Project: **15/08/2017AGRIC**

Document version 1.0 – Final Report

SOIL AND THE LAND CAPABILITY IMPACT ASSESSMENT FROM ESKOM 400KV POWER LINE CONSTRUCTION FROM FOSKOR MTS (NEAR PHALABORWA) TO SPENCER MTS (NEAR TZANEEN) IN MOPANE DISTRICT, LIMPOPO PROVINCE

Submitted

To

DIGES Group, Midrand

August 2017

Compiled by:

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SACSNAP_ 400155/08

Short biography: Kingsley Ayisi:

Kingsley is a Crop Ecologist by profession and a product of the Department of Agronomy and Plant Genetics, University of Minnesota, USA where he obtained his MSc Degree (Agronomy - Crop Physiology) and PhD in Agronomy (Agro Ecology). He has minor programmes in Soil Science and Agricultural Economics. Kingsley supervised and Co-Supervised several MSc and PhD students in South Africa and few in Europe (Germany and Belgium). He has also served as an External Assessor Postgraduate dissertations and thesis for several universities in South Africa and Australia. His area of research includes whole system biological interaction in the agro-ecosystem focusing on resource use efficiency on farmers' fields for improved biological productivity and food security. The expertise of Kingsley extends to services to the National and Limpopo government in areas of agriculture feasibility studies, climate change impact, adaptation and mitigation. His publications in scientific journals, books and conference proceeding is in excess of 74.

DECLARATION OF INDEPENDENCE

I, Kingsley Ayisi as duly authorised member of South Africa Council and Natural Professional, Agriculture, as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence as a specialist and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which DIGES was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the soil and the land Capability Impact Assessment of the proposed Foskor-Spencer 400kV power line and associated infrastructure.

Full Name: Kingsley Ayisi
Title / Posit: Professor

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PROJECT SUMMARY

Project justification

Sustainable utilisation of natural resources in the agricultural sector contributes significantly to economic growth in a country. However, to remain competitive and economically viable in a globalised integrated world, agricultural development in a country will have to run concurrently with sustainable utilization and management of its resource, amidst the demand of the same resources for other developmental projects.

Local economic development programmes result in competing demands on valuable agricultural lands. To minimize loss of high potential and prime agricultural lands that may result from non-agricultural development projects, it is imperative to assess the impact of such projects on critical resources at the site.

Project background

Preliminary studies by Eskom Holdings identified two powerline routes (Route 1 and Route 2) with two deviations (Deviation 1a and Deviation 1b) which need to be investigated in order to select the best route with minimal impact on agricultural lands. The routes will span approximately 110 km from Foskor main transmission substation (MTS) around Phalaborwa to Spencer MTS around Modjajiskloof in the Mopane district of the Limpopo Province. This assessment is essential as it will contribute to meeting the requirements of the *National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) in* compliance with *Regulation 326 of 2017, promulgated in terms of Section 24 (5) of NEMA. It will also address some aspects of the Subdivision of the Agricultural Land Act No. 70 of 1970.*

Methodology

To facilitate the studies, the following key aspects were considered:

- Review of project background,
- Review of land-use practices on the land through which the routes will traverse,
- Evaluation of the agro-ecology of the study area viz., climate, geology, land types, water resources, vegetation and agricultural activities.
- The application of the criteria for assessing agricultural potential and
- Recommendations on the best powerline route.

Findings

The studies revealed the following:

- Routes 1 and 2 start at the Foskor substation in the Ba-Phalaborwa Municipality and later merges route 2 with Deviation 1b.. Deviation 1a merges with the already merged routes;
- The two powerline routes and deviations 1a and 1b traverse conservation areas, natural vegetation areas, cultivated farms, subsistence areas and settlement areas.
- The location of the powerline routes occur on landtypes characterised largely by rocky layers or shallow depth limited by hard rock. Their potential for agricultural development is minimal and hence, construction of the powerline on these soils will have a minimal impact. However, on relative terms, Routes 2 traverses better agriculture soils but construction of the powerline on either routes will not significantly impact the soils.
- Regarding the MTS substations, Foskor occurs on the Glenrosa and Mispah soil which are of low agricultural potential. The landtype Ae326 which occurs around the Spencer MTN substation has relatively favourable soils for agriculture.
- The two powerline routes also traverse fairly similar land capability class which is the low to moderate class. There is however localised pockets of permanently transformed in the path of the two routes and a moderate to high land capability around Spencer MTS substation.
- The two powerline routes experience relatively similar geology to a large extent with Gneiss and Granite dominating.
- The vegetation under the two routes are also similar which is predominantly *Arid Lowveld* followed by a relatively smaller portion of *Lowveld Sour Bushveld* a very insignificant portion of *Mopani Veld.*

Conclusions

By definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983 and Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983), the land occurring under the two powerline routes with deviations at the project sites:

- Consists predominantly of Mispah and Glenrosa soils which are of low potential for agriculture.
- The two powerline routes and the deviations traverse approximately similar landtypes, land capability, geology and vegetation within the study area.
- On relative terms, Route 1 with Deviations 1b traverses less favourable landtype

and hence will be the preferred route for the construction.

- Regarding the location of the MTS, the Spencer substation is located on landtype Ae326 which is better soil for crop production agriculture relative the Foskor substation which occurs on landtype Fb180. This landtype is characterised by Mispah and Glenrosa soil forms.
- The water resources in the study area do not differ among the two routes and deviations and there is a potential for the development of irrigations systems for each of the routes. This renders the routes high agriculture potential area according to the classification of potential agricultural land.

Recommendation

The two powerline routes with deviations traverse similar land types and other geographical features. All things being equal and based on the findings and information gathered from the study area, the recommended for the construction of the powerline is Route 1, via Deviation 1b to merge with Route 2 and then proceed north to the Spencer Substation.

Mitigation measures:

To protect future disturbances within the project area, the following mitigation actions could be adhered to:

- All forms of cultivation within, and preferably a significant distance away from the buffer zones must be avoided. Land cultivation from soil tillage causes all forms of soil disturbances which initiate erosion processes.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Existing farming activities in close proximity to the buffer zone should be based on sustainable principles to prevent unintended infringement into the project area.
- Other construction activities such as access roads should be kept to a minimum.

1.0 INTRODUCTION

1.1. Project Background

FRN Lesedi Organic Farming Development was subcontracted by DIGES Group to carry out the Soil and the Land Capability Impact Assessment for the construction of a 400kv powerline from Foskor main transmission substation (MTS) to Spencer MTS substation in the Mopane district of the Limpopo province. Preliminary studies by Eskom Holdings initially identified two powerline routes namely Route 1; Route 2 and Deviation 1a and Deviation 1b which need to be investigated in order to select the best route with minimal impact on agriculture.

1.2. Study justification

Agriculture is identified as one of the tree pillars of economic development in the Limpopo province of South Africa, alongside mining and tourism. A well-developed agricultural sector is pivotal to sustainable use of natural resources, job creation and economic growth. However, for agriculture to succeed in a globalised integrated world, the sector will have to run concurrently with sustainable utilization and management of its resource, amidst the demand of the same resources for other developmental sectors in the province. Land is an important resource that must be managed sustainably in all landuse systems due to its great potential for preservation and enhancement of ecosystem services.

The proportion of arable land in South Africa has been decreasing over the years (World Bank Trading Economics, 2014), approximately 1.0 percentage point (Fig 1.). High-potential arable land comprises only 22 % of the total arable land and roughly 1.3 million ha of land is under irrigation.

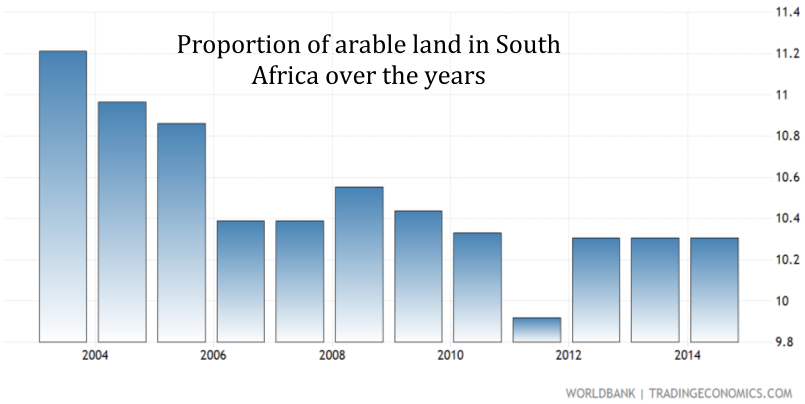

Fig. 1. Changes in arable land in South Africa over the years.

Competing demands are currently placed on available land as a result of settlement and local economic development programmes. These demands include: landuse for urbanization, agriculture, mining, growth in the industrial and the manufacturing sector, human settlement, transportation network, and protected areas for conservation. The demand for energy by the consuming public constitutes a significant pressure in recent years. This challenge has compelled ESKOM to increase its capacity to provide affordable electricity to newly developing areas and projects within South Africa. Eskom Holdings Ltd is responsible for the provision of reliable and affordable power to its consumers in South Africa and it is crucial that transmission supply keeps up with both electricity generation capacity and electricity demand.

In the current task, Eskom Holdings Ltd plans to construct an approximately 110km, 400kV power line from *Foskor Main Transmission Substation* (MTS) to Spencer MTS in the Mopane District of the Limpopo Province. The power line will span across 4 Local Municipalities namely, Ba-Phalaborwa, Maruleng, Greater Letaba and Greater Tzaneen. In addition, the project will establish a 400/132kV transformation yard with the installation of 1 x 500MVA, 400/132kV transformer at Spencer MTS.

The construction of a power line to meet energy needs will traverse some agricultural lands. This may put additional constraint on the limited arable land available for agricultural development in the Limpopo province. To minimize loss of prime agricultural lands that may result from power generation and transmission, it is imperative to assess the impact of such projects on critical resources. Two routes with two deviations have been proposed and the route with minimal impact on land and soil capability is to be recommended, hence the requirement for the present exercise.

1.3. Project location

The proposed project area is located in the Mopane District of the Limpopo Province of South Africa, traversing approximately 110 km distance. (Fig 2.):

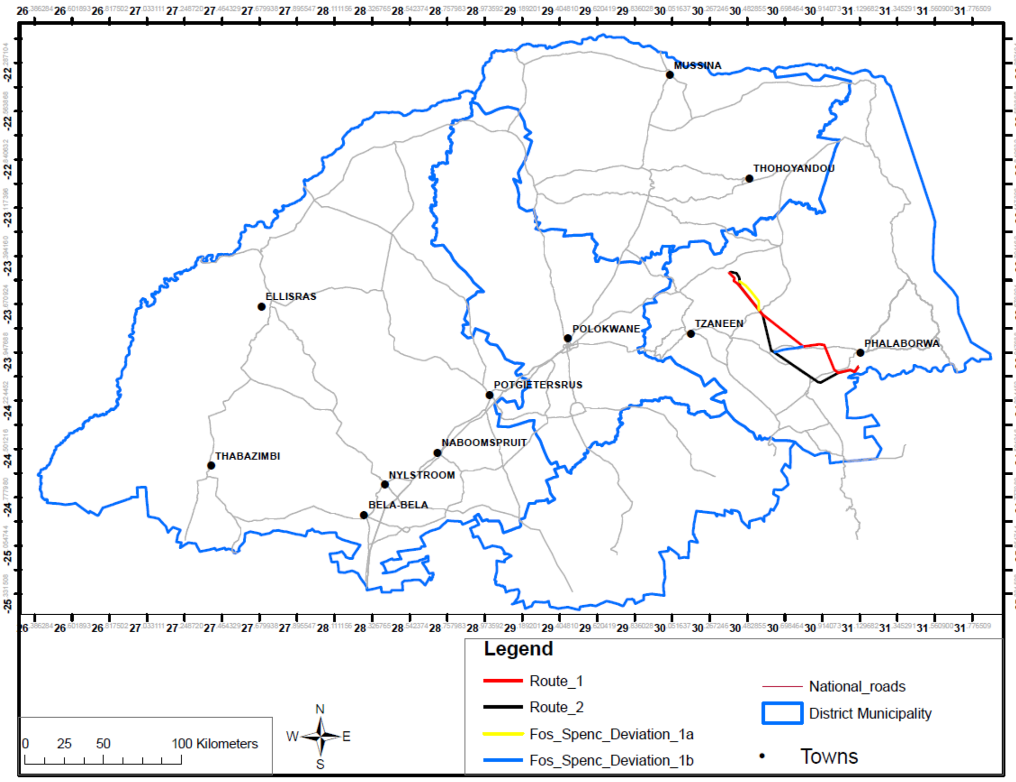

Fig. 2. Location of project site in Limpopo province.

The two proposed routes and two deviations are presented in figure 3 below:

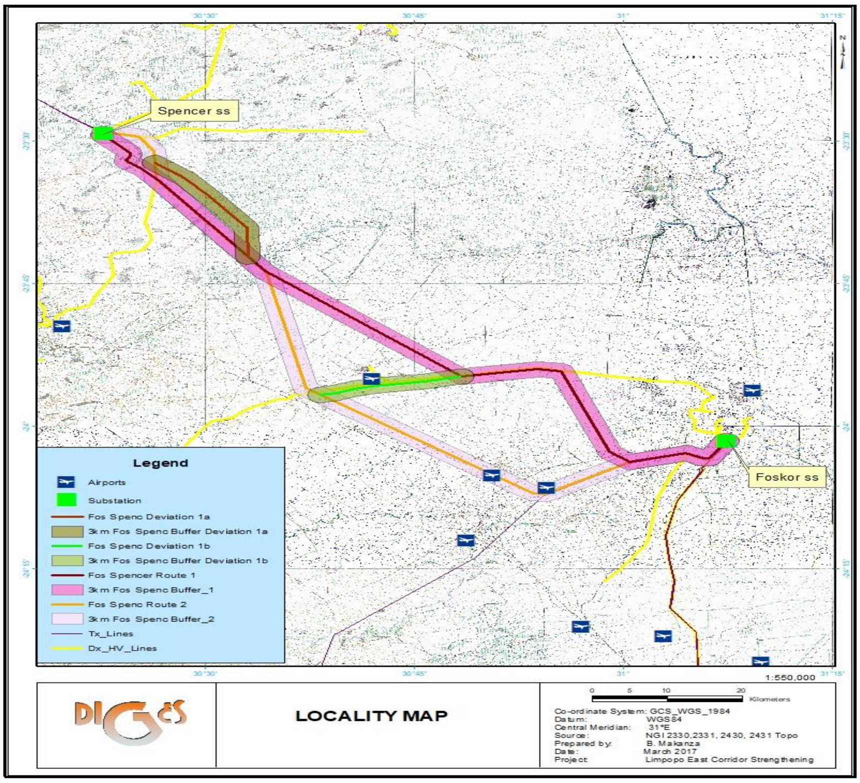

Fig. 3. Locality maps of Mopane District Municipality and proposed powerline routes and deviations.

Routes 1 commences in Ba-Phalaborwa and later joined by Route 2, Deviation 1a and Deviation 1b in Greater Letaba and Greater Tzaneen.

2.0. PROJECT OBJECTIVES

2.1 Main objective

The main objective of the study was to assess the impact of the construction of Eskom powerline from *Foskor main transmission substation (MTS)* to Spencer MTS substation on soil and land capability within two proposed alternative routes with two deviations in the Mopane District in the Limpopo province and to recommend the route with minimal impact for implementation. An additional objective is to assess the impact of the establishment of a 400/132kV transformation yard with the installation of 1 x 500MVA, 400/132kV transformer at Spencer MTS substation.

3.0 METHODOLOGY

Assessment of soil potential and land capability of the proposed routes was based on a combination of desktop studies to amass general information and then through site visits for status quo assessment.

3.1 General information

Pertinent information on the study area was obtained through a combination of background information review, public database and literature as well as GIS information. The information amassed includes the following:

a) EIA administration: Integrated Environmental Management Information Series.
b) Definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983.
c) Classification of high potential agricultural land in South Africa compiled by the Agricultural Research Council for the National Department of Agriculture which groups soils into forms and families based on the diagnostic horizon of the soil profile (Schoeman, 2004).
d) Geophysical features of the site using Geographical Information System and walkover survey.

3.2 Site visit

The project site was traversed largely by a vehicle in January and February 2017 to document the following:

a) Current landuse of the project site.
b) Soil characteristics, vegetation profile, water resources and infrastructural profile.

The classification of soils at the project site was based on Landtype description and the Binomial System for South Africa.

3.3 Determination of Agricultural potential

3.3.1 National assessment criteria

The amount of suitable agricultural lands for plant and livestock production in South Africa is dwindling and this trend needs to be halted and reversed. Interventions that will retain high potential and prime lands as much as possible are required for sustainable agricultural production for future generations. South Africa is generally dominated by shallow soils which are predominantly sandy. This poses a severe inherent limitation to crop production.

The poor quality of the soil in South Africa is primarily due to the influence of the parent material from which they were formed. This poses a great challenge if the growing human population in the country is to be fed. In line with this goal, the Department of Agriculture has developed a set of criteria to define and preserve potential and prime areas for agricultural development in South Africa, as listed below:

- By definition, based on Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983, and as reported by Schoeman (2004), an agricultural land in the Limpopo Province and specifically around the project site (including Tzaneen, Ofcolaco and Duiwelskloof) is considered high potential if the land:
    i. Is under permanent irrigation, or
    ii. Can be classified into one of the following soil forms; Avalon, Clovelly, Griffin, Hutton, Indana, Kranskop, Magwa, Oakleaf, Pinedene, Shortlands and Tukulu with a mi~~nim~~um soil depth of 600 mm. the topsoil clay content could be any value.

High potential here means prime or unique. Prime refers to the best available land, mainly from the national perspective, suited to and capable of consistently producing acceptable yields of a wide range of crops (food, feed, forage, fibre and oilseeds), with acceptable expenditure of energy and economic resources and minimal damage to the environment. Unique agricultural land means land that is or can be used for producing specific high value crops. Permanent irrigation refers to the availability for, and regular artificial application of water to the soil for the benefit of growing crops. The application may be seasonal.

3.3.2 Additional assessment criteria from provincial department

In addition to the necessary legislations relating to land classification in terms of its potential in South Africa, the assessment of agricultural potential at the project site took into consideration the following:

- Land capability for producing specific crop types according to the soil and climate,
- Surrounding developments and activities
- Current status of the land and landuse options

3.4 Assumptions

The main assumptions made about the study is that, the soil physical properties will not be altered in future as a result of human activities and the current landuse will not change significantly in future. Furthermore it is assumed that agricultural activities will not encroach the demarcated buffer zone.

4.0 CHARACTERISATION OF PROJECT SITE

4.1 Current landuse

The proposed locations for the powerlines occur mainly in rural landscape comprising largely of the natural vegetation, rural settlement areas, agricultural lands and subsistence farming (Fig. 4).

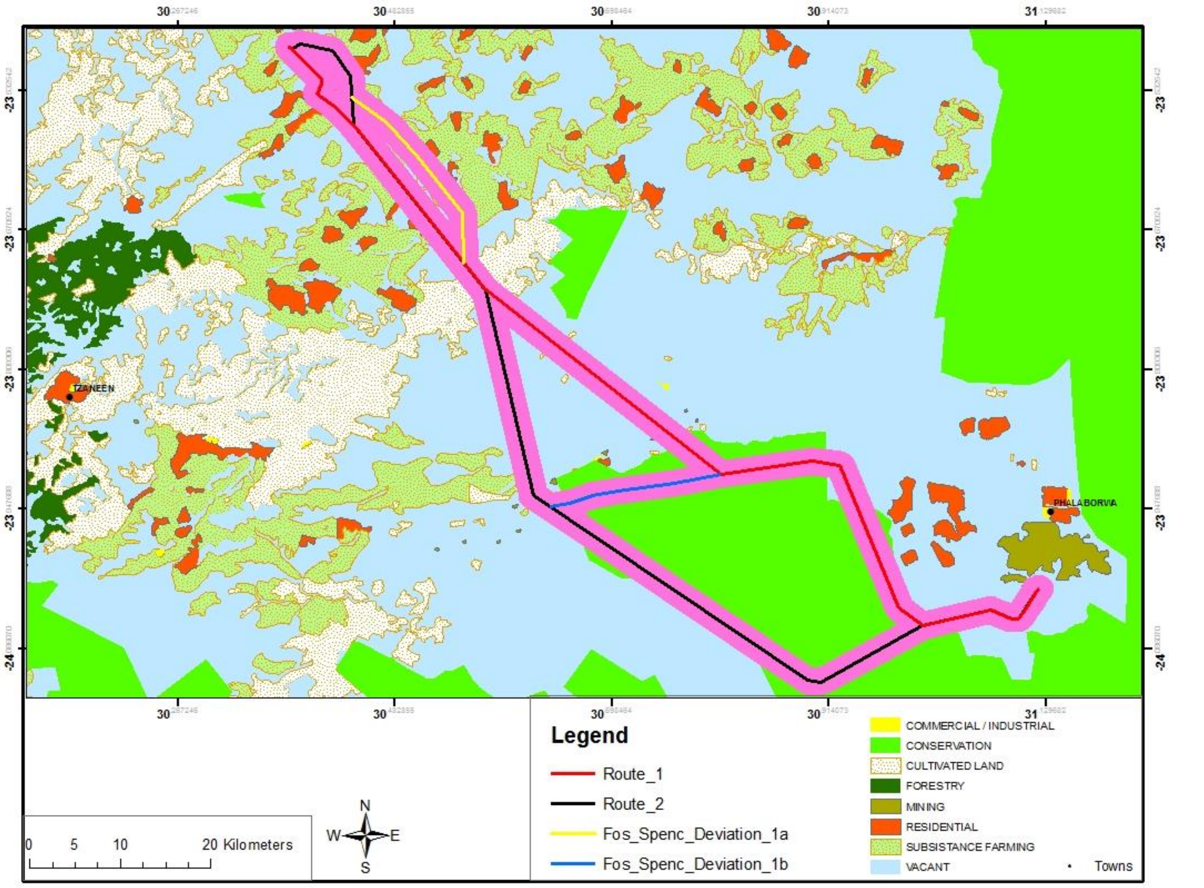

Fig. 4. Current landuse at the proposed project site.

The current landuse along the proposed routes with Deviations 1a and 1b and their potential impact on agricultural productivity are presented in table 1 below:

Landuse

Table 1. Landuse use under the proposed routes with deviations and their possible impact on agricultural productivity.

Route	Landuse	Potential impact	Extent of impact		
			Low	Medium	High
(Route 1)	Traverses largely conservation and vacant unspecified lands for about 87 km. Beyond this, it continues for approximately 3.0 km across cultivated lands. The remainder distance passes through several subsistence farming areas for approximately 29km before reaching the substation.	The route will affect cultivated and subsistence farming areas, settlement areas, natural vegetated areas and conservation areas.	X	X	

(Route 2)	Route 2 traverses the peripheries of conservation and vacant unspecified lands for about 85.6 km and 2.8 km across cultivated lands. It continues for 28.5 km through subsistence farm and settlement area. Relative to Route 1, the impact on the settlement and subsistence farms are minimal.	The route will affect cultivated and subsistence farming areas, settlement areas, natural vegetated areas and conservation areas. The impact on the various landuses will be minimal compared to Route 1 as it traverses only on the peripheries.	X	X	
Deviations 1b and Deviation 1a.	Deviation 1b emanated from Route 1 and joins Route 2	This routes traverses residential and subsistence farming areas.		X	X

Summary of landuse

The two powerline routes and deviations traverse conservation areas, natural vegetation areas, cultivated farms, subsistence areas and settlement areas, and hence could impact agricultural activities. However, on relative terms, Route 2 was found to traverse slightly more the peripheries of the conservation and subsistence farm land.

4.2 Soil distribution

4.2.1 Landtypes

Different landtypes occur at the proposed routes and the Foskor and Spencer MTS substations, being Ae319, Ae326, Ae126, Ea165, Fa753, Fb352, Fb354, Fb179, Fb 180, Fb186, Fb187 and Ib196. The dominant map unit is Fb, followed by Ae and Ea (Fig. 5). The landtype Ib196 is relatively negligible.

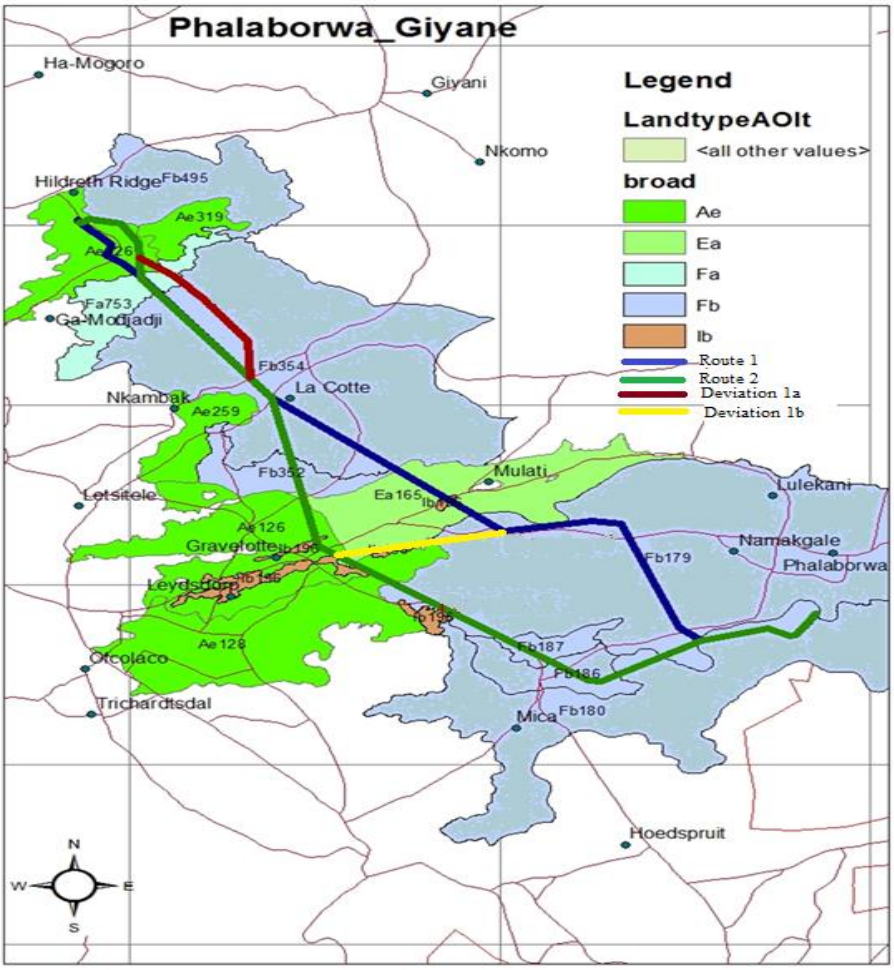

Fig. 5. Landtypes under the proposed routes with deviations.

The characteristics of the landtypes within the routes are presented in table 2 below:

Table. 2. Landtype characteristics under the proposed powerline routes.

ROUTE	MAP UNIT	LANDTYPE	SOIL CHARACTERISTICS	IMPACT ON AGRICULTURE		
				Low	Moderate	High
Route 1	Ae	Ae326	Red-yellow apedal, freely drained soils; Red, high base status > 300 mm deep.		X	X
	Ea	Ea165	One or more of: vertic, melanic, red structured diagnostic horizons; undifferentiated. High clay content, cracking, soils.		X	
	Fa	Fa753	Dominated by Glenrosa and/or Mispah forms (other soils may occur); lime rare or absent in the entire landscape. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb180	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb186	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb354	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Ib	Ib196	Miscellaneous land classes; Rock areas with miscellaneous soils	X		
Route 2	Ae	Ae326	Red-yellow apedal, freely drained soils; Red, high base status > 300 mm deep.		X	X
	Ea	Ea165	One or more of: vertic, melanic, red structured diagnostic horizons; undifferentiated. High clay content, cracking, soils.		X	
	Fa	Fa753	Glenrosa and/or Mispah forms (other soils may occur); lime rare or absent in the entire landscape. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb180	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky soils or soils with shallow depth limited by hard rock.	X		
	Fb	Fb186	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb187	Dominated by Glenrosa and/or Mispah forms	X		

			(other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock.			
	Fb	Fb352	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock	X		
	Fb	Fb354	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in upland soils but generally present in low-lying soils. The soil forms are rocky or soils with shallow depth limited by hard rock	X		
	Ib	Ib196	Miscellaneous land classes; Rock areas with miscellaneous soils	X		
Deviations 1a and 1b	Ae	Ae326	Red-yellow apedal, freely drained soils; Red, high base status > 300 mm deep.		X	X
	Fa	Fa753	Glenrosa and/or Mispah forms (other soils may occur); lime rare or absent in the entire landscape. The soil forms are rocky or soils with shallow depth limited by hard rock.	X		
	Fb	Fb354	Dominated by Glenrosa and/or Mispah forms (other soils may occur); Lime rare or absent in up The soil forms are rocky or soils with shallow depth limited by hard rock land soils but generally present in low-lying soils.	X		

A large proportion of the area, approximately 80% or more is characterised by Mispah and shallow Glenrosa or Miscellaneous soils. These are marginal soils with minimal potential for arable crop production (Soil classification working group, 1991).

Route 1 and route 2 are characterised by the same landtypes. In terms of agricultural potential, both routes are the same. These routes are covered by a mixture of weathered bedrock and tongues of topsoil that grade into more competent bedrock. Route 2 has good agricultural soils towards Gravelotte hence not recommended for the construction. Route 2 covers over 17km more than route 1, of freely drained soils with high base status. In terms of agricultural potential, the soils under route 2 are highly favoured than the other routes. Route 2 therefore, is considered the least preferred for the construction of the powerline. The distance covered by routes 1 and 2 across the different landtypes at the project site is presented in table 3.

Table 3. Distance covered by the routes 1 and 2 across Landtypes at the project site.

	Distance Covered (Approx. Km)	Characteristics
Route 1	90.8	Glenrosa / Mispah forms
	10.5	Soils with structured diagnostic horizon
	10.4	Freely drained soils
Route 2	90.5	Glenrosa / Mispah forms
	3.1	Soils with structured diagnostic horizon
	26.4	Freely drained soils

Regarding the location of the **MTS** , the Spencer substation is located on landtype Ae326 which is better soil for crop production agriculture relative the Foskor substation which occurs on landtype Fb180. This landtype is characterised by Mispah and Glenrosa soil forms.

Summary of landtype impact

The proposed route will cross several landtypes with the following map units, namely: Ae; Ea; Eb; Fa; Fb and Ib. The dominant one is Fb followed by Ea and then Ae. Fb and Ea are largely Glenrosa and Mispah soil forms characterised by rocky layers or shallow depth limited by hard rock. Their potential for agricultural development is minimal and hence, construction of the powerline on these soils will have a minimal impact. In relative terms, route 2 traverse better agricultural soils and hence, not the preferred route for the construction of the power line. Regarding the MTS , Foskor occurs on the Glenrosa and Mispah soil which are of low agricultural potential. The landtype Ae326 which occurs around the Spencer MTS has relatively favourable soils for agriculture.

4.2.2 Land capability

Land capability refers to the capability of producing common cultivated crops and pasture plants without deteriorating over a long period of time. The land capability under the different powerline routes is presented in figure 6 below:

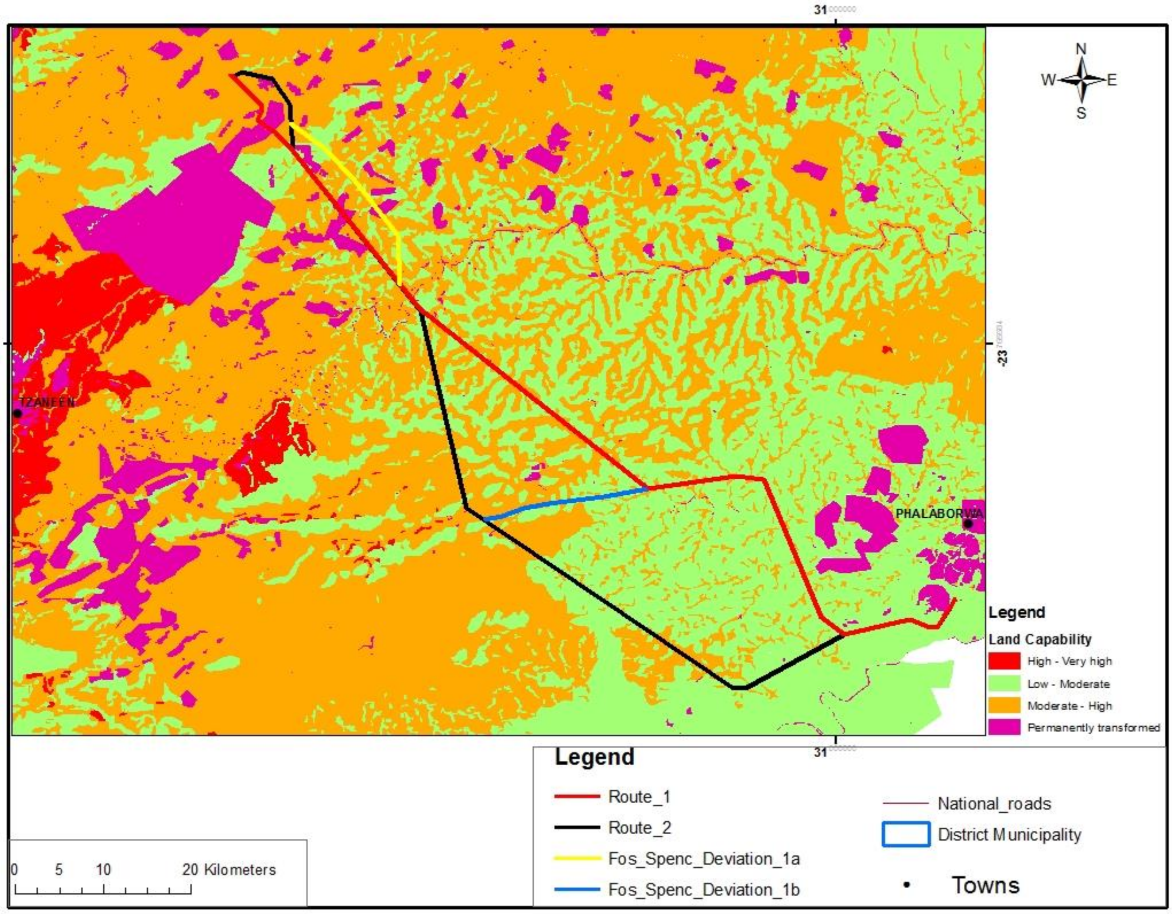

Fig. 6. Land capability traversed by the proposed alternative powerline routes.

The assessment of site capability for agricultural through local soil and climatic conditions revealed that the proposed area of development falls predominantly within the low to moderate capability class with localised pockets of permanently transformed lands. By comparison, route 2 traverses slightly more moderate to high lands relative to route 1. At the point of interception of the two routes, the land capability is predominantly moderate. The Foskor substation occurs largely on low to moderate lands whereas at the Spencer substation, land capability could be described as moderate to high.

Summary of land capability

The proposed powerline route 1 and route 2 traverse fairly similar land capability class which is the low to moderate class. In terms of land capability, these two routes can be considered for the construction of the powerlines. There is however localised pockets of permanently transformed in the path of the two routes and deviations. Considering the extent of impact on agriculture following the construction, the proposed routes of the powerline appear similar. Approximately 29 km distance of the two routes towards Spencer substation however, will traverse moderate land capability and hence, have an impact on agriculture. Moderate to high land capability however occurs at Spencer MTS

4.2.3 Geology

The geology is of the study area is fairly similar under the two proposed powerline routes (Figure 7.) The dominant geology is described as Gneiss and Granite. Other important geological formation are Quartzite, Diorite and Granodiorite.

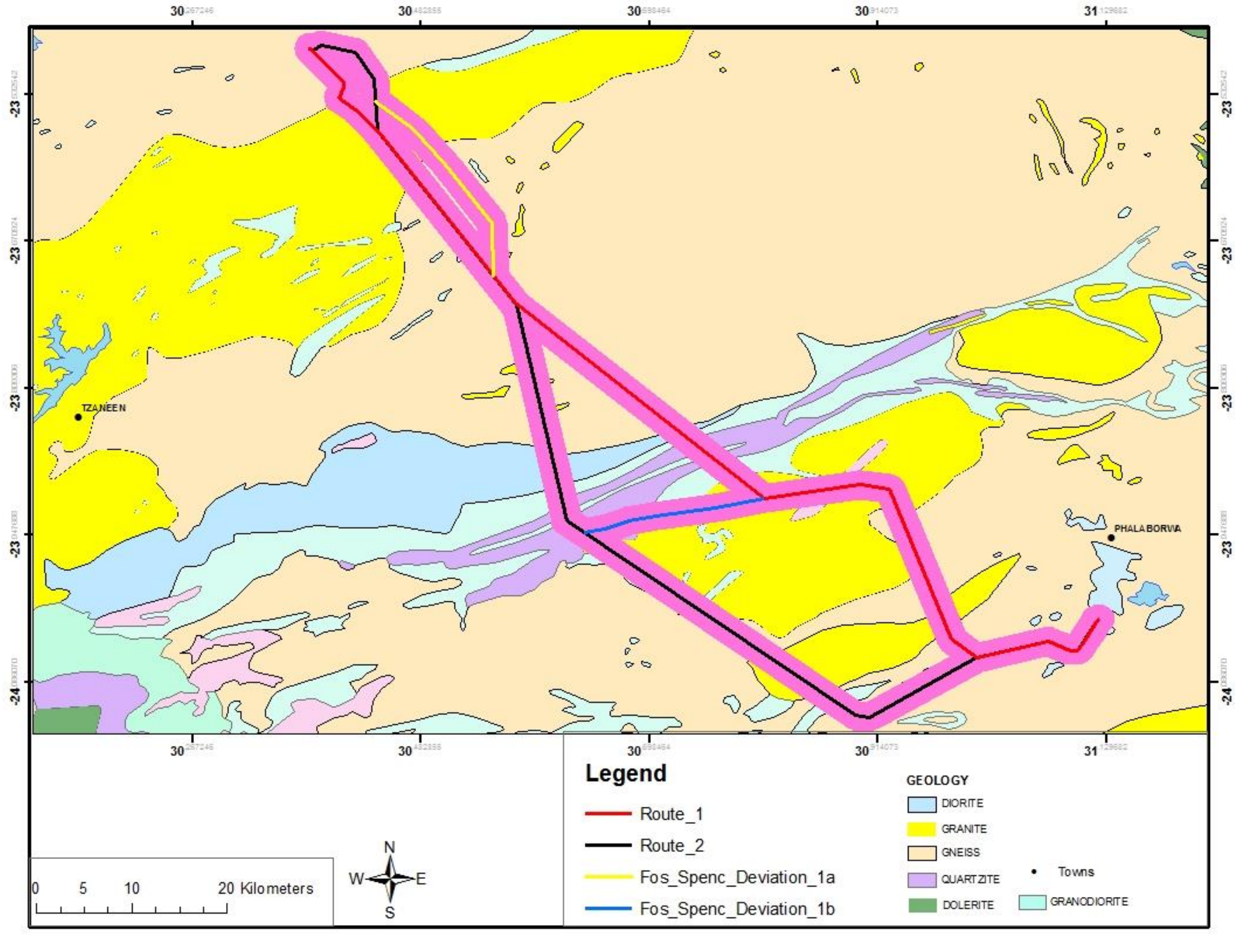

Fig. 7. Geology under the two proposed powerline routes.

Summary of geology impact
The two proposed powerline routes with deviations experience relatively similar geology to a large extent with Gneiss and Granite dominating.

4.3 Precipitation

The project site is situated in a summer rainfall region. In the Limpopo Province, the most important determinant of agricultural productivity is the availability of water during crop growth. Long-term precipitation records indicate that the proposed site for the powerline routes could receive a mean annual precipitation (rainfall and fog) range of 400 to 1000 mm. Over 90% of the site accommodating the two proposed routes experiences between 400 to 600 mm. The project site is thus, located in a generally dry to medium rainfall environment. A large proportion of the annual precipitation is expected to fall from October to March.

Summary of precipitation impact

The two powerline routes with deviations will be affected by annual precipitation to the same extent. The precipitation received at the study area is relatively low to medium and supplementary water supply through irrigation could enhance crop productivity.

4.6 Vegetation

The proposed powerline routes traverse an area characterised by a mixture of natural and disturbed vegetation with the disturbance resulting primarily from farming and settlement (Fig. 10).

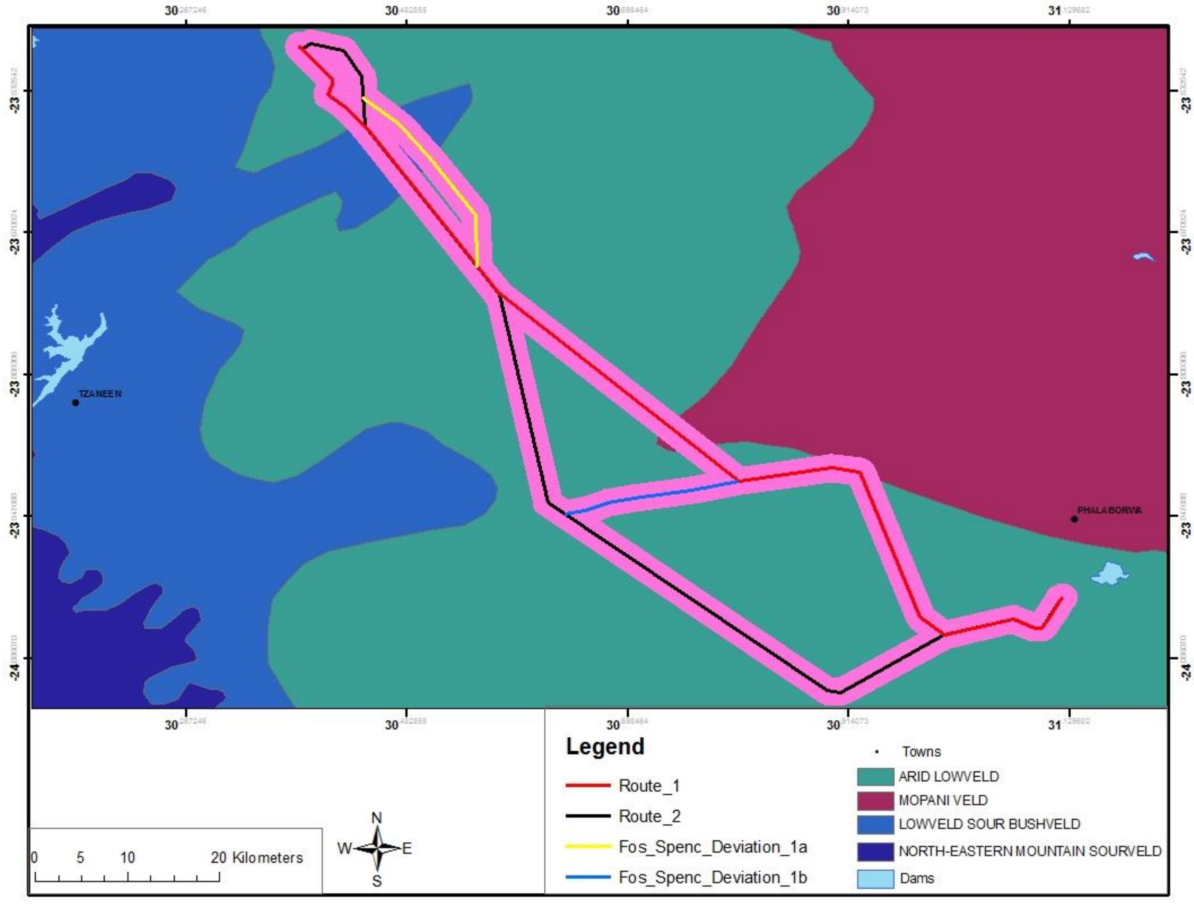

Fig. 8. Vegetation classes at the project site.

The two powerline routes largely traverse similar vegetation types. The natural vegetation under the routes is predominantly *Arid Lowveld* followed by a relatively smaller portion of *Lowveld Sour Bushveld* a very insignificant portion of *Mopani Veld* which is traversed by route 1 only. Most of the savannah vegetation types are used for grazing, mainly by cattle, goats or game.

4.7 Water Resources

The study area is drained largely by means of surface run-off (sheetwash), and a limited number of streams and rivers, most of which are non-perennial in nature (fig. 1.). The drainage systems do not differ for the two proposed routes. The presence of water bodies across the routes indicates the possibility of the development of irrigation system for agriculture.

Summary of water resource impact

The water resources in the study area do not differ among the two routes and deviations and there is a potential for the development of irrigations systems for each of the routes. This renders the routes high agriculture potential area according to the classification of potential agricultural land.

5.0 INFRASTRUCTURE

The proposed project site traverses natural vegetation, villages and smallholder and commercial farmlands. There are accessible roads to the villages and the commercial farm lands but large proportions of the natural areas do not have accessible roads. The commercial farms have their basic farm infrastructure which may be impacted from the construction of the powerline. Both routes 1 and 2 traverse commercial farming areas and may exert similar impacts. In the residential areas, all the routes with deviations are likely to have similar impacts.

6.0 AGRO-ENTERPRISE

Agricultural activities at the project site could be classified into crop cultivation and livestock production. The production of crops will include vegetable, field crops, pasture crops, fruit crop and ornamental crop production. The potential for successful agricultural productivity of any given area is a function of several natural or biological factors of the target area, socio-economic conditions as well as prevailing legislations impacting on agriculture in the country.

The main natural factors are: climate; terrain form, and soil type. Biological factors encompass prevailing diseases, pests and selection of plant and animal species to be cultured and their ability to adapt and withstand the growing and developmental conditions prevailing at the particular site. Socio-economic considerations will include factors such as level of education, managerial skills and technical experience of the prospective farmer or group of farmers as well as market availability. The interactive effects of these factors determine the potential of an area for agricultural activity.

In South Africa, water availability, temperature and soil characteristics are major determinants of agricultural productivity. The proposed routes run over several rocky and shallow soils which are limited by bed rock. Large portions of the routes also covers areas with rainfall around 500-600 mm; this is marginal for crop production unless supplementary irrigation is provided.

Summary: Agro-enterprise

The proposed project routes traverse an area that is generally not conducive for rainfed arable farming but has existing irrigated farming systems and also areas with the potential for irrigated farming.

4.0 SUMMARY OF IMPACT ON LANDSCAPE

The impact criterial is based on the extent to which soil potential could be compromised as result of the proposed powerline construction.

Table 4. Summary of impact of the proposed project on the landscape.

Activity	Nature of impact	Extent of impact	Duration of impact	Severity of impact	Probability of impact	Significance without mitigation	Significance with mitigation	Level of confidence
Construction phase								
Route 1	Negative to the disturbance of the natural landscape	Low	Permanent	Low	High	Low	Low	90%
Route 2		Low		Low	High	Low	Low	90%
Deviations 1 & 2		Low-medium		Low-medium	High	Low-to medium	Low	90%
Operational phase								
Route 1	Negative to the presence of foreign material in the natural landscape	Low	Permanent	Low	High	Low	Low	90%
Route 2		Low		Low	High	Low	Low	90%
Deviations 1 & 2		Low		Low-medium	High	Low-to medium	Low	90%

An important aspect of soils that strongly impacts crop productivity is the potential and extent of soil degradation resulting from human interference. The severity of degradation is strongly influenced by soil physical and chemical properties, slope as well as land cover. Another important component of soil that influences is soil depth as this determines how much water can be stored following rainfall or irrigation.

5.0 CONCLUSIONS

By definition of parameters of land as stipulated by the Subdivision of Agricultural Land Act, No. 70 of 1970 and the Amended Regulation of Conservation of Agricultural Resources Act No. 43 of 1983 and Part 1 of the Regulation of Conservation of Agricultural Resources Act 43 of 1983), the land occurring under the two powerline routes at the project sites:

- Consists predominantly of Mispah and Glenrosa soils which are of low potential for agriculture.
- The two powerline routes and deviations traverse approximately similar landtypes, land capability, geology and vegetation within the study area.
- On relative terms route 1 traverses less favourable landtype but has the disadvantage of traversing relatively more commercial areas. The challenge can be resolved by starting with Route 1, proceeding via deviation 1b which traverses only the peripheries of a conservation area, and then merges with Route 2 for onward transmission to the Spencer Substation.
- Regarding the location of the MTS. the Spencer substation is located on landtype Ae326 which is better soil for crop production agriculture relative to the Foskor substation which occurs on landtype Fb180. This landtype is characterised by Mispah and Glenrosa soil forms.
- The water resources in the study area do not differ among the two routes and there is a potential for the development of irrigations systems for each of the routes. This renders the routes high agriculture potential area according to the classification of potential agricultural land. However, the routes traverses low to moderated land capability with majority being low and this could impact agricultural productivity of the area.

6.0 RECOMMENDATION

The two powerline routes with deviations traverse similar land types and other geographical features. All things being equal and based on the findings and information gathered from the study area, the recommended for the construction of the powerline is Route 1, via Deviation 1b to merge with Route 2 and then proceed north to the Spencer Substation.

7.0 REFERENCES

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