REPORT

On contract research for
Nsovo Environmental Consulting (Pty) Ltd

SOIL INFORMATION FOR PROPOSED 400 kV INYANINGA-MBEWU TRANSMISSION LINE, KWAZULU-NATAL PROVINCE

By

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June 2017

Report No. GW/A/2017/08

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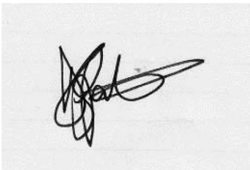
Declaration:

I declare that the author of this study is a qualified, registered natural scientist (soil science), is independent of any of the parties involved and has no other conflicting interests.



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1 INTRODUCTION

The ARC-Institute for Soil, Climate and Water was requested by Nsovo Environmental Consulting to carry out an investigation of the soils and agricultural potential for a proposed 400 kV transmission line in KwaZulu-Natal Province.

The project consists of two parts:

- The transmission line itself, with three alternative routes
- The proposed Inyaninga substation, with four proposed broad study areas (the proposed Mbewu substation has been assessed separately in another EIA process).

2 STUDY AREA

The route runs from the proposed Inyaninga substation, near Tongaat, north-eastward to the proposed Mbewu substation, near Empangeni. Three route corridors (numbered 1, 2 and 3), each of 2 km wide, have been identified, and four possible sites for the Inyaninga substation (labelled Site B, Site F, Site X and Site X3) have also been identified. The location of these corridors and substation sites is shown in Figure 1.

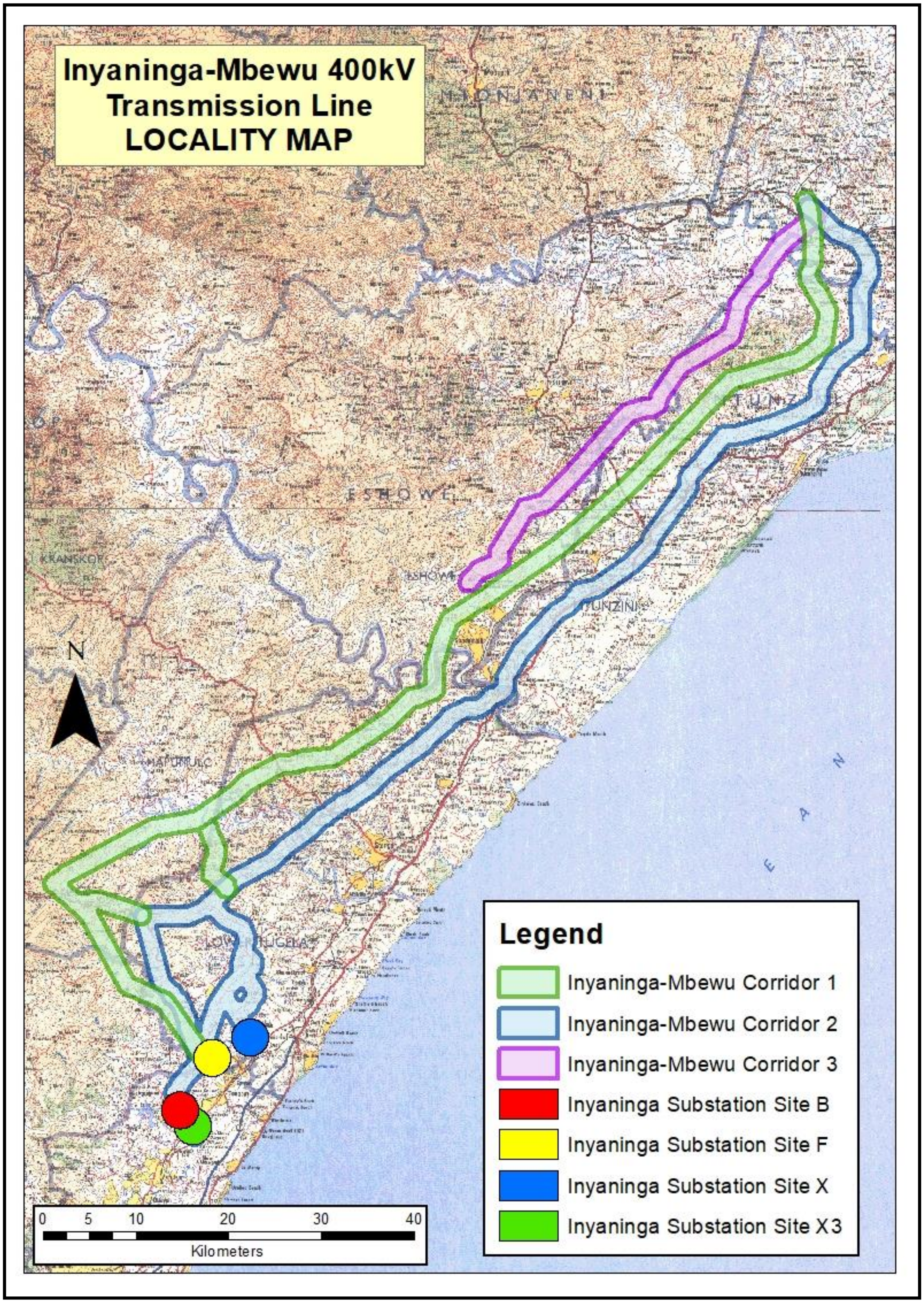


Figure 1 Locality map of the proposed transmission line routes and substation sites

2.1 Terrain

The terrain within the study area varies greatly. The route crosses generally undulating topography of the interior foothills. Slopes will mostly be between 2^{o} and 10^{o}, but could be as high as 30^{o} in places. Altitude is generally below 500 m.

The major rivers to be crossed include the Mvoti, Tugela and Mhlatuze rivers.

2.2 Climate

Climate data was obtained from the national Land Type Survey (Koch *et al.,* 2003).

Rainfall in the study area is around 750-900 mm per year, gradually increasing northward. As expected along the KZN coastal strip, temperatures will be warm, often over $30^{o}C$ in summer, with no frost hazard. Humidity levels will be high.

2.3 Geology

The area is underlain by varying parent materials, as shown in Figure 2 (Geological Survey, 1984). Most of the southern parts of the corridors are underlain by gneiss and sandstone, while the northern parts are more varied, with a mixture of metamorphic rocks and sedimentary rocks.

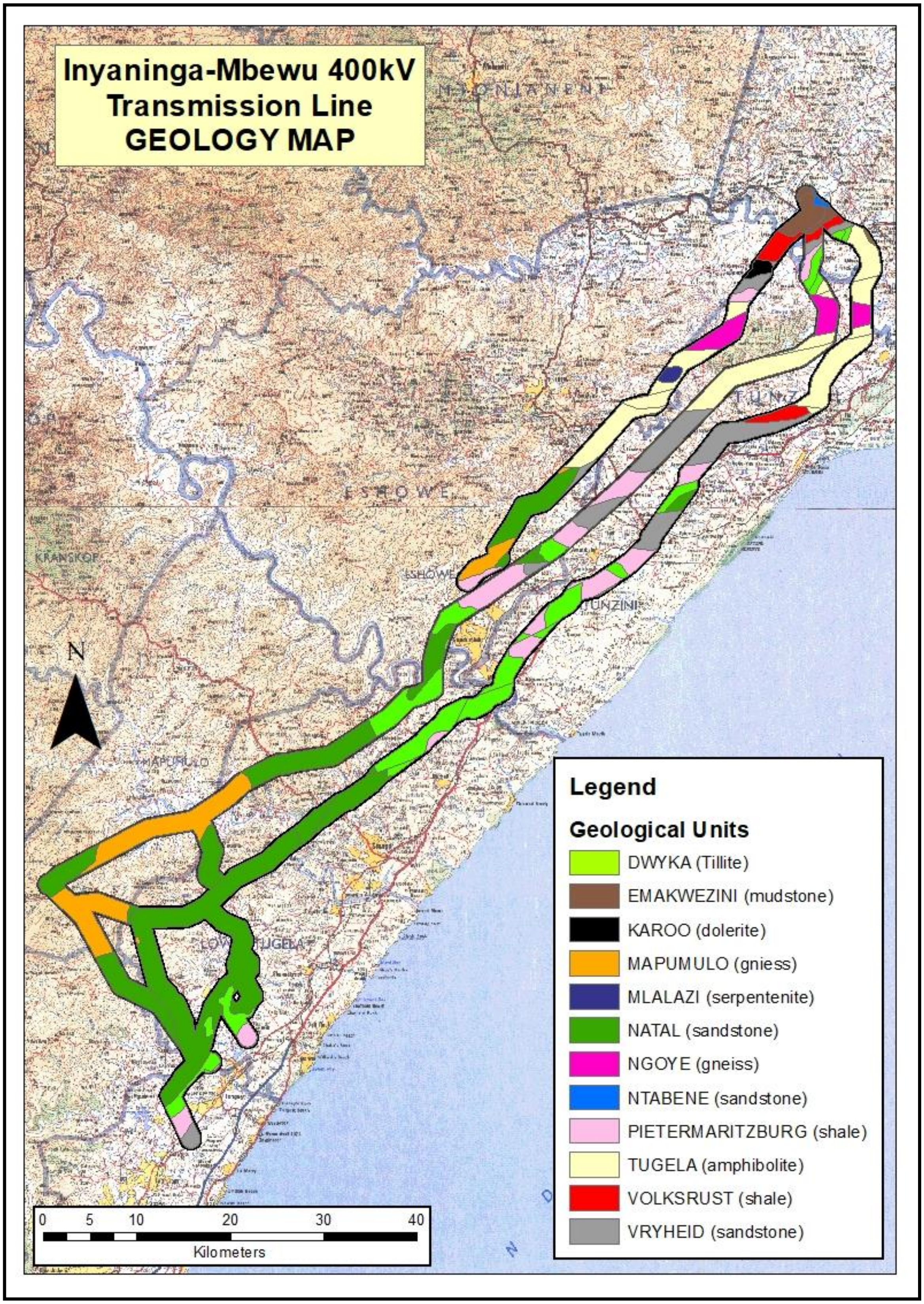


Figure 2 Geological formations

3 METHODOLOGY

As far as existing soil information is concerned, the area is covered by two land type maps at a scale of 1:250 000, which have been digitized using ArcGIS. The study area falls within the map sheets 2830 Richards bay and 2930 Durban.

Each specific ***land type*** mapping unit is a unique combination of broad soil pattern, terrain type and macroclimate. Where any of these changes, a new land type occurs.

Within any specific land type, the soil forms occurring (MacVicar *et al*, 1977) have been summarized according to their dominance, but the locality or distribution of the various soils within a land type cannot be further determined.

4. SOIL PATTERN (Transmission Line Corridors)

Due mainly to the prevailing undulating terrain pattern across most of KwaZulu-Natal, there are a great number of separate land types occurring within the study area. It was therefore decided to group the land types according to their broad soil pattern.

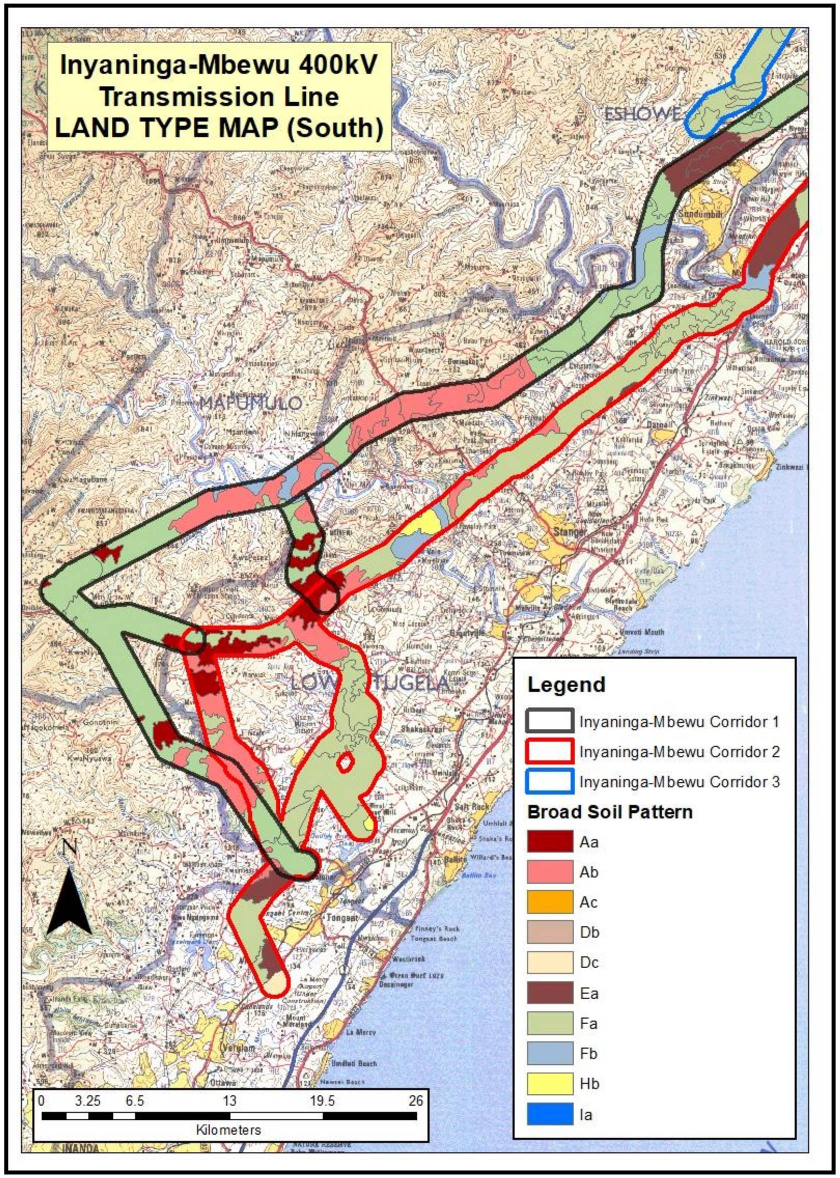
Table 1 shows the broad soil patterns that occur within one or more of the various route corridors or substation study areas.

There will be a significant variation in the soils occurring within these broad patterns, but they can generally be meaningfully grouped together to give an indication of soil variation, from which agricultural potential can be derived.

Figures 3 and 4 show the distribution of broad soil pattern across the southern and northern portions of the study area, respectively.

Table 1 **Broad soil patterns occurring in study area**

A: Red and/or yellow, freely-drained soils	
Aa	Humic topsoils (Ia, Kp, Ma >40%), red and/or yellow
Ab	Red (yellow soils <10%); dystrophic/mesotrophic > eutrophic
Ac	Yellow/red (yellow & red soils each >10%); dystrophic/mesotrophic > eutrophic
D: Duplex soils dominant	
Db	Non-red subsoils >50% of duplex component
Dc	As for Da/Db, but also with >10% Ea soils
E: One or more of: vertic melanic and/or red structured (Sd) soils dominant	
Ea	Dark, blocky clay topsoils (often swelling clays) and/or red, structured clays
F: Mainly Glenrosa and/or Mispah forms (other soils may occur as long as land type does not qualify elsewhere)	
Fa	Shallow, and/or rocky, often steep, highly leached (very little lime)
Fb	Shallow, and/or rocky, often steep, moderately leached (some lime, mainly in valleys)
H: Grey regic sands	
Hb	Some (20-80%) deep, grey sands (usually near coast). Other soils may occur
I: Miscellaneous land classes	
Ia	Deep alluvial deposits (>60%), usually on river floodplains (Du, Oa forms)



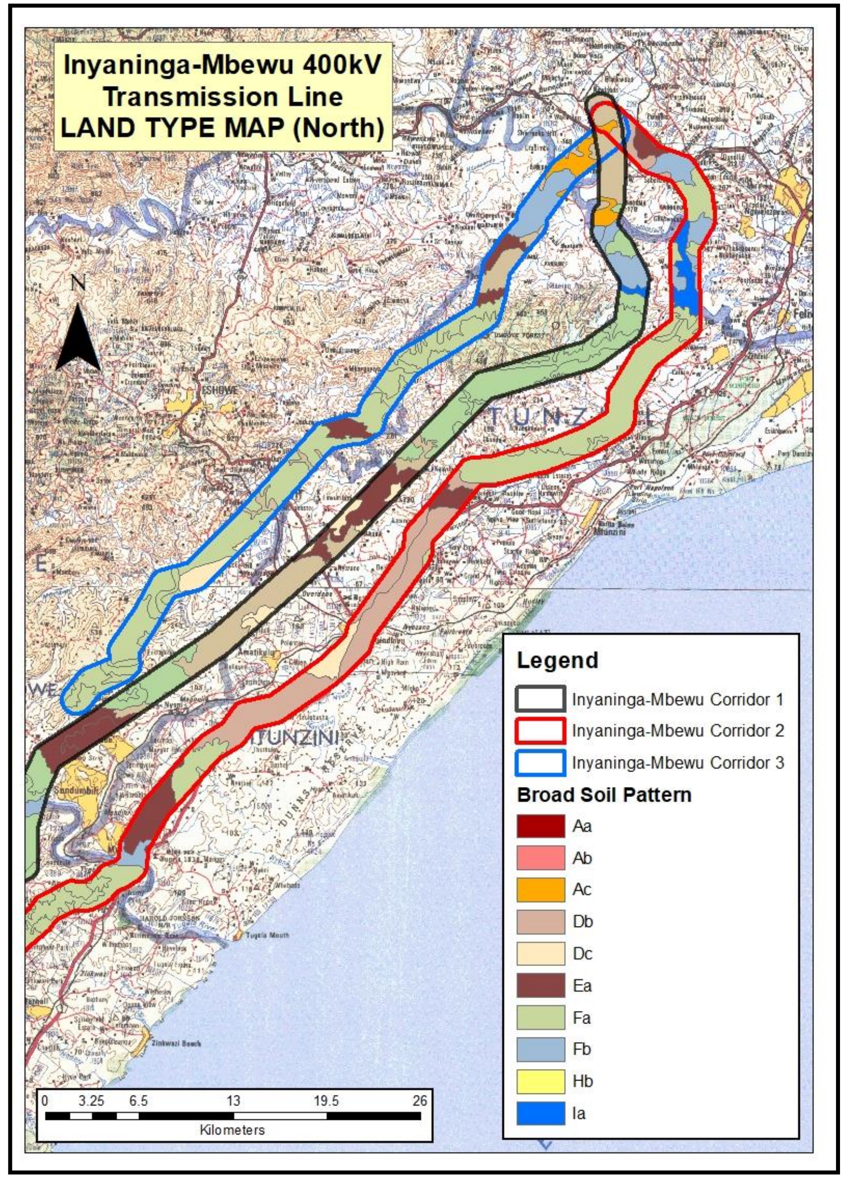


Figure 3 Broad soil patterns (south)

Figure 4 Broad soil patterns (north)

5. AGRICULTURAL POTENTIAL (Transmission Line Corridors)

The occurrence and characteristics of the soils occurring in each land type have been summarized and assessed in terms of broad agricultural potential. This is expressed in the percentage of soils within a land type that can be regarded as being of high potential, so that land types with a higher potential of such soils would be regarded as more suitable for agriculture, especially cultivation.

Soils falling into this category will include freely-drained, loamy soils with a sufficient rooting depth (generally >900 mm), lacking strong structure, stoniness or any signs of wetness.

The map of general agricultural potential is shown in Figure 5. Here, it can clearly be seen that the major areas with high potential soils (>40% of the landscape) occur immediately to the north of Inyaninga at the westward extremity of the routes and that Route 3 (the shortest route to the north) has a significant proportion of high potential soils.

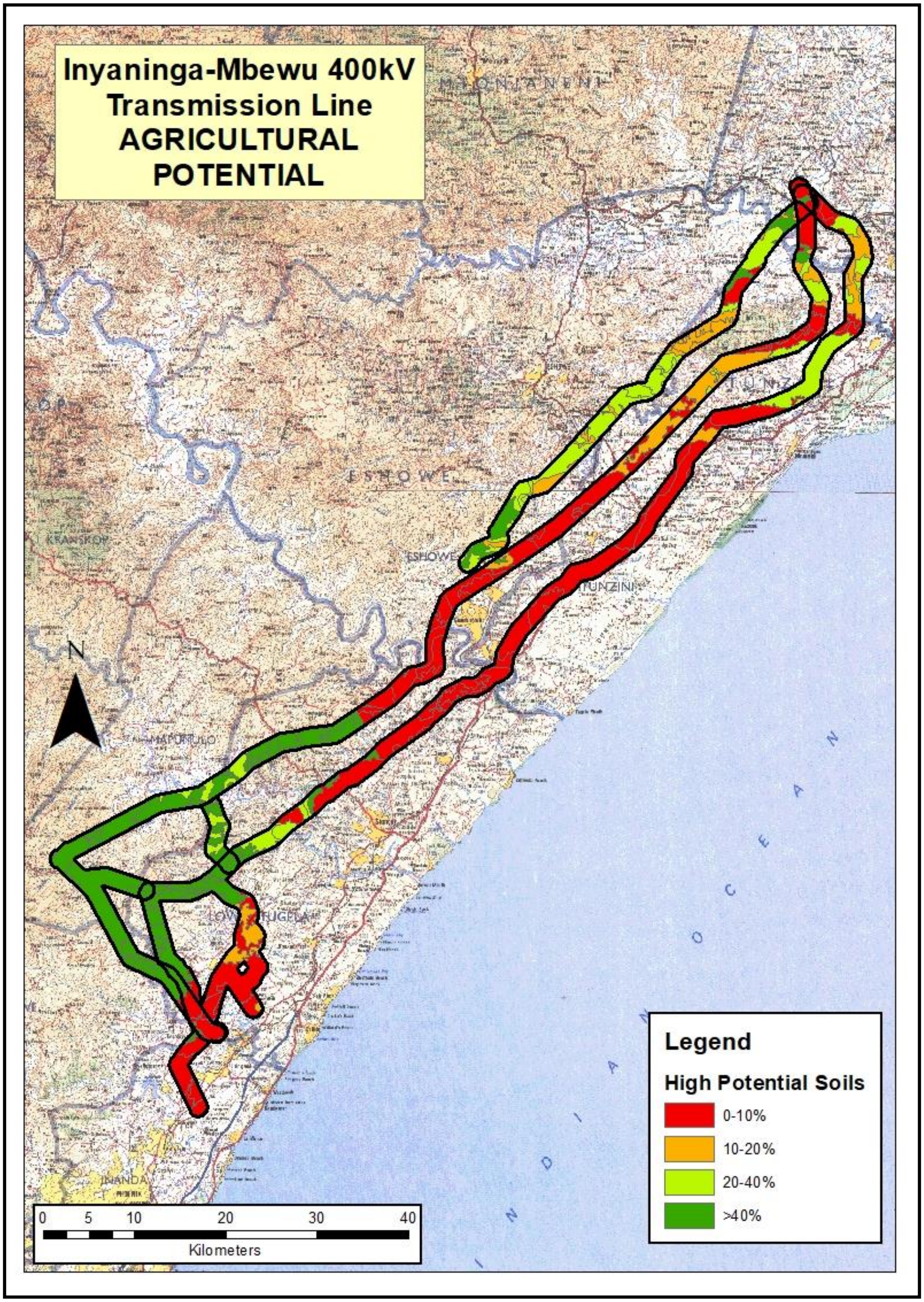


Figure 5 Broad agricultural potential

6. SOIL PATTERN (Substation Sites)

Four possible areas for the establishment of the Inyaninga substation have been identified, each with a radius of 2 km. These are denoted as Site B, Site F, Site X and Site X3. Their location is shown in Figure 6.

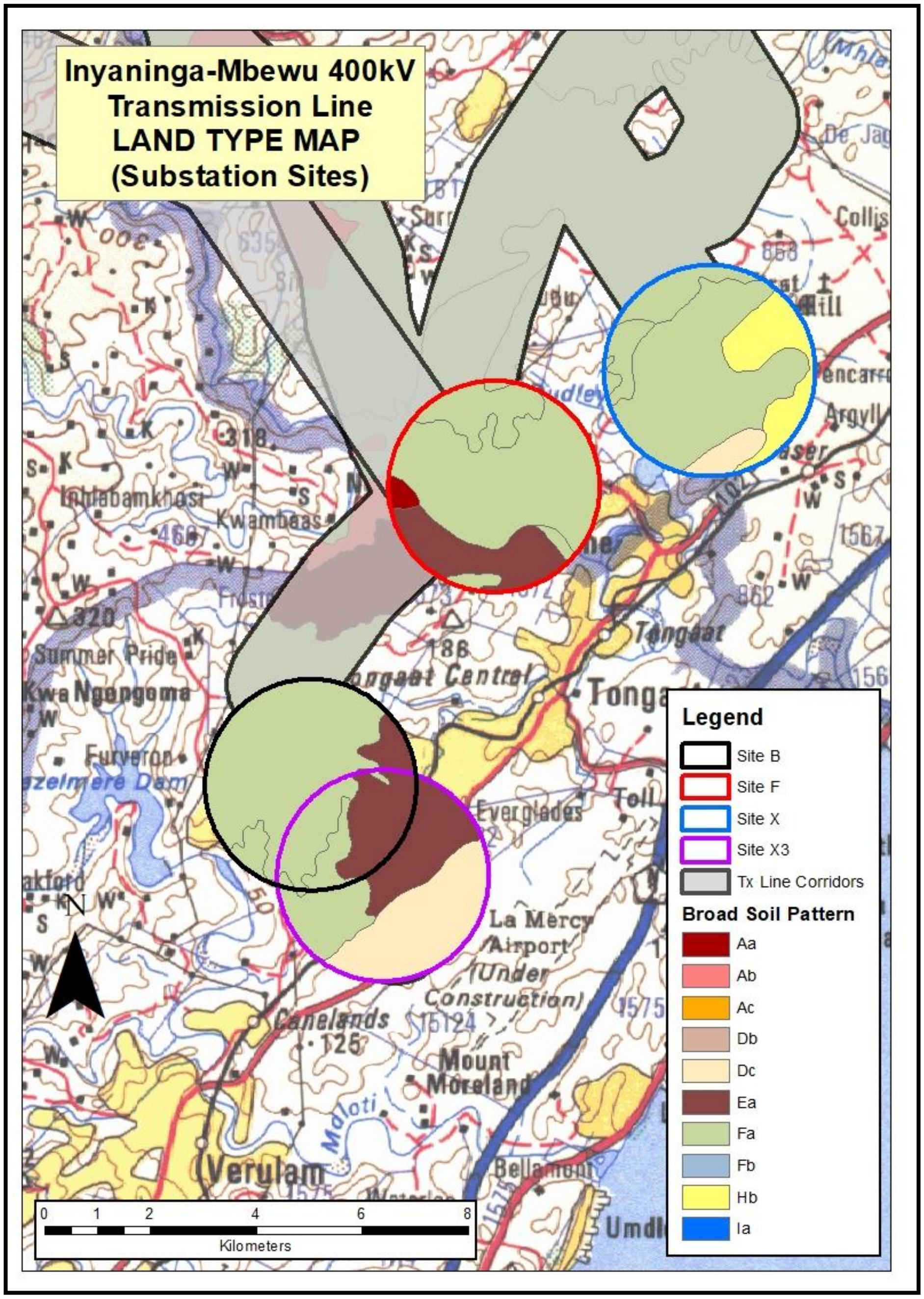


Figure 6 Substation sites

Most of the study areas are dominated by soils of ***Fa*** land types, which are generally shallow soils on weathering rock. However, Site X3 has a large proportion of ***Ea*** soils (dark clay soils) and ***Dc*** (duplex soils), which have a heavier texture and may be more erodible if the topsoil is exposed.

Very little of the soils in the four study areas has a high potential for agriculture, but a more detailed field survey would need to be carried out once specific sites are identified.

7 ERODIBILITY

Most of the study area is not significantly susceptible to erosion. The area has a relatively high rainfall, with good natural vegetation cover. However, slopes may be steep in places, which can increase the erosion susceptibility, and the areas with ***Db*** and ***Dc*** land types (see Figures 3 and 4) will have a higher percentage of duplex soils (with a sandier topsoil on top of a clayey subsoil), which are more erodible if the vegetation cover becomes disturbed.

Under any circumstances, if vegetation cover is disturbed or removed (such as during the construction phase of a transmission line) and especially on steeper slopes, then erosion can occur. Therefore, clear mitigation measures should be implemented, namely.

- Roads should avoid steep slopes wherever possible
- Where steep slopes are used, road stabilization measures (culverts, run-off trenches, banking of bends etc) should be implemented
- Restrict areas cleared of vegetation to road surfaces only

In addition, the possibility of erosion occurring in the future exists, so regular monitoring and inspection should take place, so that if any signs of soil erosion commencing are observed, measures can be put in place as timeously as possible.

8 IMPACTS AND RECOMMENDATIONS

8.1 Impacts

The impacts of constructing a transmission line will be negative, as the natural environment will be disturbed. However, the specific significance on the potential loss of agricultural soil, as well as soil disturbance, needs to be assessed.

This is summarized in Table 2.

Table 2 Impact assessment

Impact: Loss of agricultural soil resource					
Extent (E)	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (E+D+M) x P**	**Significance Class**
Site (1)	Long-term (4)	Low (2)	Medium (3)	21	Low

The isolated nature of the transmission towers means that the impact on the soil resource will be small. Most agricultural activities can still be practiced next to or underneath a transmission line.

The exception is where irrigation, especially by overhead or other spray actions, is practiced. Therefore, as far as possible, the transmission line should avoid such areas.

Mitigation measures will include the rehabilitation of any bare soil areas caused by the construction process (including any access roads or tracks) and wherever possible, the siting of pylons away from any cultivated lands, but rather to use servitudes and boundary lines. Special care should be given to areas with steeper topography.

8.2 Fatal Flaws

There are **<u>no fatal flaws</u>** regarding the study area. However, there are a number of sensitive areas that should be avoided, namely wetland soils along the river courses.

9 ALTERNATIVES

The proposed 400kV transmission line will make little difference to the impact on the soil resource and agricultural potential. The impacts and mitigation measures as outlined above must be implemented.

Regarding the alternative routes**,** it would appear that Corridor 2 (the south-eastern alternative) crosses the largest area with low potential soils (Figure 5), especially if the costal option at the southern end is chosen. However, the differences between Corridors 1 and 2 appear to be quite small, so that there is no clear preferred or non-preferred alternative at this stage. However, Corridor 3 is not recommended.

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