ENVIRO-SOLUM CONSULTING

DIGGING DEEPER FOR A BRIGHTER TOMORROW



Soil, Land Use, & Land Capability Assessment: Proposed BBR Energy Facility (Phase 2 – Gilimberg Energy Cluster) Within the Capricorn District Municipality in Limpopo Province

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DOCUMENT CONTROL

Report Name	Soil, Land Use, & Land Capability Assessment: Proposed BBR Energy Facility (Phase 2 – Gilimberg Energy Cluster) Within the Capricorn District Municipality in Limpopo Province.
Version	Final Draft
Submitted to	Abantu Environmental Services (Ltd)
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EXECUTIVE SUMMARY

Enviro-Solum Consulting Pty (Ltd) was appointed by Abantu Environmental Services Pty (Ltd) to conduct a soil, land use, and land capability assessment towards their pursuit of obtaining a decision from the Department of Forestry, Fisheries and the Environment (DFFE) for the Gillimberg Solar Energy Facility (SEF) and associated infrastructure situated approximately 3 km southeast of Macangceni within the jurisdiction of the Enoch Mgijima Local Municipality in the Eastern Cape Province of South Africa.

The study area is situated within a semi-arid to arid climatic region, characterised by high temperatures during summer and cool to cold conditions in winter, with variations influenced by elevation. These regions typically experience high rates of evapotranspiration, low atmospheric humidity, and significant differences between daytime and nighttime temperatures. Rainfall is irregular and often occurs as thunderstorms, which are difficult to predict. The study area generally receives an average annual rainfall of 401- 600 mm, suggesting that dryland farming may be feasible where soil conditions are favourable. Average annual evaporation across the area ranges from approximately 1 801 to 2 000 mm, increasing the potential for drought stress and crop wilting. Although these climatic conditions restrict the variety of crops and planting periods suitable for rain-fed agriculture, several drought-tolerant forage crops can still achieve satisfactory yields when planted at the appropriate time and/or supported by supplementary irrigation.

Based on the observations during the site assessment, the dominant soils within the study area are Mispah/Glenrosa, Dundee and Witbank. 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.

Study Area				
Soil Forms	Area (Ha)	Percentage (%)	Land Capability	Agricultural Potential
Mispah/Glenrosa	359.0	99.4	Grazing (Class VI)	Moderate
Dundee (Alluvial)	1,4	0.4	Watercourse (Class V)	Low
Witbank (Anthrosols)	0.8	0.2	Wilderness (Class VIII)	Very Low
Total Enclosed	**361.3**	**100**		

Table B: Summary findings within the study area.

Soil Form	Land Capability Groups	DFFE (2017) Classification
Mispah/Glenrosa	Grazing Land	8. Moderate

Soil Form	Land Capability Groups	DFFE (2017) Classification
Dundee (Alluvial)	Watercourse	5. Low
Witbank (Anthrosols)		2. Very Low

The The study area is proposed as the locality for the proposed solar energy project. Most of the study area (90%) is characterised by shallow soils, which are better suited to grazing and small-scale farming. Overgrazing has largely impacted the study area, leading to degraded rangeland. The dry climate and limited rainfall also limit how quickly grasses can regenerate. Thus, overgrazed, bare land cannot absorb water effectively. When sudden climate-driven flash storms hit the plateau, the water creates massive runoff and erosion rather than soaking into the water table, leaving the region even drier.

An agricultural impact is any alteration that affects the future capacity for agricultural production on a specific land area. This alteration often occurs when agriculture is excluded from a region undergoing development. Reduced agricultural production potential can also result from soil erosion, compaction, pollution, and deterioration.

Vegetation clearing and soil stripping before the construction of the solar energy facility and associated infrastructure will directly result in the loss of grazing or wildlife land, albeit in a degraded state. The study area has also not been under any large to small scale cultivation for the last 5 years, as per the scrutiny of Google imagery. The proposed overhead powerline to Borutho MTS is not expected to significantly impact agriculture, as it will not affect the future capacity of agricultural production in the study area. All agricultural activities (if any) can continue as usual underneath the power line. Additionally, construction and decommissioning of the power line may cause topsoil loss and land degradation due to land disturbance. The potential impact of the project can be effectively mitigated through the implementation of standard, generic measures inherent in the project's engineering design, as well as by adhering to standard best practices for construction sites, all of which are detailed in the Environmental Management Programme (EMPr) as contained within Part B-Section 1 and 2 of the generic EMPr and standards for powerlines and substations. The development of the powerline is anticipated to result in only minimal loss of future agricultural production potential. Therefore, the agricultural impact of the proposed solar energy facility and associated powerlines is deemed to be of very low significance.

In this case, the study area is considered below the threshold for needing conservation as agricultural production land because its limitations make it unsuitable for cropping. If this land were used for non-agricultural purposes, it would result in minimal loss of agricultural production potential relative to national food security. As a result, the overall adverse agricultural impact of the development (loss of future agricultural production potential) is considered of low significance. It should also be noted that the proposed solar PV and associated infrastructure area does not cross any protected agricultural areas.

In accordance with the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, 1998, when applying for environmental authorisation, the current use of the land and the environmental sensitivity of the site under consideration, as identified by the national web-based environmental screening tool, must be confirmed by undertaking a site sensitivity verification.
The outcome of this site sensitivity verification is to:

- Confirm or dispute the current use of the land and the environmental sensitivity as identified by the screening tool; and
- Motivate and provide evidence of either the verified or different use of the land and environmental sensitivity of the site.

The allocated sensitivities for the agricultural theme are presented on Table C below.

Table C: Summary of the screening tool vs specialist-assigned sensitivities.

Study Area	Screening Tool Assigned Sensitivity	Verified Sensitivity	Reasoning for verification outcome verification
Solar PV area	High Sensitivity	Medium Sensitivity	Most of the study areas have shallow soils more suitable for grazing than arable farming. Additionally, the region faces limited climatic conditions due to low rainfall, making irrigation necessary for cultivation. The proposed solar PV facilities and the overhead power line are not expected to significantly impact agriculture, as they will not hinder future agricultural production in the study area. Overall, the land capability of the adjacent soils, along with their agricultural potential, remains very limited.
Access Roads	High Sensitivity	Low Sensitivity	
Overhead Powerline	High Sensitivity	Low Sensitivity	

This cumulative impact assessment quantifies the loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. Figure 20 illustrates these projects. The total area with approved solar PV within the 30 km radius of the study area is 4270.5 hectares, representing 1.3% of the total area of 326 492.0 hectares. This value falls within acceptable limits. Adhering to generic mitigation measures and implementing best practices during construction can mitigate or prevent further loss and degradation of valuable soil resources. Based on the assessment, the potential impact on future agricultural productivity is deemed low with mitigation measures in place. Thus, the proposed project is not expected to have an unacceptably adverse effect on overall agricultural production capacity. Therefore, considering the cumulative agricultural impact, approval of the proposed development is recommended.

Following the assessment of the study area and the identified potential impacts as a result of the proposed development, the key mitigation and rehabilitation measures can be summarised as follows:

- The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint;
- The possibility for any agricultural (i.e., grazing) activity concurrently with solar generation should be further investigated;
- The solar project footprint should be vegetated with grass underneath the panels which can potentially be used to feed the livestock of the local community during the operational phase.
- Clean water with only biodegradable detergents should be used to clean the panels to limit any soil contamination that might occur;
- A stormwater and erosion management plan must be developed to prevent the loss of soil resources;
- The contractor(s) appointed for the removal of infrastructure during closure must commit to the disposal of materials at registered sites;

- Post-removal of the solar PV, the site must be rehabilitated (compacted areas ripped, topsoil re-instated and the area vegetated with indigenous seed mix); and
- Use of heavy machinery should be avoided as far as possible to minimise further soil compaction during final rehabilitation.

It is the opinion of the specialist that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area are made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

DECLARATION OF INDEPENDENCE

- I Tshiamo Setsipane, in my capacity as a specialist consultant, hereby declare that I:
- Act/acted as an independent specialist to Abantu Environmental Services (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.



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Tshiamo Setsipane (Pr. Sci. Nat)

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 in 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	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 5
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 5.2.1
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
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 1.6

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 1.6
2.5.2	change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure and	N/A
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 5.2
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;	Figures 1,2 and 3
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;	Section 1.6

2.7.7	An indication of possible long-term benefits that will be generated by the project in relation to the benefits of the agricultural activities on the affected land;	Section 5
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 5.2.1
2.7.9	Information on the current agricultural activities being undertaken on adjacent land parcels;	Section 4.1
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 “medium” or “low” agriculture sensitivity and that were not considered appropriate;	Section 5
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
2.7.14	Any conditions to which this statement is subjected;	Section 5
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

Enviro-Solum Consulting Pty (Ltd) was appointed by Abantu Environmental Services Pty (Ltd) to conduct a soil, land use, and land capability assessment towards their pursuit of obtaining a decision from the Department of Forestry, Fisheries and the Environment (DFFE) for the Gillimberg Solar Energy Facility (SEF) and associated infrastructure. The project will be located approximately 46 km West of Polokwane within the Capricorn District (Polokwane Local Municipality) and Waterberg District (Mogalakwena Local Municipality) in Limpopo Province, South Africa. The plant will connect to the Eskom Borutho substation via a 132 kV transmission line.

1.1 PROJECT DESCRIPTION

The BBR Energy Facility (Phase 2 – Gilimberg Energy Cluster) is a proposed hybrid renewable energy project consisting of a utility-scale Solar Photovoltaic (PV) plant integrated with a Battery Energy Storage System (BESS) over approximately 300 ha. The facility is designed with a solar PV capacity of up to 200 MWac and a BESS of up to 150 MW / 600 MWh. The project aims to deliver dispatchable renewable energy, enhance grid reliability, and support South Africa's transition to a low-carbon energy mix. The project will be located approximately 46 km west of Polokwane within the Capricorn District (Polokwane Local Municipality) and Waterberg District (Mogalakwena Local Municipality) in Limpopo Province, South Africa. The plant will connect to the Eskom Borutho substation via a 132 kV transmission line.

The project site is situated on communal land on farm Gilimberg No. 861, LR, under the administration of Bohwa Bja Rena Communal Property Trust

The proposed solar facility (~300 hectares) will comprise of the following key components:

- Ground-mounted mono or bifacial solar PV modules installed on single-axis tracking systems designed to generate clean electricity using photovoltaic (PV) technology
- Battery Energy Storage System (BESS)
- Inverters/Transformer Stations
- On-site Substation and Switching Substation
- Operations and maintenance (O&M) building
- Access roads
- Temporary laydown areas
- Grid connection infrastructure for a 132 kV transmission line to Eskom Borutho substation

The key components of the proposed project are summarised below:

Table 1. Summary of the key components

Component and associated infrastructure	Description/dimensions
Solar field	• Technology: Solar Photovoltaic (PV) • Contracted Capacity: up to 200 MWac • Estimated Yearly Production: 454.88 9 GWh (P50) and 442.86 GWh (P90) • Structure: Bifacial or monofacial single-axis tracking system

Component and associated infrastructure	Description/dimensions
	• Number of solar PV module: 294912 units • Height: 3.5m • Area of PV Array: 305 ha
Battery Energy Storage System (BESS)	• Technology: Lithium-Ion • Footprint: Up to 2 ha • Height: Up to 10 m • Capacity: Up to 150 MW/600 MWh • The BESS is designed for a 4-hour duration, allowing effective shifting of solar energy from midday generation periods to evening peak demand periods (typically 17:00–21:00).
On-site Substation and Switching Substation	• Footprint: Approximately 2 ha • Height of the on-site substation complex (including switching substation): Up to 10 m. However, the on-site substation will include switchgear portals up to 15 m and lightning masts up to 25 m. • Capacity of the on-site substation complex: 132 kV • Powerline height: 32 m • Fence: Galvanised palisade fencing to be used at the substations • Fence height: Up to 2.5 m

132 kV Overhead Transmission Power Line (OHPL)	• Point of Connection: Borutho MTS
	• Line capacity: 132 kV
	• Approximate length: 4 km
	• Pylon height: 32m
	• Tower type: Self-supporting and Angle Strain towers
	• Pylon type, span, working area and footprint:
	  ○ Type: Monopole or steel lattice type pylons, or combination of both where required.
	  ○ Span: The pylons will have a span of 200 m to 350 m for monopole pylons and up to approximately 500 m for lattice structures.
	  ○ Footprint: The size of the final constructed pylon footprint depends on the type of structure used, which will typically range from approximately 0.5 m^2 to 8 m^2 for monopole pylons, and 36 m^2 to 64 m^2 for steel lattice pylons.

Inverter/Transformer Stations	• Number of Inverters: 64 units • Height: Approximately 2 m
Access roads (including upgrading and widening of existing roads, where relevant)	• Existing roads will be used as far as practically achievable. • Details: New Access roads will need to be established. These would either comprise farm roads (compacted dirt/gravel) or paved roads. • Length: up to 5 km • Width: Approximately 8 -15 m
Internal roads	• New internal service roads will need to be established. These would either comprise farm roads (compacted dirt/gravel) or paved roads. • Length: up to 15 km • Width: up to 10 m
On-site medium voltage internal cables	• Placement: Underground (maybe above ground pending technical constraints) • Capacity: 33 kV

Component and associated infrastructure	Description/dimensions
	• Depth: Maximum depth of 1.5 m
Auxiliary Buildings	• Type: These include, but are not limited to, Operation and Maintenance (O&M) building / centre, site office, workshop, staff lockers, bathrooms/ablutions, warehouses, guard houses, etc. • Cumulative Footprint: Approximately up to 5000 m^2 • Height: Up to 10 m
Work area during the construction phase (i.e. laydown area)	Temporary Laydown: Up to 4 ha.
Fencing around the PV Facility Perimeter	• Type: palisade or mesh or electric fencing • Height: Up to 3 m

The project design considers both DC-coupled and AC-coupled configurations, with AC coupling recommended to enable independent battery dispatch and future grid charging capability. Lithium-ion battery technology (likely LFP chemistry) is expected due to its maturity, cost-effectiveness, and safety profile. The plant will include modular battery containers, inverter stations, and energy management systems (EMS). Design provisions will allow scalability and future expansion beyond 600 MWh. PV technology options include single-axis tracking systems to maximise generation yield.

Several Listed Activities are triggered by the proposed development and, as such, Environmental Authorisation (EA) is required prior to commencement of the activities detailed in Section **Error! Reference source not found.** of this report. Abantu Environmental Services has been appointed as the independent environmental assessment practitioners to facilitate the EIA process and obtain the relevant authorisations. The EA application is subject to a Full Scoping and Environmental Impact Assessment (EIA) Process and will be adjudicated by the identified competent authority, the Department of Forestry, Fisheries and the Environment (DFFE). This Scoping Report is prepared in accordance with the requirements of Appendix 2 of the Environmental Impact Assessment Regulations, 2014, as part of the National Environmental Management Act (NEMA, Act 107 of 1998).

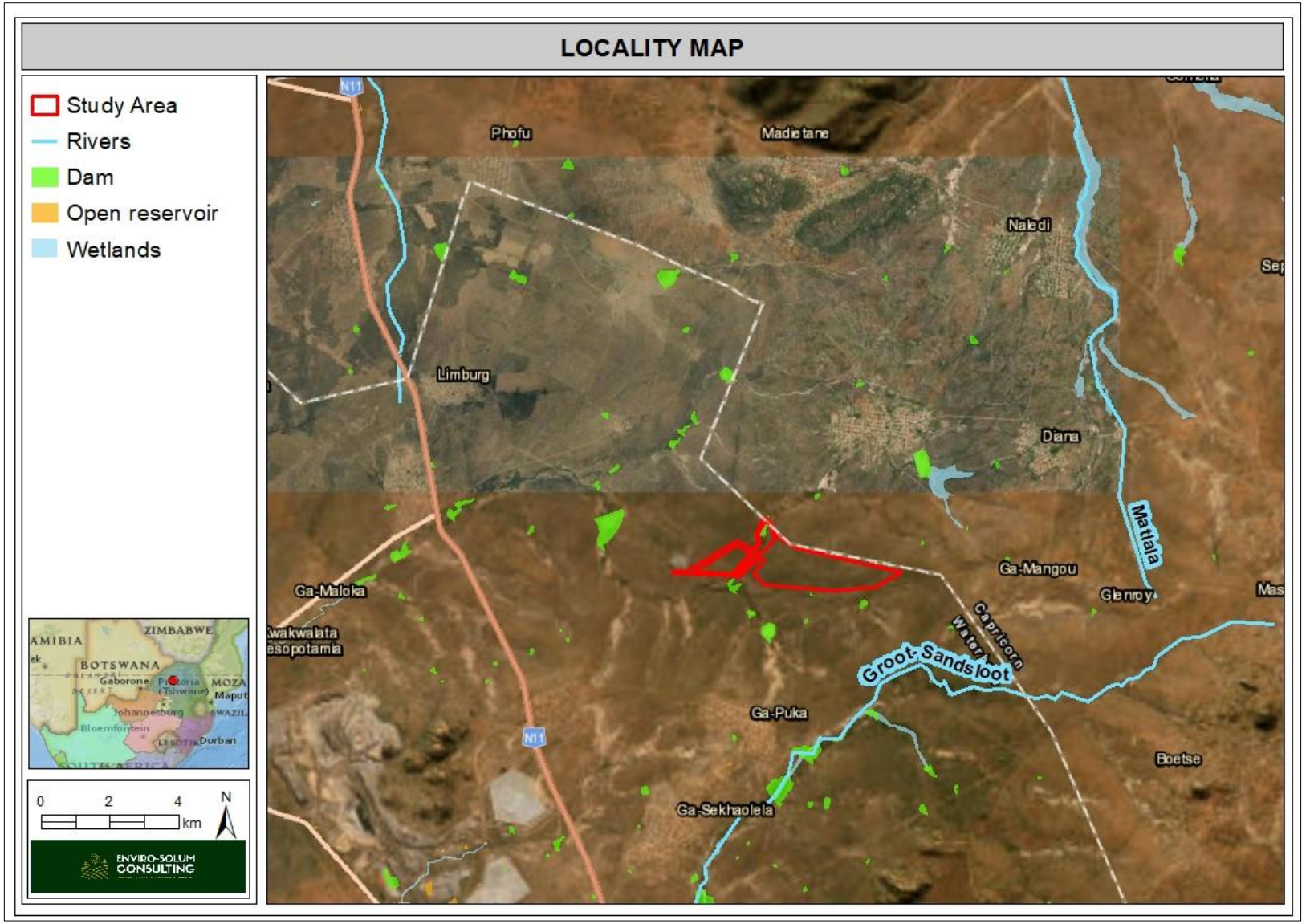


Figure 1: Locality of the study area in relation to the surrounding areas.

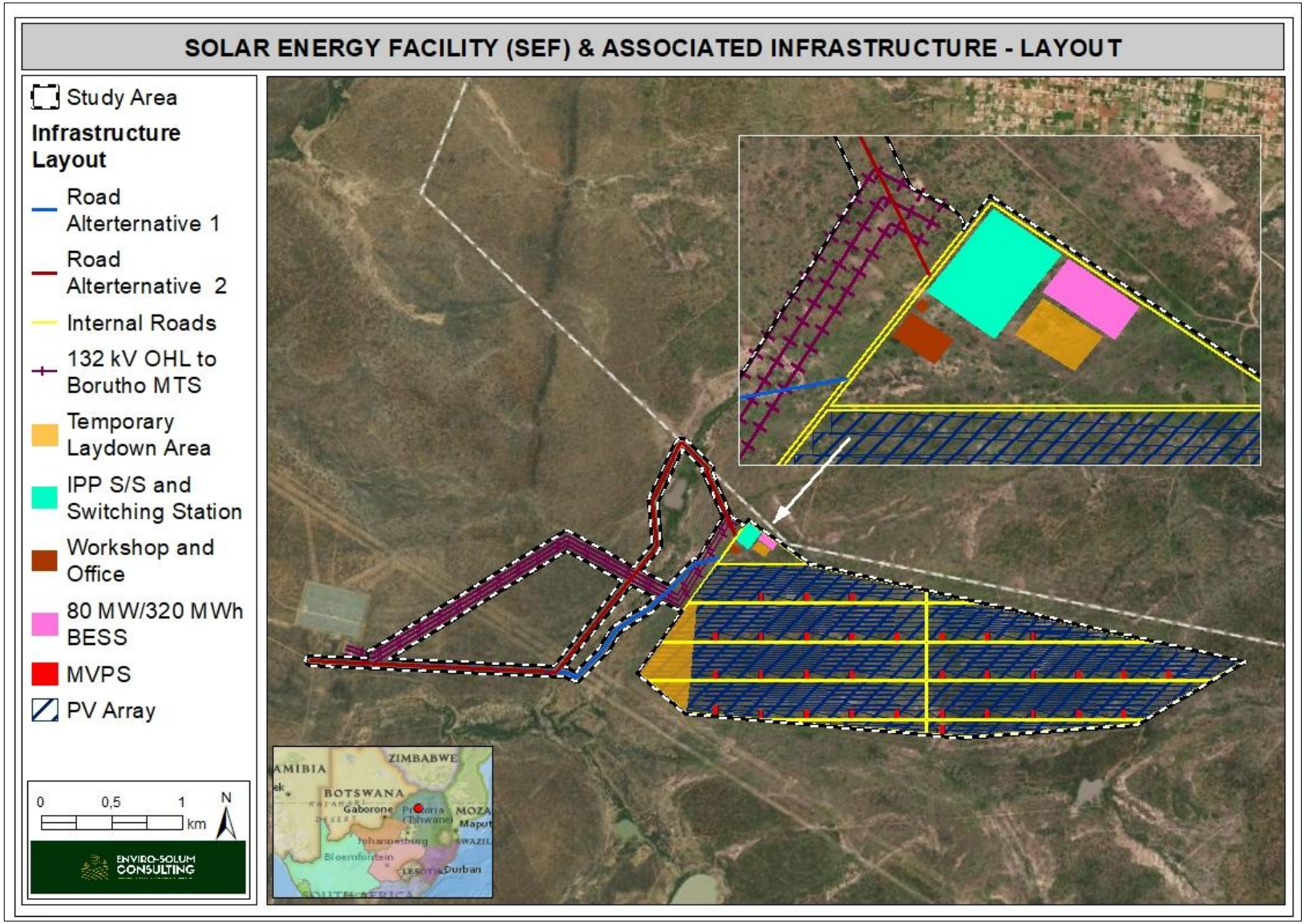


Figure 2: Proposed layout of the BBR solar energy facility in relation to the surrounding areas.

1.2 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 for the majority 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.

1.3 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.

1.4 TERMS OF REFERENCE

The terms of reference for this study are to fulfil the requirements of the Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The summarised 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 minimise the negative impacts anticipated from the proposed development and
- Compile soil, land use, and land capability reports based on the field-finding data under on-site conditions.

1.5 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; and
- Soil profiles were observed using a 1.5 m hand-held soil auger; thus, a description of the soil characteristics deeper than 1.5 m cannot be given.

2. METHODOLOGY

The assessment of the study area's agricultural potential was based on a combination of desktop studies to gather general information, site visits for status quo assessment, soil classification and characterization, and validation of the information generated 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 two days in November 2026, during which time 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 2 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 Scotney *et.al* (1987).

Table 2: Soil Capability Classification (after Scotney *et al.*, 1987).

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 2017. 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 3 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 producing cultivated crops. (DAFF, 2017). Several factors affect soil agricultural potential (see Table 4 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 too low to the updated land capability ratings.

Table 3: National Land Capability Values (DAFF, 2017).

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 4: 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 potentially limit the agricultural use thereof.
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 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 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 pertaining to 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.

Figure 3 below presents the screening tool for the study area where the proposed development is to take place.

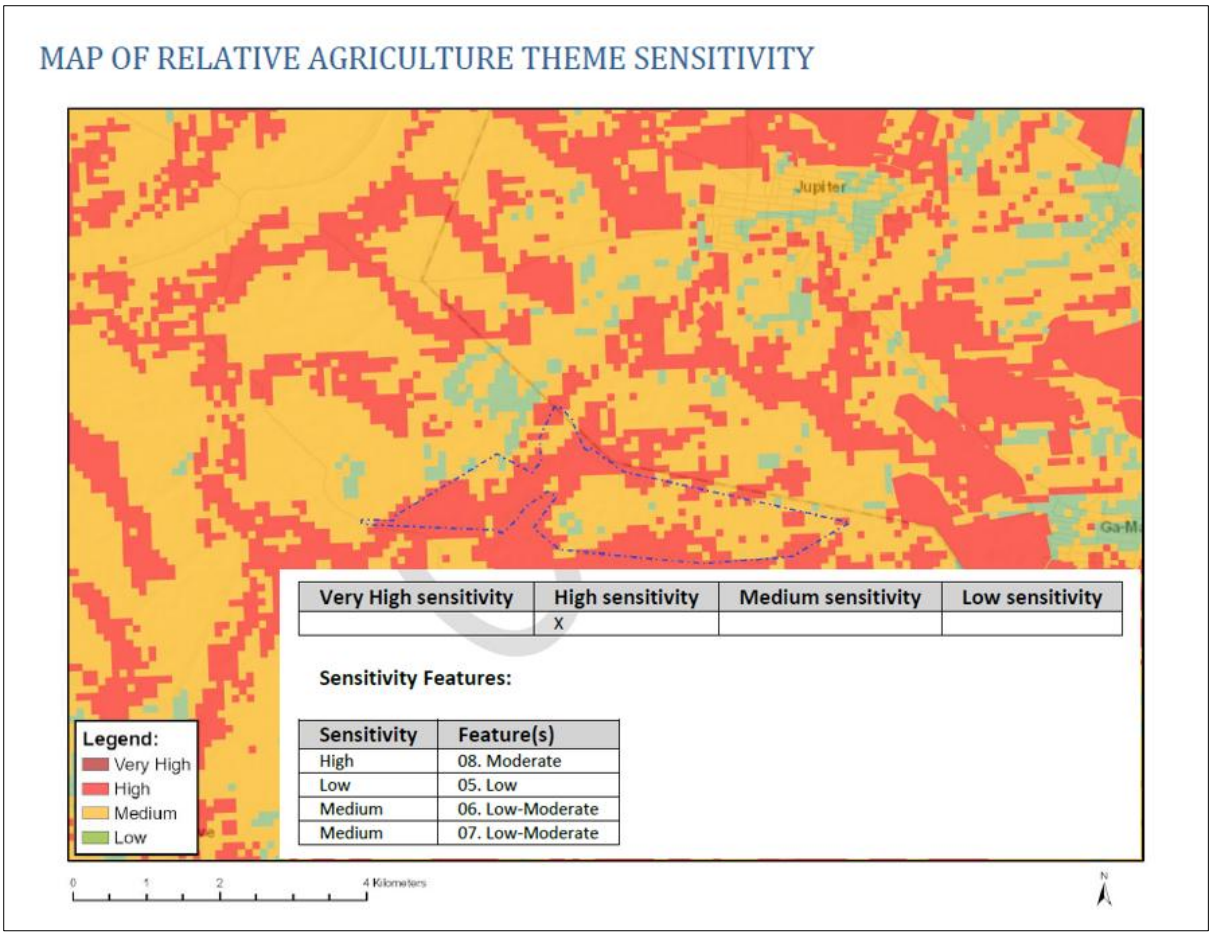


Figure 3: Screening tool sensitivity for the study area.

3. DESKTOP RESULTS AND DISCUSSIONS

3.1 CLIMATIC DATA

The study area is situated within a semi-arid to arid climatic region, characterised by high temperatures during summer and cool to cold conditions in winter, with variations influenced by elevation. These regions typically experience high rates of evapotranspiration, low atmospheric humidity, and significant differences between daytime and nighttime temperatures. Rainfall is irregular and often occurs as thunderstorms, which are difficult to predict. The study area generally receives an average annual rainfall of 401- 600 mm, suggesting that dryland farming may be feasible where soil conditions are favourable. Average annual evaporation across the area ranges from approximately 1 801 to 2 000 mm, increasing the potential for drought stress and crop wilting. Although these climatic conditions restrict the variety of crops and planting periods suitable for rain-fed agriculture, several drought-tolerant forage crops can still achieve satisfactory yields when planted at the appropriate time and/or supported by supplementary irrigation. Figure 4 below shows the mean annual rainfall associated with the study area.

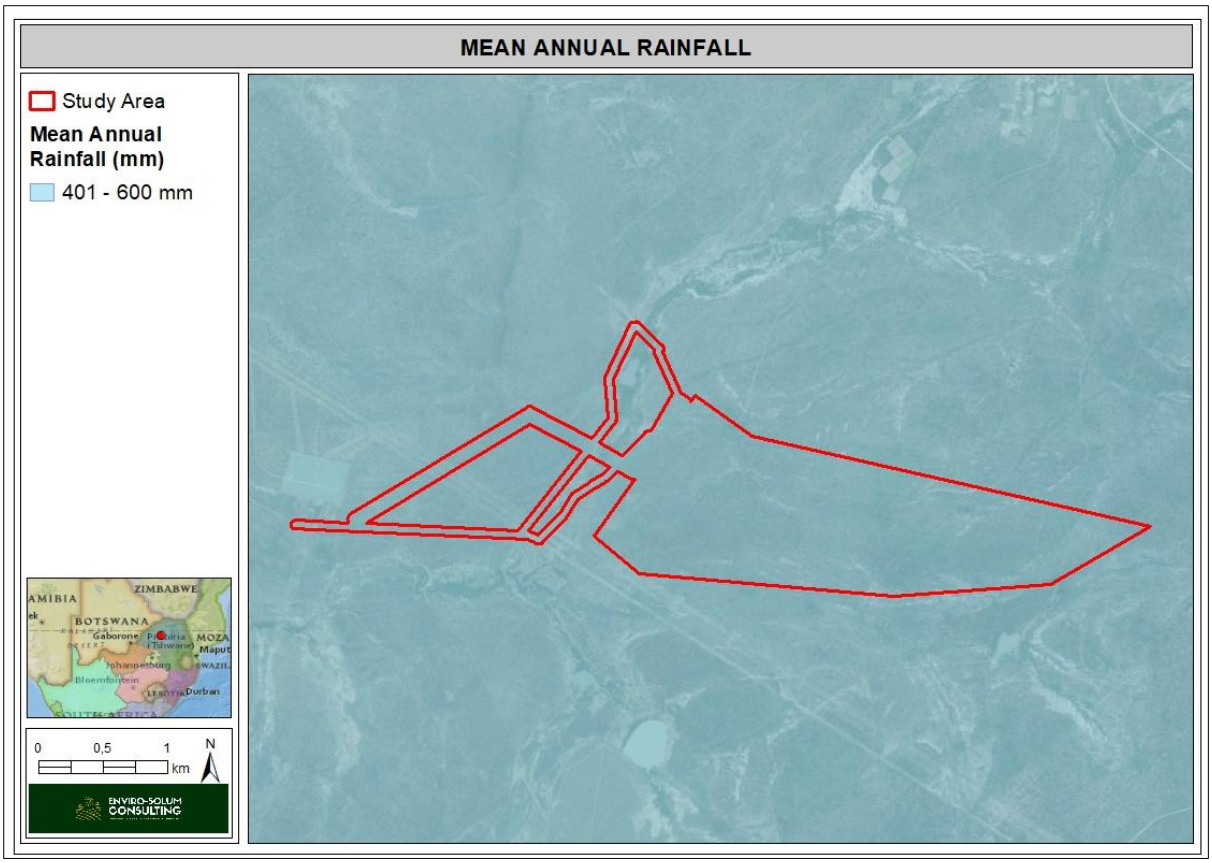


Figure 4: Mean Annual Rainfall associated with the study area.

3.2 GEOLOGY

The geological material dominating the study area is Meinhardskraal, Granite, Sand River, Gneiss formations. Soils developed from these geological formations generally originate through the physical and chemical weathering of granitic rock, which commonly contains quartz, feldspar and mica. These soils may range from shallow, coarse-textured and gravelly profiles to deeper, sandy loam or loamy profiles, depending on the degree of weathering and landscape position. Crop farming requires fertilisation and irrigation. Figure 5 below depicts the geology associated with the study area.

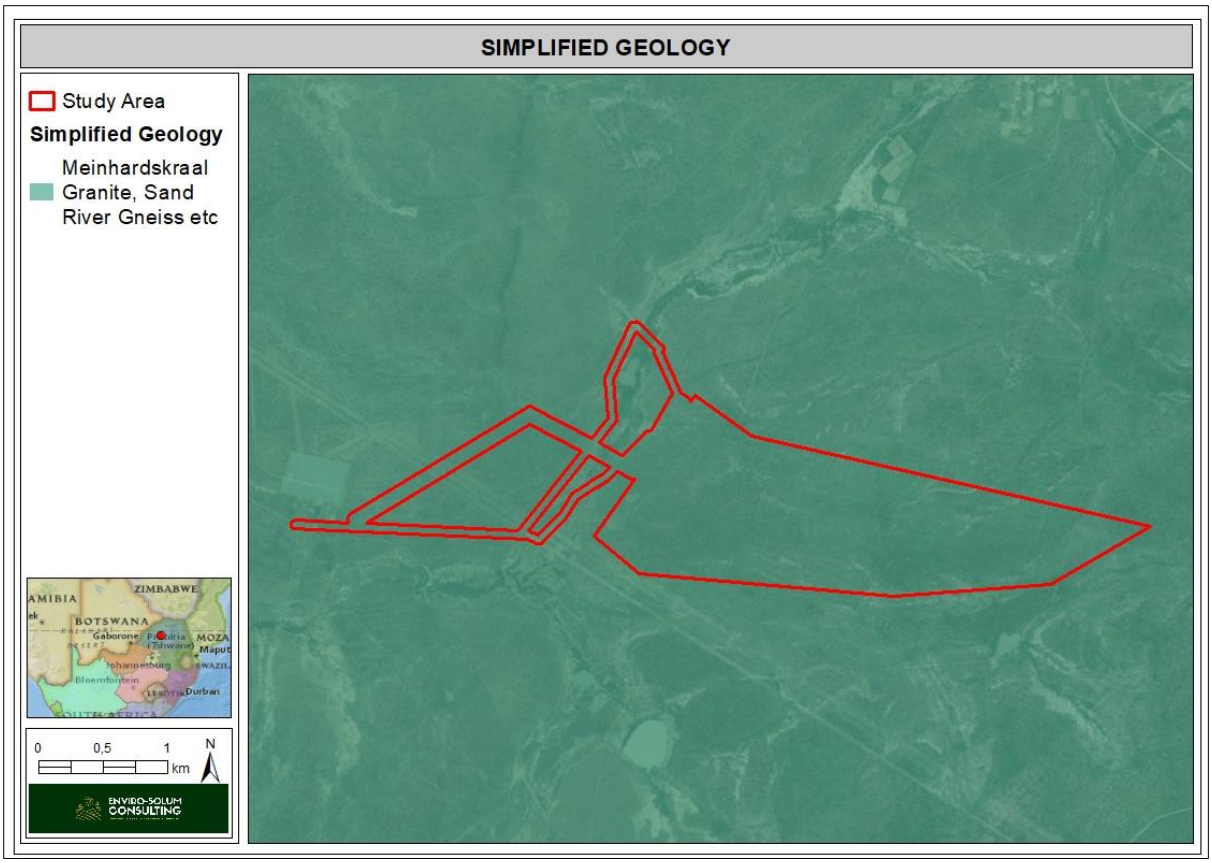


Figure 5: Geological formations associated with the study area.

3.3 Soil Physical Characteristics

The entire study area is dominated by soils with no beneficial water retaining characteristics below the rooting zone. This means the soils within the study area may not have the necessary capability to store and retain moisture to facilitate dryland farming all year round. Considering the little annual rainfall as well as high evaporative demand associated with the area, successful dryland farming may not be feasible without supplementary irrigation for sustainable cropping.

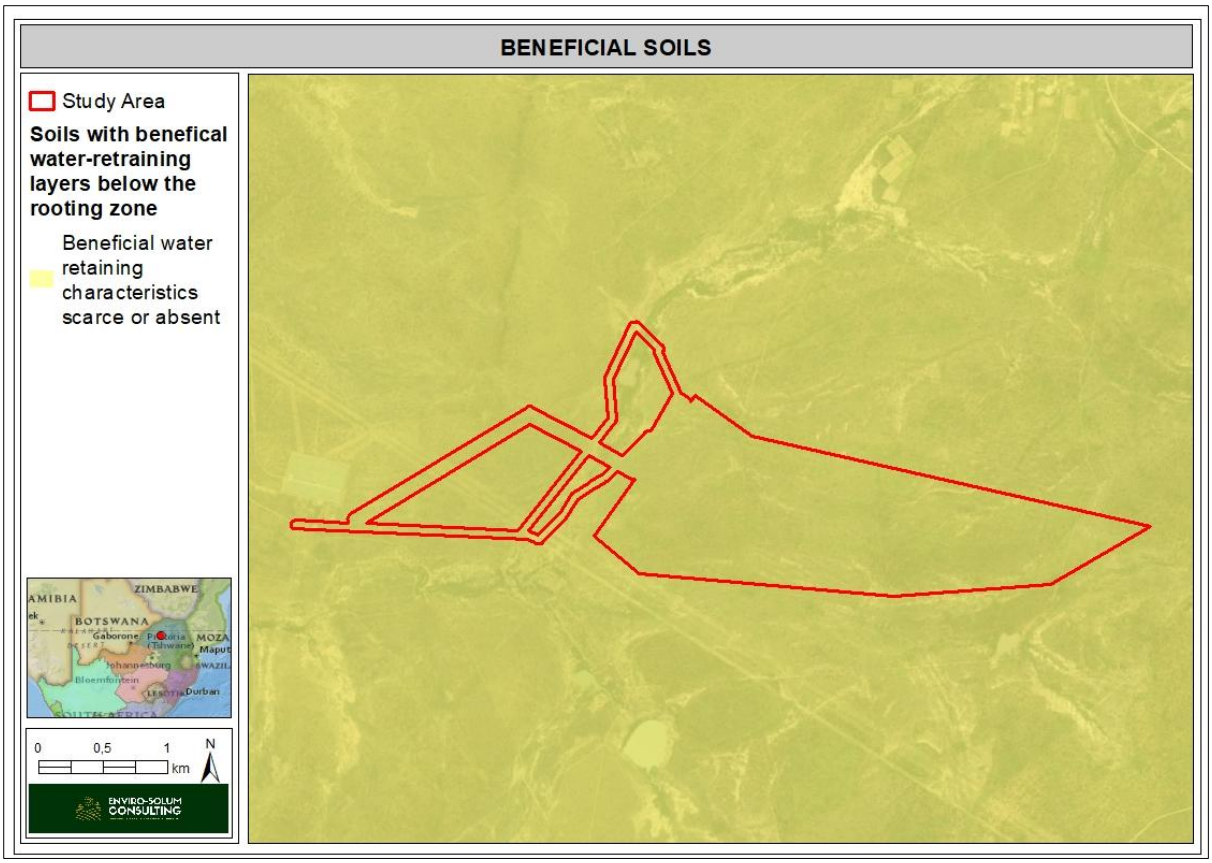


Figure 6: Soils with beneficial water-retaining layers below the rooting zone.

3.4 SALINITY AND SODICITY

The entire study area does not comprise of soils with salinity and sodicity and challenges. Soil salinity and sodicity negatively affect farming and cultivation by reducing soil fertility, limiting plant growth, and lowering crop yields. Salinity occurs when excess soluble salts accumulate in the soil, making it difficult for plants to absorb water and essential nutrients, which can lead to poor growth and wilting. Sodicity, on the other hand, occurs when excessive sodium affects the soil structure, causing soil particles to disperse, reducing water infiltration, drainage, and aeration. Both conditions make it difficult for crops to grow successfully, reduce agricultural productivity, and may eventually render land unsuitable for cultivation (Figure 7)

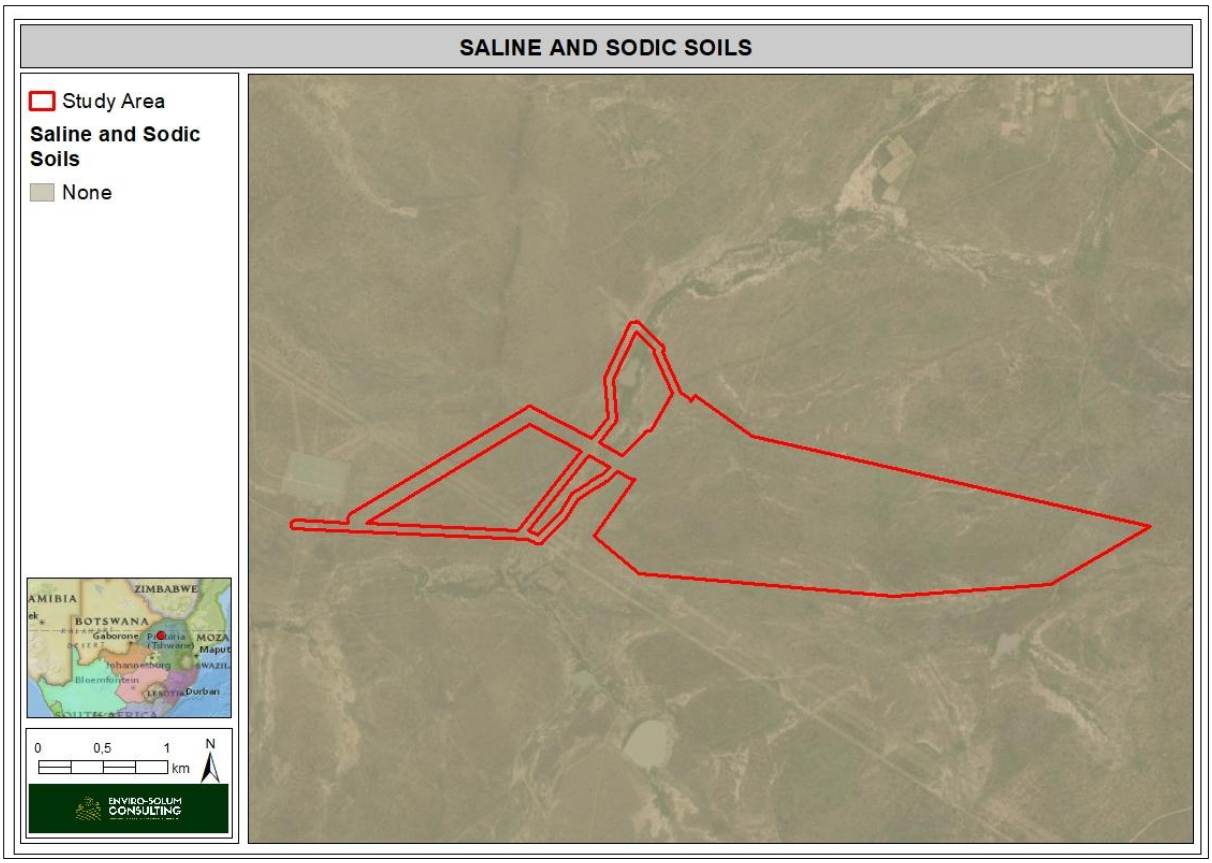


Figure 7: Salinity and sodicity of the soils associated with the study area.

3.5 Landform Types

The entire study area is dominated by level plains as the dominant landform type. Plain landforms are broad, relatively flat or gently sloping areas of land that play an important role in farming and cultivation. They are generally suitable for agriculture because they allow easy movement of machinery, support large-scale crop production, and often provide good conditions for irrigation. However, their agricultural suitability depends on factors such as soil fertility, drainage, rainfall, and the risk of flooding. Different types of plains, such as floodplains, coastal plains, and alluvial plains, can offer fertile soils that support crop growth, although some may experience waterlogging or flooding.

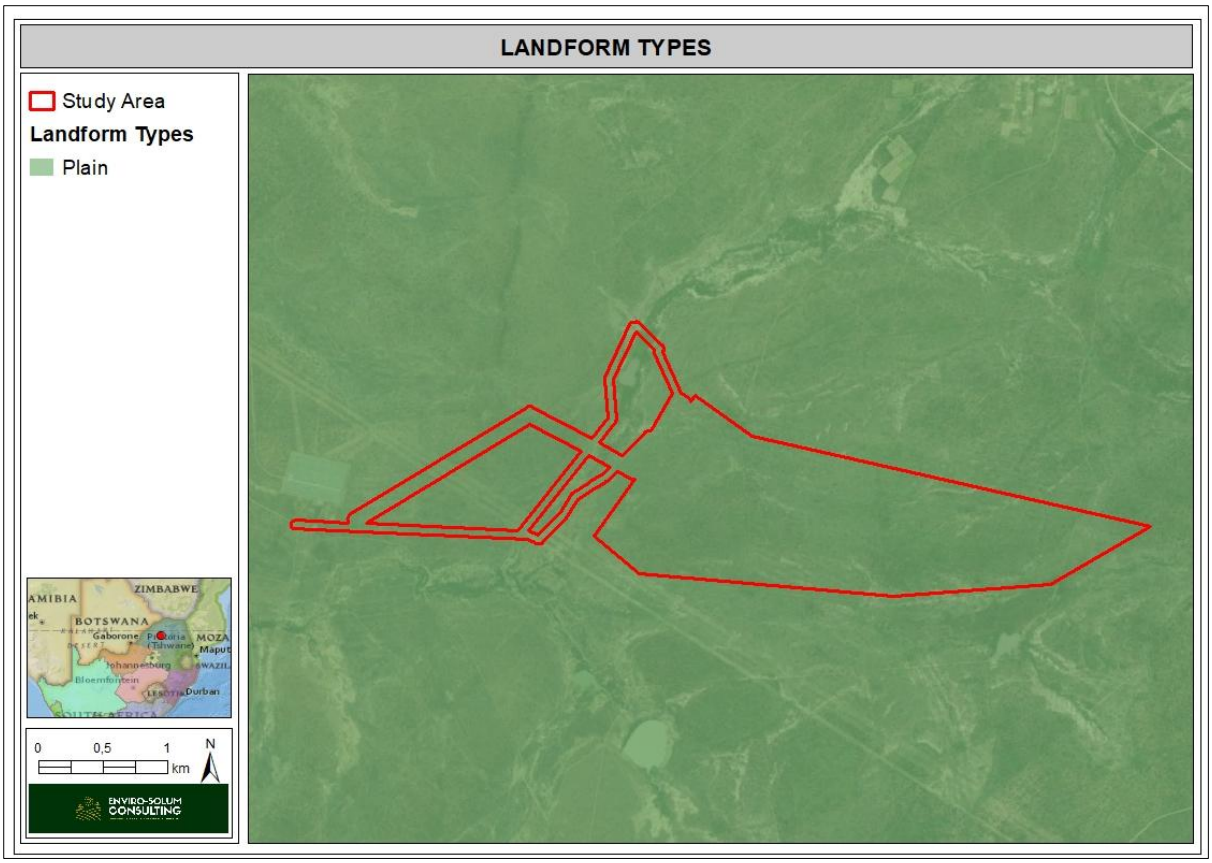


Figure 8: Landform types associated with the study area.

3.6 Land type Classes

The majority of the study area is dominated by the Ae335 land type class while a small portion is dominated by the Bd57 land type class. Ae land type is generally associated with soils that have limited agricultural potential due to shallow soil depth, rockiness, or restricted effective rooting depth. These conditions can limit crop growth and reduce the suitability of the land for intensive cultivation. Bd land type is often associated with relatively deep, well-developed soils, often occurring in gently sloping or flatter landscapes. These soils may offer better potential for cultivation, depending on their fertility, drainage, and soil texture. Figure 9 below depicts the land type classes associated with the study area.

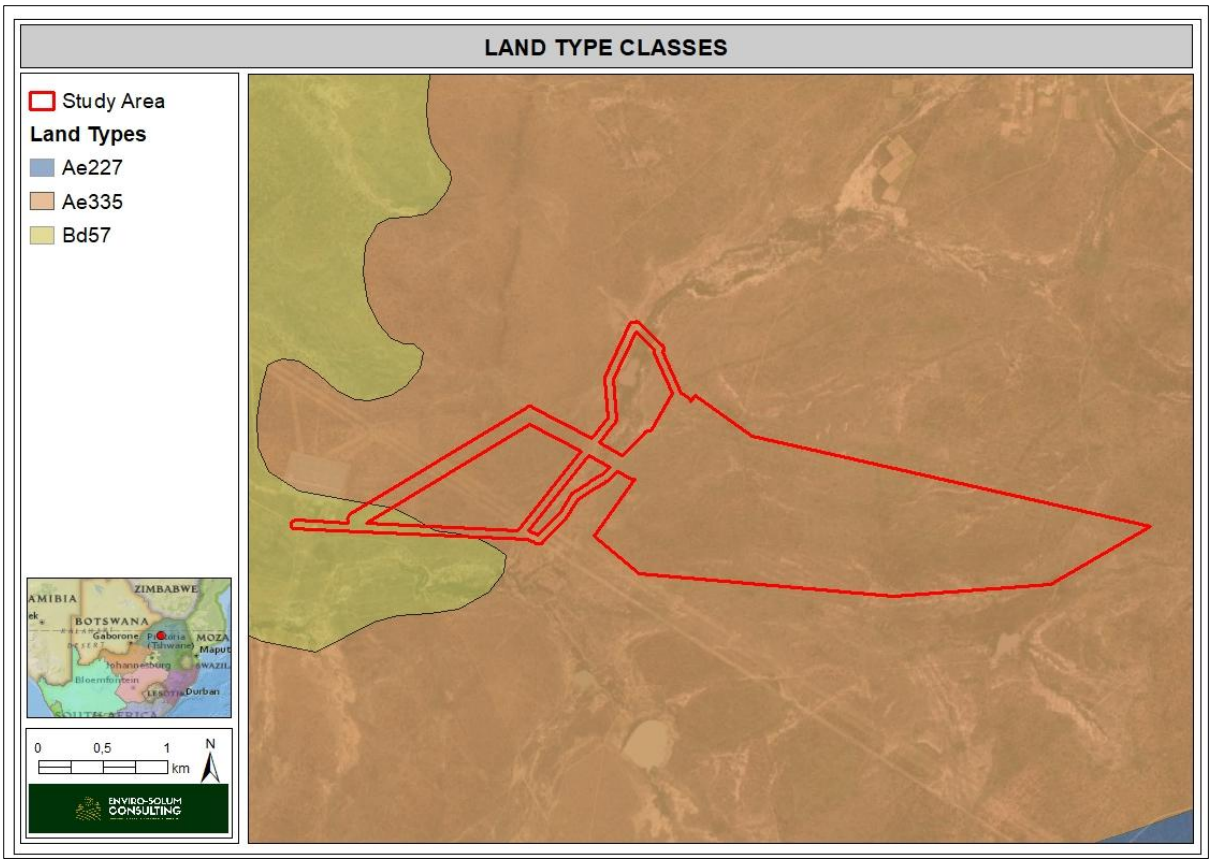


Figure 9: Land type classes associated with the study area.

3.7 Desktop Land Capability

Most of the study area is dominated by arable land capability class while a small portion is characterised by land capability more suited for grazing of livestock. According to the Department of Agriculture, Land Reform, and Rural Development (DALRRD, 2016), land capable of sustained long-term agricultural production is a very limited resource in South Africa. Generally, the dataset indicates that most of the study area has land capability suitable for agricultural cultivation of crops. The perceived potential impacts on soil and land capability are unlikely to be severe and within acceptable limits, especially if mitigating measures are implemented sufficiently and adequately during all phases of development and associated infrastructure. Figure 10 below shows the desktop land capability associated with the study area.

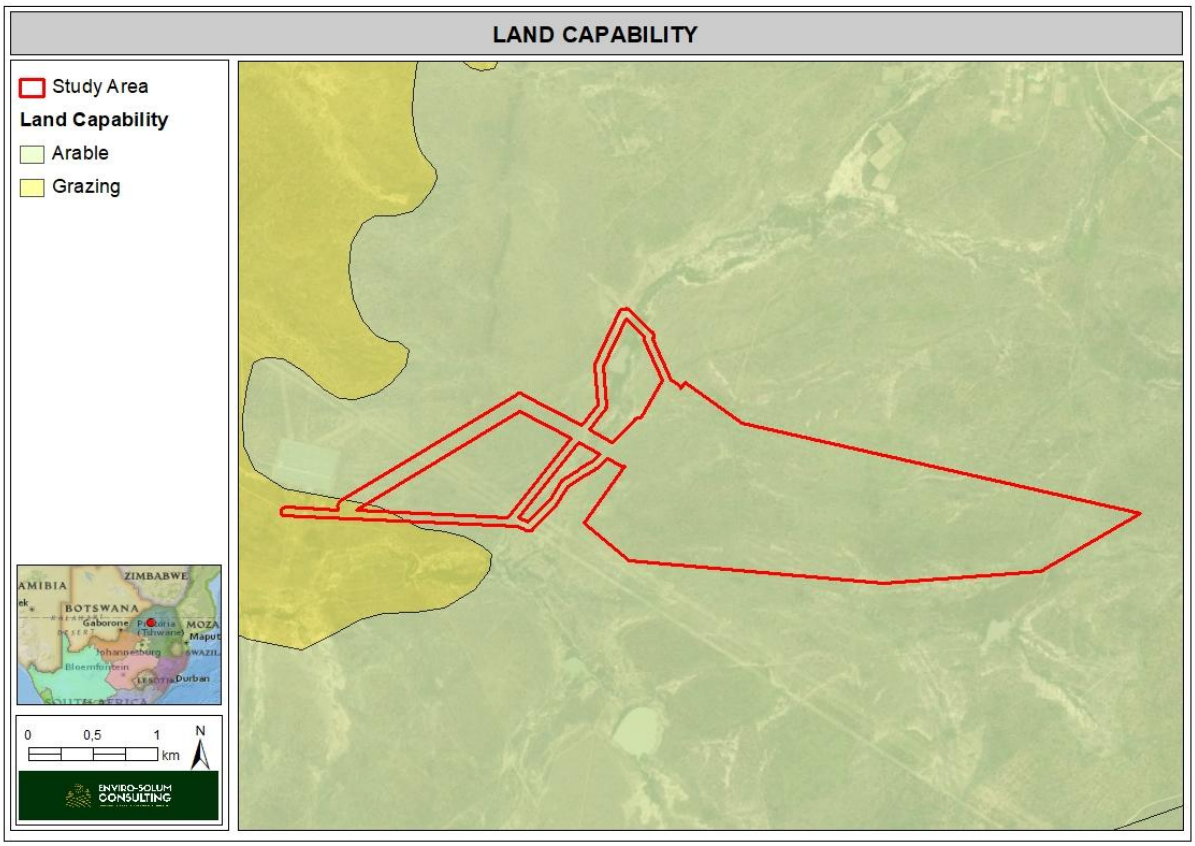


Figure 10: Desktop land capability classes associated with the study area.

3.8 Grazing Capacity

The livestock grazing capacity potential for most of the study area is estimated to range from 11 – 13 hectares per livestock unit (ha/LSU) while small patches within the study area are characterised by 14 – 17 ha/LSU. This level of grazing capacity is regarded as low to moderate and unsuitable for sustained subsistence and/or commercial livestock farming. Veld and pasture management remain imperative to achieve successful grazing rotations within camps. Refer to Figure 11 below.

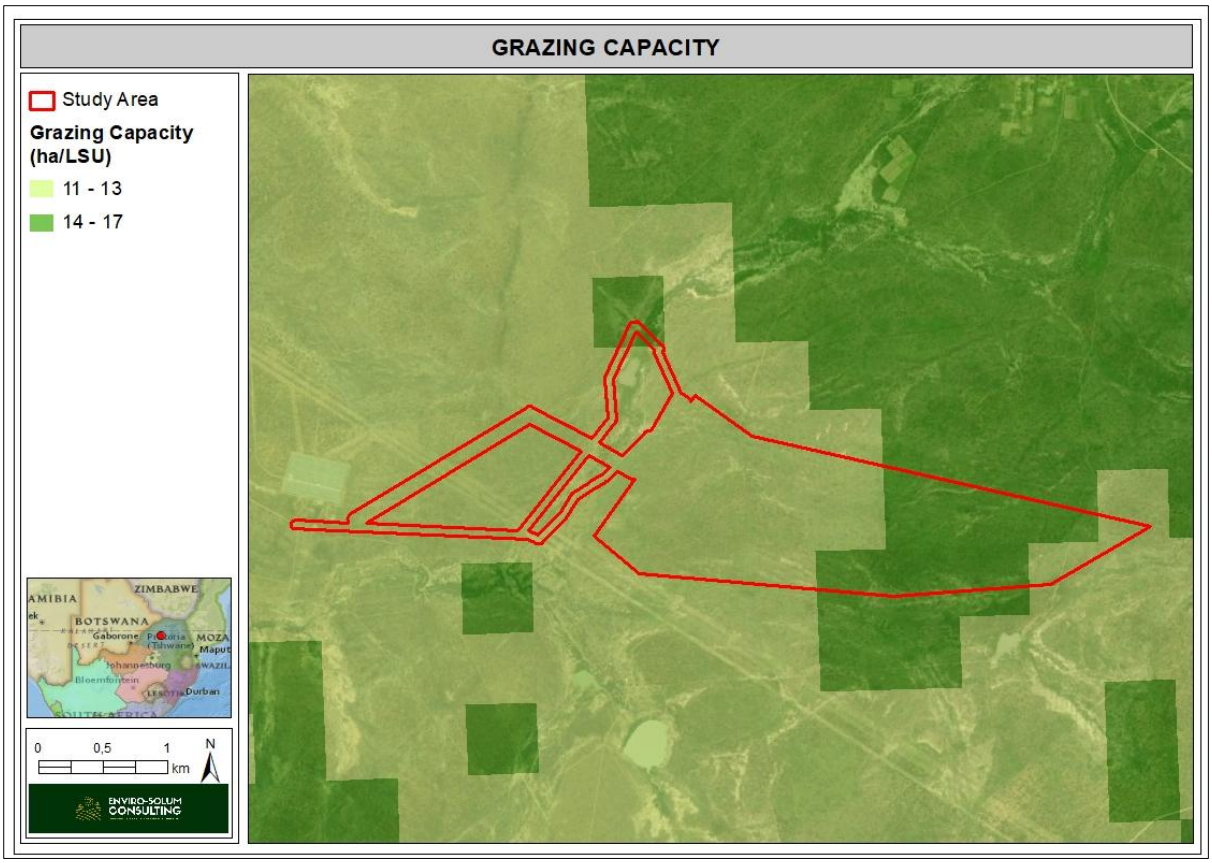


Figure 11: Grazing capacity potential associated with the study area.

3.9 Soil & Terrain (SOTER) Dominant Soils

According to the Soil & Terrain (SOTER) dominant soils dataset, most of the study area is dominated by Ferric Luvisols while a tiny portion of the study area is comprised of Lithic Leptosols. Ferric Luvisols are soils characterised by the accumulation of clay in the subsoil (clay-enriched B horizon) and the presence of iron-rich compounds, which often give them a reddish or yellowish colour. They generally develop through weathering and clay movement from the upper soil layers into the lower horizons. In agriculture, Ferric Luvisols can support crop cultivation because they may have relatively good soil depth and nutrient-retention capacity. However, their farming potential depends on soil fertility, acidity, drainage, erosion risk and the degree of compaction. Proper soil management, fertilisation and erosion control are important to maintain their productivity (Figure 12).

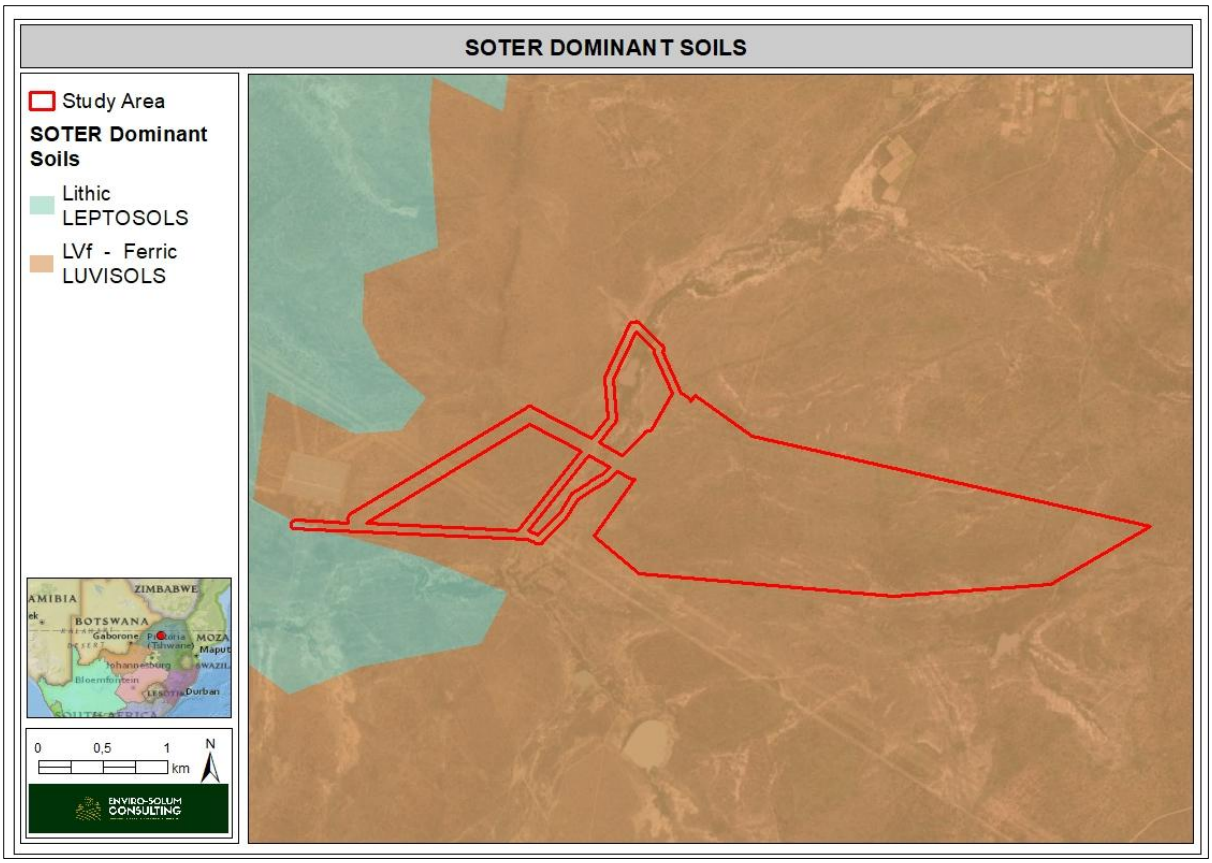


Figure 12: Soil & Terrain (SOTER) Dominant Soils associated with the study area.

3.10 Predicted Soil Loss

The study area is predominantly characterised by a moderate probability of predicted soil loss, with smaller portions exhibiting a high probability of soil loss. This indicates that a considerable proportion of the area is susceptible to soil erosion, posing a potential threat to soil fertility and agricultural productivity. Therefore, implementing appropriate soil conservation and erosion-control measures is essential to minimise the loss of fertile topsoil, maintain soil quality and ensure sustainable agricultural cultivation (Figure 13).

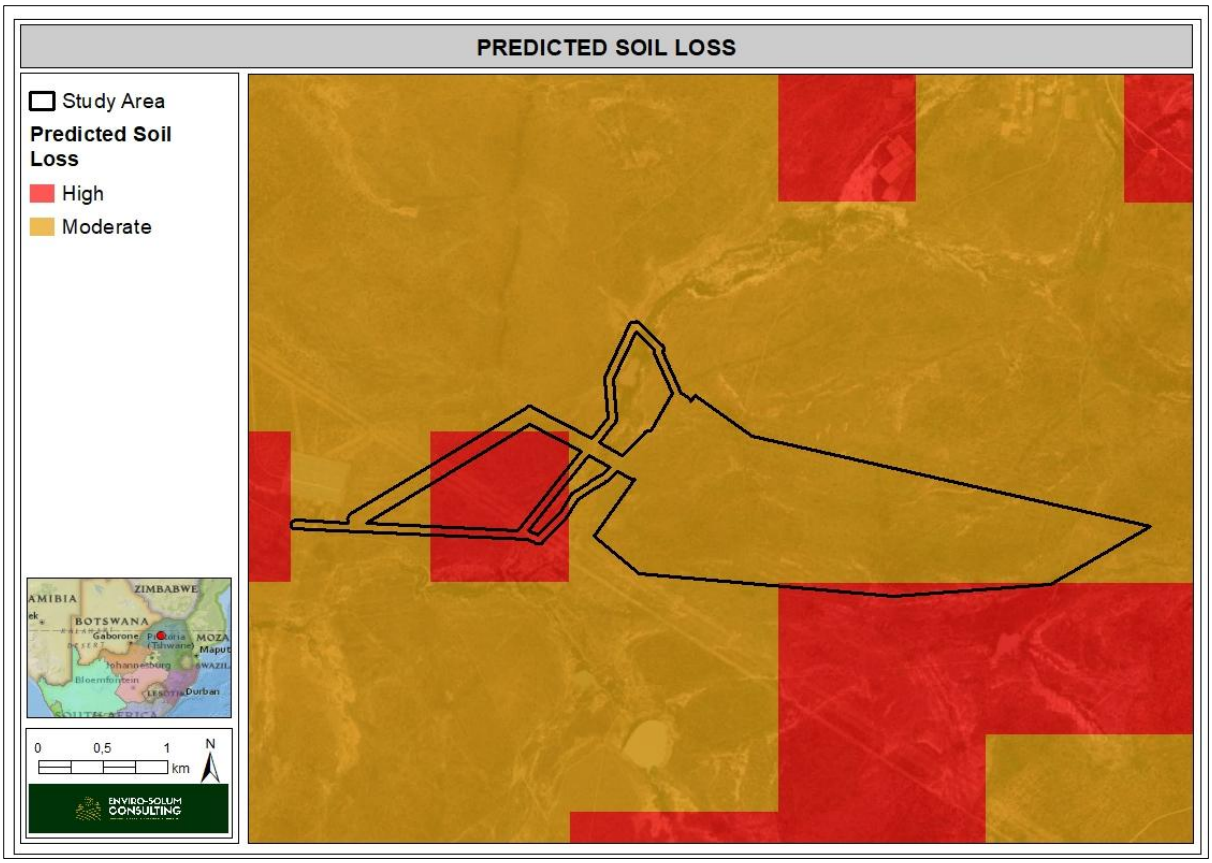


Figure 13: Predicted soil loss associated with the study area.

4. FIELD VERIFIED RESULTS AND DISCUSSIONS

4.1 Land Uses Within And In the Vicinity Of the Study Area

The study area is predominantly characterised by natural vegetation and wilderness areas, primarily used for livestock grazing, particularly cattle. Other identified land uses include an existing overhead powerline infrastructure and subsistence cultivation of vegetable crops, mainly cabbage, outside the assessment area. These land use activities reflect the existing utilisation of the study area and its immediate surroundings. Figure 14 below illustrates the current land use activities identified during the site assessment.

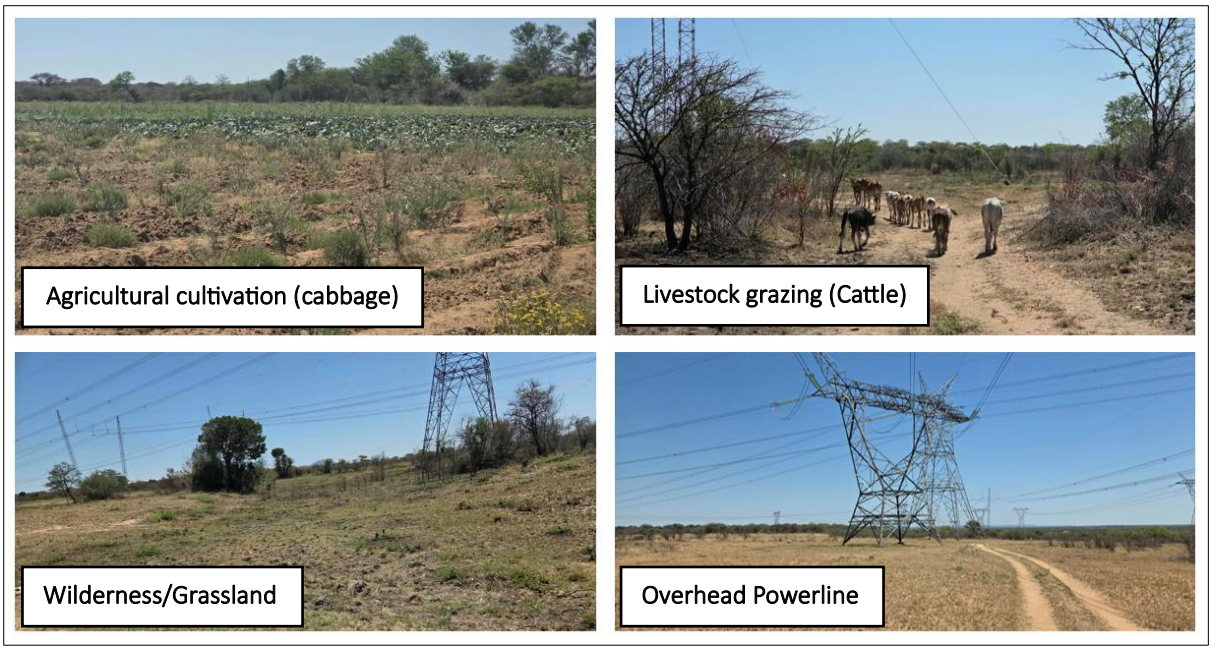


Figure 14: Current land uses associated with the study area.

4.2 Soil Forms in the Study Area

The section below focuses on the identified soil forms within the study area. Figure 16 presents the spatial distribution of the identified soil forms within each study area. Table 5 presents a summary of the area of coverage for each identified soil form.

4.2.1 Mispah/Glenrosa

Glenrosa soil form is characterised by a shallow soil profile over weathered rock, usually with an A horizon overlying a lithocutanic B horizon. It has limited effective rooting depth and water-holding capacity, which may restrict crop growth and agricultural productivity while Mispah soil form is characterised by a shallow soil profile directly over hard rock, typically with an A horizon overlying hard rock. Its limited rooting depth restricts water storage and root development, making it generally less suitable for intensive crop cultivation. It is more commonly associated with natural vegetation and grazing. Both soil forms generally have limitations for intensive cultivation due to their shallow depth, restricted root penetration and relatively low water-holding capacity. However, they may support natural vegetation and livestock grazing. Figure 15 below depicts the transformed soils and the underlying lithic material excavated during the deep in-situ ripping.



Figure 15: View of the identified shallow soils suitable for grazing land.

4.2.2 Dundee (Alluvial/Surface Water)

The wet-based soil identified within the study area is classified as Dundee soil form, typically associated with alluvial deposits and areas influenced by surface water accumulation. These soils generally have low nutrient levels in the topsoil and alluvial horizons, which may limit their suitability for crop cultivation. Furthermore, prolonged soil wetness can create waterlogged, anaerobic conditions within the root zone (approximately 30 cm), restricting root respiration, nutrient uptake, and overall crop development. Consequently, these soils are considered to have low to moderate agricultural potential, with their primary agricultural suitability being livestock grazing rather than intensive cultivated crop production.



Figure 16: View of the identified wet-based soil associated with the study area.

4.2.3 Witbank (Disturbed Areas)

The Witbank (Disturbed) soil forms are characterised by areas that have undergone significant physical disturbance as a result of human activities and infrastructure development. Within the study area, these soils are associated with developed areas, including residential structures, farm storage facilities and existing road networks. Such activities have resulted in the removal, mixing or burial of natural soil materials, making it difficult to identify the original diagnostic soil horizons. Consequently, these soils generally have limited agricultural potential and are considered unsuitable for intensive crop cultivation due to the altered soil structure, disturbed soil profile and potential restrictions on natural soil development.



Figure 17: View of the identified disturbed areas associated with Witbank formation.

Table 5: Soil forms in hectares (ha) occurring within the study area.

Study Area				
Soil Forms	**Area (Ha)**	**Percentage (%)**	**Land Capability**	**Agricultural Potential**
Mispah/Glenrosa	359.0	99.4	Grazing (Class VI)	Moderate
Dundee (Alluvial)	1,4	0.4	Watercourse (Class V)	Low
Witbank (Anthrosols)	0.8	0.2	Wilderness (Class VIII)	Very Low
Total Enclosed	**361.3**	**100**		

Table 6: Land capability (DFFE, 2017) associated with the soils occurring within the study area.

Soil Form	Land Capability Groups	DFFE (2017) Classification
Mispah/Glenrosa	Grazing Land	8. Moderate
Dundee (Alluvial)	Watercourse	5. Low
Witbank (Anthrosols)		2. Very Low

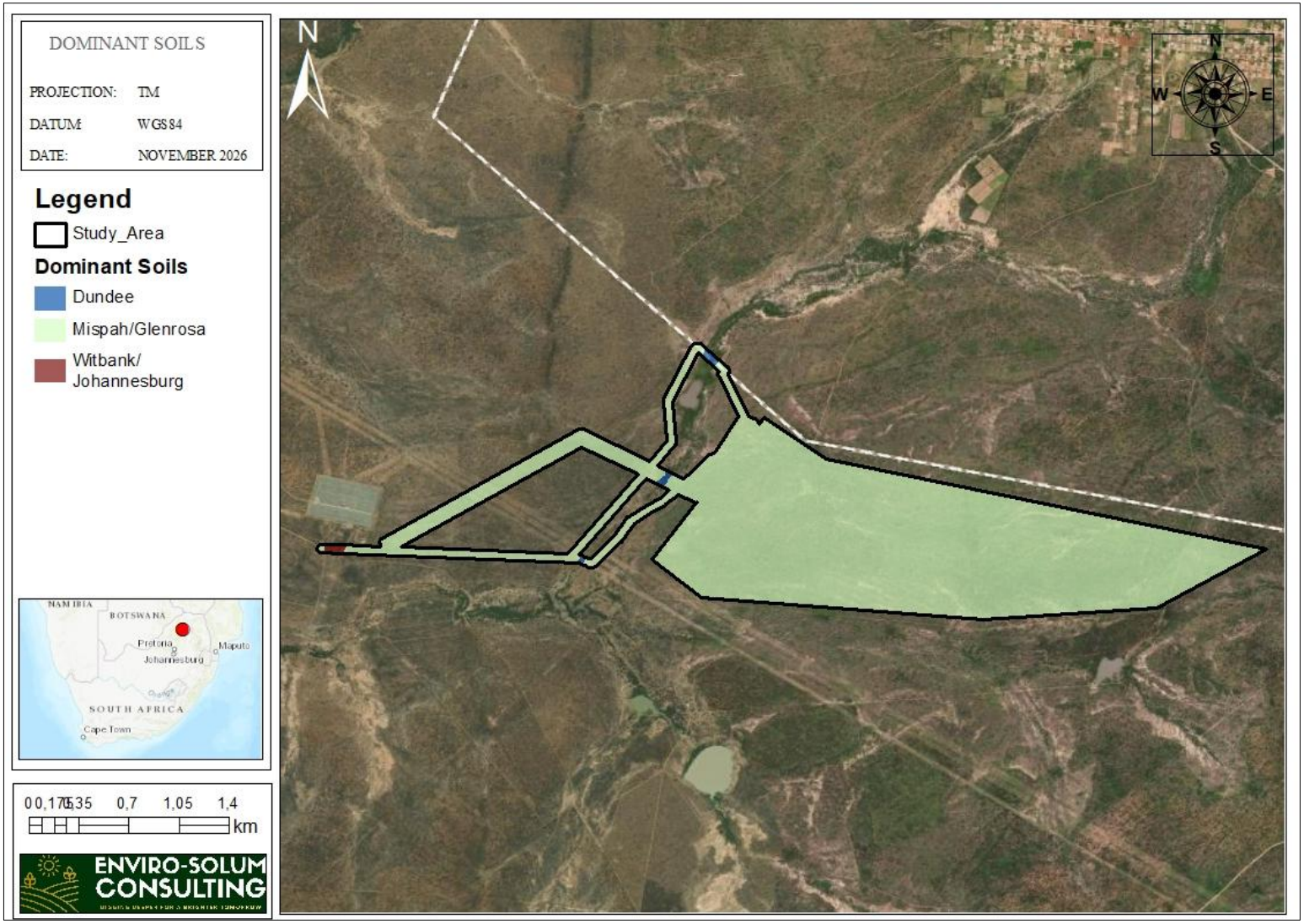


Figure 18: Dominant soils form within the study area.

4.3 Land Capability and Agricultural Potential

Land capability is defined as the most intensive long-term use of land for 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 were considered in light of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Figures 19 and 20 below depict land capability in the study area, while Figure 21 depicts agricultural potential.

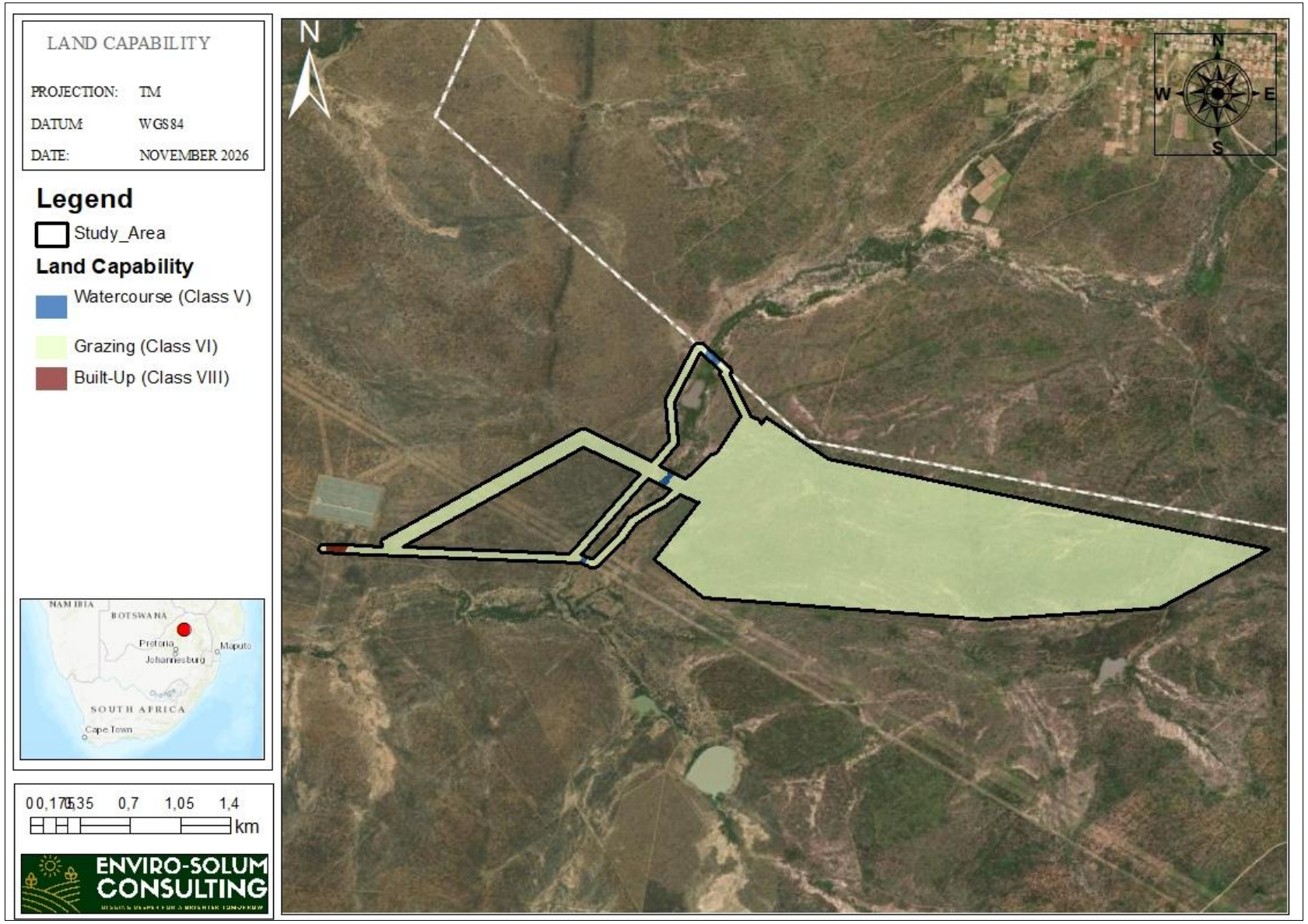


Figure 19: Map depicting land capability of soils within the study area.

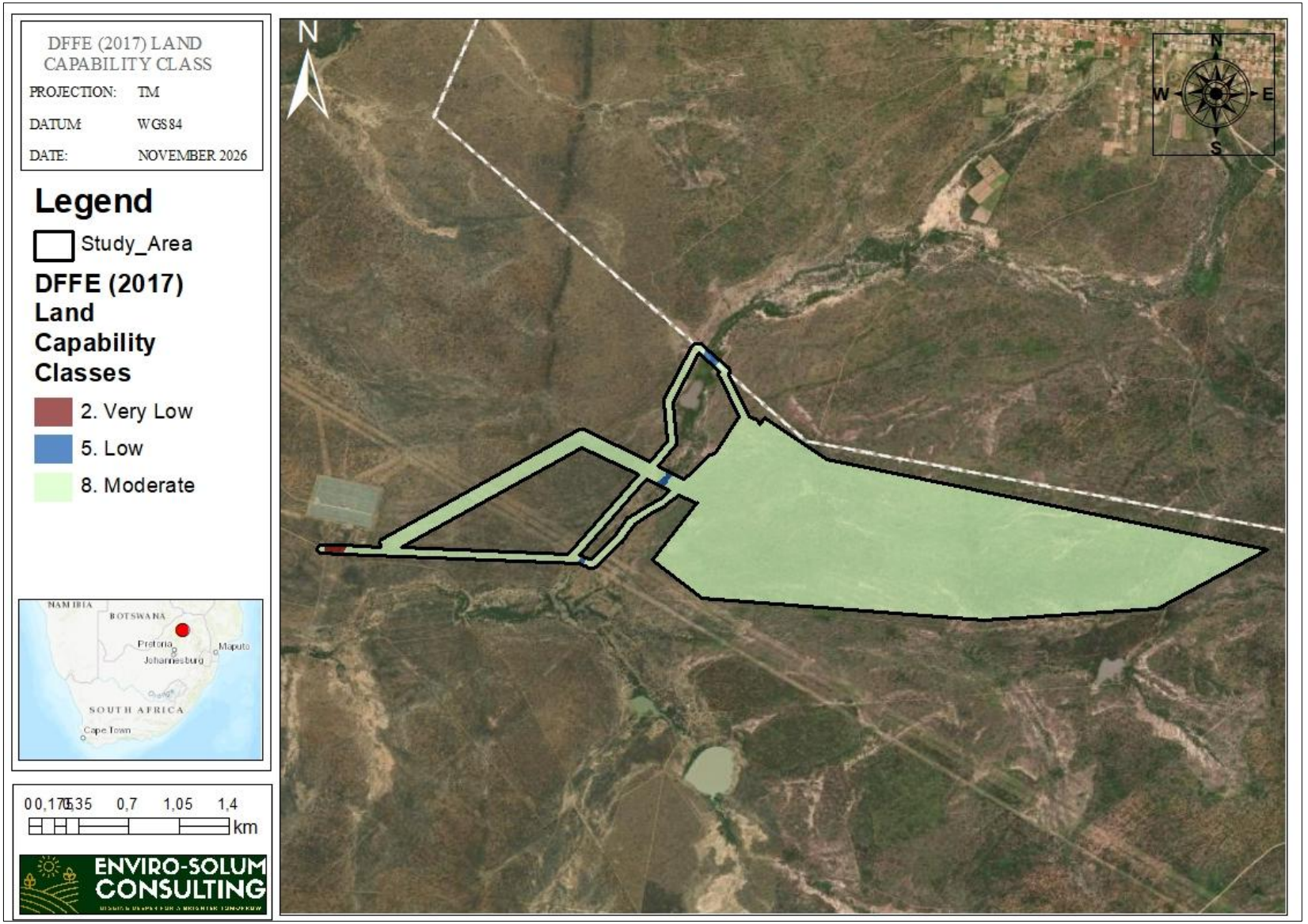


Figure 20: DFFE (2017) land capability classes associated with the study area.

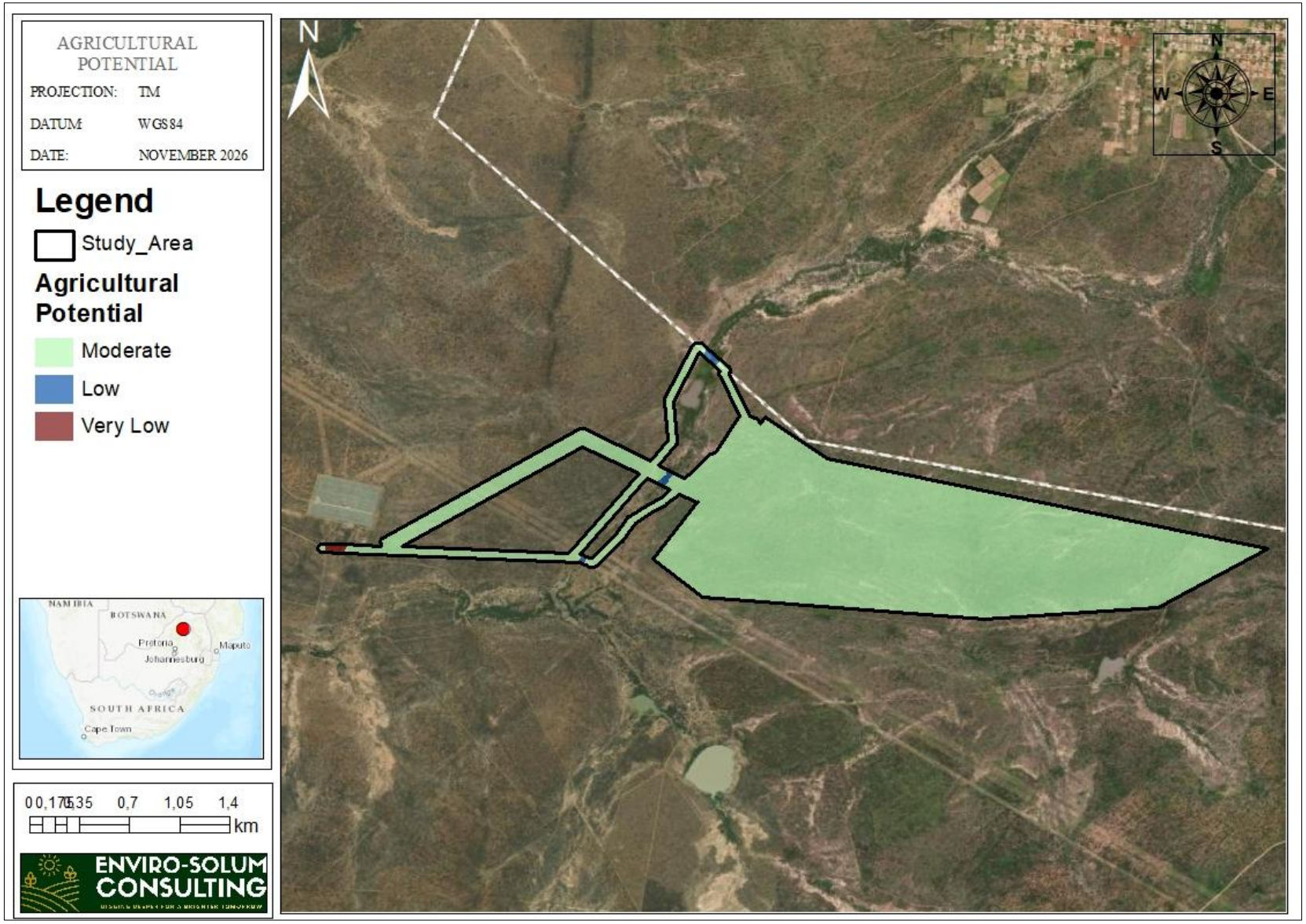


Figure 21: Agricultural potential for soils associated with the study area.

5. IMPACT ASSESSMENT

According to the NEMA regulations (2014), all the impact assessments should provide quantified scores that likely show the expected impact and those likely to 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 phases, 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 requirements 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 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.

5.1 Impact Assessment Per Project Phase

5.1.1 Construction Phase

During the construction phase of the proposed powerlines and the associated substation, 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 will include clearing of vegetation 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 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 handling and storing building materials and different kinds of waste. When not managed properly, these activities have the potential to result in soil pollution.

The disturbance of original soil profiles and horizon sequences during earthworks is considered a measurable erosion deterioration. This impact is considered to be localised within the development footprint. If not managed, this impact will be localised within the site boundary and have a high impact significance on the soil resource.

Soil chemical pollution caused by potential oil and fuel spillages from vehicles is considered to be a moderate deterioration of the soil resource. If not managed, this impact will be localised within the site boundary and have medium significance on the soil resource.

Soil compaction will be a measurable deterioration that will occur as a result of heavy vehicles commuting on the existing roads and any newly constructed access road to increase access to the solar energy site. Without mitigation measures, the impacts will be localised within the site boundary with high impact consequence and significance.

5.1.2 Operational Phase

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

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

- General activities, including transport on access roads, that 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. This impact is reversible over time and but will be localised within the site boundary. This impact is possible and will have medium significance if not managed.

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 if not mitigated. If

appropriately mitigated, this impact will be localised within the site boundary and have a low significance on the soil resource.

Soil compaction will be a measurable deterioration that will occur due to the movement of vehicles on the soil surfaces (including access roads). This reversible impact over time will be localised within the site boundary and immediate surroundings with medium consequence and significance if not mitigated properly. If mitigated, the impact significance can be regarded as low.

5.1.3 Closure and Decommissioning Phase

Decommissioning can be considered the reverse of the construction phase, with the demolition and removal of the majority of 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:

- Transport of materials away from the site. This 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 topsoil to increase 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, as well as accidental spills and leaks with decommissioning activities. When not managed properly, these activities can potentially result in soil pollution.

5.2 Impact Summary Table

The impact summary tables are presented in Tables 7 below for the impact on loss of land capability, soil erosion, soil compaction, and soil contamination.

Table 7: Summary of the impact assessment associated with proposed development during different phases.

Activity	Potential Impact	Without or With Mitigation	Nature (Negative or Positive Impact)	Probability		Duration	Scale		Magnitude/ Severity		Significance		Management Measures
				Magnitude	Score	Score	Magnitude	Score	Magnitude	Score	Score	Magnitude	
Construction Phase													
Site clearing, removal of vegetation as part of the construction of the proposed solar energy facility and associated overhead powerline and site roads.	**Soil erosion** Loosening of soils due to removal of vegetation. Increased runoff, erosion, and consequent loss of land capability in cleared areas.	WOM	Negative	Definite	5	4	Site	2	High	6	60	Moderate	*All activities should be limited to the area of disturbance; *The footprint of the proposed solar PV area must be clearly demarcated to restrict vegetation clearing to within the infrastructure footprint; *Moisture control will be necessary on large bare areas during dry-season construction to reduce the frequency and amount of dust suspended in the ambient air; *All disturbed areas adjacent to the solar PV areas can be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover and minimise soil erosion and dust emissions; *All vehicular traffic should be restricted to the existing service roads and the selected road servitude, as far as practicable; *Compacted soils adjacent to the solar PV and associated infrastructure footprint should be lightly ripped to at least 25 cm below the ground surface to alleviate compaction;
		WM	Negative	Highly Probable	4	3	Site	2	Medium	5	48	Low	
	Soil Compaction Potential frequent movement of digging machinery and construction vehicles within lose and exposed soils, leading to excessive soil compaction.	WOM	Negative	Definite	5	4	Site	2	High	7	65	High	
		WM	Negative	Probable	4	3	Site	2	Medium	6	44	Moderate	
	Soil contamination Spillage of petroleum hydrocarbons during construction of	WOM	Negative	Highly Probable	4	4	Site	2	Medium	6	48	Moderate	

	associated infrastructure. Disposal of hazardous and non-hazardous waste, including waste material spills and refuse into the soil.	WM	Negative	Highly Probable	4	2	Site	2	Medium	6	40	Low	*Regular monitoring of site activities and machinery must be undertaken to identify spills or leaks; *A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans must be developed and be implemented; and *Spill kits (such as spill-sorb or a similar type product) must be kept on site and used to clean up hydrocarbon spills in the event that they should occur.
	Land Capability Loss of land capability	WOM	Negative	Definite	5	4	Site	2	Medium	6	60	Moderate	
		WM	Negative	Highly Probable	4	3	Site	2	Medium	5	40	Low	
Operational Phase													
Operation of the proposed Solar energy facility	**Soil Erosion** Constant disturbances of soils, resulting in risk of erosion	WOM	Negative	Definite	5	4	Site	2	Medium	6	60	Moderate	*Stormwater and erosion management plan be developed to prevent the soil of soil resources; *Use of heavy machinery should be avoided as far as possible to minimise soil compaction during the construction phase; *Moisture control will be necessary on large bare areas during dry season operational, to reduce the frequency and amount of dust suspended in the ambient air; *Clean water with only biodegradable detergents should be used to clean the panels to limit any soil contamination that might occur; *All disturbed areas adjacent to the solar PV areas can be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission; and *All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible.
		WM	Negative	Highly Probable	4	3	Local	1	Medium	6	40	Low	
	Soil Compaction Constant disturbances of soils, resulting in risk of compaction	WOM	Negative	Highly Probable	4	4	Site	2	High	8	56	Moderate	
		WM	Negative	Highly Probable	4	3	Local	1	Medium	6	40	Low	
	Soil contamination Leaching of hydrocarbons chemicals into the soils during vehicular traffic, leading to alteration of the soil chemical status.	WOM	Negative	Highly Probable	4	4	Site	2	Medium	6	48	Moderate	
		WM	Negative	Probable	2	3	Site	2	Medium	6	22	Low	

	Land Capability Loss of land capability	WOM	Negative	Definite	5	4	Site	2	Medium	5	55	Moderate	
		WM	Negative	Highly Probable	4	3	Site	2	Medium	4	36	Low	
Closure and Post closure													
Dismantling of the Solar energy facility and associated infrastructure	**Soil Erosion** Loosening of soils due to removal of the solar PV facility. Increased runoff, erosion, and consequent loss of land capability in cleared areas.	WOM	Negative	Definite	5	4	Site	2	Medium	6	60	Moderate	* Removal Activities should be limited to area of disturbance; * The footprint should be ripped to alleviate compaction; * The contractor(s) appointed for the removal of infrastructure activities must commit to the disposal of materials at registered sites; *Salvageable materials may be sold to interested parties where these are not hazardous; *Post-removal of the solar PV, the site must be rehabilitated (compacted areas ripped, topsoil re-instated and the area vegetated with indigenous seed mix); and *Post-rehabilitation monitoring of soil fertility should be considered; *The mine should implement adequate dust suppression techniques to limit dust release.
		WM	Negative	Highly Probable	4	3	Local	1	Medium	6	40	Low	
	Soil Compaction Vehicle and machinery movement during removal of the Solar PV facility.	WOM	Negative	Definite	5	4	Site	2	Medium	6	60	Moderate	
		WM	Negative	Highly Probable	4	3	Local	1	Medium	6	40	Low	
	Soil contamination Spillage of hydrocarbons resulting from leakages from demolition equipment/machinery and other chemical storage facilities, leading to soil contamination (soil chemical characteristics).	WOM	Negative	Highly Probable	4	4	Site	2	High	8	56	Moderate	
		WM	Negative	Probable	2	3	Site	2	Medium	6	22	Low	
	strategies may lower infiltration rates and	WOM	Negative	Definite	5	3	Site	2	High	6	55	Moderate	

	increase surface runoff. Implementing effective mitigation measures can prevent soil erosion and resource loss, ensuring compliance with land use regulations.	WM	Negative	Highly Probable	4	3	Site	2	Medium	5	40	Low	

5.3 Allowable Development Limits

GN320 includes the following requirement: "2.6.17. confirmation whether the development footprint is in line with the allowable development limits set in Table 8 below, including where applicable, any deviation from the set development limits and motivation to support the deviation, including:

(a) where relevant, reasons why the proposed development footprint is required to exceed the limit;

(b) where relevant, reasons why this exceedance will be in the national interest; and

(c) where relevant, reasons why there are no alternative options available, including evidence of alternatives considered"

In addition to the verification above, GN320 specifies allowable development limits for renewable energy projects of 20MW or more linked to the various land capability categories, as shown in the Table below.

For the assessed area, development is within land capability classes 7 and 2, rated Moderate to Very Low. Only 0.35 ha per MW is permitted in Medium-sensitivity zones, since the entire area is not under cultivation.

The development application is for 150 MW of installed capacity across the 361.3 ha farm portion of the study area. The development areas are:

Moderate to Low Potential Land	361.3 ha * 2.50 ha/MW	= 903,75 MW
Total allowable development		**= 903,55 MW**

The proposed 150 MW development does not exceed the allowable limits set by the Strategic Environmental Assessment (SEA) recommendations for Wind and Solar in South Africa (CSIR, 2015).

Table 8: Allowable development limits for renewable energy generation developments (GN320).

Criteria (land capability evaluation value and category of crop boundary)	Allowable development limits in hectares per MW of installed generation capacity (with sensitivity ratings from the national web based environmental screening tool shown in brackets)	
	Within field crop boundaries	Outside field crop boundaries
Land capability evaluation value of 11 – 15; Irrigation, horticulture/viticulture, shade-net; high value agricultural areas with a priority rating A and/or B	0 (Very High Sensitivity)	0 (Very High Sensitivity)
Land capability evaluation value of 8 – 10; all cultivated areas including sugarcane; high value agricultural areas with a priority rating C and/or D	0.20 (High Sensitivity)	0.35 (Medium Sensitivity)
Land capability evaluation value of 6 - 7;	0.25 (High Sensitivity)	2.50 (Low Sensitivity)
Land capability evaluation value of 1 - 5;	0.30 (High Sensitivity)	2.50 (Low Sensitivity)

5.4 Impact Statement and Screening Tool Sensitivity Verification

The study area is proposed as the locality for the proposed solar energy project. Most of the study area (90%) is characterised by shallow soils, which are better suited to grazing and small-scale farming. Overgrazing has largely impacted the study area, leading to degraded rangeland. The dry climate and limited rainfall also limit how quickly grasses can regenerate. Thus, overgrazed, bare land cannot absorb water effectively. When sudden climate-driven flash storms hit the plateau, the water creates massive runoff and erosion rather than soaking into the water table, leaving the region even drier.

An agricultural impact is any alteration that affects the future capacity for agricultural production on a specific land area. This alteration often occurs when agriculture is excluded from a region undergoing development. Reduced agricultural production potential can also result from soil erosion, compaction, pollution, and deterioration.

Vegetation clearing and soil stripping before the construction of the solar energy facility and associated infrastructure will directly result in the loss of grazing or wildlife land, albeit in a degraded state. The study area has also not been under any large to small scale cultivation for the last 5 years, as per the scrutiny of Google imagery. The proposed overhead powerline to Borutho MTS is not expected to significantly impact agriculture, as it will not affect the future capacity of agricultural production in the study area. All agricultural activities (if any) can continue as usual underneath the power line. Additionally, construction and decommissioning of the power line may cause topsoil loss and land degradation due to land disturbance. The potential impact of the project can be effectively mitigated through the implementation of standard, generic measures inherent in the project's engineering design, as well as by adhering to standard best practices for construction sites, all of which are detailed in the Environmental Management Programme (EMPr) as contained within Part B-Section 1 and 2 of the generic EMPr and standards for powerlines and substations. The development of the powerline is anticipated to result in only minimal loss of future agricultural production potential. Therefore, the agricultural impact of the proposed solar energy facility and associated powerlines is deemed to be of very low significance.

In this case, the study area is considered below the threshold for needing conservation as agricultural production land because its limitations make it unsuitable for cropping. If this land were used for non-agricultural purposes, it would result in minimal loss of agricultural production potential relative to national food security. As a result, the overall adverse agricultural impact of the development (loss of future agricultural production potential) is considered of low significance. It should also be noted that the proposed solar PV and associated infrastructure area does not cross any protected agricultural areas as depicted in Figure 22 below.

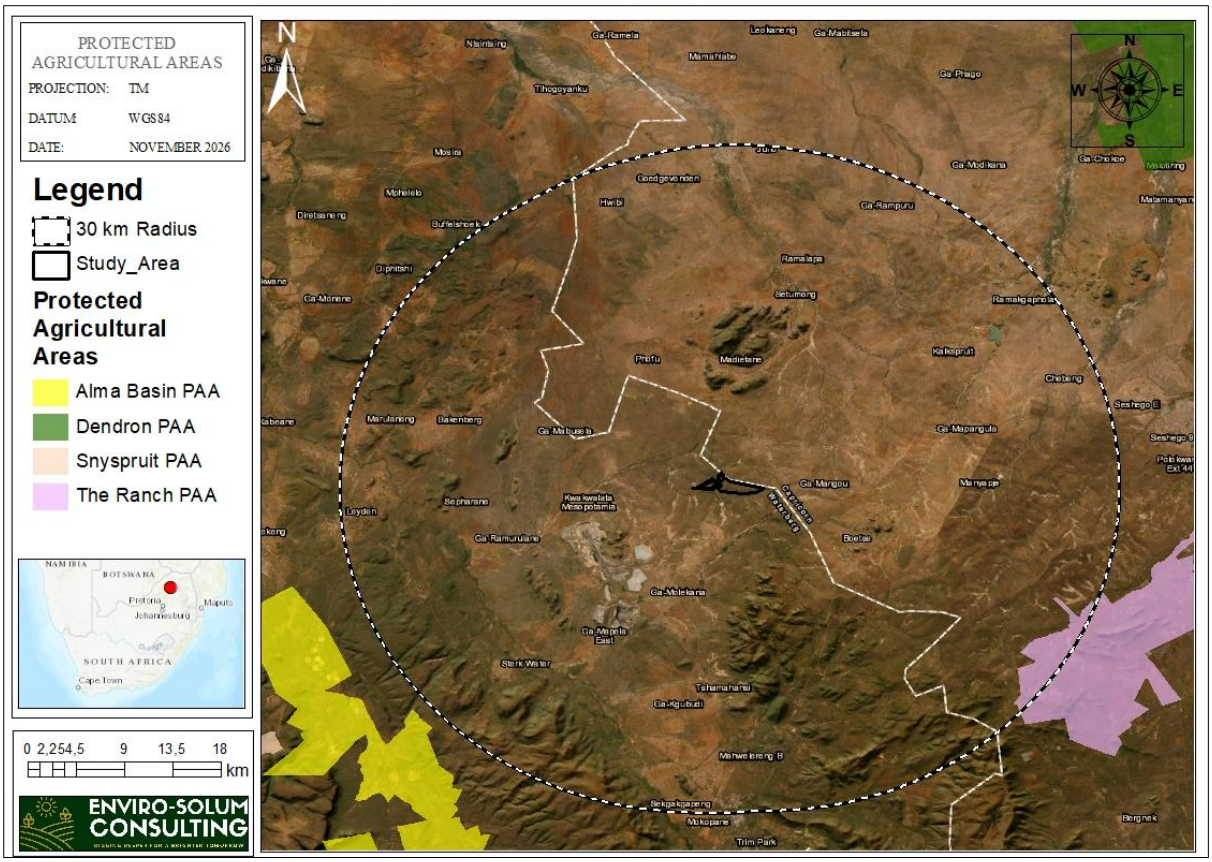


Figure 22: Protected Agricultural Areas associated with the study area.

conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is subject to adherence to the mitigation measures outlined in the document. In addition, the low sensitivity of the area assessed in terms of agricultural production triggers the Norms and Standards for the exclusion of the development and expansion of solar photovoltaic facilities in areas of low or medium environmental sensitivity, in terms of section 24(10) of the National Management Environmental Act, 1998 (Act No.107 of 1998) and exclude, in terms of section 24(2)(d) of the National Environmental Management Act, 1998 (Act No.107 of 1998) activities identifies in terms of section24(2)(a) and (b) of the National Environmental Management Act, 1998 (Act No.107 of 1998) for the expansion of solar photovoltaic facilities, including any associated activity or infrastructure, from the requirement to obtain an environmental authorisation, based on compliance with the norm.

In accordance with the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, 1998, when applying for environmental authorisation the current use of the land and the environmental sensitivity of the site under consideration as identified by the national web-based environmental screening tool, must be confirmed by undertaking a site sensitivity verification.

The outcome of this site sensitivity verification is to:

- Confirm or dispute the current use of the land and the environmental sensitivity as identified by the screening tool; and

- Motivate and provide evidence of either the verified or different use of the land and environmental sensitivity of the site.

The allocated sensitivities for the agricultural theme are presented on Table 9 below.

Table 9: Summary of the screening tool vs specialist-assigned sensitivities.

Study Area	Screening Tool Assigned Sensitivity	Verified Sensitivity	Reasoning for verification outcome verification
Solar PV area	High Sensitivity	Medium Sensitivity	Most of the study areas have shallow soils more suitable for grazing than arable farming. Additionally, the region faces limited climatic conditions due to low rainfall, making irrigation necessary for cultivation. The proposed solar PV facilities and the overhead power line are not expected to significantly impact agriculture, as they will not hinder future agricultural production in the study area. Overall, the land capability of the adjacent soils, along with their agricultural potential, remains very limited.
Access Roads	High Sensitivity	Low Sensitivity	
Overhead Powerline	High Sensitivity	Low Sensitivity	

5.4.1 Cumulative Impacts

Agricultural protocols require specific evaluations for environmental approval to assess cumulative effects. The cumulative impact of a project is the overall consequence when its effects are combined with the gradual impacts of previous, current, or anticipated future activities that influence the same environment. The potential cumulative long-term impact on agriculture involves the regional loss, including degradation, of future agricultural production potential, highlighting the need for careful planning and sustainable practices to safeguard agricultural productivity.

This cumulative impact assessment quantifies the loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. Figure 20 illustrates these projects. The total area with approved solar PV within the 30 km radius of the study area is 4270.5 hectares, representing 1.3% of the total area of 326 492.0 hectares. This value falls within acceptable limits. Adhering to generic mitigation measures and implementing best practices during construction can mitigate or prevent further loss and degradation of valuable soil resources. Based on the assessment, the potential impact on future agricultural productivity is deemed low with mitigation measures in place. Thus, the proposed project is not expected to have an unacceptably adverse effect on overall agricultural production capacity. Therefore, considering the cumulative agricultural impact, approval of the proposed development is recommended.

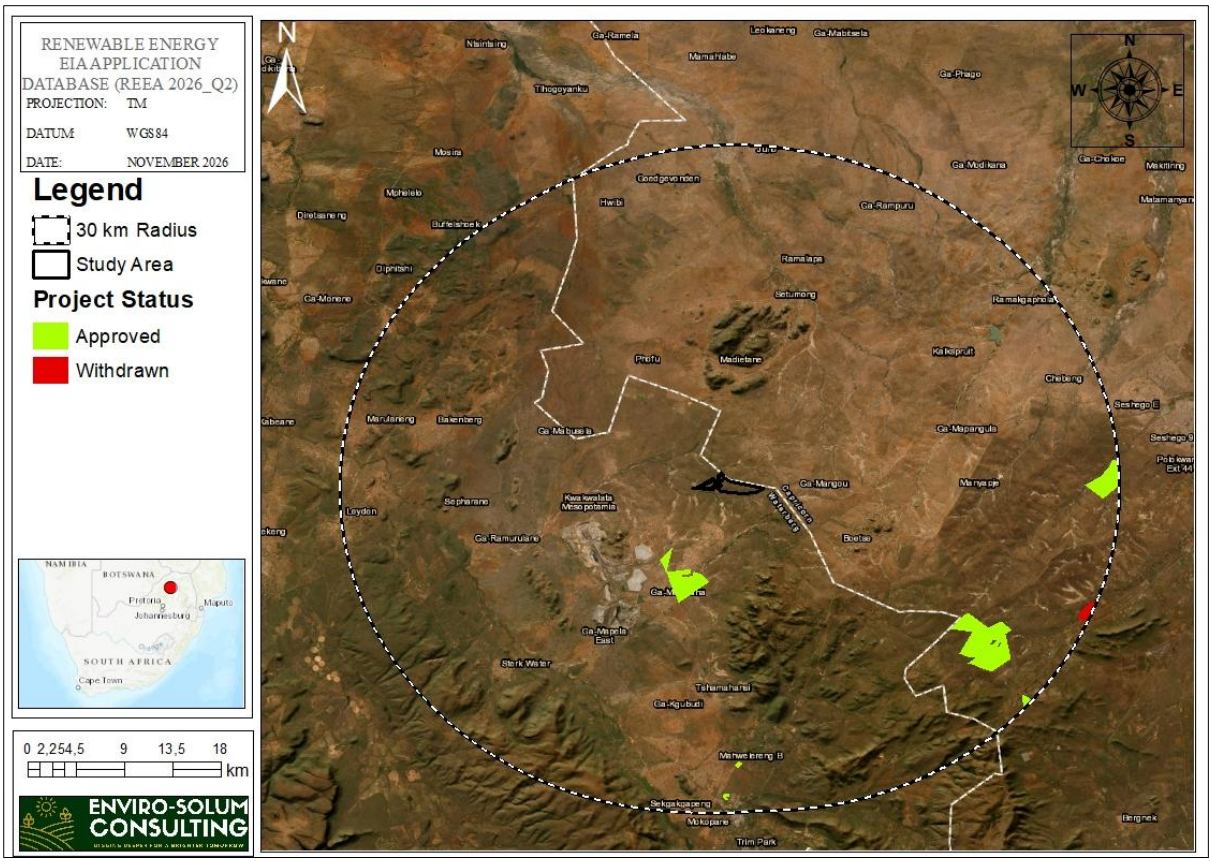


Figure 23 : Known renewable energy projects within a 30 km radius of the proposed solar energy facilities project.

5.4.2 Micro Siting and Confirmation of Linear Activity

The agricultural protocol requires verifying the implementation of all practical measures through micro-siting to reduce fragmentation and disturbance of agricultural activities. This involves carefully planning the location and layout of agricultural infrastructure and operations to minimise any negative impact on the surrounding agricultural activities. As previously discussed, micro-siting within the solar energy facility development footprint area will not significantly impact agriculture and disturbance.

The agricultural protocol also mandates that, for activities carried out in a linear fashion, the land must be restored to its original state within two years of completion of the construction phase. This requirement only applies to the overhead powerline, haul roads and access roads in line with the project. It has been verified that the land adjacent to the roads, not occupied by other infrastructure, can be returned to its original agricultural productivity within two years of construction. However, the roads will remain in place throughout the operational lifetime of the powerline.

6 INTERGRATED MITIGATION MEASURES

The Environmental Impact Assessment (EIA) plays a crucial role in evaluating the potential environmental impacts of the proposed project. It is essential that the EIA thoroughly examines the environmental implications, taking into account both the impacts with and without mitigation measures. This comprehensive assessment is vital to effectively minimize any adverse effects on the soil resources in the area. Furthermore, it is imperative to adhere to the mitigation hierarchy, as illustrated in Figure 25, to ensure that the principles of the National Environmental Management Act (NEMA) are effectively applied.

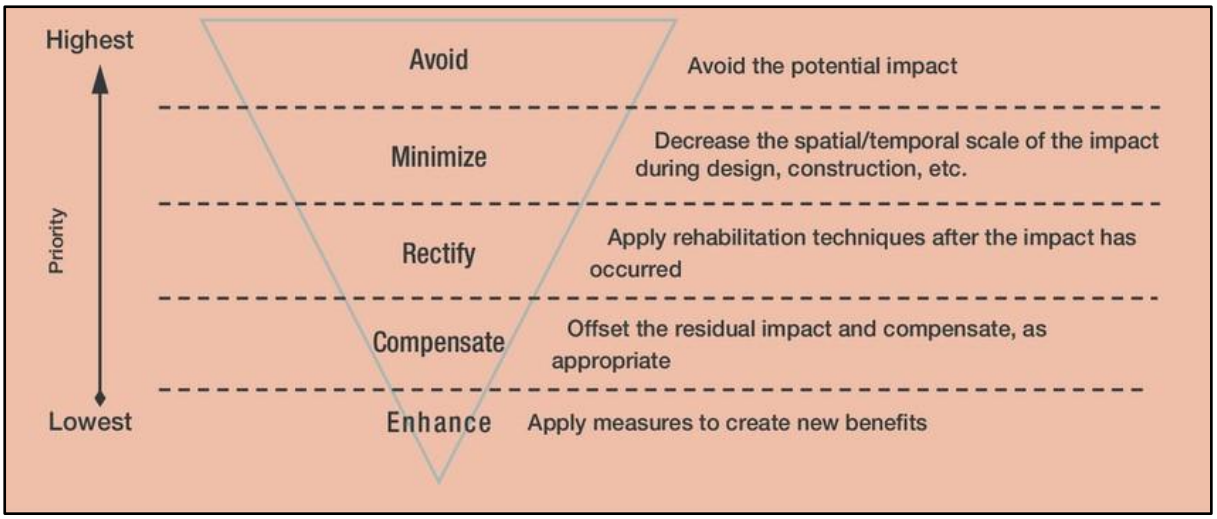


Figure 24: Mitigation hierarchy.

The principles of NEMA are critical for attaining sustainable development as they recognize the need to incorporate social, economic, and ecological factors into decision-making processes concerning the environment. These principles are relevant to all decisions concerning the understanding and application of NEMA and other regulations related to environmental management and protection. Hence, it is essential for the EIA to consider the NEMA principles.

6.1 Management of Loss of Land Capability

- Direct surface disturbance of the identified arable soils can be avoided where possible to minimise loss of arable soils;
- Avoid construction on the active agricultural soils where feasible;
- Minimise the development footprint within the actively cultivated soils;
- The footprint areas should be lightly ripped to alleviate compaction;
- Limit removal of vegetation to demarcated areas only;
- Limit earthworks and vehicle movement to demarcated paths and areas.

6.2 Soil Compaction Management

- Soil Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible;
- Heavy equipment movement over replaced soils should be minimised;
- Minimise compaction during smoothing of replaced soils by using dozers rather than graders; and
- Following placement, compacted soils should be ripped to full rooting depth (30cm as the bare minimum seedbed) to allow penetration of plant root.

6.3 Soil Contamination Management

- Contamination prevention measures should be addressed in the Environmental Management Programme (EMPr) for the proposed development, and this should be always implemented and made available and accessible to the contractors and construction crew conducting the works on site for reference;
- A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works;
- An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and
- Burying of any waste, including rubble, domestic waste, and empty containers, on the site should be strictly prohibited, and all construction rubble waste must be removed to an approved disposal site.

6.4 Soil Erosion and Dust Management

- Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces, must be re-vegetated or stabilised as soon as is practically possible;
- All excavation/construction vehicles should be in good condition and inspected regularly to ensure there are no chemical spills (diesel/oil) which will negatively impact the receiving environment;
- After the powerline installation, the ground should be seeded with an indigenous grass or other native cover;
- Vegetation clearance and commencement of construction activities can be scheduled to coincide with low rainfall conditions when the erosive stormwater and wind are anticipated to be low whenever possible;
- Avoid vegetation clearance prior to periods of prolonged inactivity;
- All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix or vegetation mix, if necessary, to re-establish a protective cover, to minimise soil erosion;

- Temporary erosion control measures should be used to protect the disturbed soils during the construction phase until adequate vegetation has established.

7 CONCLUSION

Enviro-Solum Consulting Pty (Ltd) was appointed by Abantu Environmental Services Pty (Ltd) to conduct a soil, land use, and land capability assessment towards their pursuit of obtaining a decision from the Department of Forestry, Fisheries and the Environment (DFFE) for the Gillimberg Solar Energy Facility (SEF) and associated infrastructure situated approximately 3 km southeast of Macangceni within the jurisdiction of the Enoch Mgijima Local Municipality in the Eastern Cape Province of South Africa.

The study area is proposed as the locality for the proposed solar energy project. Most of the study area (90%) is characterised by shallow soils, which are better suited to grazing and small-scale farming. Overgrazing has largely impacted the study area, leading to degraded rangeland. The dry climate and limited rainfall also limit how quickly grasses can regenerate. Thus, overgrazed, bare land cannot absorb water effectively. When sudden climate-driven flash storms hit the plateau, the water creates massive runoff and erosion rather than soaking into the water table, leaving the region even drier.

An agricultural impact is any alteration that affects the future capacity for agricultural production on a specific land area. This alteration often occurs when agriculture is excluded from a region undergoing development. Reduced agricultural production potential can also result from soil erosion, compaction, pollution, and deterioration.

Vegetation clearing and soil stripping before the construction of the solar energy facility and associated infrastructure will directly result in the loss of grazing or wildlife land, albeit in a degraded state. The study area has also not been under any large to small scale cultivation for the last 5 years, as per the scrutiny of Google imagery. The proposed overhead powerline to Borutho MTS is not expected to significantly impact agriculture, as it will not affect the future capacity of agricultural production in the study area. All agricultural activities (if any) can continue as usual underneath the power line. Additionally, construction and decommissioning of the power line may cause topsoil loss and land degradation due to land disturbance. The potential impact of the project can be effectively mitigated through the implementation of standard, generic measures inherent in the project's engineering design, as well as by adhering to standard best practices for construction sites, all of which are detailed in the Environmental Management Programme (EMPr) as contained within Part B-Section 1 and 2 of the generic EMPr and standards for powerlines and substations. The development of the powerline is anticipated to result in only minimal loss of future agricultural production potential. Therefore, the agricultural impact of the proposed solar energy facility and associated powerlines is deemed to be of very low significance.

In this case, the study area is considered below the threshold for needing conservation as agricultural production land because its limitations make it unsuitable for cropping. If this land were used for non-agricultural purposes,

it would result in minimal loss of agricultural production potential relative to national food security. As a result, the overall adverse agricultural impact of the development (loss of future agricultural production potential) is considered of low significance.

It is the opinion of the specialist that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area are made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

8 REFERENCES

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APPENDIX A: INDEMNITY

- This report is based on survey and assessment techniques 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 related to the site to be affected, *in situ* fieldwork, surveys, and 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 as well as 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, serves to confirm acknowledgment of these terms and liabilities.



Tshiamo Setsipane

04 November 2026

APPENDIX B: 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 the 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 implement to manage the anticipated impacts and to 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 flowpaths 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)