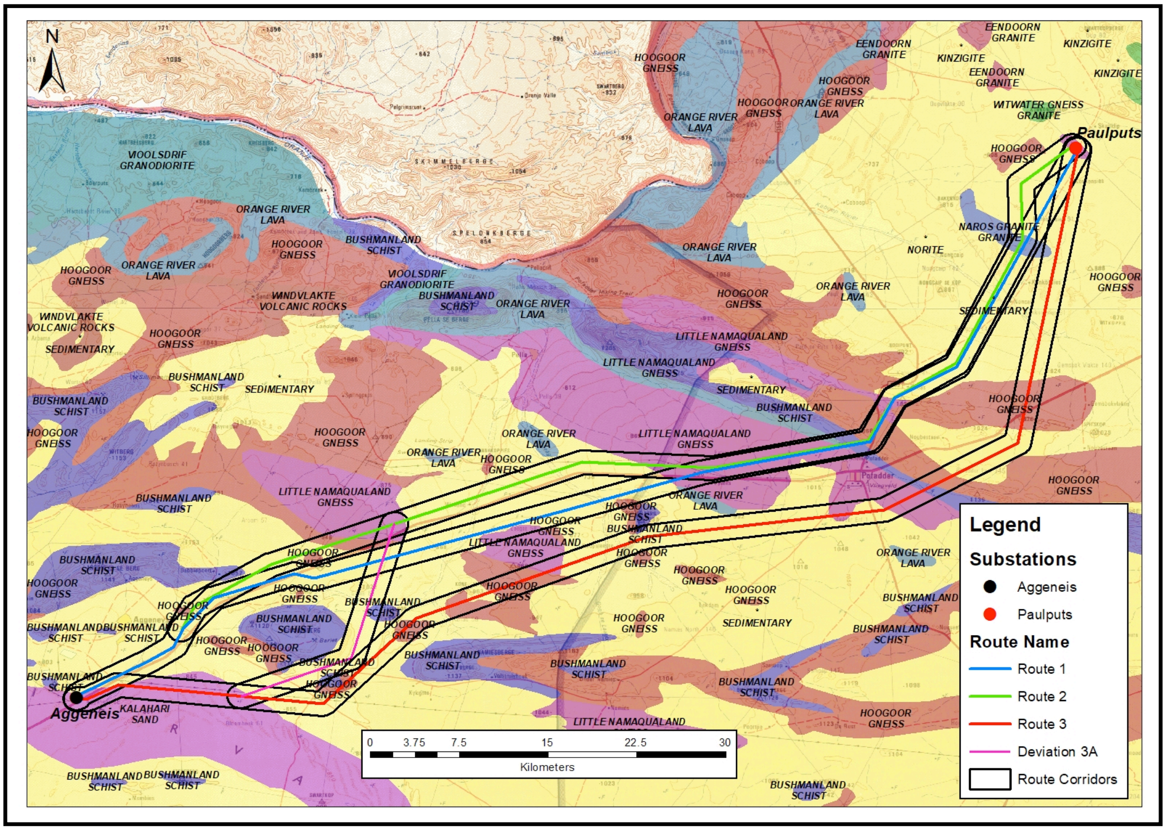

Figure 2 Geological map

3. METHODOLOGY

For the purposes of this investigation, ArcGIS shape files of the proposed alternatives were obtained and a buffer area of approximately 2 km around each of the routes was created. This was taken to be the study area.

Existing information was obtained from the map sheets 2818 Warmbad and 2918 Pofadder 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 a total of 13 land types, namely:

- **Ae67, Ae94** *(high base status, red, structureless soils, often deep)*
- **Af14, Af21, Af26** *(high base status, red, structureless sandy soils, deep **with dunes**)*
- **Ag25, Ag36, Ag37, Ag43, Ag63** *(high base status, red, structureless soils, shallow)*
- **Ic136, Ic137, Ic151** *(mostly rock, little soil)*

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 composition of the specific land types has not been ground-truthed.**

4. SOILS

A summary of the dominant soil characteristics is given in **Table 2** below (the colours correspond to those used in the map in the Appendix). The dominant class of agricultural potential within each specific land type is shown in **bold font**.

Note: the agricultural potential in the right-hand column refers to **soil potential only**, and does not take any climatic or other factors into account.

Table 2 Broad soil patterns occurring (with general soil characteristics)

Land Type	Dominant and sub-dominant soil forms	Agric. Potential
Ae67	Hu32/35/42/45 – Moderately deep (500-1000 mm), red, freely-drained sandy soils on calcrete (49%) Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on calcrete (30%)	High – 6.0% **Mod – 49.0%** Low – 45.0%
Ae94	Hu32/35 – Moderately deep to deep (400-800 mm), red sandy soils on dorbank (68%) Hu31 – Deep (>1200 mm), red, freely-drained sandy soils (16%)	High – 26.7% **Mod – 68.1%** Low – 5.2%
Af14	Hu30/31/32 – Deep (>1200 mm), red, freely-drained sandy dune soils (70%) Hu30/32 – Moderately deep (600-1000 mm), red, freely-drained sandy soils on calcrete (12%)	High – 4.0% Mod – 12.5% **Low – 83.5%**
Af21	Hu31 – Deep (>1200 mm), red, freely-drained sandy dune soils (75%) Hu32 – Shallow to moderately deep (300-700 mm), red, freely-drained sandy soils on calcrete (11%)	High – 0.0% Mod – 14.0% **Low – 86.0%**
Ag25	Hu32/42 – Shallow (150-300 mm), red, freely-drained sandy soils on dorbank or calcrete (49%) Rock (16%)	High – 0.0% Mod – 1.6% **Low – 98.4%**
Ag26	Hu31/32 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank or calcrete (53%) Hu34/35 – Shallow (300-500 mm), red, freely-drained sandy soils on dorbank or calcrete (23%)	High – 9.6% Mod – 5.6% **Low – 84.6%**
Ag36	Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank, calcrete or rock (48%) Rock (32%)	High – 0.0% Mod – 3.0% **Low – 97.0%**
Ag37	Hu32/35/42/45 – Shallow (200-300 mm), red, freely-drained sandy soils on dorbank, calcrete or rock (48%) Rock (20%)	High – 0.0% Mod – 23.0% **Low – 67.0%**
Ag43	Hu32/35 – Shallow (200-350 mm), red, freely-drained sandy soils on dorbank or calcrete (47%) Hu32/35 – Shallow (400-600 mm), red, freely-drained sandy soils on dorbank or calcrete (35%)	High – 4.0% Mod – 10.5% **Low – 85.5%**
Ag63	Hu35 – Shallow (200-300 mm), red, freely-drained sandy/loamy soils on dorbank or calcrete (52%) Hu32/42 – Shallow (150-300 mm), red, freely-drained sandy soils on dorbank or calcrete (23%)	High – 4.0% Mod – 12.5% **Low – 83.5%**
Ic136	Rock (89%) Mispah 10/20 – Shallow (100 -300 mm), red and brown, freely-drained sandy soils on rock (7%)	High – 0.0% Mod – 3.5% **Low – 96.5%**
Ic137	Rock (82%) Mispah 10/20 – Shallow (50 -150 mm), red and brown, freely-drained sandy soils on rock (10%)	High – 0.0% Mod – 0.0%

		Low – 100%
Ic151	Rock (86%) Mispah 10 – Shallow (50 -100 mm), red and brown, freely-drained sandy soils on rock (7%)	High – 0.0% Mod – 0.0% **Low – 100%**

5. AGRICULTURAL POTENTIAL

In a dry, hot part of South Africa like this area of the Northern Cape, the limiting factor to agriculture is not soil, but climate. Unless there is a source of water for irrigation, it will not make a significant difference which soils are occurring within a specific area.

As can be seen from the information contained in Table 2, there is only one reasonably significant portion of moderately deep soils that are not dunes (Land Type **Ae67**, north-east of Pofadder).

The very low rainfall in the area (Table 1) means that the only means of cultivation would be by irrigation and the satellite image of the area (Figure 3) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

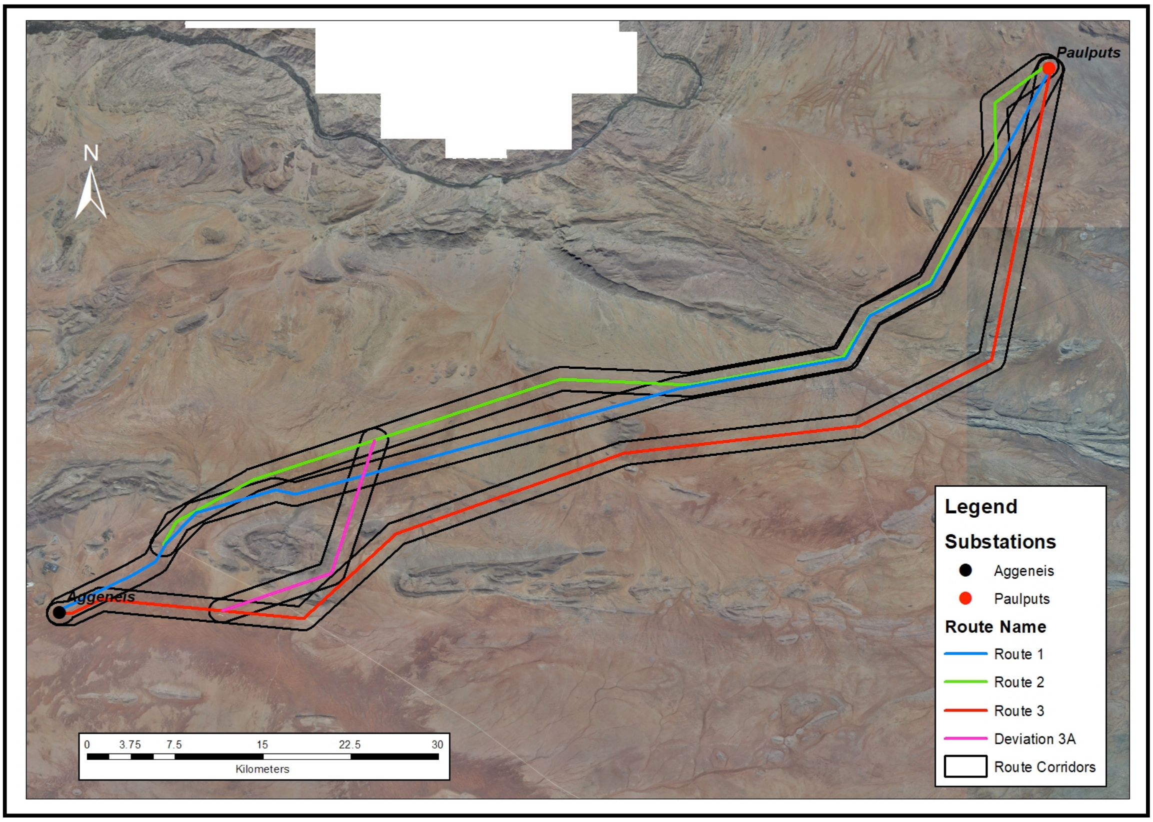

Figure 3 Remote sensing image of study area.

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is very low, around 40-50 ha/large stock unit (ARC-ISCW, 2004).

6. IMPACTS

For many developments, the major impact on the natural resources of the study area would be the loss of arable land due to the construction of infrastructure. However, for the project under consideration, this impact would in all probability be of limited significance and would be local in extent, due mainly to the limited footprint of the towers for the transmission line and the upgrade of the two substations. At the end of the project life, it is anticipated that removal of any structures would enable the land to be returned to more or less a natural state, with little impact, especially given the low prevailing agricultural potential.

However, with the prevailing climate (especially the low rainfall, Section 2.3), coupled with sandy topsoils (Table 2), there could potentially be an increased possibility of soil erosion due to wind action, especially where vegetation cover is disturbed, leading to the bare soil becoming exposed.

The impacts can be summarized as follows:

Table 3 Impact significance

Nature of impact	**Loss of agricultural land**	Land that is no longer able to be utilized due to construction of infrastructure
Extent	Site only	Confined to project areas only
Duration	Long term	Ceases after operational life of project
Probability	Unlikely	Little agricultural potential in vicinity
Reversibility	Reversible	Full rehabilitation will usually be possible
Magnitude	Low	Minor impact on the environment
Mitigation factors	The main mitigation aspects would be: • Minimize the footprint to ensure that as little physical disturbance as possible occurs during the construction phase; • To ensure that if disturbance (roads, pylons etc) takes place on steep slopes, appropriate soil conservation measures are put in place. • As little disturbance as possible (especially removal of vegetation) in areas of dunes, to minimize wind erosion.	

Nature of impact	**Increased wind erosion hazard**	Land that is no longer able to be utilized due to construction of infrastructure
Extent	Local	Wind action may transport loose soil for a considerable distance
Duration	Long term/ Permanent	If unmitigated, soil erosion can be very long-lasting
Probability	Can occur	Uncontrolled removal of vegetation will be problematic
Reversibility	Reversible with human intervention	Full rehabilitation will usually be possible only if immediately mitigated
Magnitude	Moderate	Soil processes could be significantly affected
Mitigation factors	The main mitigation aspects would be: • Minimize the footprint to ensure that as little physical disturbance as possible occurs during the construction phase; • To ensure that if disturbance (roads, pylons etc) takes place on steep slopes, appropriate soil conservation measures are put in place. • As little disturbance as possible (especially removal of vegetation) in areas of dunes, to minimize wind erosion. • Re-vegetation should take place immediately, along with appropriate soil conservation measures (geotextiles, contours, windbreaks etc), as needed • Regular monitoring of all mitigation measures (at least bi-annually for the first two years, annually thereafter)	

6.1 Alternatives

Based on the reconnaissance-level soil and climate information contained in this report, it is clear that the three routes traverse very similar soil units in the same or very similar proportion. There is thus no clear preference for any one of the three proposed alternatives and all are rated equally.

No fatal flaws are expected from a soils perspective.

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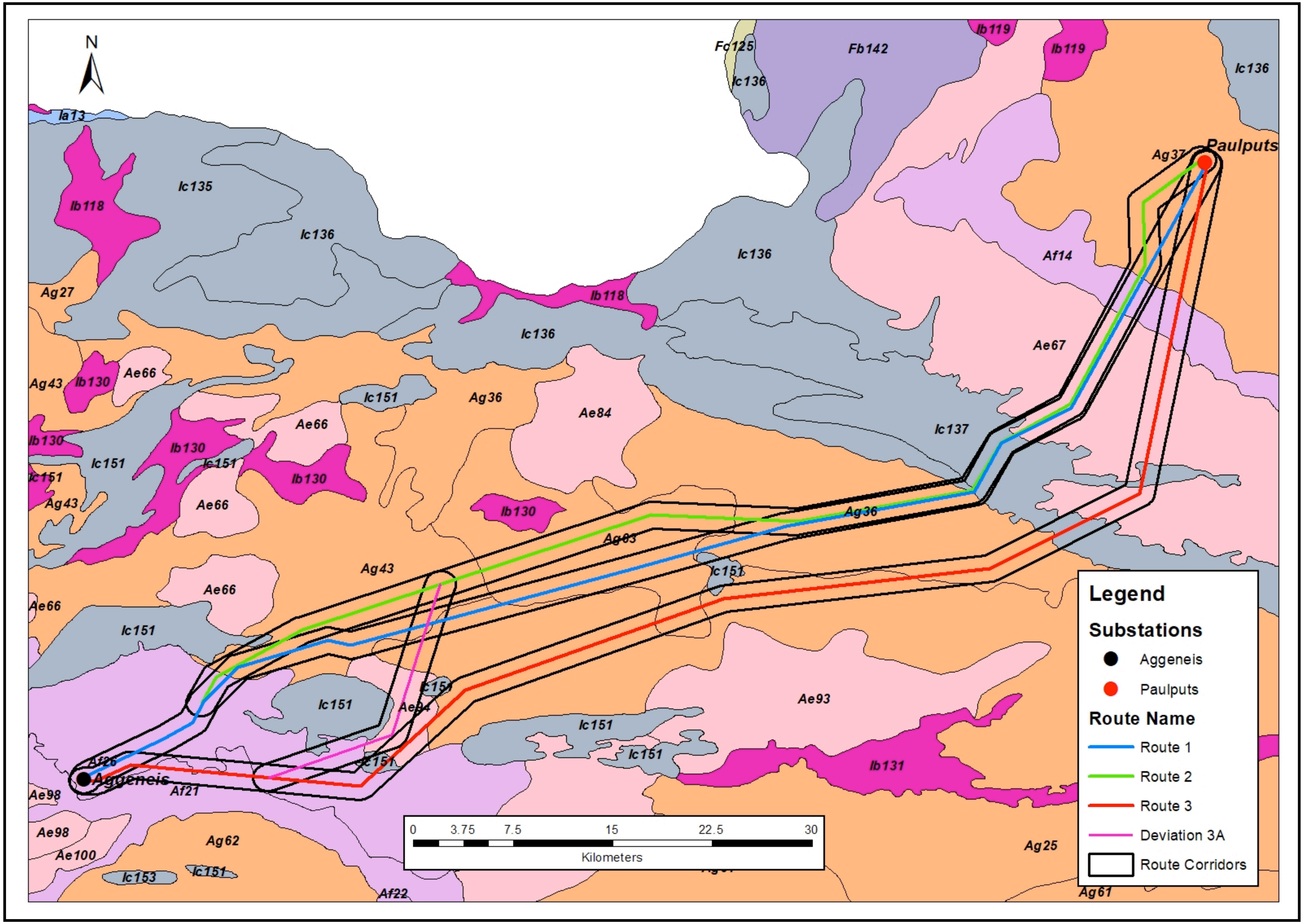
MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

APPENDIX

MAP OF LAND TYPES



N
Paulputs
Aggeneis
Legend
Substations
Aggeneis
Paulputs
Route Name
Route 1
Route 2
Route 3
Deviation 3A
Route Corridors
0
3.75
7.5
15
22.5
30
Kilometers
Fb142
Fc125
Ib119
Ic136
Ia13
Ic135
Ib118
Ag27
Ag43
Ib130
Ae66
Ic151
Ag36
Ae84
Ic137
Ae67
Af14
Ag37
Ag63
Ae93
Ib131
Ag25
Ag61
Ae98
Ae100
Ag62
Ic153
Af22
Af21
Af26
Ae94