SOIL, LAND USE, AND LAND CAPABILITY ASSESSMENT: FOR THE PROPOSED DEVELOPMENT OF KHANYAZWEFLEXPOWER (PTY) LTD (KFP) AND ASSOCIATEDN INFRASTRUCTURE IN MALELANE WITHIN THE JURISDICTION OF NKOMAZI LOCAL MUNICIPALITY, MPUMALANGA PROVINCE.

REF: AGR_KFP_24

DATE OF FINAL DRAFT:

27 JUNE 2024

PREPARED FOR

KHANYAZWE FLEXPOWER

PREPARED BY

NSOVO ENVIRONMENTAL CONSULTING
"From the world we live to the world we seek"
40 Lyncon Road,
Carlswald Midrand,
1684
Tel: 087 803 2369
Email: admin@nsovo.co.za

DOCUMENT CONTROL

Report Name	Soil, Land Use, and Land Capability Assessment: For the Proposed Development of Khanyazwe Flexpower (Pty) Ltd (KFP) and Associated Infrastructure in Malelane Within the Jurisdiction Of Nkomazi Local Municipality, Mpumalanga Province.
Reference	AGR_KFP_24
Version	Final Draft
Submitted to	Khanyazwe Flexpower (Pty) Ltd
Author	Tshiamo Setsipane, (Pr. Nat. Sci 114882)
Date Produced	27 June 2024

EXECUTIVE SUMMARY

Nsovo Environmental Consulting was appointed by Khanyazwe Flexpower (KFP) to a conduct the soil, land use, and land capability verification assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Flexpower power Plant and associated infrastructures (Hereafter collectively referred to as 'Study Area' unless referring to each individual infrastructure). The proposed project is located in a farming town, on Portions 1, 4, and 116 of Farm Malelane 389 FP, in Malelane within the Nkomazi Local Municipality, Mpumalanga Province.

The project involves developing, constructing, and operating a (maximum) 800MW natural gas-fired power plant using either Gas Engines (or Internal Combustion Engines (ICE) or Combined Cycle Gas Turbines (CCGT). KFP will source gas from the Republic of Mozambique Pipeline Investments Company (ROMPCO), which has an existing gas pipeline that connects Mozambique's Pande Temane gas fields to Sasol's operations in South Africa, as well as several industrial and retail customers. Alternative sources of gas if gas from the existing Pande Temane fields is not sufficient may include imported LNG projects being developed in Matola, which will be able to provide additional gas into the ROMPCO pipeline. KFP is also proposing the development of approximately two 500m 275 and/or 132 kV overhead powerlines from the proposed power plant to the existing Eskom Khanyazwe substation. The power plant will provide a mid-merit power profile to the national grid.

The entire study area is characterised by a hot semi-arid climate associated with hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. This type of climate is most commonly found around the fringes of subtropical deserts. The majority of the study area is characterised by mean annual precipitation between 401 – 600 mm, and this precipitation range is deemed moderately adequate to support rainfed agriculture; thus, supplementary irrigation may be required to cultivate successfully on these soils. The remaining portion of the study area is characterised by a mean annual precipitation between 601 – 800 mm; this rainfall range for the application area is deemed adequate for most cultivated crops with moderately high yield potential. These conditions have a moderate to high yield potential for a wide range of adapted crops supporting rain-fed agriculture. This results in a wide range of suitable crops for cultivation.

Based on the observations during the site assessment, the dominant soils occurring within the study area are of the Glenrosa formation. The majority of the soils occurring within the study area do not meet the conditions for agricultural suitability to a certain extent, and these conditions include:

1. Adequate depth (greater than 60 cm) to accommodate root development for the majority of cultivated crops;
2. Good structure, as in water-stable aggregates, which allows for root penetration and water retention;
3. Sufficient distribution of high-quality and potential soils within the study area to constitute a viable economic management unit and
4. Good climatic conditions, such as sufficient rainfall and sunlight, increase crop variety.

Tables A and B below depict the summary findings of the soils identified within the study area and their respective land capability and agricultural potential status.

Table A: Summary findings within the study area.

Khanyazwe Flexpower Study Area				
Soil Forms	**Area (Ha)**	**Percentage (%)**	**Land Capability Class – According to (Smith, 2006)**	**Agricultural Potential**
Mispah/Glenrosa	75.43	96.7	Grazing (Class VI)	Moderate
Dam/Artificial Ponding	0.5	0.6	Wet-Based (Class V)	Very Low
Witbank	2.04	2.6	Wilderness (Class VIII)	Very Low
Total Enclosed	**77.98**	**100**		

Table B: Land capability (DAFF, 2017) associated with the soils occurring within the study area.

Soil Form	Land Capability Groups	DAFF (2017) Classification
Glenrosa	Grazing Land	6. Low - Moderate
Dam/Artificial Ponding	Watercourse	4. Very Low to Low
Witbank	Infrastructure	1. Very Low

The study area present areas of active cultivation with sugarcane, under irrigation. Thus, the proposed development is likely to impact on the sugarcane production. The cumulative loss from a soil and land capability point of view is anticipated to be of moderately high significance. The reason being that a significant portion soils under cultivation will be subject to different forms of soil degradation due to the different operations to take place during the construction of the proposed development. These proposed activities may likely have a negative impact on sugarcane production on a local and regional scale. Surface soil stripping and landscape fragmentation are anticipated to impact on agricultural productivity through loss of farmland, thus resulting in land use intensification and possibly loss of income.

Irrigated agriculture utilises large portions of South Africa's water resources, however it is responsible for the production of high value crops. Thus, the Preservation and Development of Agricultural Land Framework Bill published on 18 September 2020, although not approved yet, stipulates that land under irrigation is automatically regarded as high potential, even though the soils within the study area can generally be classified as low potential soils due to their inherent physical properties (i.e., stoniness, insufficient depth) which are generally not ideal for cultivation. This is due to the high production capability and the possibility of exponentially increasing crop yields, and this is of high importance for food security at a local and regional scale. In most cases these irrigated areas indicate high capital investments made onto the farm. As such these areas are typically fall under protected agricultural areas (PAA).

A prefeasibility assessment was conducted to assess various site options with regards to the proposed development and the study area was deemed the most preferred with respect to logistical aspects such as the ROMPCO proximity, transmission length, water accessibility, gradient, general site accessibility and proximity to the Khanyazwe Eskom substation. Therefore, in terms of the mitigation hierarchy total avoidance was not a viable option. Should the proposed development proceed, the loss of agricultural soils and the permanent change in land use will be localised within the study area. However, approximately 20 hectares will be lost out of a 600 hectares farm and this loss is not anticipated to impact on the agricultural viability of the farm in the long term. It is the opinion of the specialist that the unmitigated scenario poses a threat to the sustainability of sugarcane production since it is the dominant land use within the study area and surrounding areas. Henceforth, integrated mitigation measures must be implemented accordingly to minimise the potential loss of these valuable agricultural areas, considering the need for sustainable development and increased electricity generation and transmission capacity.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The field verification results were largely in support of the screening tool due to the favourable conditions for commercialised sugarcane agriculture.

In terms of a change in employment figures, the proposed development is anticipated to increase the number of employed personnel from the current land use (sugarcane farming), albeit for a short period of time (1 to 2 years) during the construction phase and long-term during the operation of the power plant. In addition, skills development, especially in the construction of power-producing plants, will contribute significantly to the viability of other potential projects of a similar type in the Mpumalanga Province. Thus, should the mitigation measures outlined in the report in conjunction with other specialist studies the proposed development can be considered for authorisation.

DECLARATION OF INDEPENDENCE

- I, Tshiamo Setsipane, in my capacity as a specialist consultant, hereby declare that I:
- Act/acted as an independent specialist to Khanyazwe Flexpower (Pty) Ltd for this project.
- Do not have any personal, business, or financial interest in the project except for financial remuneration for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014, as amended.
- Will not be affected by the outcome of the environmental process, of which this report forms part.
- Do not have any influence over the decisions made by the governing authorities.
- Do not object to or endorse the proposed developments but aim to present facts and my best scientific and professional opinion about the impacts of the development.
- Undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2014, as amended.

(*Pr. Nat. Sci* 114882)

DOCUMENT GUIDE

This report was compiled according to the following information guidelines for a specialist report in terms of the Environmental Impact Assessment (EIA) Sections 24(5)(a) And (h) and 44 of The National Environmental Management (NEMA), Act 1998, as summarised on the Table below.

Table A: Document guide according to Regulation (No. R. 982) as amended.
Theme-Specific Requirements as per Government Notice No. 320Agricultural Resources Theme – Very High and High Sensitivity Rating as per Screening Tool Output

No.	NEMA Regs (2014) - Appendix 6	The relevant section in the report
2	**Agricultural Agro-Ecosystem Specialist Assessment**	
2.1	The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professionals (SACNASP).	CV Attached
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1.1
2.3	**The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:**	
2.3.1	the extent of the impact of the proposed development on the agricultural resources and	Section 4
2.3.2	whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event it does, whether the positive impact of the proposed development on agricultural resources outweighs such a negative impact.	Section 5.4
2.4	**The status quo of the site must be described, including the following aspects, which must be considered as a minimum in the baseline description of the agro-ecosystem:**	
2.4.1	the soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit, and slope;	Section 4
2.4.2	where applicable, the vegetation composition, available water sources, as agro-climatic information;	
2.4.3	the current productivity of the land-based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units;	Section 5.5
2.4.4	the current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure and	Section 1.6
2.4.5	existing impacts on the site, located on a map (e.g., erosion, alien vegetation, non-agricultural infrastructure, waste, etc.).	Section 4.1

2.5	**Assessment of impacts, including the following aspects which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem:**	
2.5.1	change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units;	Section 5.5
2.5.2	change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure and	Section 1.6
2.5.3	any alternative development footprints within the preferred site would be of "medium" or "low" sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification.	Section 5.4
2.6	**The Agricultural Agro-Ecosystem Specialist Assessment findings must be written up in an Agricultural Agro-Ecosystem Specialist Report.**	
2.7	**This report must contain the findings of the agro-ecosystem specialist assessment and the following information, as a minimum:**	
2.7.1	Details and relevant experience, as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment, including a curriculum vitae;	Appendix C
2.7.2	A signed statement of independence by the specialist;	Appendix A
2.7.3	The duration, date, and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2.2
2.7.4	A description of the methodology used to undertake the on-site assessment, inclusive of the equipment and models used, as relevant;	Section 2
2.7.5	A map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Figure 2
2.7.6	An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development;	Sections 5.4 and 5.5
2.7.7	An indication of possible long-term benefits that the project will generate will generate in relation to the benefits of the agricultural activities on the affected land;	Section 5.4
2.7.8	Additional environmental impacts expected from the proposed development based on the current status quo of the land, including erosion, alien vegetation, waste, etc.;	Section 4.1
2.7.9	Information on the current agricultural activities being undertaken on adjacent land parcels;	Section 3.2
2.7.10	An identification of any areas to be avoided, including any buffers;	N/A
2.7.11	A motivation must be provided if there were development footprints identified as per paragraph 2.5.3 above that were identified as having a	Section 5

	"medium" or "low" agriculture sensitivity and that were not considered appropriate;	
2.7.12	Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;	Section 5
2.7 .13	A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development;	Section 5.4
2.7.14	Any conditions to which this statement is subjected;	Section 5.3
2.7.15	Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and	Section 5
2.7.16	A description of the assumptions and any uncertainties or gaps in knowledge or data.	Section 1.6
2.8	**The Agricultural Agro-Ecosystem Specialist Assessment findings must be incorporated into the Basic Assessment Report or Environmental Impact Assessment Report, including the mitigation and monitoring measures identified, which are to be contained in the EMPr.**	
2.9	**A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.**	

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1. INTRODUCTION

Nsovo Environmental Consulting was appointed by Khanyazwe Flexpower (KFP) to a conduct the soil, land use, and land capability verification assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Flexpower power Plant and associated infrastructures (Hereafter collectively referred to as 'Study Area' unless referring to each individual infrastructure). The proposed project is located in a farming town, on Portions 1, 4, and 116 of Farm Malelane 389 FP, in Malelane within the Nkomazi Local Municipality, Mpumalanga Province. The locality of the study area illustrated in Figure 1 below.

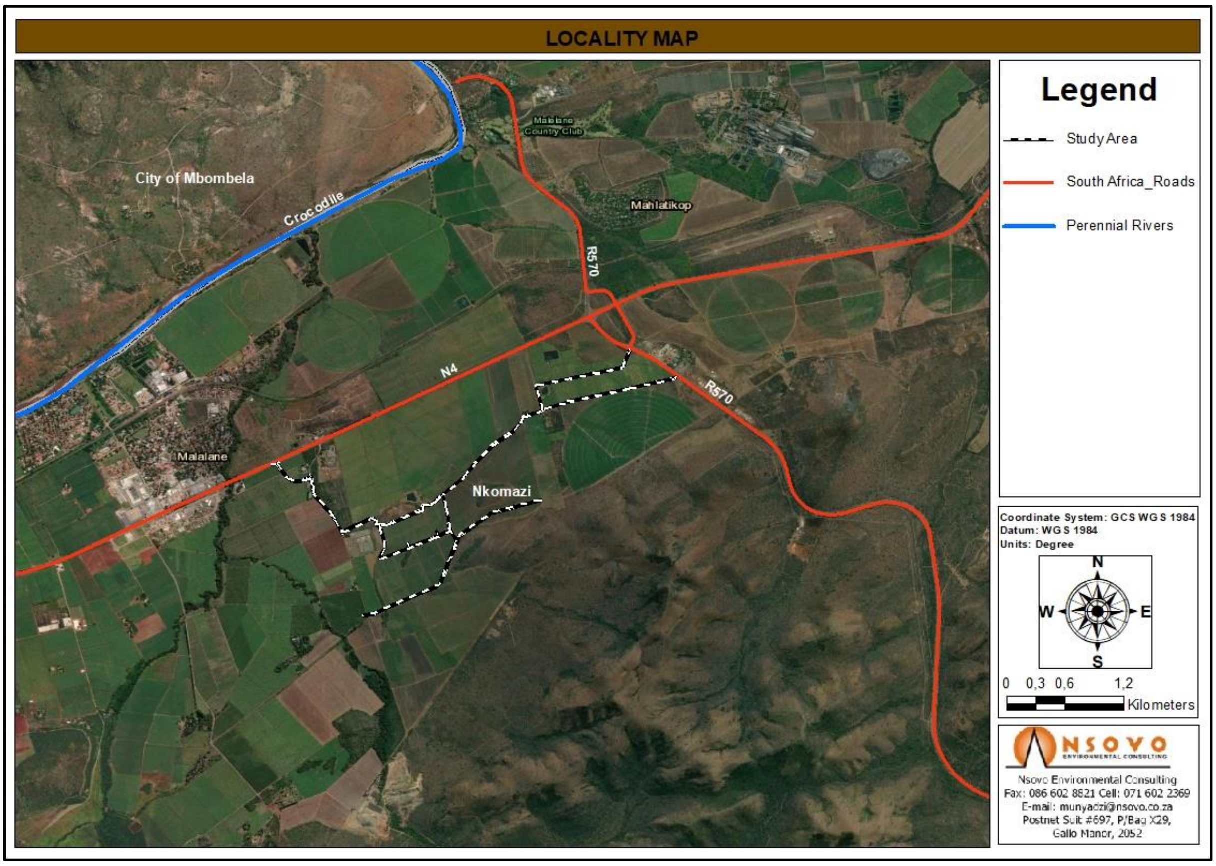

Figure 1: Locality of the study area in relation to the surrounding areas.

1.1 PROJECT DESCRIPTION

The project involves developing, constructing, and operating a (maximum) 1000MW natural gas-fired power plant using either Gas Engines (or Internal Combustion Engines (ICE) or Combined Cycle Gas Turbines (CCGT).

The proposed project will take a phased development approach, with Phase 1, 440MW, to be built by 2028 and Phase 2, 560MW, to be completed by 2030. KFP will source gas from the Republic of Mozambique Pipeline Investments Company (ROMPCO), which has an existing gas pipeline that connects Mozambique's Pande Temane gas fields to Sasol's operations in South Africa, as well as several industrial and retail customers.

Alternative sources of gas if gas from the existing Pande Temane fields is not sufficient may include imported LNG projects being developed in Matola, which will be able to provide additional gas into the ROMPCO pipeline. KFP is also proposing the development of approximately two 500m 275 and/or 132 kV overhead powerlines from the proposed power plant to the existing Eskom Khanyazwe substation. The power plant will provide a mid-merit power profile to the national grid.

The proposed development will include the construction and assembly of the following associated infrastructures:

- Gas turbines for the generation of electricity using natural gas.
- Heat recovery steam generators (HRSG) to capture heat from high-temperature exhaust gases to produce high-temperature and high-pressure dry steam to be utilised in the steam turbines.
- Steam turbines for the generation of additional electricity using dry steam generated by the HRSG.
- Bypass stacks associated with each gas turbine.
- Medium Speed Gas Engines for the generation of electricity using natural gas.
- Waste storage facilities (general and oily water).
- Clustered exhaust stacks for the discharge of combustion gases into the atmosphere.
- Dirty water retention dams and clean water dams.
- Firewater tanks.
- Storm water channels.
- Waste storage facilities (general and hazardous).
- Exhaust stacks for the discharge of combustion gases into the atmosphere.
- A water treatment plant for the treatment of raw water into potable water and the production of demineralised water (for steam generation).

The proposed development triggers the NEMA EIA listed activities; as such, KFP must undertake the Environmental Impact Assessment (EIA) process to obtain an environmental authorisation before construction of the above-mentioned activities in accordance with the EIA Regulations, 2014 (promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended.

Figure 2: KFP proposed layout

1.2 Aims and Objectives of the Study

The objective of the Soil, Land Use, and Land Capability is to fulfill and align the proposed project with the requirements of the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) of South Africa. This act aims to promote the conservation of soil, water sources, vegetation and the control of weeds and invader plants by managing natural agricultural resources. Thus, the proposed study aims to determine the possible impacts of the proposed development on the soil, land use, land capability, and agricultural potential and identify areas of high sensitivity within the study area. This will be achieved by considering parameters such as soil quality, drainage, topography, climate, and water availability and providing sound input to ensure that land is used sustainably and responsibly. As such, this specialist report has assessed and considered the following:

- The soil forms occurring within the study area;
- The associated land capability and agricultural sensitivity of the soils occurring within the study area;
- Discussion of the land capability and sensitivity in terms of the soils, water availability, surrounding development, and current status of land;
- Discussion of potential and actual impacts as a result of the proposed development; and
- Provide mitigation for the impacts as part of the Environmental Management Programme (EMPr).

1.3 SUITABILITY OF SOILS FOR AGRICULTURAL CULTIVATION

Assessing soil suitability for agricultural cultivation rests primarily on identifying soils suited to crop production. For soils to be classified as being suitable for crop cultivation, they must have the following properties:

- Adequate depth (greater than 60 cm) to accommodate root development of cultivated crops;
- Good structure, as in water-stable aggregates, which allows for root penetration and water retention;
- Sufficient clay and organic matter to provide nutrients for growing crops;
- Sufficient distribution of high-quality and potential soils within the study area to constitute a viable economic management unit;
- Adequate clay content and deep enough water table to allow for water storage; and
- Good climatic conditions, such as sufficient rainfall and sunlight, increase crop choice variety.

1.4 APPLICABLE LEGISLATION

The most recent South African Environmental Legislation that needs to be considered for any new or expanding development with reference to assessment and management of soil and land use includes:

- The National Environmental Management Act. 1998 (Act 107 of 1998) requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided, be minimised and remedied.
- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal.
- The Conservation of Agriculture Resources (Act 43 of 1983) requires the protection of land against soil erosion and the prevention of water logging and salinization of soils employing suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges, and watercourses is also addressed.

1.5 TERMS OF REFERENCE

The terms of reference applicable to the Soils, Land Capability, and Land Use Study include the following:

- A review of available desktop information about the study area site and compile various maps illustrating the desktop data;
- Discussion of the relevant desktop literature;
- Conduct a soil classification survey covering the study area according to the South African Soil Classification System: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);

- Determination of the current (baseline) soil physical, climatic conditions, and land uses, as well as the current land capabilities and agricultural sensitivity associated with the identified soil forms present in the study area;
- Identification and assessment of the potential impacts of the different project phases on the baseline soil, land use, and land capability properties as a result of the proposed development;
- Development of mitigation and management measures to minimize the negative impacts anticipated from the proposed development and
- Compile soil, land use, and land capability verification report based on the field-finding data under current on-site conditions.

1.6 ASSUMPTIONS, ASSUMPTIONS UNCERTAINTIES, LIMITATIONS, AND GAPS

The following assumptions, uncertainties, limitations, and gaps were applicable for the soil, land use, and land capability assessment:

- It is assumed that the infrastructure components will remain as indicated on the layout and that the activities for the construction and operation of the infrastructure are limited to that typical for a project of this nature;
- The soil survey was confined to the study area outline with consideration of various land uses outside the study area;
- During the site assessment and compilation of the report, employment figures pertaining to the study area could not be sourced,
- Soil profiles were observed using a 1.5m hand-held soil auger; thus, a description of the soil characteristics deeper than 1.5m cannot be given; and
- It can be challenging to classify soils as one specific form due to the infinite variations that exist in the soil continuum. Therefore, the classifications presented in this report are based on the "best fit" to South Africa's soil classification system.

2. METHODOLOGY

The assessment of the study area's agricultural potential was based on a combination of desktop studies to amass general information and site visits for status quo assessment, soil classification, and characterization, and the validation of generated information from the desktop studies.

2.1 Desktop Study and Literature Review

Literature review and background study were carried out before beginning the field assessment to gather the study area's predetermined soil, land use, and land capability data. The data was sourced from the Soil and Terrain(SOTER) database and the Natural Agricultural Atlas of South Africa Version 3: (https://ndagis.nda.agric.za/portal/apps/webappviewer/index.html?id=8b72eb2a25c04660a1ab2b562f6ec0bf)

2.2 Site Survey and Sensitivity Verification

A desktop assessment was followed by a field investigation to validate the predetermined soil results obtained at the desktop level. The field survey was conducted over 2 days in January 2024, wherein soil auger tests were conducted, and soils were classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). It must be noted that the season has no bearing on the soil's morphological properties over a short-term period.

The aim of the on-site Site Sensitivity Verification was to:

- Ground truth if there are any cultivation activities and consequent agricultural sensitivity;
- Gain an understanding of the agricultural potential of the study through the identified soils on site as well infrastructure; and
- Confirm or dispute the current land use and the environmental sensitivity as indicated by the National Environmental Screening Tool.

2.3 Land Capability Classification

A land capability class is an interpretive grouping of land units with similar potential and containing limitations or hazards for long-term intensive use of land for rainfed farming determined by the interaction of climate, soil, and terrain. It is a more general term than land suitability and is more conservation oriented (See Table 1 below). It involves consideration of:

- Varying limitations to land use pertaining to rainfed cultivation and soil properties; and
- The risks of land damage from erosion and other causes.

Eight land capability classes were employed, with potential decreases, limitations, and hazards increasing from class 1 to class 8. Classes 1 to 4 are considered arable, whereas Class 5 is considered wet-based soils or watercourses, and Classes 6 to 8 are classified as grazing, forestry, or wildlife. This system is based on the Land Capability Classification system of the United States Department of Agriculture (USDA) Soil Conservation Service by Klingelbiel and Montgomery (1961) as well as by Smith (2006).

Table 1: Soil Capability Classification (after Smith (2006).

Land Capability Group	**Land Capability Class**	**Intensity of Land Use**									
		wildlife	**Forestry**	**Light grazing**	**Moderate grazing**	**Intensive grazing**	**Light cultivation**	**Moderate cultivation**	**Intensive cultivation**	**Very intensive cultivation**	**Limitations**
Arable	I										There are no or few limitations. Very high arable potential. Very low erosion hazard
	II										Slight limitations. High arable potential. Low erosion hazard
	III										Moderate limitations. Some erosion hazards
	IV										Severe limitations. Low arable potential. High erosion hazard.
Grazing	V										Water course and land with wetness limitations
	VI										Limitations preclude cultivation. Suitable for perennial vegetation
	VII										Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII										Extremely severe limitations. Not suitable for grazing or afforestation.

The updated and refined land capability ratings and database for the whole of South Africa were released by the Department of Fishery and Forestry (DAFF) in 2016. These land capability ratings were derived through a spatial evaluation modelling approach and a raster spatial data layer comprising fifteen (15) land capability evaluation values 9 (see Table 2 below). The new land capability describes the categories as 1 being the lowest and 15 being the highest. Values of below 8 are generally not suitable for the production of cultivated crops. (DAFF, 2016). Soil agricultural potential is impacted by several factors (see Table 3 below). The soil agricultural potential was evaluated based on the factors mentioned and described in Table 3 by assigning qualitative criteria ratings such as High, Moderate, or Marginal to low to the updated land capability ratings.

Table 2: National Land Capability Values (DAFF, 2016).

Land Capability evaluation value	Land Capability Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

Table 3: Soil Agricultural Potential Criteria

Criteria	Description
Rock Complex	If a soil type has prevalent rocks in the upper sections of the soil, it is a limitingfactor to the soil's agricultural potential.
Flooding Risk	The risk of flooding is determined by the closeness of the soil to water sources.
Erosion Risk	The soil erosion risk is determined by combining the wind and watererosion potentials.
Slope	The slope of the site could limit its agricultural use.
Texture	The texture of the soil can limit its use by being too sandy or too clayey.
Depth	The effective depth of soil is critical for the rooting zone for crops.
Drainage	The capability of soil to drain water is important as most grain crops do nottolerate

Criteria	Description
	submergence in water.
Mechanical Limitations	Mechanical limitations are any factors that could prevent the soil from beingtilled or ploughed.
pH	The pH of the soil is important when considering soil nutrients and fertility.
Soil Capability	This section highlights the soil type's capability to sustain agriculture.
Climate Class	The climate class highlights the prevalent climatic conditions that couldinfluence the agricultural use of a site.
Land Capability / Agricultural Potential	The land capability or agricultural potential rating for a site combines the soil capability and the climate class to arrive at the potential of the site to support agriculture.

2.4 DFFE Screening Tool

The Agricultural Agro-Ecosystem Assessment protocol provides the criteria for assessing and reporting impacts on agricultural resources for activities requiring Environmental Authorisation (EA). The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool, which, for agricultural resources, is based on the most recent land capability evaluation values provided by the Department of Forestry, Fisheries, and the Environment (DFFE). The national web-based environmental screening tool can be accessed at: https://screening.environment.gov.za/screeningtool.

The primary purpose of the Agricultural Agro-Ecosystem Assessment is to determine the site's sensitivity considering the proposed land use change (from potential agricultural land to the proposed development is sufficiently considered). The information in this report aims to enable the Competent Authority (CA) to draw a sound conclusions and recommendations on the proposed project and its potential impacts with a specific focus on food security.

To meet this objective, the protocol requires that site sensitivity verification be conducted, and subsequent outcomes must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as indicated by the National Environmental Screening Tool;
- It must contain proof (e.g., photographs) of the current land use and environmental sensitivity of the study area;
- All data and conclusions are submitted together with the main report for the proposed development;
- It must indicate whether the proposed development will have an unacceptable impact on the agricultural production capability of the site, and if it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources and

- The report is prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

Thus, the report is compiled to meet the minimum report content requirements for impacts on agricultural resources by the proposed development.

2.5 DFFE Screening Tool

The Screening tool sensitivity for the study area options are presented in Figure 3 below:

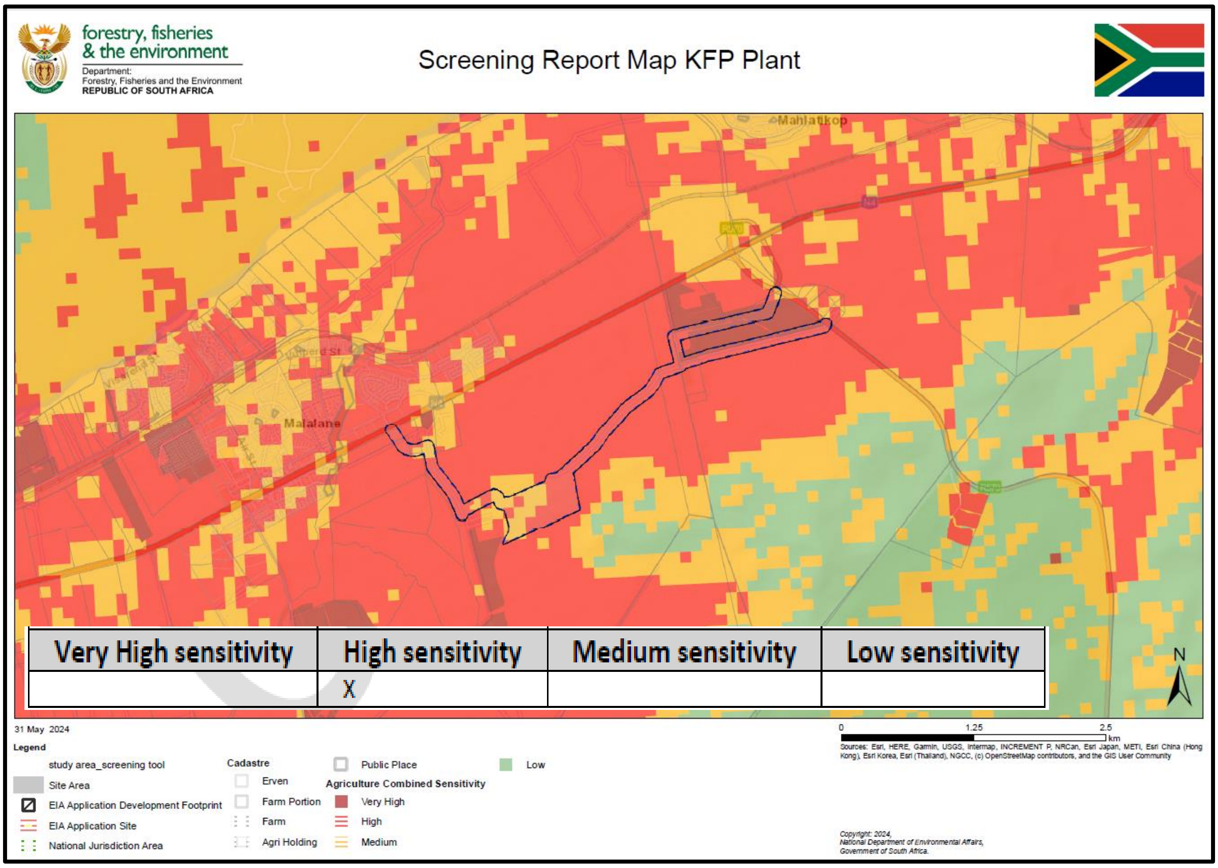

Figure 3: Screening tool sensitivity for the study area.

3. DESKTOP RESULTS AND DISCUSSIONS

As part of the desktop site assessment, background information related to the study area and literature reviews were gathered from various databases, including AGIS (Agricultural Geo-referenced Information System) and SOTER (Soil and Terrain). In addition, the Department of Agriculture, Forestry & Fisheries provided the Natural Agricultural Resources Atlas of South Africa (NAR Atlas Manual, 2018). Even though desktop results are not field verified, the data presented may contain inaccuracies. Nevertheless, the data provide valuable information regarding the soils within the study area.

3.1 Climatic Data

The entire study area is characterised by a hot semi-arid climate associated with hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. This type of climate is most commonly found around the fringes of subtropical deserts. The majority of the study area is characterised by mean annual precipitation between 401 – 600 mm, and this precipitation range is deemed moderately adequate to support rainfed agriculture; thus, supplementary irrigation may be required to cultivate successfully on these soils. The remaining portion of the study area is characterised by a mean annual precipitation between 601 – 800 mm; this rainfall range for the application area is deemed adequate for most cultivated crops with moderately high yield potential. These conditions have a moderate to high yield potential for a wide range of adapted crops supporting rain-fed agriculture. This results in a wide range of suitable crops for cultivation. Figure 3 shows the mean annual rainfall associated with the study area.

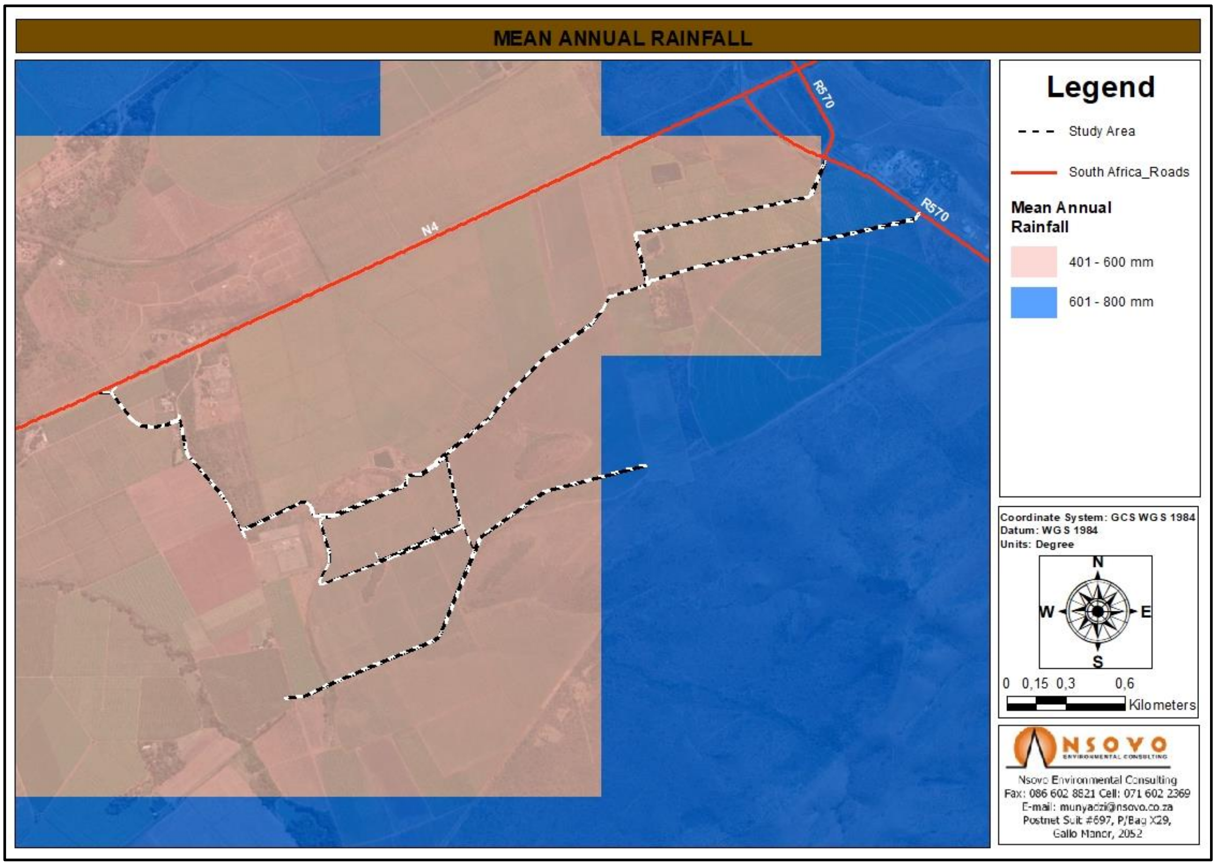

Figure 4: Mean Annual Rainfall associated with the study area.

3.2 Geology

The entire study area is underlain by predominantly mafic and ultramafic lavas and schists with banded ironstone and chert of the Tjakastad Formation (Onverwacht Group) and some mafic to felsic sediments and schists of the Moodies Group (Barberton Sequence). Figure 5, below, depicts the geology associated with the study area.

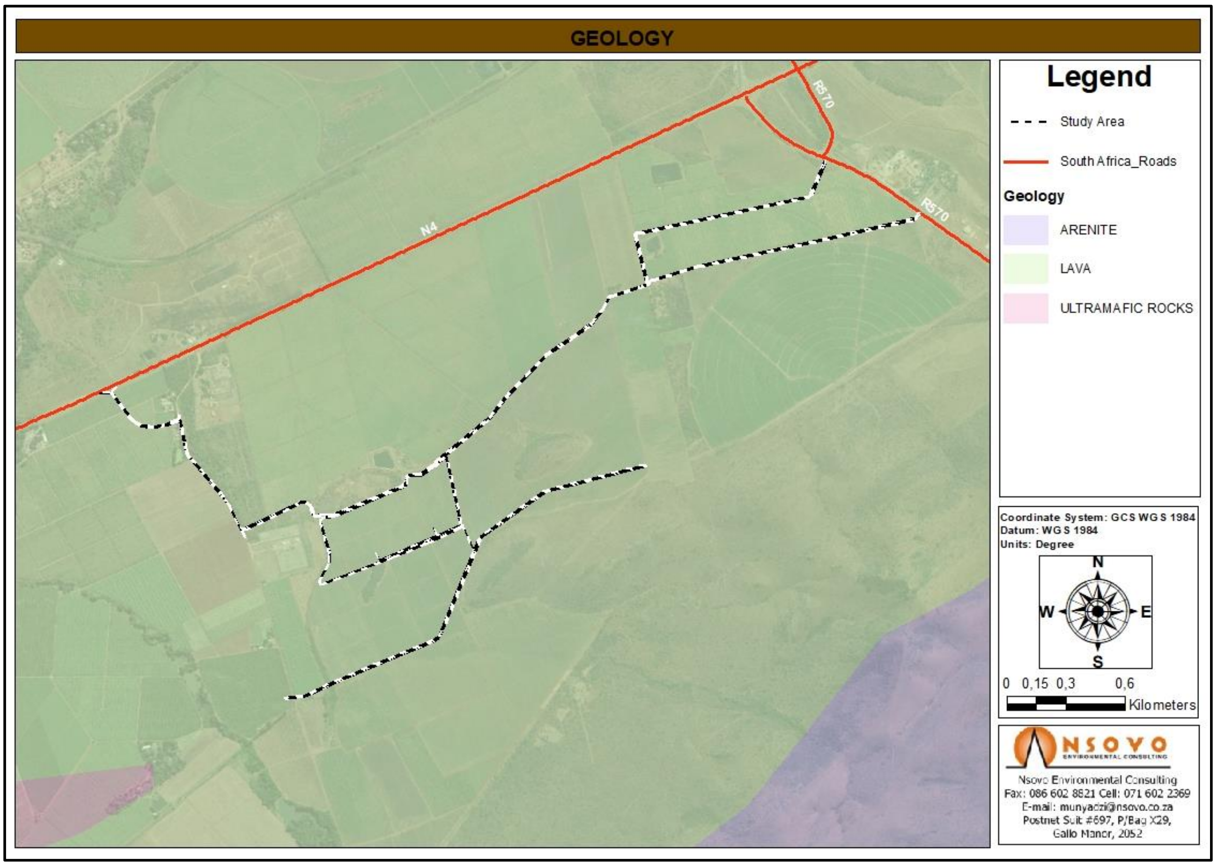

Figure 5: Geological formations associated with the study area.

3.4 Soil pH

The soil pH associated with the soils occurring within the study area is between 6.5 and 7.4, which is slightly acidic to neutral. This pH range is considered ideal for most cultivated crops, and the majority of plant nutrients can be available for uptake by plants. Figure 6 below depicts the soil pH associated with soils occurring within the study area.

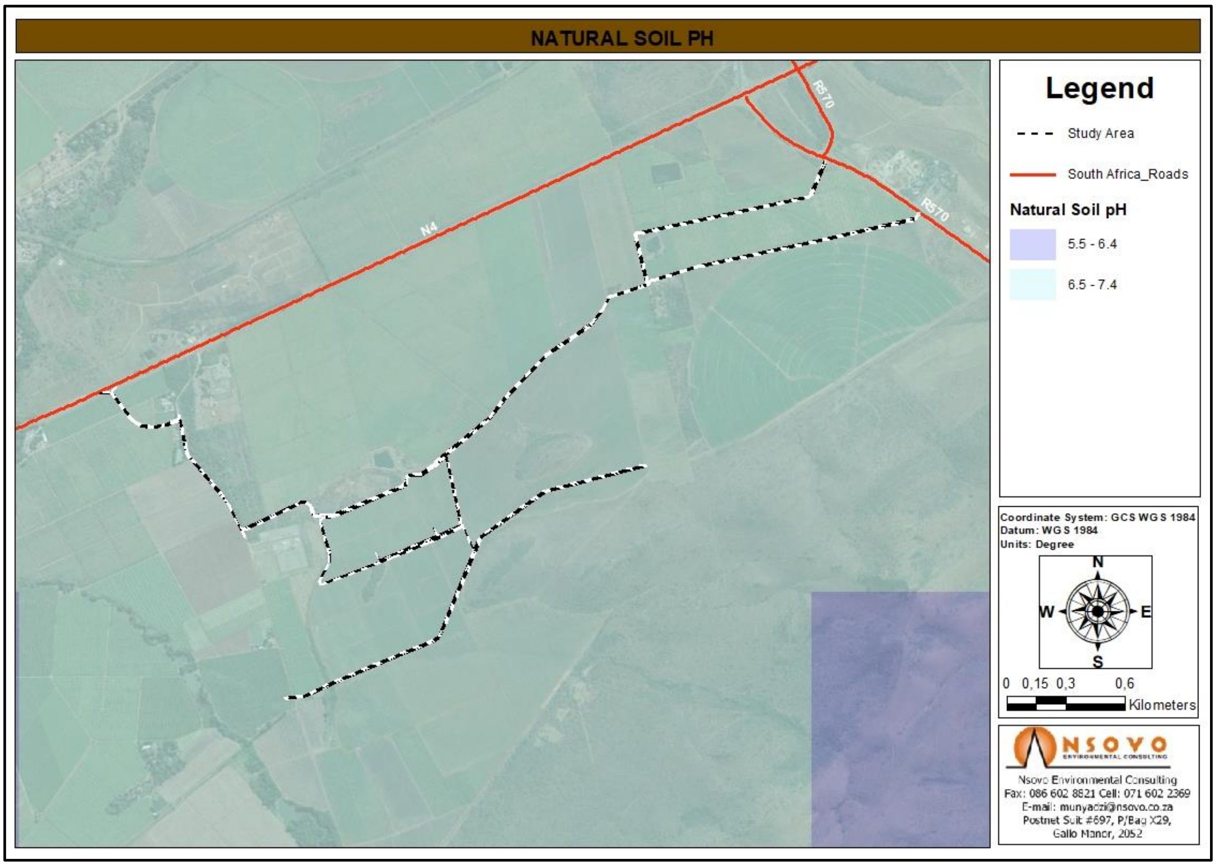

Figure 6: Soil pH associated with the project area.

3.5 Soil and Terrain (SOTER) Dominant Soils

Rhodic Nitisols characterise the study area. These soils are typically deep and well-drained, with a subangular soil structure and more than 30% clay content in the subsurface soil horizons. These soils can be considered productive for agricultural cultivation as they allow root penetration and a fair to good water-holding capacity. Figure 7 below illustrates the SOTER-dominant soils associated with the study area.

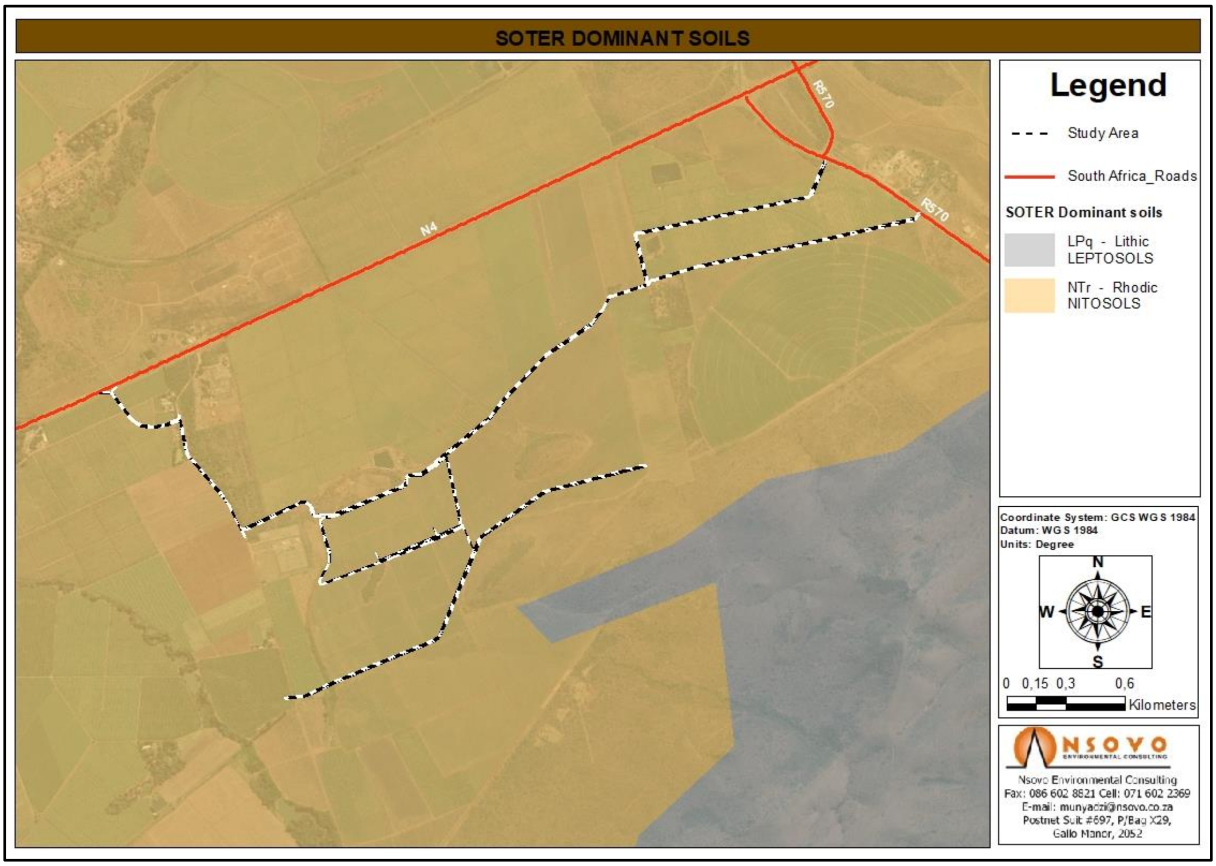

Figure 7: SOTER dominant soils associated with the study area.

3.6 Landtype Classes

The study area is characterised by the Ea75 landtype. The Ea landtypes are characterised by dark and red coloured, structured and high base status soils. Thus, These soils are not easily prone to leaching and erosion, indicating the soil's ability to retain nutrients. Figure 10 below depicts the landtypes classes associated with the study area.

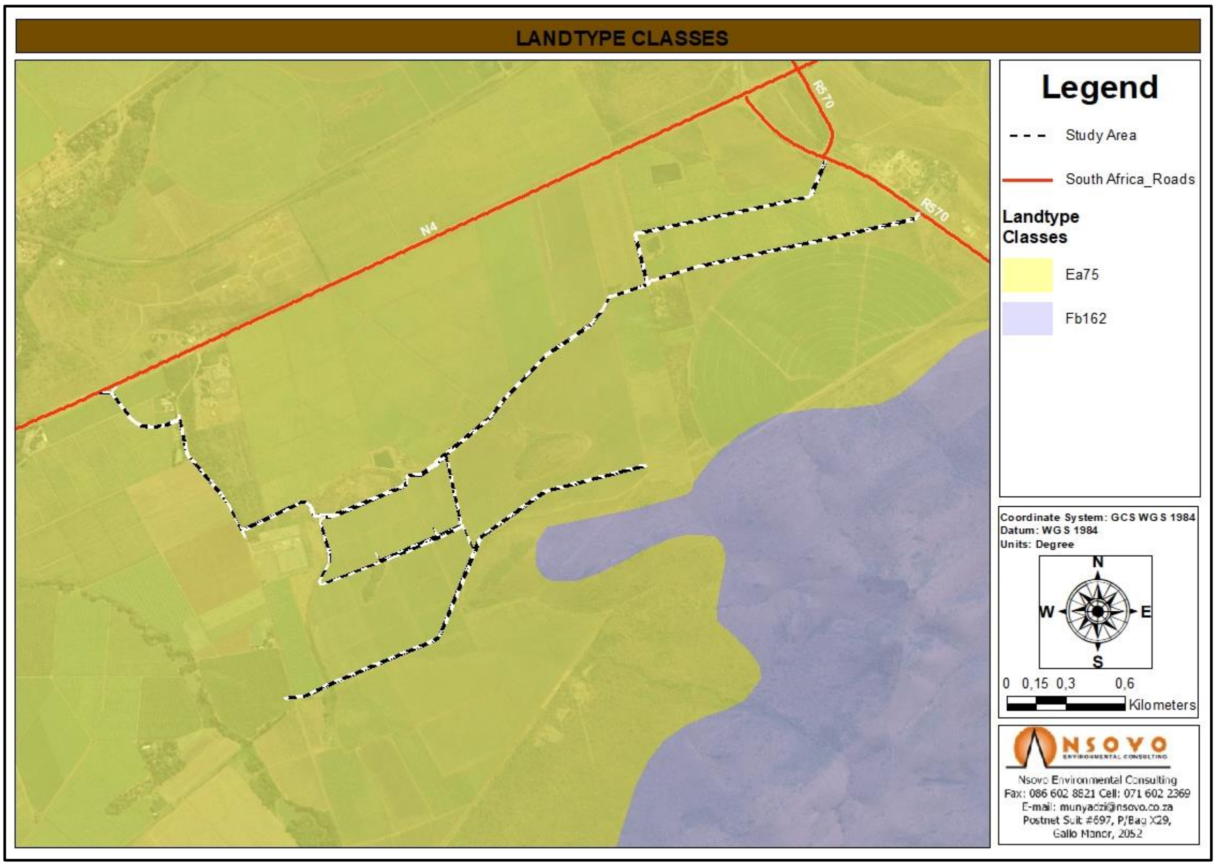

Figure 8: Desktop land capability associated with the study area.

3.7 Desktop Land Capability

The desktop land capability associated with the soils occurring within the study area is characterised by moderate potential arable land of Class III rating. Figure 9 below shows the desktop land capability associated with the study area.

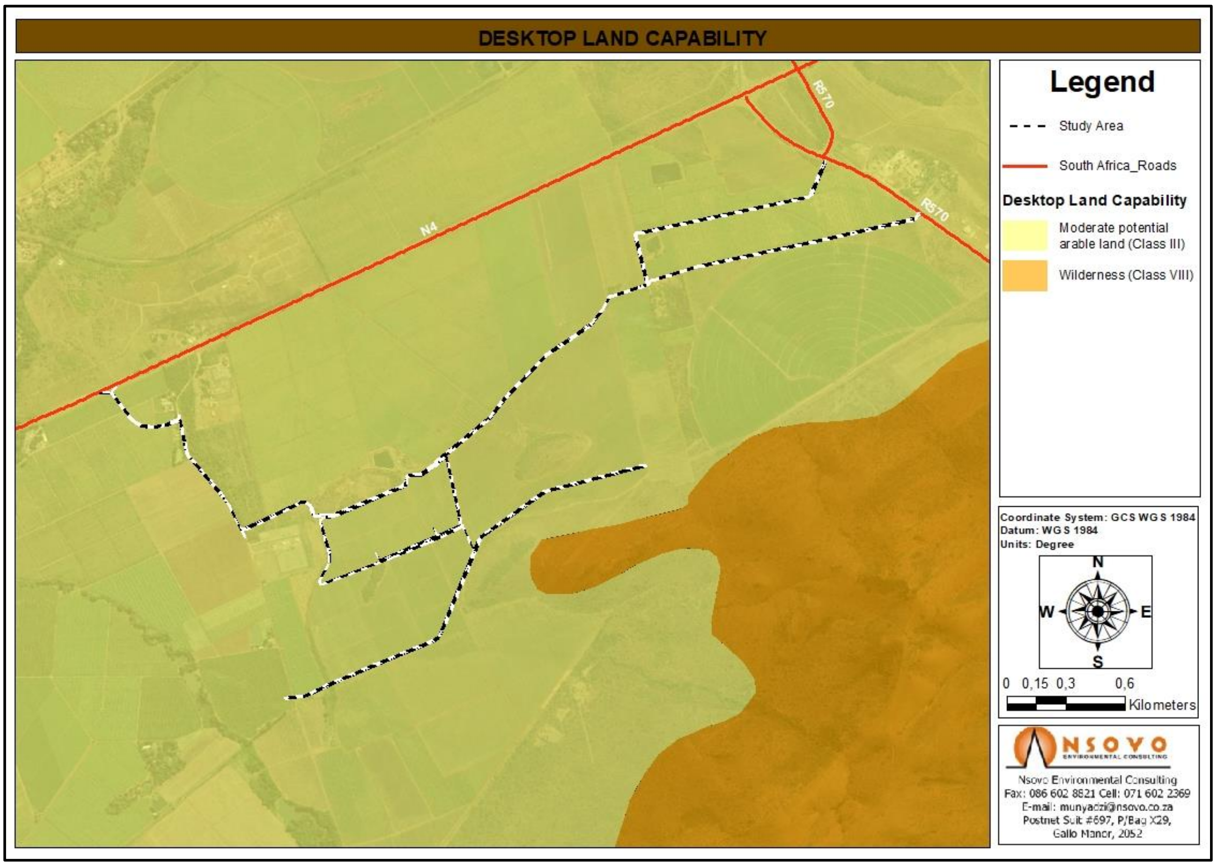

Figure 9: Desktop land capability associated with the study area.

3.8 Soil Potential

The potential of soils associated with the study area is of no dominant class. Figure 10 below depicts the soil potential associated with the study area.

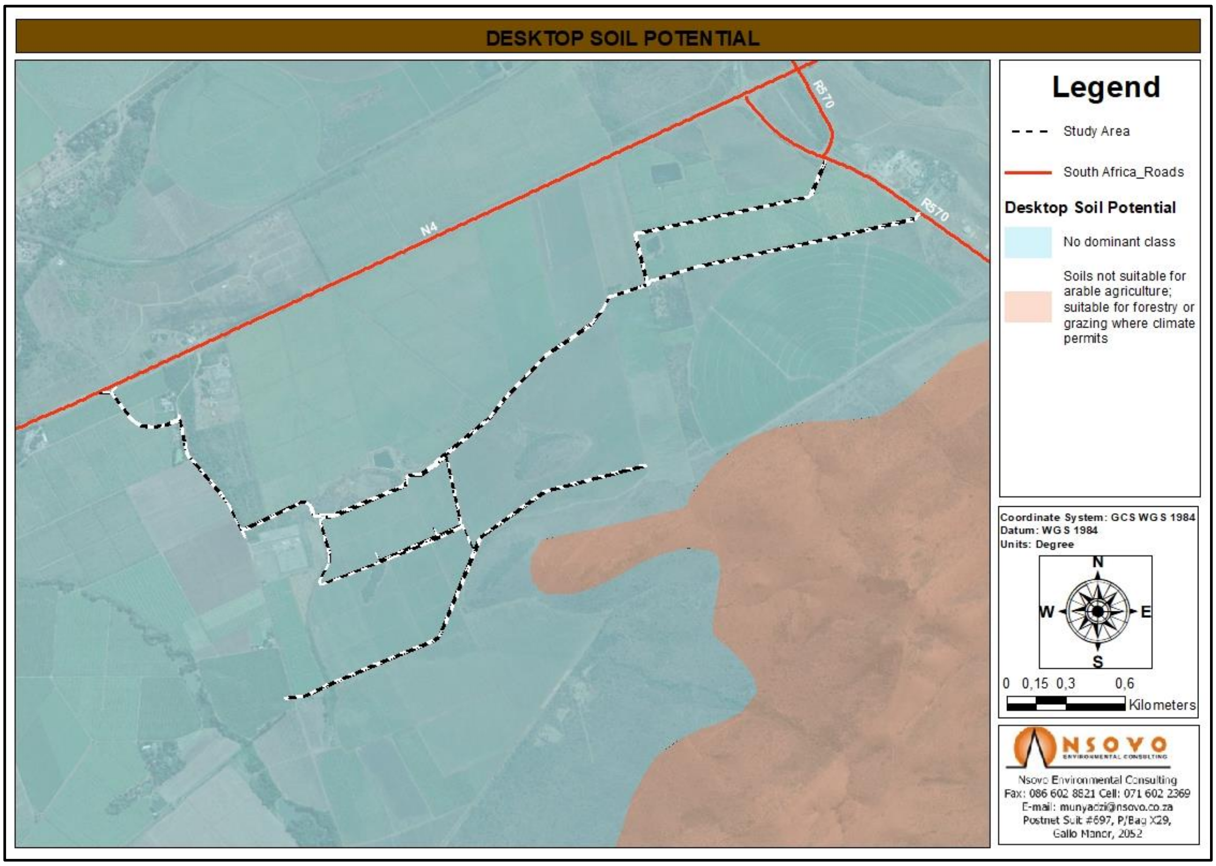

Figure 10: Soil potential associated with the study area.

4. FIELD VERIFIED RESULTS AND DISCUSSIONS

4.1 LAND USES WITHIN THE STUDY AREA

The proposed areas to serve as the locality of the proposed Flexpower power Plant and associated infrastructures comprise areas under irrigated sugarcane production. The other areas near the study areas comprise the Eskom substation, with transmission and distribution power lines traversing the study area. Residential areas were also observed, as well as areas of commercial accommodation establishments (i.e., guest houses). Minimal signs of soil degradation in soil erosion were observed, which can be because of the active irrigation taking place and the small water-storing capacity of the soils, possibly leading to an overland flow of water along steeper slopes. Figure 10 depicts the different land uses identified within the study area.

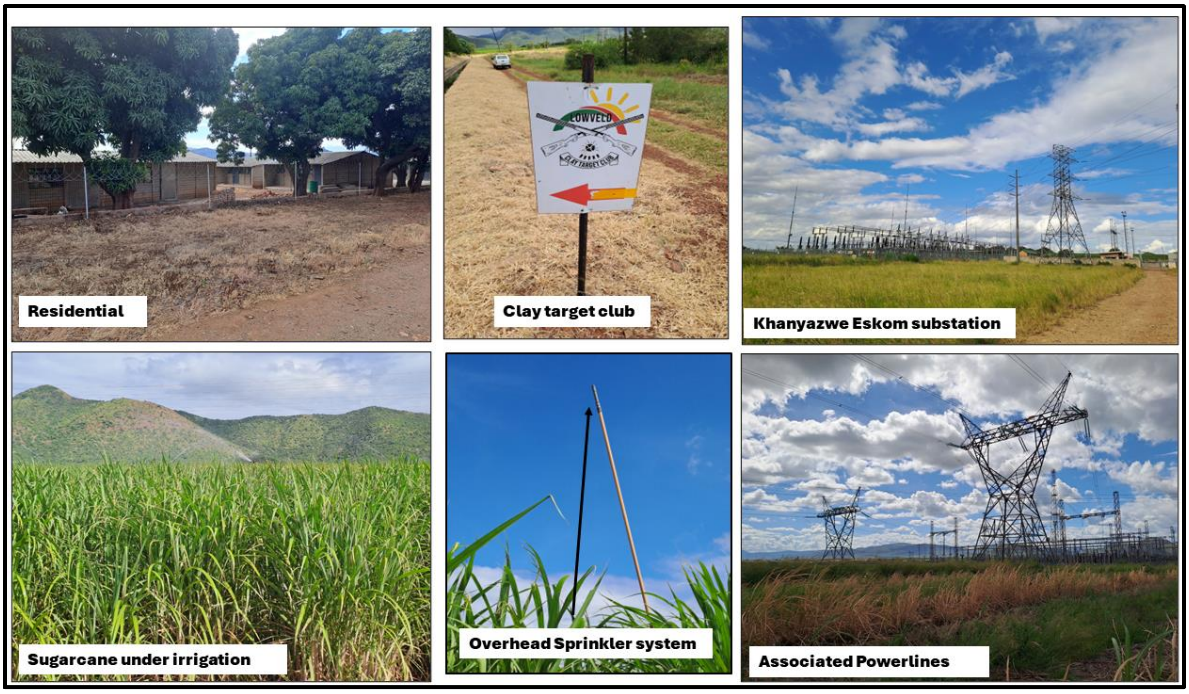

Figure 11: Land uses associated with the study area.

4.2 SOIL FORMS IN THE STUDY AREA

The section below focuses on the identified soil forms within the study area and is described below. Figure 14 presents the spatial distribution of the identified soil forms within each study area. Table 4 presents a summary table depicting the area of coverage of each specified soil form.

4.2.1 Mispah/Glenrosa

Lithic soils such as the Glenrosa are considered shallow soils, attributed to their shallow pedogenic and effective depth. The shallow nature of the dominant soil forms can be largely attributed to limited rock weathering and convex topography, which result in divergent water flow, which ultimately may result in soil erosion and, in some instances, leaving rocky outcrops behind. However, these soils can also be subject to preferential flowpaths, which give rise to preferential flow paths and influence the pattern of plant root development. Provided slope conditions, ripping machinery, and irrigation water are available, these soils can be cultivated, although under intense management systems. Under dryland conditions, these soils are usually avoided for intensive use and thus left for grazing, forestry, and wildlife land uses. Due to depth and fertility limitations, these soils are classified under the Grazing (Class VI) land capability class. Figure 12 below depicts the soils associated with the Glenrosa soil form.

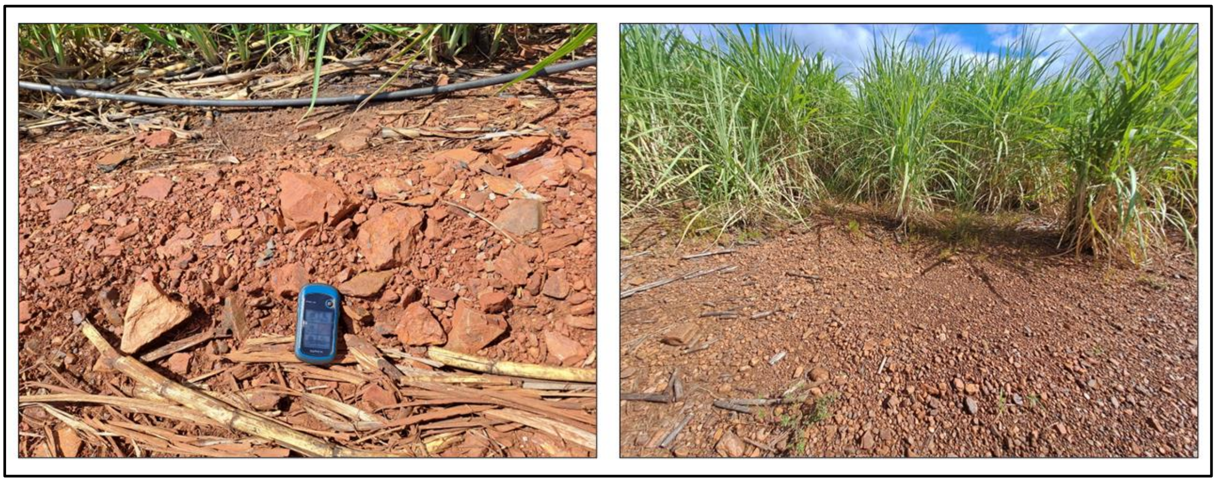

Figure 12: View of the identified Glenrosa soil formation.

4.2.2 Dam/Artificial Ponding

These are areas of water impoundment identified within the study area near the stream used to store water for irrigation purposes. These areas are generally saturated with water for prolonged periods and thus cannot be utilised for any cultivation but as a supplement to cultivated areas. Due to the limitation of water logging, these areas are classified in the wet-based (Class V) land capability class.

Figure 13: Water impoundment areas.

4.2.3 Witbank

These soils are usually disturbed by anthropogenic influences such as intentional transportation and severe physical disturbance caused by urban development (industrial and residential, in this case). Therefore, they are typically unsuitable for large-scale cultivation and classified under wilderness (Class VIII).

Figure 14: Transformed areas.

Table 4: Soil forms in hectares (ha) occurring within the study area.

Khanyazwe Flexpower Study Area				
Soil Forms	**Area (Ha)**	**Percentage (%)**	**Land Capability Class – According to (Smith, 2006)**	**Agricultural Potential**
Mispah/Glenrosa	75.43	96.7	Grazing (Class VI)	Moderate
Dam/Artificial Ponding	0.5	0.6	Wet-Based (Class V)	Very Low
Witbank	2.04	2.6	Wilderness (Class VIII)	Very Low
Total Enclosed	**77.98**	**100**		

Table 5: Land capability (DAFF, 2016) associated with the soils occurring within the study area.

Soil Form	Land Capability Groups	DAFF (2017) Classification
Glenrosa	Grazing Land	6. Low - Moderate
Dam/Artificial Ponding	Watercourse	4. Very Low to Low
Witbank	Infrastructure	1. Very Low

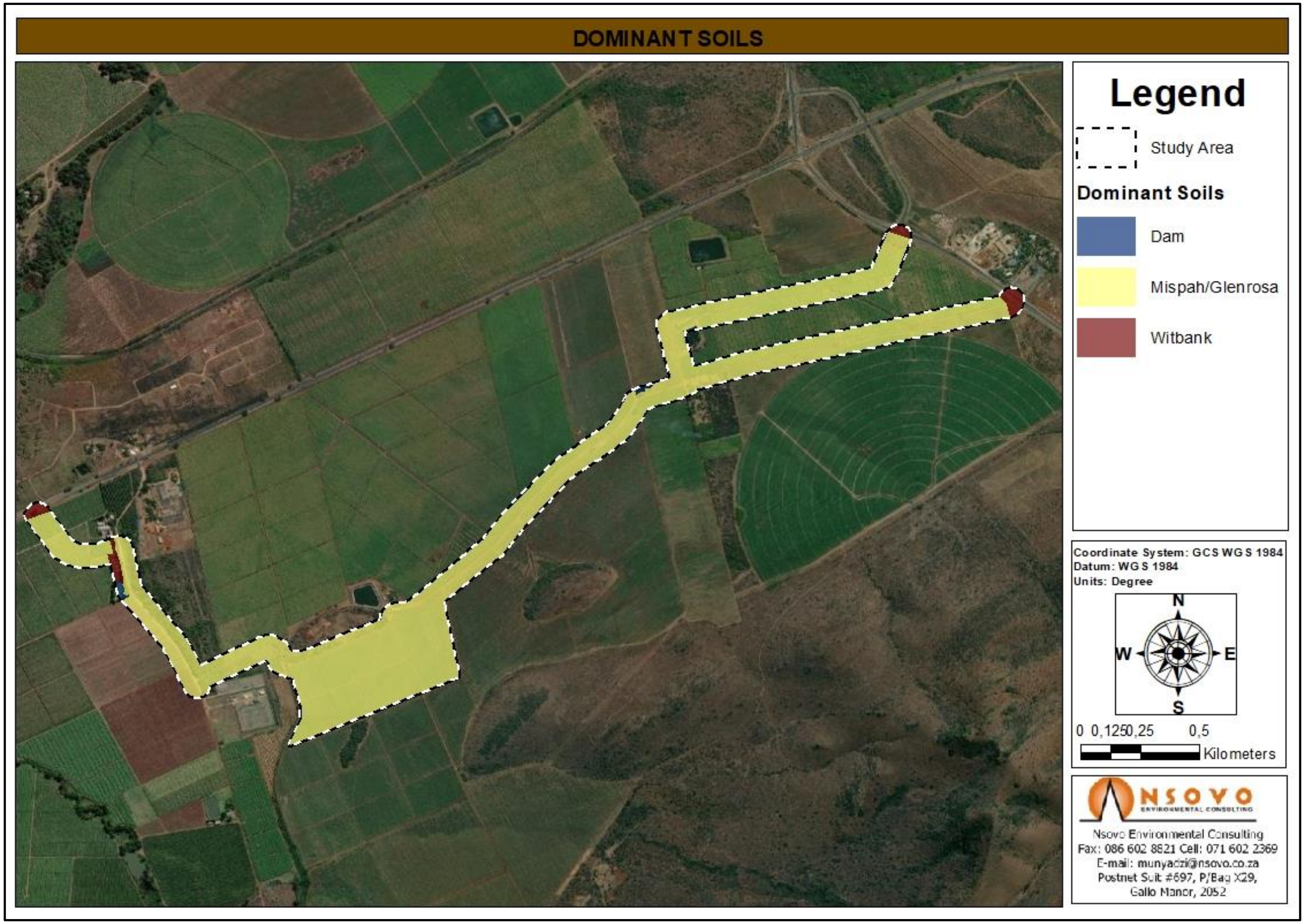

Figure 15: Dominant soils form within the study area.

4.2 LAND CAPABILITY AND AGRICULTURAL POTENTIAL

Land Capability is defined as the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of climate, soil, and terrain. The soil physical properties with which the agricultural potential for this assessment, agricultural sensitivity, was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Figures 16 and 17 below depict the land capabilities, while Figure 18 depicts the agricultural potential.

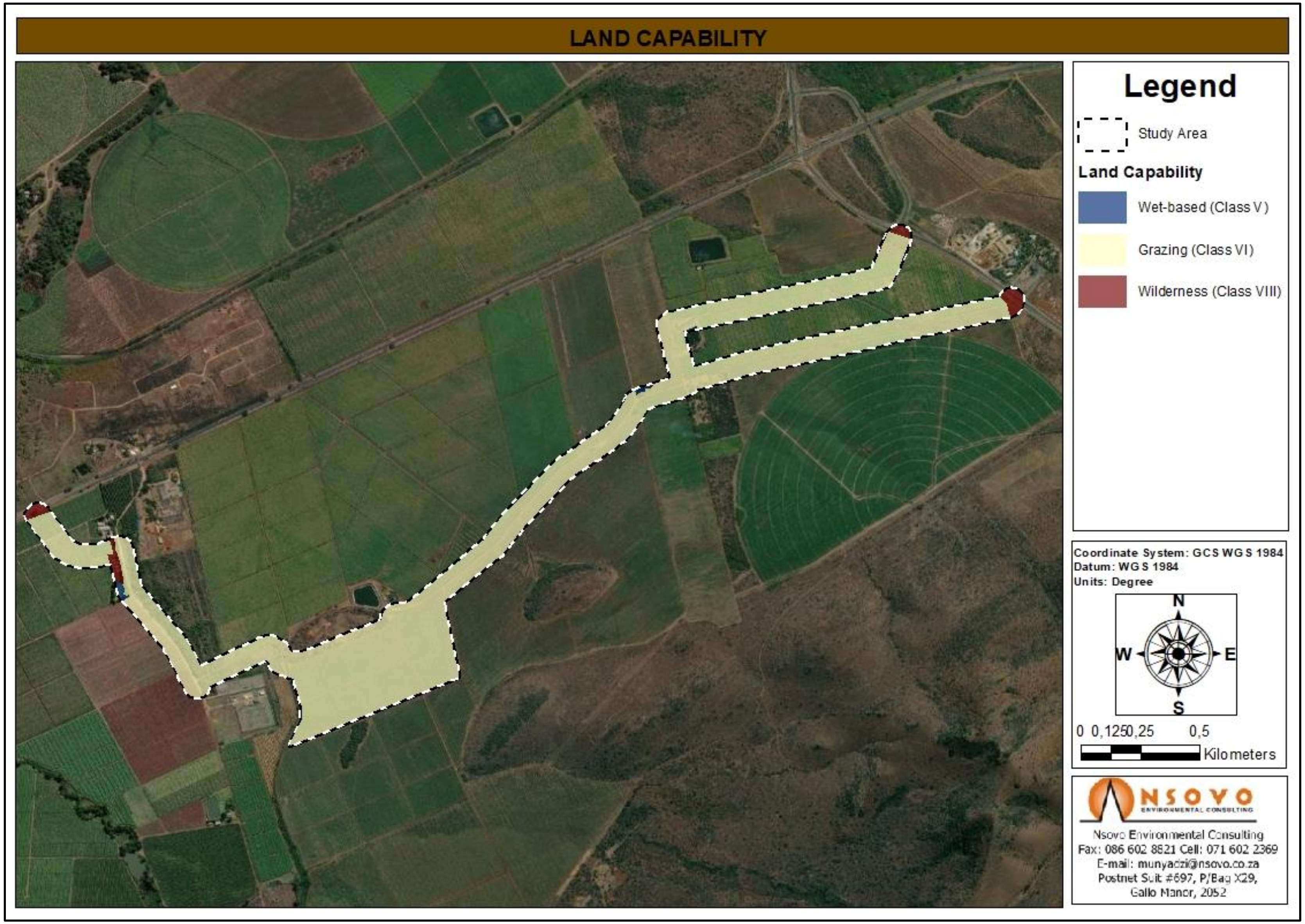

Figure 16: Map depicting land capability of soils within the Study Area.

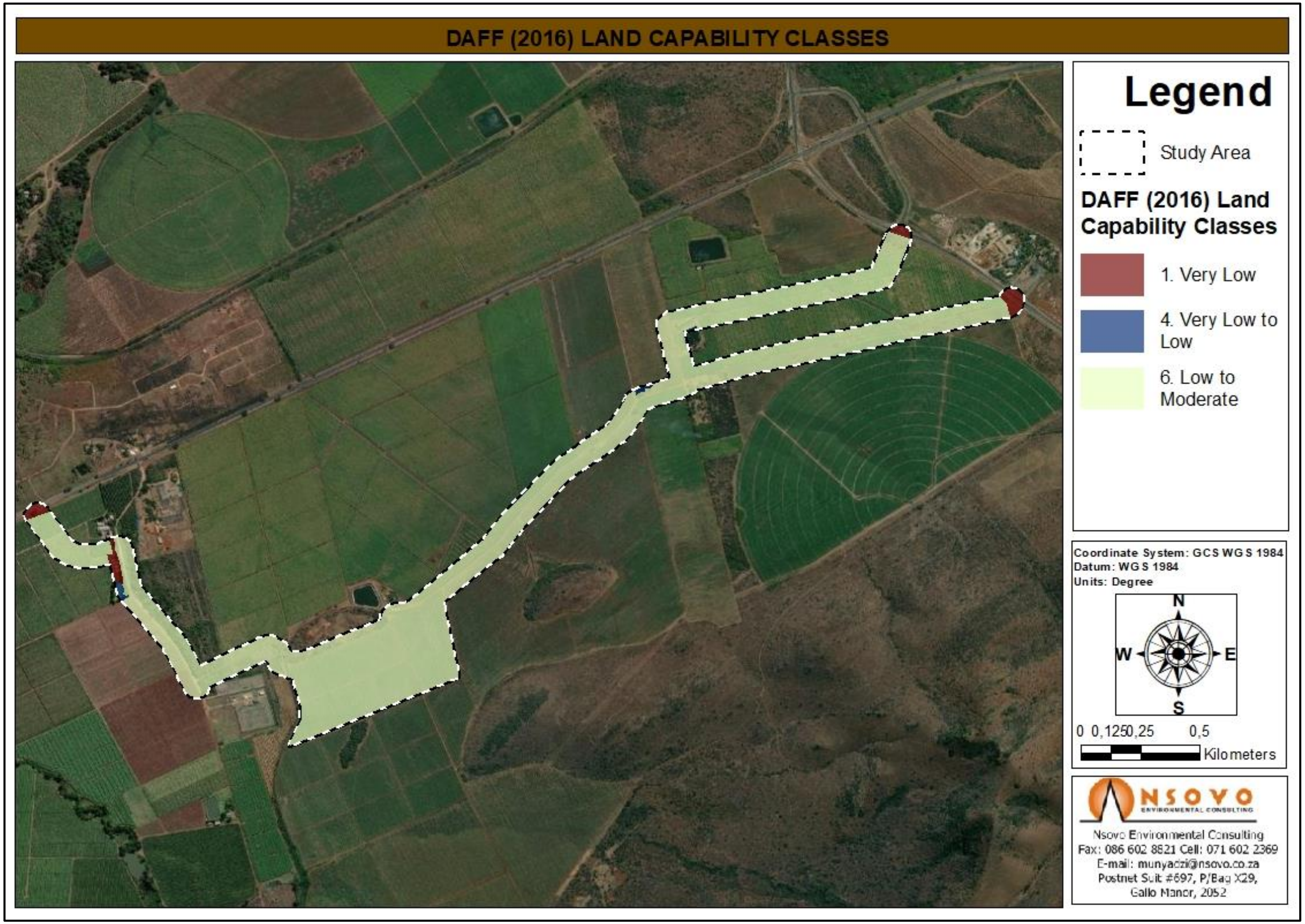

Figure 17: Land capability (DFFE, 2017) of the soil forms associated with the study area.

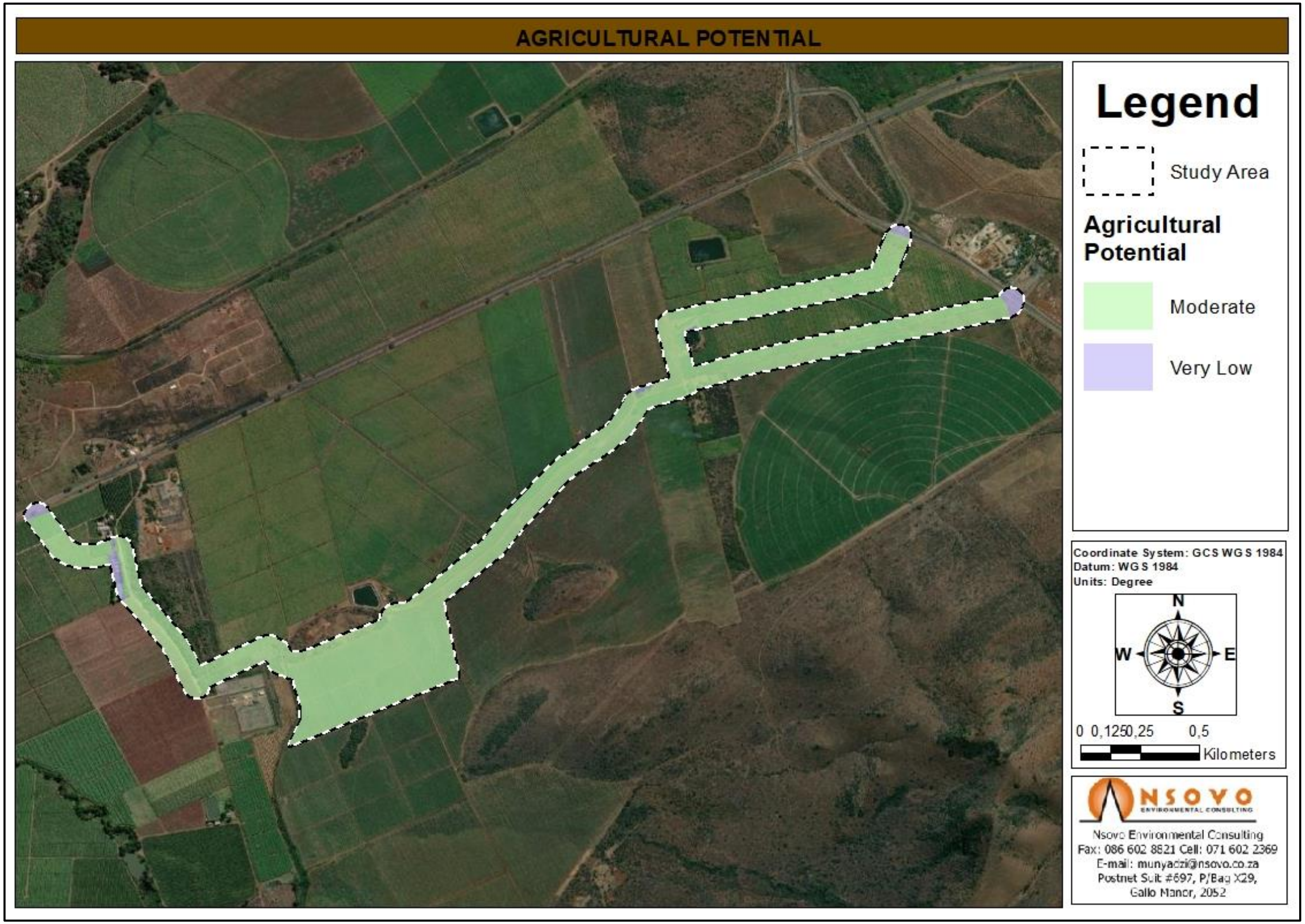

Figure 18: Agricultural potential for soils associated with the soils occurring within the study area.

5. IMPACT ASSESSMENT

5.1 ASSESSMENT METHODOLOGY

According to the NEMA regulations (2014), all the impact assessments should provide quantified scores that show the expected impact and those that will likely result from proposed activities. Significance scoring both assesses and predicts the environmental impacts through the evaluation of the following factors;

- Probability of the impact,
- Duration of the impact,
- Extent of the impact, and
- Magnitude of the impact.

The objective of the assessment of impacts is to identify and assess all the significant impacts that may arise due to the Proposed Development implementation and place the consequences of the Proposed Development before the competent authority.

For each main project phase, the existing and potential future impacts and benefits (associated only with the Proposed Development) were described using the criteria listed in Appendix B. This was done in accordance with the EIA Regulations, promulgated in terms of Section 24 of the NEMA and the criteria drawn from the Integrated Environmental Management (IEM) Guidelines Series, Guideline 5: Assessment of Alternatives and Impacts, published by the Department of Environmental Affairs (April 1998).

The assignment of significance ratings has been undertaken based on the specialist team's experience and research. Subsequently, mitigation measures have been identified and considered for each impact. The assessment is repeated to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented). Each of the above impact factors has been used to assess each potential impact using ranking scales as detailed in Appendix B.

The significance of the impacts that may occur due to the proposed activities and a description of the mitigation required to limit the identified adverse impacts on the identified soils on site are presented in Section 5.2 below.

5.2 IMPACT ASSESSMENT PER PROJECT PHASE

The impact assessment will individually focus on the KFP substation extension and access roads.

5.2.1 Construction Phase

During the construction phase of the proposed development, the soils are anticipated to be exposed to erosion, dust emission, potential soil contamination, and loss of land capability impacts. The main envisaged activities include the following:

- Earthworks (where necessary) will include vegetation clearing from the surface and stripping topsoil (soil excavation) for foundation preparation where the proposed infrastructure is to be placed. These activities are the most disruptive to natural soil horizon distribution and will impact on the current soil hydrological properties and functionality of soil if not mitigated properly;
- Frequent movement of heavy machinery increasing the likelihood of soil contamination from petroleum, oil, and grease substances;
- Other activities in this phase that will impact soil are the handling and storage of building materials and different kinds of waste. This will potentially result in soil pollution when not managed properly.

The disturbance of original soil profiles and horizon sequences during earthworks is considered to be a measurable erosion deterioration.

Soil chemical pollution due to potential oil and fuel spillages from vehicles, is considered to be a moderate deterioration of the soil resource.

Soil compaction will be a measurable deterioration that will occur due to the heavy vehicles commuting on the existing roads and any newly constructed access road to increase access to the solar Khanyazwe substation.

5.2.2 Operational Phase

The operational phase includes the completion and operation of the proposed development, and the perceived impacts include possible runoff, which can result in erosion, constant disturbances of soils by maintenance vehicles and machinery, which can increase the risk of soil compaction, and poor waste management, which can result in waste materials being improperly stored, which can increase the risk of soil compaction.

The main envisaged operational activities that will impact soil, land use, and land capability include the following:

- General activities, including transport on access roads, will result in soil compaction or generation of runoff, respectively.
- Waste generation (non-mineral waste) and accidental spills and leaks may result in soil chemical pollution if not managed.

The disturbance of original soil profiles and horizon sequences of these profiles is considered a measurable deterioration, leading to soil erosion.

Soil chemical pollution, caused by pollutants leaching into subsurface soil horizons where waste is stored or from leaking maintenance vehicles, is considered to be a moderate deterioration of the soil resource.

Soil compaction is a measurable deterioration caused by vehicle movement on soil surfaces (including access roads).

The change in land use will result in the loss of the current land capability and land use of areas, as the current agricultural practices will cease for the duration of the substation's lifespan.

5.2.3 Closure and Decommissioning Phase

Decommissioning can be considered the reverse of the construction phase, with the demolition and removal of the infrastructure and activities very similar to those described in the construction phase.

The main envisaged decommissioning activities that will impact on soil, land use, and land capability include the following:

- Transporting materials away from the site will compact the soil of the existing roads, and fuel and oil spills from vehicles may result in soil chemical pollution.
- Earthworks will include redistribution of inert waste materials to fill the ponds and ditches and add topsoil to the soil surface. These activities will not further impact land use and capability but may increase soil compaction.

- Other activities in this phase that will impact soil are handling and storing materials and different kinds of waste generated and accidental spills and leaks with decommissioning activities. When not managed properly, these activities can potentially result in soil pollution.

5.3 IMPACT SUMMARY TABLES

Tables 7 to 10 below present the impact summary tables for the loss of land capability, soil erosion, soil compaction, and soil contamination associated with the powerlines. Tables 11 to 14 show the summary tables for the proposed substation.

5.3.1 KFP Power Plant Impact Ratings

Table 6: Rating of impacts for the loss of land capability and associated mitigation measures for the KFP Power Plant

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Clearing vegetation and levelling soils where necessary, such as removing topsoil material to create the foundation for the construction of the power plant, and temporary laydown areas potentially encroaching cultivated areas.							
WOM		Neg	3	2	8	5	65
WM		Neg	2	1	6	4	36
Mitigation Measures							
To minimise edge effects, the project operations must be kept within the demarcated footprint areas as far as practically possible.							
Avoid permanently impacting topsoil and subsoil but salvage the maximum depth of these when clearing areas for infrastructure.							
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.							
Construction vehicle movement should be limited to within the project perimeter fence to avoid unnecessary compaction and erosion of adjacent soils.							
Always strip a suitable time before commencing construction activities to avoid soil loss and contamination.							
The proposed development within the study area should aim to minimise the impact on soils used for cultivation as far as practically possible.							
Operational and Maintenance Phase							
Operation and maintenance of the KFP power plant; constant traffic and frequent soil disturbances resulting in land capability loss.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
No Corrective Measures		Neg	2	4	6	4	48
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Maintenance vehicles should be checked for hydrocarbon leakages before commencement of maintenance activities.							
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit potential soil erosion.							
Use geotextiles and contours to prevent soil erosion and revegetate exposed soil surfaces where possible.							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removal of the power plant and other on-site buildings, equipment, and facilities, including possible excavation and removal of concrete pads; transferring of waste materials to disposal, recycling, and/or treatment facilities, as applicable (where re-use is not possible)							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with erosion and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring and revegetation.							
Dismantled equipment should be recycled, and an approved service provider should appropriately landfill non-recyclable material.							
Any portions of the site with compacted soil should be decompacted and any excavations backfilled with soil to restore the site for future use.							

Table 7: Rating of impacts on soil erosion and associated mitigation measures for the KFP power plant

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Potential frequent movement of earth-moving machinery within loose and exposed soils, leading to excessive erosion. Site clearing, removal of vegetation, and associated disturbances to soils, leading to increased runoff, erosion, and consequent loss of land capability in cleared areas and subsequent loss of soils utilised for cultivation.							
WOM		Neg	2	2	6	5	50
WM		Neg	2	1	4	4	28
Mitigation Measures							
The project operations should be kept within the demarcated footprint areas as far as possible to minimise edge effects.							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
No site-clearing activities should take place during periods of heavy rainfall.							
Loosening of the soil through ripping and discing before the stripping process is recommended to break up crusting.							
Compacted soils should be ripped at least 20cm to alleviate.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Operation and maintenance of the KFP power plant; constant traffic and frequent disturbances of soils resulting in soil compaction.							
No Corrective Measures		Neg	2	4	6	3	36

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.							
Unnecessary trafficking and movement over the areas targeted for maintenance must be MUST be minimised as far as practically possible, especially heavy machinery.							
Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil compaction.							
Access roads should be inspected and maintained as necessary.							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removal of the power plant and other on-site buildings, equipment, and facilities. During this period, there will be heavy vehicular traffic and thus increasing the likelihood of soil erosion.							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with soil compaction, runoff, erosion and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring, revegetation, and ripping soils to alleviate soil compaction.							
Dismantled equipment should be recycled, and an approved service provider should appropriately landfill non-recyclable material.							
Any portions of the site with compacted soil should be de-compacted and any excavations backfilled with soils to restore the site for future use.							

Table 8: Rating of impacts on soil compaction and associated mitigation measures for all project phases for the KFP plant.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Site clearing, removal of vegetation, and associated disturbances to soils, leading to, increased runoff, soil compaction and consequent loss of land capability in cleared areas.							
	WOM	Neg	2	2	6	5	50
	WM	Neg	2	1	4	4	28
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
No site clearing activities should take place during periods of heavy rainfall.							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.							
Compacted soils should be ripped at least 20cm to alleviate.							
Operational and Maintenance Phase							
Operation and maintenance of the KFP power plant; constant traffic and frequent disturbances of soils resulting in soil compaction.							
	No Corrective Measures	Neg	2	4	6	3	36
	Corrective Measures	Neg	1	4	4	3	27

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Mitigation Measures							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.							
Unnecessary trafficking and movement over the areas targeted for maintenance must be minimised, especially heavy machinery.							
Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil compaction.							
Access roads should be inspected and maintained as necessary.							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removal of the power plant and other on-site buildings, equipment, and facilities. During this period, there will be heavy vehicular traffic and thus increasing the likelihood of soil compaction.							
	No Corrective Measures	Neg	2	2	6	3	30
	Corrective Measures	Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with soil compaction, runoff, erosion and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring, revegetation, and ripping soils to alleviate soil compaction.							
Dismantled equipment should be recycled, and non-recyclable material should be appropriately landfilled by an approved service provider.							
Any portions of the site with compacted soil should be de-compacted and any excavations backfilled with soils to restore the site for future use.							

Table 9: Rating of impacts on soil contamination and associated mitigation measures for all project phases for the KFP power plant.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Leaching of hydrocarbon chemicals into the soils from maintenance equipment of the hydrogen plant leads to alteration of the soil chemical status as well as contamination of ground water. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.							
WOM		Neg	2	2	6	4	40
WM		Neg	2	1	4	4	28
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Maintenance of vehicles and equipment should be carried out in designated appropriate facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean up.							
Operational and Maintenance Phase							
Direct chemical spills on soils from KFP power plant, construction vehicles, or other construction equipment used.							
No Corrective Measures		Neg	2	4	6	4	48
Corrective Measures		Neg	1	4	4	3	27

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Mitigation Measures							
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Maintenance of vehicles and equipment should be carried out in designated appropriate facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean up.							
Decommissioning Phase							
Potential decommissioning activities will likely involve dismantling and removing the hydrogen plant and other on-site buildings, equipment, and facilities. During this period, there will be heavy vehicular traffic thus increasing the likelihood of soil contamination.							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with soil compaction, runoff, erosion, and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring, revegetation, and ripping soils to alleviate soil compaction.							
Dismantled equipment should be recycled, and an approved service provider should appropriately landfill non-recyclable material.							
Any portions of the site with compacted soil should be decompacted, and any excavations should be backfilled with soils to restore the site for future use.							

5.3.1 Access, Construction and New Eskom Roads Impact Ratings

Table 10: Rating of impacts for the loss of land capability and associated mitigation measures for the access, construction and new Eskom road.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Clearing vegetation and levelling soils where necessary, such as removing topsoil material to create the smooth foundation for the roads.							
WOM		Neg	2	2	6	4	40
WM		Neg	1	1	4	3	18
Mitigation Measures							
To minimise edge effects, the project operations must be kept within the demarcated footprint areas as far as practically possible.							
Establish the site boundary/servitude at the start of construction and keep all activities within this boundary/servitude.							
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.							
Rehabilitate and landscape disturbed areas not occupied by infrastructure.							
Always strip a suitable time before commencing construction activities to avoid soil loss and contamination.							
The proposed roads development within the study area should aim to minimise the impact on soils used for cultivation as far as practically possible.							
Operational and Maintenance Phase							
Operation and maintenance of the access and construction roads, constant traffic and frequent soil disturbances resulting in land capability loss.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
No Corrective Measures		Neg	2	4	6	4	48
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Maintenance vehicles should be checked for hydrocarbon leakages before commencement of maintenance activities.							
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit potential soil erosion.							
Use geotextiles and contours to prevent soil erosion and revegetate exposed soil surfaces where possible.							

Table 11: Rating of impacts for soil erosion and associated mitigation measures for all project phases for the access, construction and new Eskom road.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Potential frequent movement of earth-moving machinery within loose and exposed soils, leading to excessive erosion. Site clearing, removal of vegetation, and associated disturbances to soils, leading to increased runoff, erosion, and consequent loss of land capability in cleared areas and subsequent loss of soils utilised for cultivation.							
WOM		Neg	2	2	6	4	40
WM		Neg	1	1	4	4	24
Mitigation Measures							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
The project operations should be kept within the demarcated footprint areas as far as possible to minimise edge effects.							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
No site-clearing activities should take place during periods of heavy rainfall.							
Loosening of the soil through ripping and discing before the stripping process is recommended to break up crusting.							
Compacted soils should be ripped at least 20cm to alleviate.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Operation and maintenance of the roads; constant traffic and frequent disturbances of soils resulting in soil compaction.							
No Corrective Measures		Neg	2	4	6	3	36
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Unnecessary trafficking and movement over the areas targeted for maintenance must be minimised as far as practically possible, especially heavy machinery.							
Disturbed areas adjacent to the roads should be revegetated with indigenous grass mix to limit potential soil compaction.							
Access roads should be inspected and maintained as necessary.							

Table 12: Rating of impacts for soil compaction and associated mitigation measures for all project phases for the access, construction and new Eskom road.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Heavy vehicle traffic within and around the study area and potentially compacting the soil during the construction of the access, construction and new Eskom road.							
WOM		Neg	2	2	5	5	45
WM		Neg	2	1	4	4	28
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
No site clearing activities should take place during periods of heavy rainfall.							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting.							
Compacted soils should be ripped at least 20cm to alleviate.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Operation and maintenance of the access, construction and new Eskom road; constant traffic and frequent disturbances of soils resulting in soil compaction.							
No Corrective Measures		Neg	2	4	6	3	36
Corrective Measures		Neg	1	4	4	3	27

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Mitigation Measures							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting							
Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil compaction.							
Access roads should be inspected and maintained as necessary.							

Table 13: Rating of impacts on soil contamination and associated mitigation measures for all project phases for the access, construction and new Eskom road.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Leaching of hydrocarbon chemicals into the soils from maintenance equipment of the hydrogen plant leads to alteration of the soil chemical status as well as contamination of ground water. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.							
WOM		Neg	2	2	5	4	36
WM		Neg	2	1	4	4	28
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Maintenance of vehicles and equipment should be carried out in designated appropriate facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean up.							
Operational and Maintenance Phase							
Direct chemical spills on soils from the hydrogen plants, construction vehicles, or other construction equipment used.							
No Corrective Measures		Neg	2	4	6	3	36
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Maintenance of vehicles and equipment should be carried out in designated appropriate facilities fitted with spillage containment, floors, and sumps to capture any fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean up.							

6. IMPACT STATEMENT AND SCREENING TOOL VERIFICATION

The study area present areas of active cultivation with sugarcane, under irrigation. Thus, the proposed development is likely to impact on the sugarcane production. The cumulative loss from a soil and land capability point of view is anticipated to be of moderately high significance. The reason being that a significant portion soils under cultivation will be subject to different forms of soil degradation due to the different operations to take place during the construction of the proposed development. These proposed activities may likely have a negative impact on sugarcane production on a local and regional scale. Surface soil stripping and landscape fragmentation are anticipated to impact on agricultural productivity through loss of farmland, thus resulting in land use intensification and possibly loss of income.

Irrigated agriculture utilises large portions of South Africa's water resources, however it is responsible for the production of high value crops. Thus, the Preservation and Development of Agricultural Land Framework Bill published on 18 September 2020, although not approved yet, stipulates that land under irrigation is automatically regarded as high potential, even though the soils within the study area can generally be classified as low potential soils due to their inherent physical properties (i.e., stoniness, insufficient depth) which are generally not ideal for cultivation. This is due to the high production capability and the possibility of exponentially increasing crop yields, and this is of high importance for food security at a local and regional scale. In most cases these irrigated areas indicate high capital investments made onto the farm. As such these areas typically fall under protected agricultural areas as depicted on Figure 19 below.

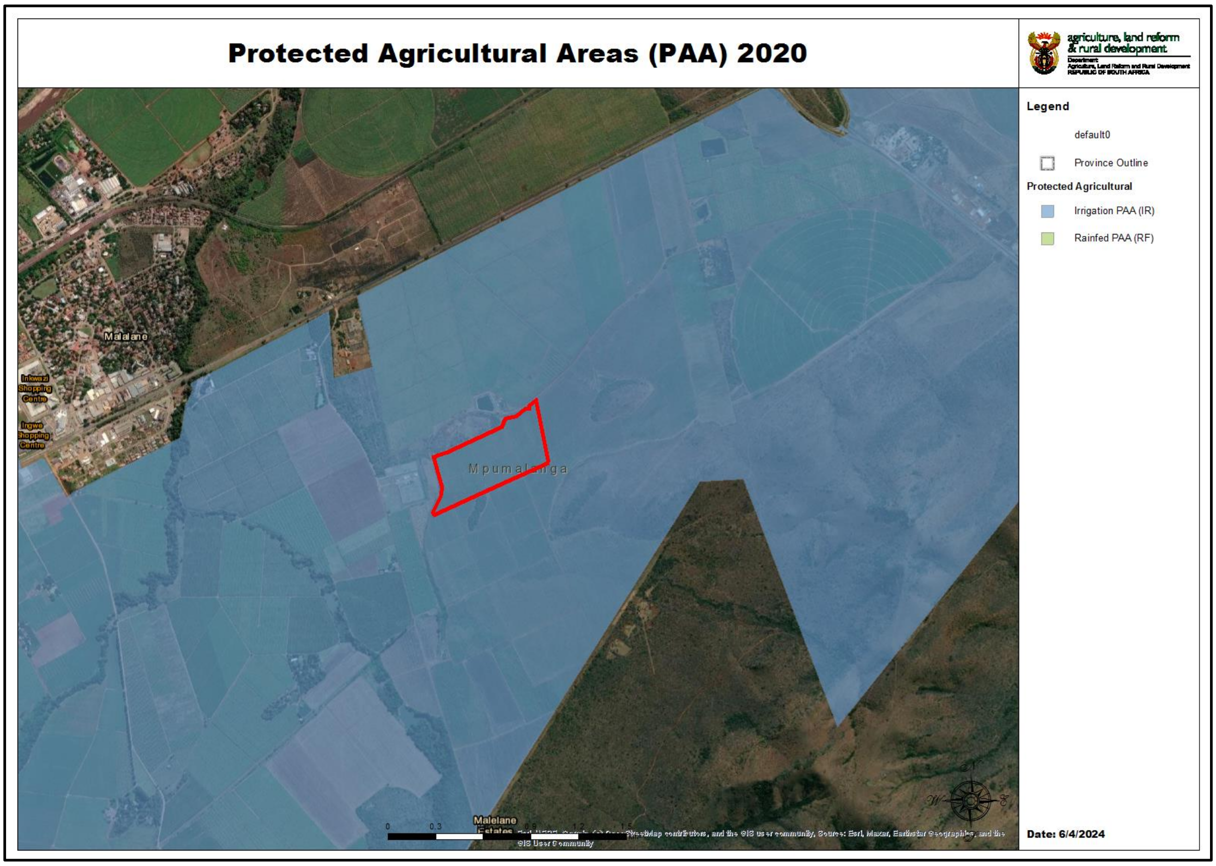

Figure 19: Protected Agricultural Areas along the study area.

A prefeasibility assessment was conducted to assess various site options with regards to the proposed development and the study area was deemed the most preferred with respect to logistical aspects such as the ROMPCO proximity, transmission length, water accessibility, gradient, general site accessibility and proximity to the Khanyazwe Eskom substation. Therefore, in terms of the mitigation hierarchy total avoidance was not a viable option. Should the proposed development proceed, the loss of agricultural soils and the permanent change in land use will be localised within the study area. However, approximately 20 hectares will be lost out of a 600 hectares farm and this loss is not anticipated to impact on the agricultural viability of the farm in the long term. It is the opinion of the specialist that the unmitigated scenario poses a threat to the sustainability of sugarcane production since it is the dominant land use within the study area and surrounding areas. Henceforth, integrated mitigation measures must be implemented accordingly to minimise the potential loss of these valuable agricultural areas, considering the need for sustainable development and increased electricity generation and transmission capacity.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The field verification results were largely in support of the screening tool due to the favourable conditions for commercialised sugarcane agriculture.

In terms of a change in employment figures, the proposed development is anticipated to increase the number of employed personnel from the current land use (sugarcane farming), albeit for a short period of time (1 to 2 years) during the construction phase and long-term during the operation of the power plant. In addition, skills development, especially in the construction of power-producing plants, will contribute significantly to the viability of other potential projects of a similar type in the Mpumalanga Province. Thus, should the mitigation measures outlined in the report in conjunction with other specialist studies the proposed development can be considered for authorisation.

7. CONCLUSION

Nsovo Environmental Consulting was appointed by Khanyazwe Flexpower (KFP) to a conduct the soil, land use, and land capability verification assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Flexpower power Plant and associated infrastructures (Hereafter collectively referred to as 'Study Area' unless referring to each individual site options). The proposed project is located in a farming town, on Portions 1, 4, and 116 of Farm Malelane 389 FP, in Malelane within the Nkomazi Local Municipality, Mpumalanga Province.

The entire study area is characterised by a hot semi-arid climate associated with hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. This type of climate is most commonly found around the fringes of subtropical deserts. The majority of the study area is characterised by mean annual precipitation between 401 – 600 mm, and this precipitation range is deemed moderately adequate to support rainfed agriculture; thus, supplementary irrigation may be required to cultivate successfully on these soils. The remaining portion of the study area is characterised by a mean annual precipitation between 601 – 800 mm; this rainfall range for the application area is deemed adequate for most cultivated crops with moderately high yield potential. These conditions have a moderate to high yield potential for a wide range of adapted crops supporting rain-fed agriculture. This results in a wide range of suitable crops for cultivation.

The study area present areas of active cultivation with sugarcane, under irrigation. Thus, the proposed development is likely to impact on the sugarcane production. The cumulative loss from a soil and land capability point of view is anticipated to be of moderately high significance. The reason being that a significant portion soils under cultivation will be subject to different forms of soil degradation due to the different operations to take place during the construction of the proposed development. These proposed activities may likely have a negative impact on sugarcane production on a local and regional scale. Surface soil stripping and landscape fragmentation are anticipated to impact on agricultural productivity through loss of farmland, thus resulting in land use intensification and possibly loss of income.

Irrigated agriculture utilises large portions of South Africa's water resources, however it is responsible for the production of high value crops. Thus, the Preservation and Development of Agricultural Land Framework Bill published on 18 September 2020, although not approved yet, stipulates that land under irrigation is automatically regarded as high potential, even though the soils within the study area can generally be classified as low potential soils due to their inherent physical properties (i.e., stoniness, insufficient depth) which are generally not ideal for cultivation. This is due to the high production capability and the possibility of exponentially increasing crop yields, and this is of high importance for food security at a local and regional scale. In most cases these irrigated areas indicate high capital investments made onto the farm. As such these areas typically fall under protected agricultural areas.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of a very high sensitivity in terms of agricultural potential. The outcomes of the field verification results were largely in support of the screening tool due to the favourable conditions for commercialised sugarcane agriculture.

In terms of a change in employment figures the proposed development is anticipated to increase the number of employed personnel from the current land use, albeit for a short period of time (1 to 2 years) during the construction phase. However, skills development especially in the construction of power producing plants will contribute significantly to the viability of other potential projects of a similar type in the Mpumalanga Province. Thus, should the mitigation measures outlined in the report in conjunction with other specialist studies the proposed development can be considered for authorisation.

8. REFERENCES

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APPENDIX A: INDEMNITY

- This report is based on survey and assessment techniques, which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.
- This report is based on a desktop investigation using available information and data on the site to be affected, in situ fieldwork, surveys, assessments, and the specialist's best scientific and professional knowledge.
- The Precautionary Principle has been applied throughout this investigation.
- The findings, results, observations, conclusions, and recommendations given in this report are based on the specialist's best scientific and professional knowledge and information available at the time of the study.
- Additional information may become known or available later in the process for which no allowance could have been made at the time of this report.
- The specialist reserves the right to modify this report, recommendations, and conclusions at any stage should additional information become available.
- Information and recommendations in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist as specified above.
- Acceptance of this report, in any physical or digital form, confirms acknowledgment of these terms and liabilities.

Tshiamo Setsipane

27 June 2024

(*Pr. Nat. Sci* 114882)

APPENDIX B: IMPACT ASSESSMENT METHODOLOGY

Status of Impact

The impacts are assessed as either having a:

The negative effect (i.e., at a `cost' to the environment),

positive effect (i.e., a `benefit' to the environment) or

Neutral effect on the environment.

Extent of the Impact

(**1**) Site (site only),

(**2**) Local (site boundary and immediate surrounds),

(**3**) Regional (within the project area),

(**4**) National, or

(**5**) International.

Duration of the Impact

The length that the impact will last is described as either:

(**1**) immediate (<1 year)

(**2**) short term (1-5 years),

(**3**) medium term (5-15 years),

(**4**) long-term (ceases after the operational life span of the project),

(**5**) Permanent.

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:

(**0**) none,

(**2**) Minor,

(**4**) Low,

(**6**) Moderate (environmental functions altered but continue),

(**8**) High (environmental functions temporarily cease), or

(**10**) Very high / Unsure (environmental functions permanently cease).

Probability of Occurrence

The likelihood of the impact actually occurring is indicated as either:

(**0**) None (the impact will not occur), (**1**) improbable (probability very low due to design or experience)

(**2**) low probability (unlikely to occur),

(**3**) medium probability (distinct probability that the impact will occur),

(**4**) high probability (most likely to occur), or

(5) Definite.

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.

S=(E+D+M) P

The significance ratings are given below.

(**<30**) low (i.e., where this impact would not have a direct influence on the decision to develop in the area),

(**30-60**) medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),

(**>60**) high (i.e., where the impact must influence the decision process to develop in the area).

assessment of impacts

The following section presents the impacts and the significance as rated by the specialists as well as the EAP. The Tables below highlight the significance of the identified impacts for both the construction and operational phases of the proposed development.

The impacts are assessed according to the criteria outlined below. Each issue is ranked according to extent, duration, magnitude (intensity), and probability. From these criteria, a significance rating is obtained, the method and formula is also described below. Mitigation measures and recommendations have been made and are presented in tabular form below.

The ratings are assessed with and without mitigation and color-coded as follows to indicate the significance:

High	**>60**
Medium	**>30 - 60**
Low	**<30**

APPENDIX C CURRICULUM VITAE OF SPECIALISTS

CURRICULUM VITAE OF TSHIAMO SETSIPANE

PROFESSIONAL EXPERIENCE

Soil Science Consultant

- Conducting Soil, Land Use and Land Capability Assessments:
  - Assess existing information for rainfall data and current land uses.
  - Conduct a desktop assessment within the study area using digital satellite imagery and other suitable digital aids.
  - A soil classification survey and agricultural potential will be conducted within the proposed development area.
  - A soil classification survey and agricultural potential will be conducted within the proposed development area.
  - Provide recommended mitigation measures to manage the anticipated impacts and comply with the applicable legislations.
  - Compile a report on the findings of the assessment and presented in an electronic format.
- Conducting Hydropedological Impact Surveys:
  - Identify dominant hillslopes (from crest to stream) of the project area using terrain analysis.
  - Conduct a transect soil survey on each of the identified hillslope.
  - Hydrological behaviour of the identified hillslope described according to the identified hydropedological groups;
  - Graphical representation of the dominant and sub-dominant flow paths at hillslope scale prior to development and post development.
  - The impact of the proposed development on the hydropedological behaviour described in a report format.
  - Quantification of hydropedological fluxes using the Soil and Water Analysis Tool (SWAT+) to determine the losses to the wetland systems though the proposed project
- Conducting Land Contamination Assessments and Soil Monitoring Assessments:
  - Assessments of historic and current storage of hazardous waste and materials on soils.
  - Topsoil stockpile quality assessment for future usage.
  - Monitoring programme to determine the dust suppression impact on soil chemical parameters.

EDUCATION

- M.Sc. (Agric): Soil Science **01/2016– 03/2019**
  - Dissertation: Characterisation of hydropedological processes and properties of a sandstone and a tillite hillslope, Kwa-Zulu Natal, South Africa.
  - Graduated *Cum-Laude*.
- B.Sc. (Agric) Honours: Soil Science **01/2014 – 11/2014**
  - Majored in soil fertility, soil physics, soil geography and soil chemistry.

- Research Project: Soil as an indicator of soil water regime.

- B.Sc. (Agric): Soil Science and Agrometeorology **2010 – 11/2013**
  - Majored in soil science and agrometeorology.
  - Minored in agronomy and plant pathology.

PROFESSIONAL MEMBERSHIP AND AFFILIATION

- Professional Natural Scientist with South African Council for Natural Scientific Professions (SACNASP) Registered, 11/2015 – Current
- Member of the Soil Science Society of South Africa (SSSSA)
- Member, South African Soil Surveyors Organization (SASSO)
- Member of the South African Wetland Society (SAWS)