INSTITUTE FOR SOIL CLIMATE AND WATER
Agricultural Research Council

REPORT

for Tswelopele Environmental

by

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SOILS AND AGRICULTURAL POTENTIALOF PROPOSED GARONA-ARIES TRANSMISSION LINE

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1. TERMS OF REFERENCE

The Institute for Soil, Climate and Water of the Agricultural Research Council (ARC-ISCW) was requested by Tswelopele Environmental to carry out a desk-top study concerning the soils and agricultural potential occurring along a proposed power line corridor in Northern Cape Province.

2. STUDY AREA

The study area concerns a corridor of approximately 130 kms, running from the Garona Sub-station, south-west of Kenhardt to the Aries Sub-station, north of Groblershoop, in Northern Cape Province. The proposed route within the study area is marked by the red line on the maps in the Appendix.

3. METHODOLOGY

The soil information for the study area was obtained from the national ***Land Type Survey***, which is an inventory of the soils, terrain and macroclimate of South Africa, at a scale of 1:250 000. It was decided to combine the various land types into their ***broad soil patterns***, and to provide a general description of the soils (Soil Classification Working Group, 1991) occurring within each broad soil pattern, as well as a summary of the limitations associated with each one.

The land type information has been digitized using ArcInfo software, and a clip was made of the relevant study area for incorporation as a layer into the existing GIS map. An algorithm has been developed to assess dominant dryland land capability per land type, and this was also incorporated as a separate layer.

It should be noted that, at the scale of the survey, within each broad soil pattern, there will be some variation in agricultural potential, due to variation in soil features, such as depth and texture.

4. SOILS

As can be seen on the broad soil pattern map (Appendix), the study area comprises a number of broad soil patterns. These various broad soil patterns are listed in Table 1 below, along with their chief limitations.

Note: it is important to bear in mind that, due to the scale of the land type survey, and the fact that the land types have been further combined, the broad soil pattern deals only with the ***dominant*** soil(s) occurring, and that significant areas of different soils can, and will occur within each land type and within each broad soil pattern zone.

Table 1. Broad soil patterns occurring in the Majuba-Umfolozi study area

Map Symbol	General dominant soil characteristics	Soil limitations
Ae	Red, freely-drained soils with high base status, occasionally calcareous. Dominant soils: *Hutton*	Restricted soil depth in places
Af	Red, freely-drained sandy soils with high base status, including dunes; occasionally calcareous. Dominant soils: *Hutton*	Restricted soil depth in places; Excessively freely-drained
Ag	Shallow, red soils with high base status, occasionally calcareous. Dominant soils: *Hutton, Mispah*	Shallow soils, often stony/rocky.
Ah	Red and yellow, freely-drained sandy soils with high base status, occasionally calcareous. Dominant soils: *Hutton, Clovelly*	Restricted soil depth in places; Excessively freely-drained
Ia	Alluvial soils close to Gariep River. Variable textures. Dominant soils: *Dundee, Oakleaf*	Occasional flooding
Ib	Dominantly rocky areas, often with steep slopes. Dominant soils: *Glenrosa, Mispah* Usually little soil is present	Little soil available
Ic	Dominantly very rocky areas, often with steep slopes. Dominant soils: *Glenrosa, Mispah* Usually very little soil is present	Very little soil available

In general, most of the area has red, shallow to very shallow, often calcareous soils on rock. There are small areas of deeper red and yellow soils in the south-west as well as a larger area of deeper red soils (some with dunes) in the north-east.

The various broad soil patterns will have different **dominant** potential as far as farming systems and types of agriculture are concerned (although this will obviously vary with slope angle and soil depth). These are summarized below:

Ae: Moderate to high potential soils, support most types of agriculture ***where rainfall is sufficient***
Af: Low potential soils, support little agriculture where dunes are present.
Ag: Low potential soils, support only grazing due to shallow soils
Ah: Moderate to high potential soils, support most types of agriculture ***where rainfall is sufficient***
Ia: High potential soils near river, support most types of agriculture **where irrigated**
Ib: Very rocky, usually steep. Only supports grazing at best.
Ic: Very rocky, usually steep. Usually not enough soil for vegetation for grazing.

5. LAND CAPABILITY

The full methodology for this determination is set out in Schoeman *et al* (2000) and is also available on the www.agis.agric.za web site.

Soil Capability

This involves dividing land into one of eight classes of ***soil*** capability, whereby Classes I-IV are arable and Classes V-VIII are non-arable. This is done by allocating a number of defined terrain/soil factors (flooding hazard and erosion hazard) and soil factors (soil depth, soil texture, internal drainage, mechanical limitations, other soil properties) to an area of land, according to the table below.

Table 2. Terrain, soil and climate factors constituting soil capability classes I to VIII

TERRAIN/SOIL FACTORS		**SOIL FACTORS**					**SOIL CAPA-BILITY CLASS**
Flooding hazard	Erosion hazard	Soil depth	Soil texture	Internal drainage	Mech. limitations	Other soil Props.	
F1, F2	E1; E5	D1	T1	W2	MB0	P1	I
F1-F3	E1-E2; E5	D1, D2	T1, T2	W2, W3	MB0	P2	II
F1-F4	E1-E3; E5	D1-D3	T1-T3	W1-W4	MB0-MB1	P2	III
F1-F4	E1-E4; E5	D1-D4	T1-T3	W1-W4	MB0-MB1	P2	IV
F1-F5	E1-E5	D1-D4	T1-T3	W1-W5	MB0-MB1	P2	V
F1-F5	E1-E6	D1-D4	T1-T3	W1-W5	MB2-MB3	P2	VI
F1-F5	E1-E7	D4-D5	T1-T3	W1-W5	MB2-MB4	P2	VII
F1-F5	E1-E8	D4-D5	T1-T3	W1-W5	MB2-MB4	P2	VIII

The table should be applied from the top downwards. To qualify as soil capability Class I, for example, a polygon must have the following assigned to it: either F1 or F2; E1or E5; D1; T1; W2; MB0 and P1. If not, the polygon is tested for subsequent rows until it qualifies.

Each entry for each land type was tested against the above criteria, and the percentages of each land type with each soil capability class were calculated. The **dominant** soil capability class of each land type was determined and this distribution appears on the map. This classification **excludes** climate factors, so areas with soils of arable capability may well occur in zones with unfavourable climatic factors for agriculture.

Land Capability

Once the soil capability determination per land type is done as in Table 2 above, a combined climatic factor (Schoeman *et al*, 2000) is applied, according to Table 3 below. In this way, the combination of ***soil*** capability class and climate class produces the ***land*** capability class.

Table 3. Terrain, soil and climate factors constituting land capability classes I to VIII

SOIL CAPABILITY CLASS	CLIMATE CLASS	LAND CAPABILITY CLASS
I	C1	I
I, II	C1, C2	II
I-III	C1-C3	III
I-IV	C1-C4	IV
I-V	C1-C5	V
I-VI	C1-C5	VI
I-VII	C1-C6	VII
I-VIII	C1-C6	VIII

Table 3 should also only be applied from the top downwards. The land capability class is determined by the lowest of the soil capability and the climate class.

The final land capability map of the route thus divides the area, per land type, into one of eight classes of **dominant** land capability, whereby Classes I-IV are arable and Classes V-VIII are non-arable (in fact, no land types with **dominant** land capability class I were encountered, although smaller areas of land capability class I will certainly occur within several of the individual land types).

If one compares the maps showing broad soil pattern and land capability, it can be seen that the harsh climate of the area (200 mm rainfall per year, hot temperatures) is the main restricting factor for agriculture in the study area, no matter how favourable the soils might otherwise be. The entire area is classed as Land Capability Class VII or VIII, due almost entirely to the shallow soils and dry climate.

The only area with agricultural possibilities is the zone of alluvial soils along the Gariep River, where irrigation might be applied.

Note: It should be borne in mind that the scope of this investigation was to provide a broad overview of the proposed route. If more specific information is required about a portion of the route, or about some critical area, it can be the subject of a separate investigation, either using existing land type information or, if required, an *ad hoc* soil investigation.

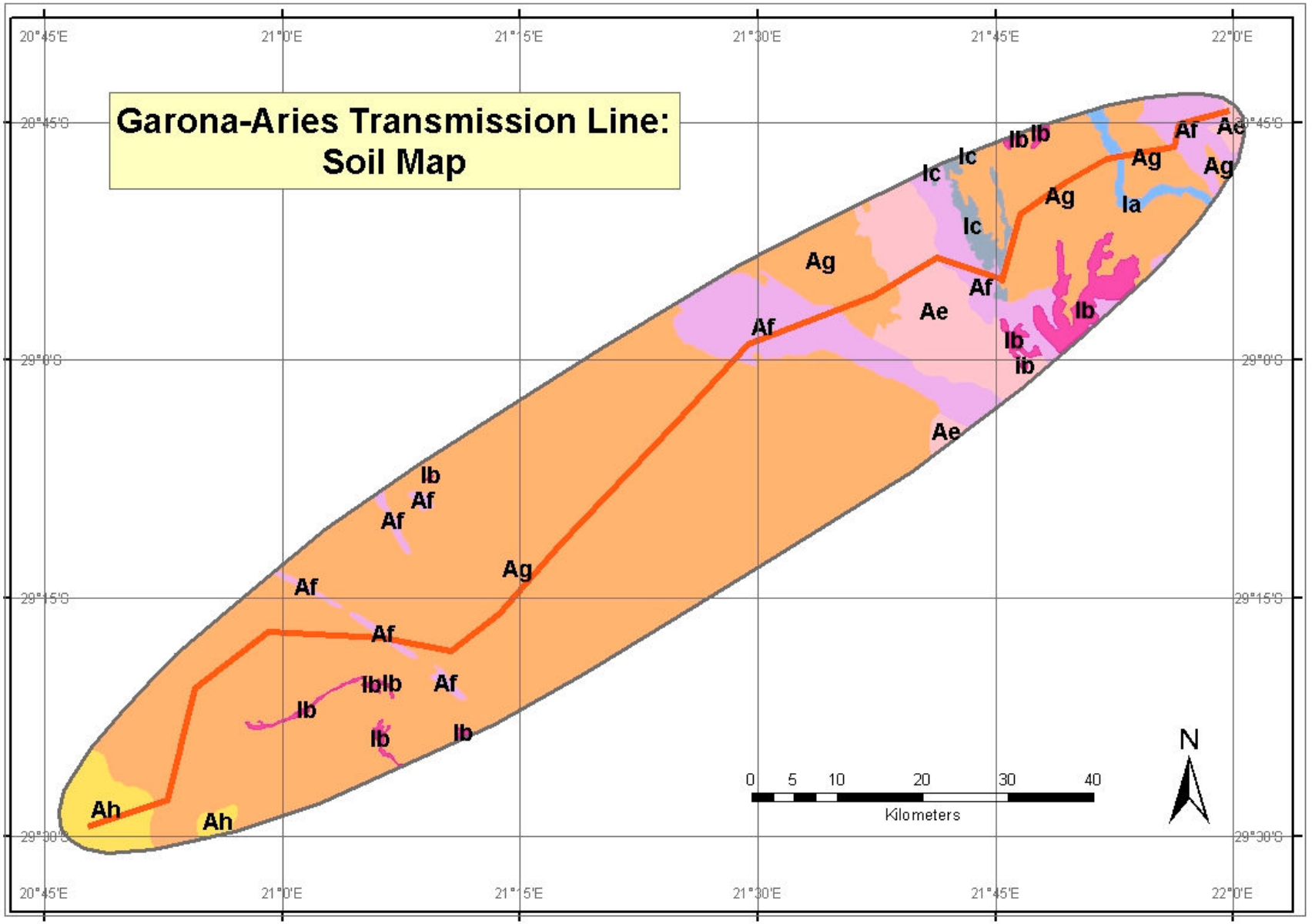
REFERENCES

Schoeman, J.L., van der Walt, M., Monnik, K.A., Thackrah, A., Malherbe, J & le Roux, R.E., 2000. The development and application of a land capability classification system for South Africa. ARC-ISCW Report No. GW/A/2000/57, ARC-Institute for Soil, Climate and Water, Pretoria.

Soil Classification Working Group, 1991. Soil classification - a taxonomic system for South Africa. ARC-Institute for Soil, Climate and Water, Pretoria

APPENDIX:

Maps


Garona-Aries Transmission Line:
Soil Map
20°45'E
21°0'E
21°15'E
21°30'E
21°45'E
22°0'E
29°0'S
29°15'S
29°30'S
Ah
Ah
Af
Ag
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Ib
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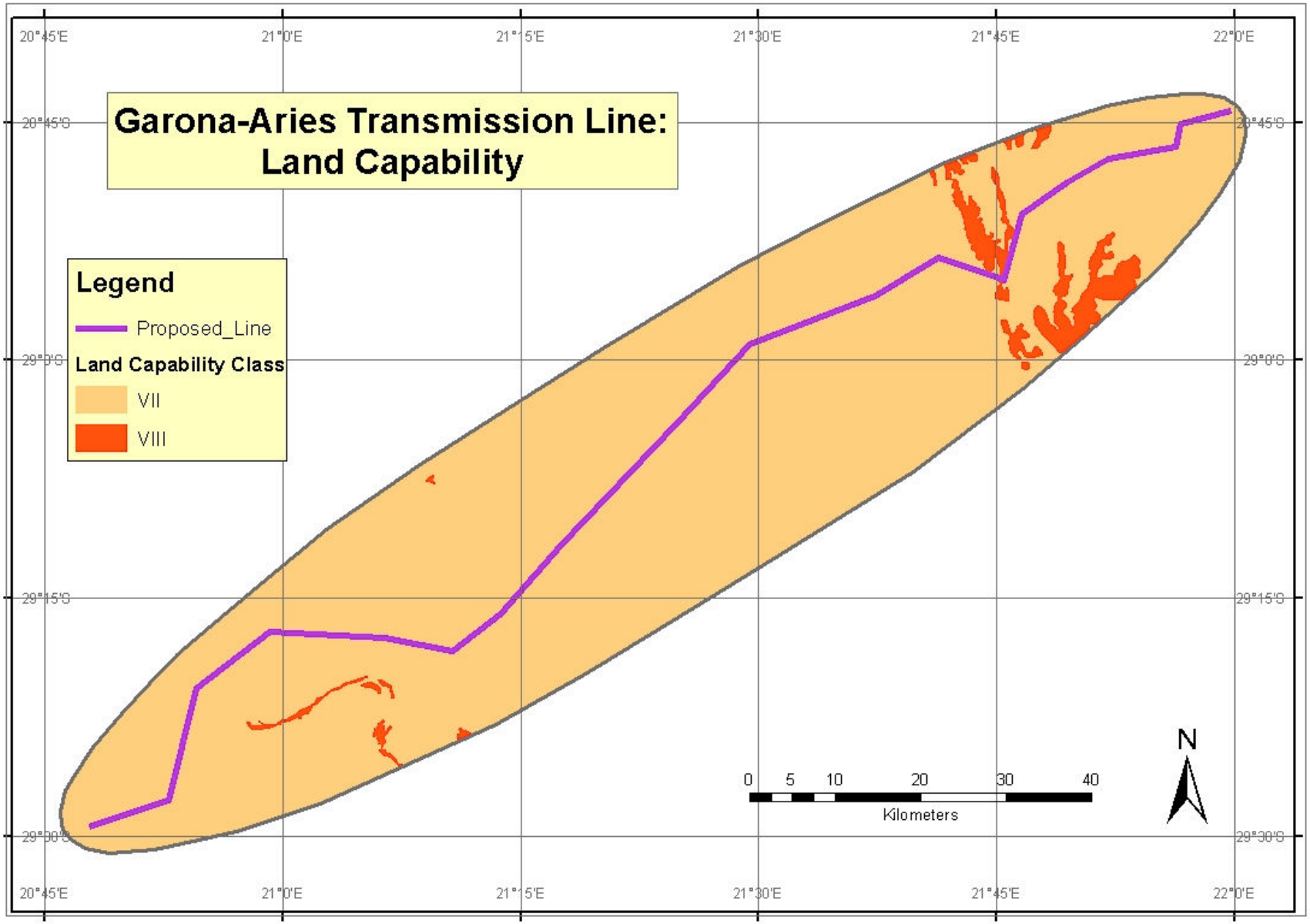
Garona-Aries Transmission Line:
Land Capability
Legend
Proposed_Line
Land Capability Class
VII
VIII
20°45'E
21°0'E
21°15'E
21°30'E
21°45'E
22°0'E
20°45'S
29°0'S
29°15'S
29°30'S
0 5 10 20 30 40
Kilometers
N