REPORT

for Nsovo Environmental Consulting
by

INSTITUTE FOR SOIL CLIMATE AND WATER
AGRICULTURAL RESEARCH COUNCIL

ARC • LNR

Proposed Tubatse Strengthening Phase 1 – Senakangwedi B Integration Project, Limpopo Province

Land types and Agricultural Potential

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1. INTRODUCTION

1.1 Terms of Reference

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was requested by Nsovo Environmental Consulting to obtain soil information for a proposed power generation project near Steelpoort, in Limpopo Province. The aim of the study was to describe and map the soil patterns occurring within the study area, and to assess the agricultural potential.

Three possible alternative sites for a new substation have been identified, as well as possible route for transmission lines to connect to the existing distribution network.

2 STUDY AREA

2.1 Location

The area that was investigated occurs to the south-east of the R555 Stoffberg-Steelpoort road, near the junction with the D1261 secondary road.

The areas involved, which are located approximately 20 kms south-west of Steelpoort, are shown by the black lines in Figure 1.

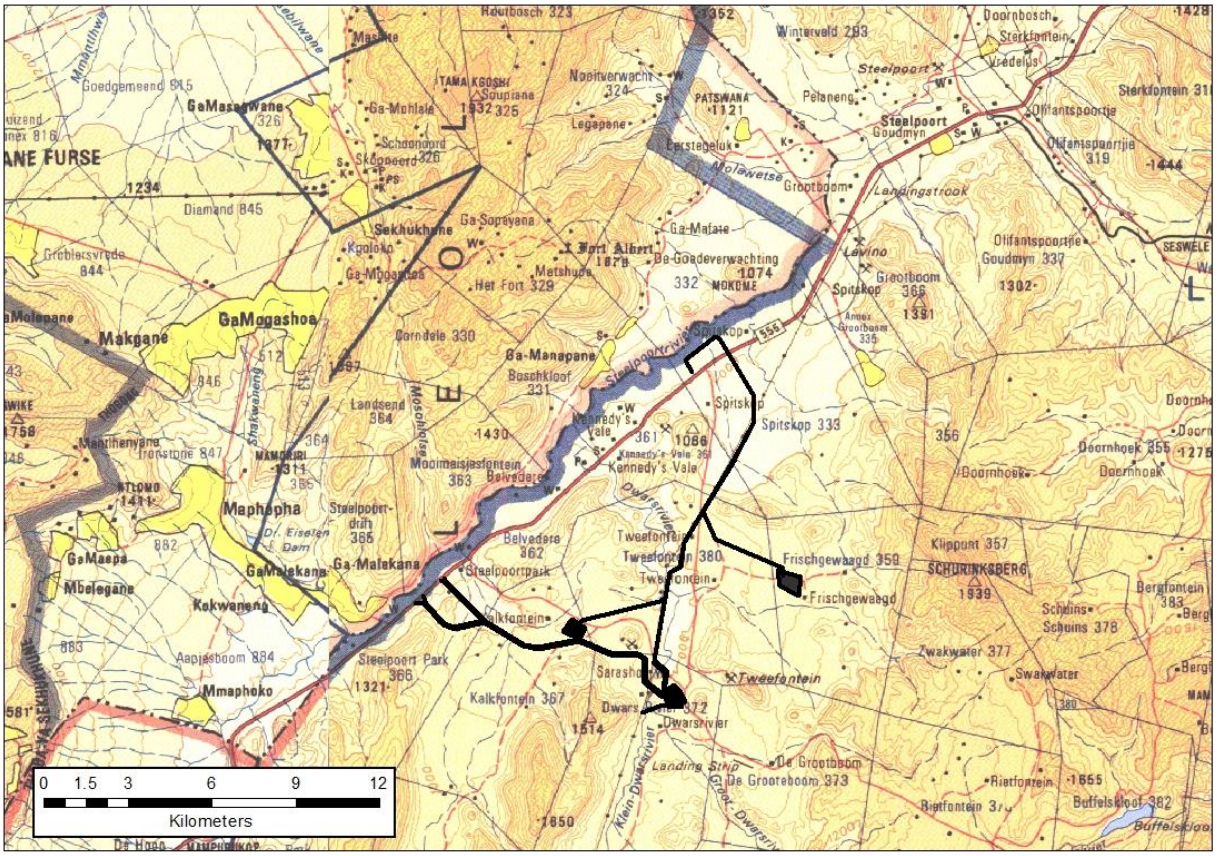

Figure 1 Location map

2.2 **Terrain**

The terrain morphological class of the area can described as hills and mountains with moderate and high relief (Kruger, 1983). The area is characterized by steep-sided mountain ridges, with flatter terrain in between. The highest points of the ridges reach between 1000 and 1200 m above sea level, while the flatter plains lie at around 900 m above sea level. Slopes are generally between 2 and 6%.

2.3 Parent Material

The underlying parent material comprises gabbro, norite and anorthosite of the Dsjate and Dwarsrivier Subsuites, Rustenburg Layered Suite, Bushveld Complex overlain by Quaternary sediments in the flatter areas (Geological Survey, 1988).

2.4 Climate

The climate of the area can be regarded as typical of the northern edge of the Highveld, with cool to cold, dry winters and warm, moist summers (Paterson, Koch & Barrow, 1989). The main climatic indicators are given in Table 1.

Table 1 Climate Data

Month	Average Rainfall (mm)	Average Min. Temp (ºC)	Average Max. Temp (ºC)
Jan	98.6	17.6	30.1
Feb	81.8	17.4	29.7
Mar	62.6	15.7	28.2
Apr	37.1	11.4	27.4
May	11.0	7.0	24.5
Jun	6.3	3.4	21.7
Jul	6.3	3.8	21.6
Aug	4.1	6.3	24.0
Sep	19.2	10.5	27.5
Oct	43.3	13.9	28.5
Nov	88.4	16.4	29.1
Dec	97.3	17.4	30.7
Year	**556.0 mm**	**19.3 ºC (Average)**	

The long-term average annual rainfall is 556 mm, of which 472 mm, or 84.9%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 30.1ºC and 17.6ºC for January to 21.6ºC and 3.8ºC for July respectively. The extreme high temperature that has been recorded is 39.7ºC and the extreme low –2.3ºC. Frost will occur occasionally, but will usually be light.

3 METHODOLOGY

Existing information was obtained from the map sheet 2430 Pilgrim's Rest (Paterson *et al*., 1989) 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 various proposed infrastructure (substations and transmission lines) is covered by a total of 4 land types, namely:

- **Ae27 -** high base status, red, structureless soils, often deep)
- **Dc31 -** mixed soils, with structureless soils and duplex soils (sandy topsoil over structured clay subsoil)
- **Ib192 -** rock outcrops (>60% of the landscape) with shallow soils
- **Ic154 -** mostly rock (>80% of the landscape) with little soil

The distribution of the land types within the study area is shown by the black lines on the map in the Appendix.

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 across the study area has not been ground-truthed.

4 SOILS

The dominant soils occurring in each of the land types are shown in Table 2. The right-hand column shows the total estimated percentage per land type of high, moderate and low potential soils, with the dominant category ***in bold***.

However, it should be noted that this refers to soil potential only, and that climatic restrictions are not taken into account.

Table 2 Soil properties per land type

Land Type	Dominant soils	Sub-dominant soils	Dominant Slopes	Agricultural Potential (%)
Ae27	Hutton 36/46; 450-1200+ mm SaClLm 39%	Valsrivier/Swartland 41; 600-1200+ mm; Cl 30%	2-12%	***H: 52.1*** M: 30.8 L: 17.1
Dc31	Hutton 36/46; 450-1200+ mm SaClLm 29%	Valsrivier/Swartland 21/41; 450-1200+ mm; Cl 20%	1-5%	H: 38.5 ***M: 44.5*** L: 27.0
Ib192	Rock 64%	Mispah/Glenrosa; <300 mm; SaLm-SaClLm 24%	3-40%	H: 0.0 M: 0.6 ***L: 99.4***
Ic154	Rock 85%	Mispah 10; 50-150 mm; SaLm-SaClLm 5%	6-100%	H: 0.0 M: 0.4 ***L: 99.6***

4.1 Agricultural Potential

From Table 2 and the land type distribution map in the Appendix, it can be seen that most of the infrastructure (including all three substation alternatives) falls in land type **Dc31**, with smaller portions of the proposed transmission lines in the north and west falling in land type **Ae27**. Only a very small portion of the infrastructure crosses either of the other two land types.

The soils across the study area are a mixture of red, structureless, freely-drained sandy clay loam soils of the Hutton (and occasionally Shortlands) form, with varying depth. Where these soils are deep, they have a high arable potential. However, there are also significant areas of duplex soils of the Valsrivier and Swartland forms, where a relatively sandy topsoil layer abruptly overlies a subsoil clay layer, usually structured. These soils are problematic for cultivation, as the removal of surface vegetation can often result in the exposed topsoil being eroded, leading to the formation of gullies, which can be very difficult to rehabilitate.

The climate of the study area (Table 1) shows that the rainfall is marginal for dryland (rain-fed) cultivation, especially in this area of warm to hot summer temperatures, exacerbated by the "bowl effect" of the surrounding steeper topography. The variable nature of the rainfall, both within seasons and across seasons, means that arable cultivation has significant risks, if no source of irrigation water is available to supplement the rainfall in times of shortfall.

5. RECOMMENDATIONS

5.1 Comparison of Alternatives

Note: This section is based on 1:250 000 scale reconnaissance information only.

Land type **Dc31** contains a wide mixture of soils, with a spread of agricultural potential (Table 2). For this reason, it is difficult to compare the three substation sites. All three sites are located on areas of natural vegetation, with little or no indication of any cultivation. In addition, the occurrence of eroded areas (gullies) throughout the area, which are associated with the Valsrivier and Swartland duplex soils, also indicates the variable nature of the soils occurring.

If the transmission line alternatives are added, part of each route will have to traverse land type **Ae27**, where a higher proportion of higher potential Hutton soils occur. Despite the reduced footprint of each transmission tower, as opposed to a larger area required for a substation, it would be desirable for the route to be as short as possible.

For this reason, a ranking of the three sites would be:

Preferred: Alternative **2**

Least preferred: Alternative **3** and Alternative **1** (equally)

A more detailed soil investigation, where the soils on each site, as well as those along the proposed transmission line routes, are surveyed using a soil auger to produce a soil map of each site, is required in order for a more meaningful comparison to be made.

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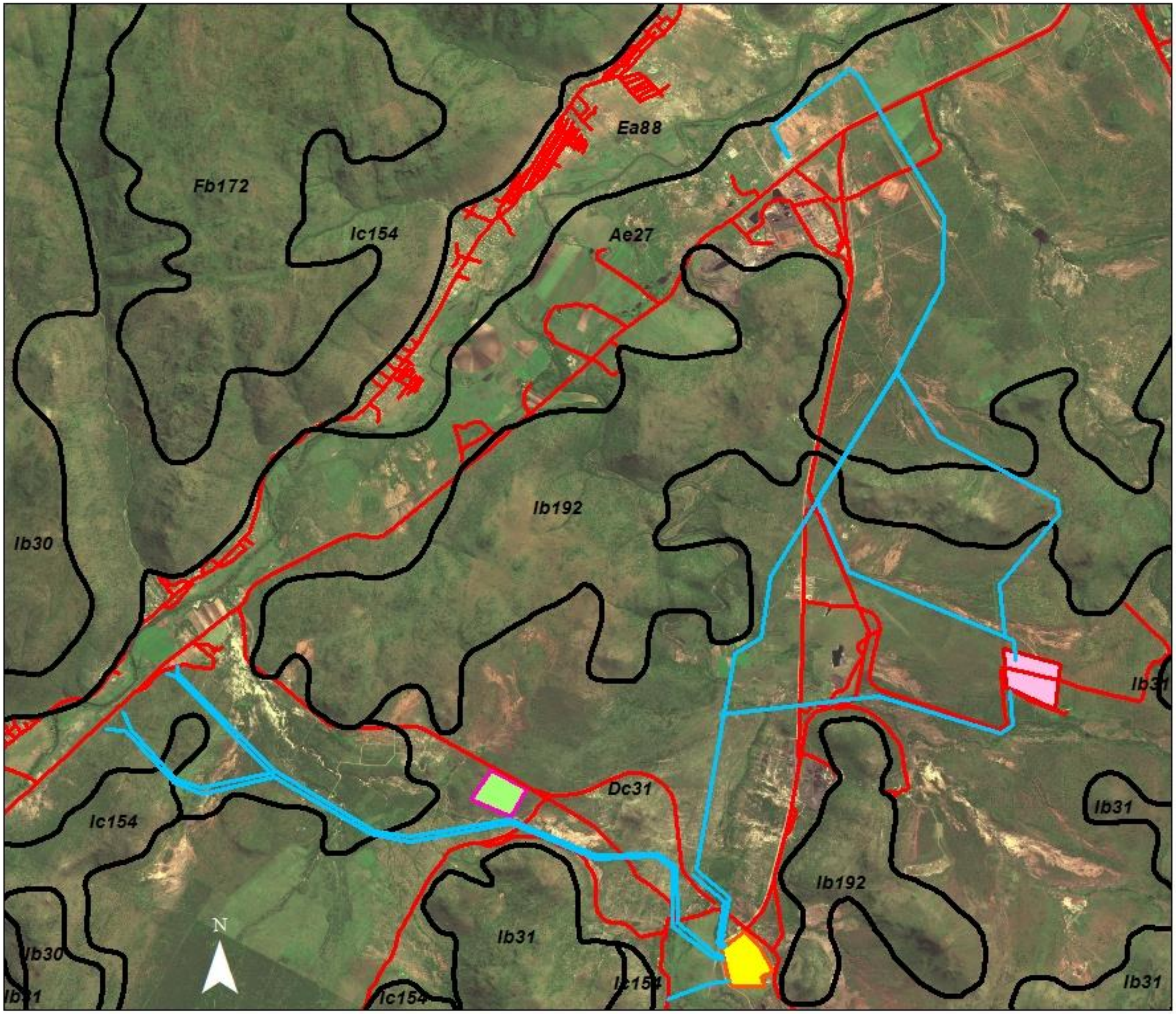
Appendix:

Land Type Map



Tubatse Strengthening Phase 1 - Senakangwedi B Integration Project

LAND TYPE MAP

Legend

- Senakangedi Loop-out
- Senakangwedi Line
- Proposed Tx Line
- Roads
- Substation Alt 1
- Substation Alt 2
- Substation Alt 3
- Land type boundary

0 0.5 1 2 3

Kilometers

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