SOIL, LAND USE, AND LAND CAPABILITY ASSESSMENT: FOR THE PROPOSED SOUTH 3 OPENCAST MINE AND ASSOCIATED SUPPORT INFRASTRUCTURE WITHIN THE FETAKGOMO TUBATSE MUNICIPALITY, LIMPOPO, SOUTH AFRICA.

REF: AGR_MPM SOUTH3_24

DATE OF FIRST DRAFT:

13 May 2024

PREPARED FOR

Segope Water & Environmental Services

PREPARED BY

ENVIRO-SOLUM CONSULTING
DIGGING DEEPER FOR A BRIGHTER TOMORROW!

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DOCUMENT CONTROL

Report Name	Soil, Land Use, and Land Capability Assessment: For the Proposed South 3 Opencast Mine and Associated Support Infrastructure Within the Fetakgomo Tubatse Municipality, Limpopo, South Africa.
Reference	AGR_MPM SOUTH3_24
Version	Draft_V01
Submitted to	Segope Water and Environmental Services
Author	Tshiamo Setsipane, (*Pr. Sci. Nat* 114882)
Draft Date Produced	13 May 2024

EXECUTIVE SUMMARY

Enviro-Solum Consulting was appointed to conduct a soil, land use and land capability assessment as part of the Environmental Authorisation (EA) for the proposed South 3 Opencast Mine and associated support infrastructure (hereafter referred to as study area). The area wherein the proposed development is to take place will be located approximately 2km north of the R555 road and approximately 5km west of the Steelpoort town, within the Fetakgomo Tubatse Municipality, Limpopo, South Africa.

The Modikwa Platinum Mine (MPM) has intended on developing another open pit on Winterveld which will follow the conventional Open Cast methods, which include the stripping at 40 to 60 ktpm with concurrent backfill. The ore from the open pit will be extracted by a combination of excavation, crushing, washing and concentration. The ore will be transported by truck to the primary crusher stockpile. Waste is disposed to waste dumps on the surface.

The study area falls within the humid subtropical climate zone, characterised by hot and humid summers and cool to mild winters. A deep current of tropical air dominates the humid subtropics at the time of high sun, and daily intense (but brief) convective thundershowers are common but lack any predictability. The entire study area is characterised by rainfall ranging between 401 and 600 mm. The study area can, therefore, be described as water-stressed. While the range of planting dates is limited for supporting rain-fed agriculture under these conditions, a limited range of adapted crops can receive good yields if planted on time.

The study area is primarily characterised by soils of Mispah/Glenrosa, Coega, and Rocky Outcrops formation in the crest. In the midslope positions, the soils of the Bonheim/Abbotspoort and the Inhoek/Dundee formations were identified in the valley bottom. 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 present summary table depicting the area of coverage of each specified soil form for the study area respectively.

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

Study Area					
Soil Forms	**Area (Ha)**	**Percentage (%)**	**Land Capability Class – According to (Smith, 2006)**	**Agricultural Potential**	**DAFF (2016) Classification**
Bonheim/Abbotspoort	111,19	35,9	Arable (Class IV)	Moderate	8. Moderate
Coega	5,18	1,7	Grazing (Class VI)	Low	4. Very Low to Low
Inhoek/Dundee	55,45	17,9	Watercourse (Class V)	Very Low	2. Very Low
Mispah/Glenrosa	70,13	22,6	Grazing (Class VI)	Low	5. Low
Rocky Outcrop	52,81	17,0	Grazing (Class VII)	Very Low	3. Very Low to Low
Witbank	15,29	4,9	Wilderness (VIII)	Very Low	1. Very Low
Total Enclosed	**310,06**	**100**			

The study area is largely characterised by soils of duplex character, such as the Bongeim/Abbotspoort, which account for 35.9% of the area. This is followed by shallow soils and rocky outcrops, which account for 41.3% of the area. The remaining soils are associated with watercourses and disturbed areas and account for 17.9% and 4.9% of the area, respectively.

The findings of this assessment suggest that the relevant soil and climatic limiting factors within the proposed project area for land capability and land use potential include the following:

- Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss, based on the climatic conditions associated with the study area. To cultivate successfully, additional or supplementary irrigation must be utilised.
- High clay content of the Bonheim/Abbotspoort soil forms will likely restrict root growth, and poor internal drainage may render the soils waterlogged during the rainy season. However, these soils tend to be highly fertile due to the less leaching propensity.
- Shallow effective rooting depth due to shallow indurated bedrock of the Mispah/Glenrosa, Coega and rocky outcrops soil forms. As such, these soils are not considered able to contribute significantly to agricultural production on a national or provincial scale.
- Susceptibility to erosion of Mispah/Glenrosa soils form as they are located in moderately sloping areas.

The type of soils identified within the study area render it largely suitable for grazing and wildlife purposes due to the dominance of the shallow soils and rocky outcrops. The soils of moderate potential, such as the Bonheim/Abbotspoort, will require extensive management strategies to be cultivated due to the inherent soil properties associated with these soils. However, the loss of moderate potential agricultural soils and the permanent change in land use (for the lifespan of the Modikwa south3 open cast and associated infrastructure) will be localised within the study area. It is the opinion of the specialist that the unmitigated scenario poses a threat to the sustainability of the moderate potential soils, which could be utilised for agricultural purposes. Therefore, integrated mitigation measures must be implemented accordingly to minimise the potential loss of these valuable soils, considering the need for sustainable development. It is far preferable to incur a minimal loss of potential agricultural land with marginal cultivation potential based on inherent soil properties than to lose agricultural land that has a higher potential and that is much scarcer to the proposed development elsewhere in the country. The study area does not fall under the protected agricultural area (PAA, 2021), likely due to the soils associated with the study area, as well as the climatic conditions and the lack of available options for irrigation water in the immediate surroundings of where the moderate potential soils were identified.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of High sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment, this was found to have a less significant impact as presented on the screening tool due to the dominant soil forms that are not high-potential agricultural soils due to various limitations, including shallower depth and requiring intensive management strategies to cultivate. The land capability of the surrounding soils as well as the agricultural potential, are Low to moderate due to adequate climatic conditions (i.e., rainfall, temperature) and appropriate slope, which allows for intensive commercial agricultural practices.

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 Segope Water and Environmental Services 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.

13 May 2024

DOCUMENT GUIDE

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

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

No.	NEMA Regs (2014) - Appendix 6	The relevant section in the report
2	**Agricultural Agro-Ecosystem Specialist Assessment**	
2.1	The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professionals (SACNASP).	CV Attached
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1.1
2.3	**The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:**	
2.3.1	the extent of the impact of the proposed development on the agricultural resources and	Section 7
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 7
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 3.1 and 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 6.1
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 6.1
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 6.1
2.5.2	change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure and	Section 6.1
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 6
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;	Section 2.5
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 6.1
2.7.7	An indication of possible long-term benefits that the project will generate will generate in relation to the benefits of the agricultural activities on the affected land;	Section 7
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 7
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	Section 6

	"medium" or "low" agriculture sensitivity and that were not considered appropriate;	
2.7.12	Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;	Section 75
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 6
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 was appointed to conduct a soil, land use and land capability assessment as part of the Environmental Authorisation (EA) for the proposed South 3 Opencast Mine and associated support infrastructure (hereafter referred to as study area). The area wherein the proposed development is to take place will be located approximately 2km north of the R555 road and approximately 5km west of the steelpoort town, within the Fetakgomo Tubatse Municipality, Limpopo, South Africa. Figure 1 below shows the locality of the study area, whereas Figure 2 depicts the layout associated with the proposed development.

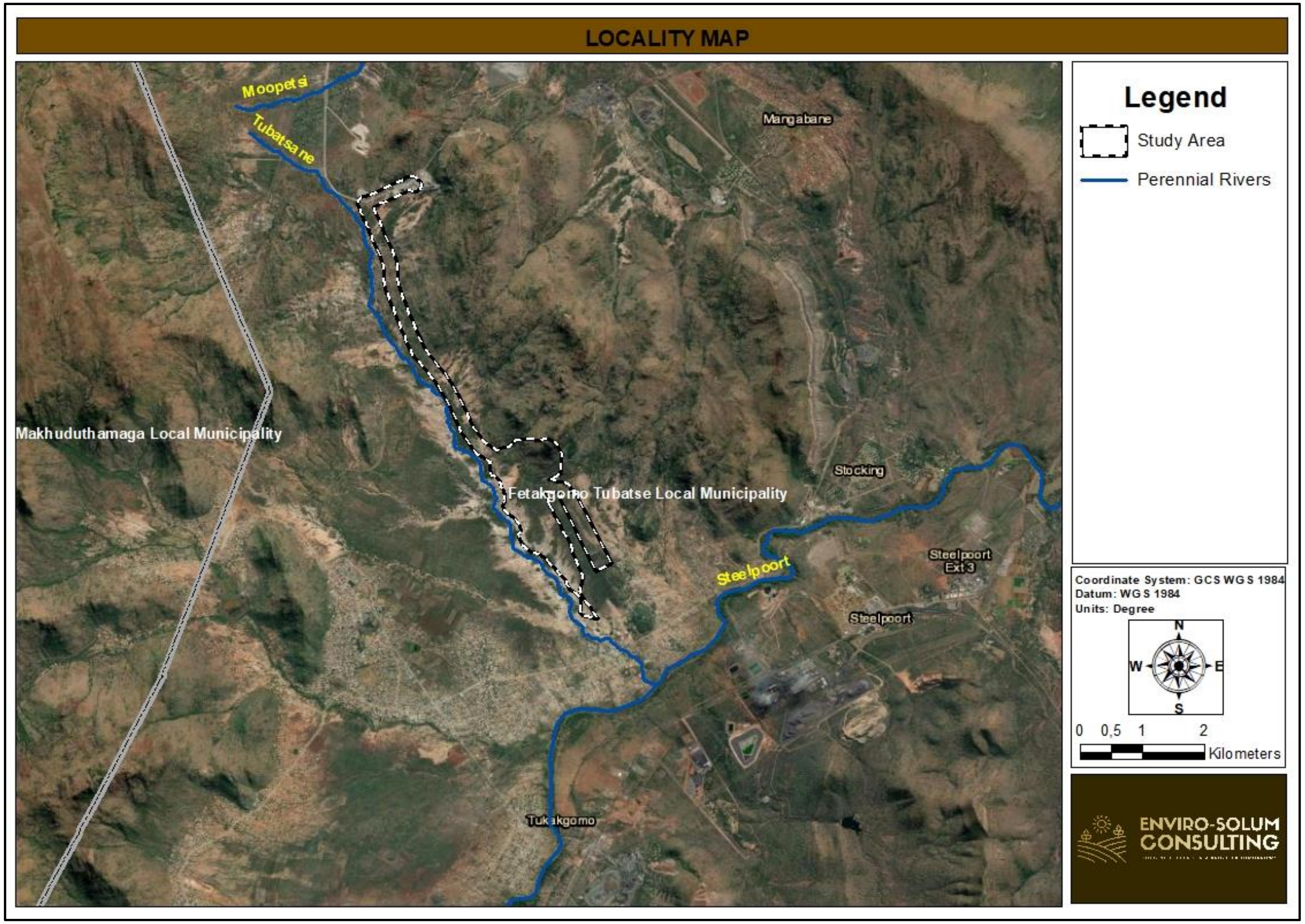

Figure 1: Locality of the study area in relation to the surrounding areas.

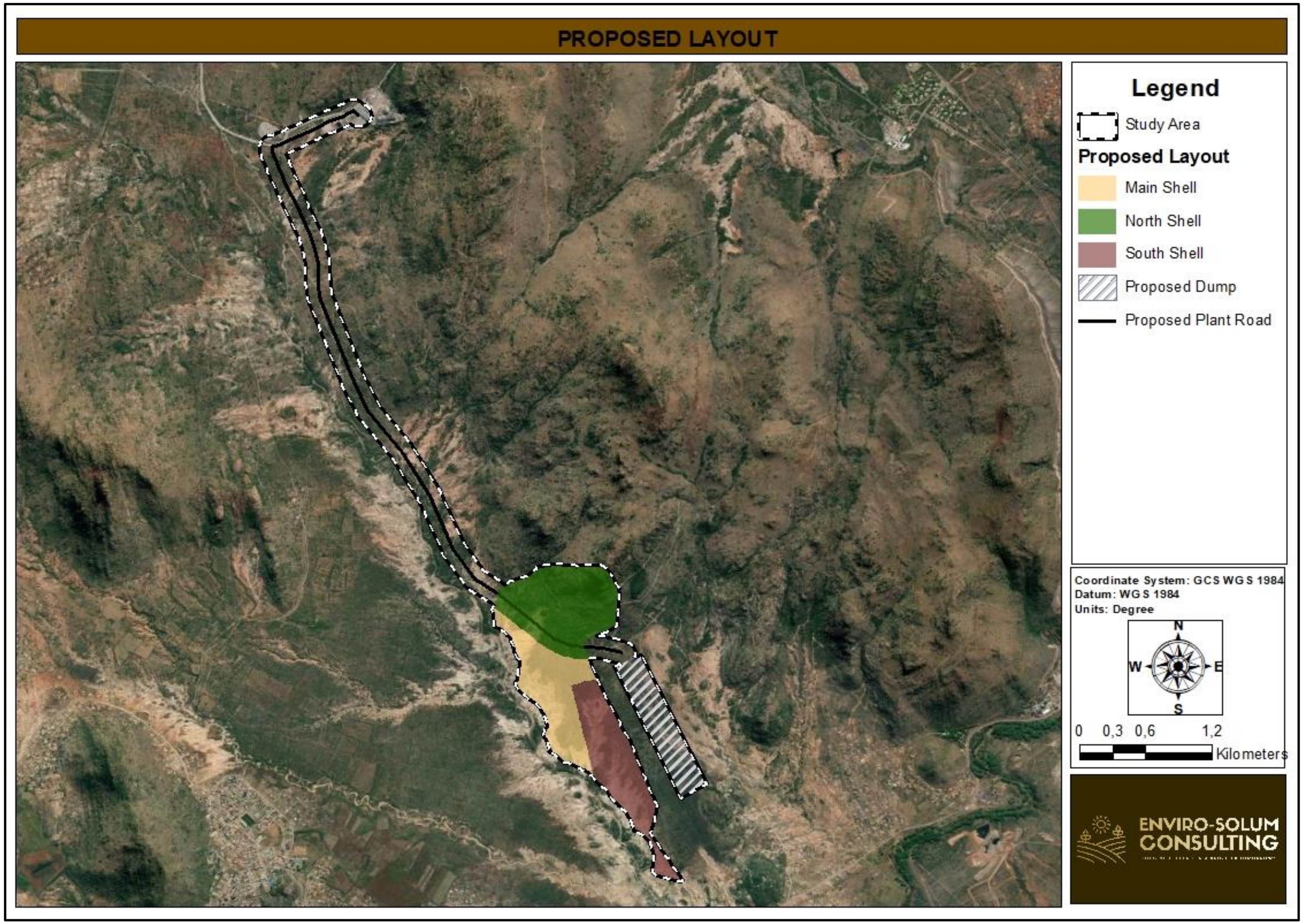

Figure 2: Proposed layout.

1.1 PROJECT DESCRIPTION

The Modikwa Platinum Mine (MPM) has intended on developing another open pit on Winterveld which will follow the conventional Open Cast methods, which include the stripping at 40 to 60 ktpm with concurrent backfill. The ore from the open pit will be extracted by a combination of excavation, crushing, washing and concentration. The ore will be transported by truck to the primary crusher stockpile. Waste is disposed to waste dumps on the surface.

1.2 AIMS AND OBJECTIVES OF THE STUDY

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

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

1.3 SUITABILITY OF SOILS FOR AGRICULTURAL CULTIVATION

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

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

1.4 Applicable Legislation

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

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

1.5 Terms of Reference

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

- A review of available desktop information about the study area site and compile various maps illustrating the desktop data;
- Discussion of the relevant desktop literature;
- Conduct a soil classification survey covering the study area according to the South African Soil Classification System: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);
- Determination of the current (baseline) soil physical, climatic conditions, and land uses, as well as the current land capabilities and agricultural sensitivity associated with the identified soil forms present in the study area;
- Identification and assessment of the potential impacts of the different project phases on the baseline soil, land use, and land capability properties as a result of the proposed development;
- Development of mitigation and management measures to minimize the negative impacts anticipated from the proposed development and
- Compile soil, land use, and land capability reports based on the field-finding data under current on-site conditions.

1.6 Assumptions, Assumptions uncertainties, limitations, and gaps

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

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

2. METHODOLOGY

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

2.1 Desktop Study and Literature Review

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

2.2 Site Survey

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 3 days in April 2024, wherein soil auger tests were conducted, and soils were classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). It must be noted that the season has no bearing on the soil's morphological properties over a short-term period.

2.3 Land Capability Classification

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

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

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

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

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

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

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

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

Table 3: Soil Agricultural Potential Criteria

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

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

2.4 DFFE Screening Tool

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

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

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

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

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

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

2.5 DFFE Screening Tool

The Screening tool for the study area is presented in Figure 3 below:

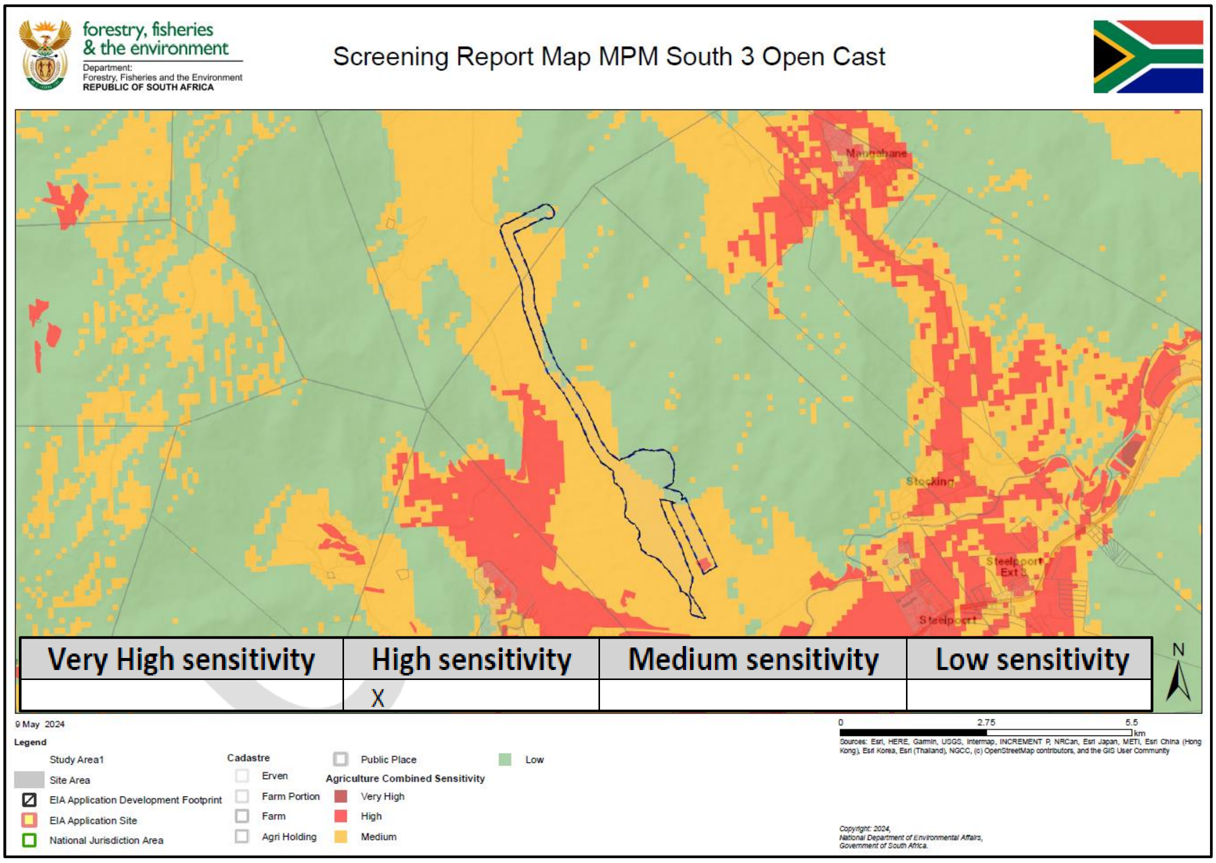

Figure 3: Screening tool sensitivity for the MPM south 3 open cast and associated infrastructure.

3. DESKTOP RESULTS AND DISCUSSIONS

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

3.1 Climatic Data

The study area falls within the humid subtropical climate zone, characterised by hot and humid summers and cool to mild winters. A deep current of tropical air dominates the humid subtropics at the time of high sun, and daily intense (but brief) convective thundershowers are common but lack any predictability. The entire study area is characterised by rainfall ranging between 401 and 600 mm. The study area can, therefore, be described as water-stressed. While the range of planting dates is limited for supporting rain-fed agriculture under these conditions, a limited range of adapted crops can receive good yields if planted on time. Figure 4 shows the mean annual rainfall associated with the study area.

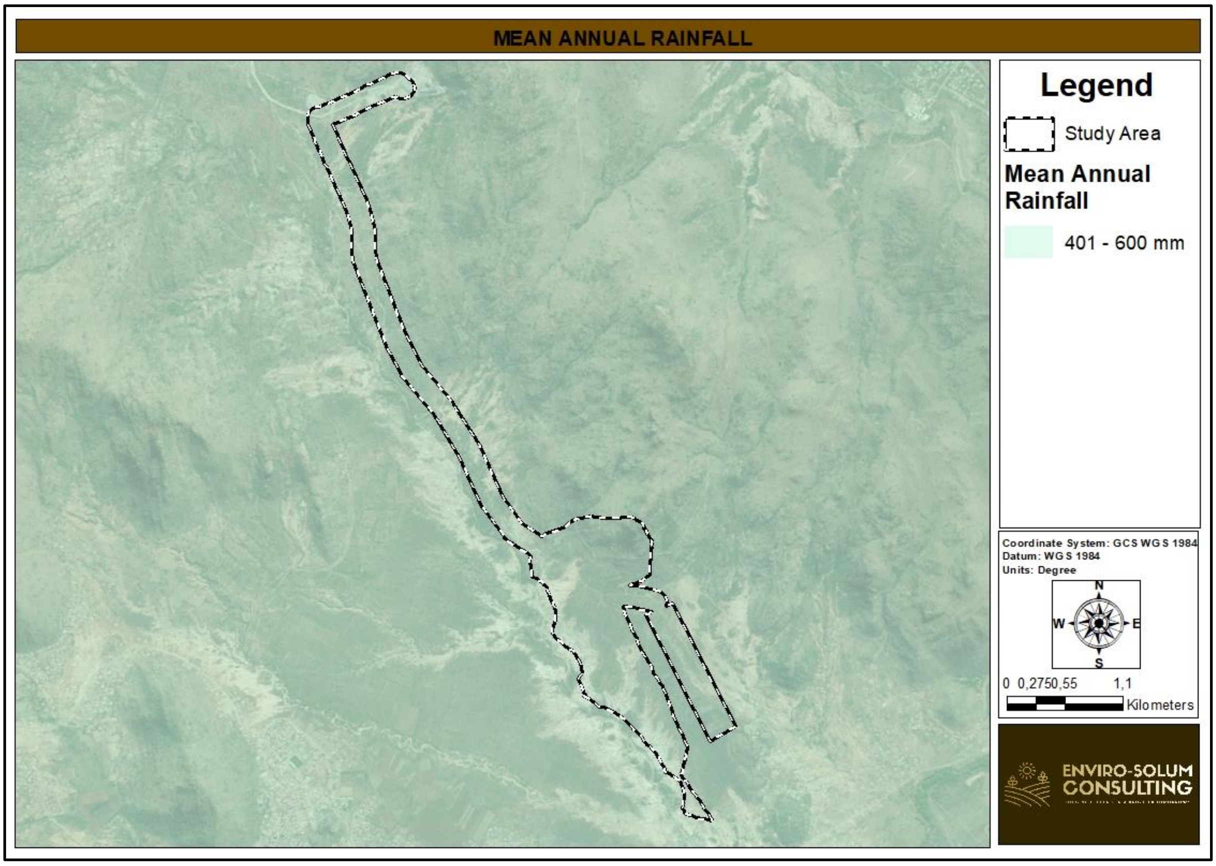

Figure 4: Mean Annual Rainfall associated with the study area.

3.2 Geology

The soils of the study area are underlain by the Norite geological formations. Norite is a coarse-grained basic igneous rock dominated by essential calcic plagioclase and orthopyroxene. Norite may be indistinguishable from gabbro without a thin section study under the petrographic microscope. The principal difference between norite and gabbro, however, is the type of pyroxene of which it is composed; norite is predominately composed of orthopyroxenes, largely high magnesian enstatite or an iron-bearing intermediate hypersthene, whereas the principal pyroxenes in gabbro are clinopyroxenes, generally medially iron-rich augites. Norite occurs with gabbro and other mafic to ultramafic rocks in layered intrusions, which are often associated with platinum orebodies such as in the Bushveld Igneous Complex in South Africa. Figure 5, below, depicts the geology associated with the study area.

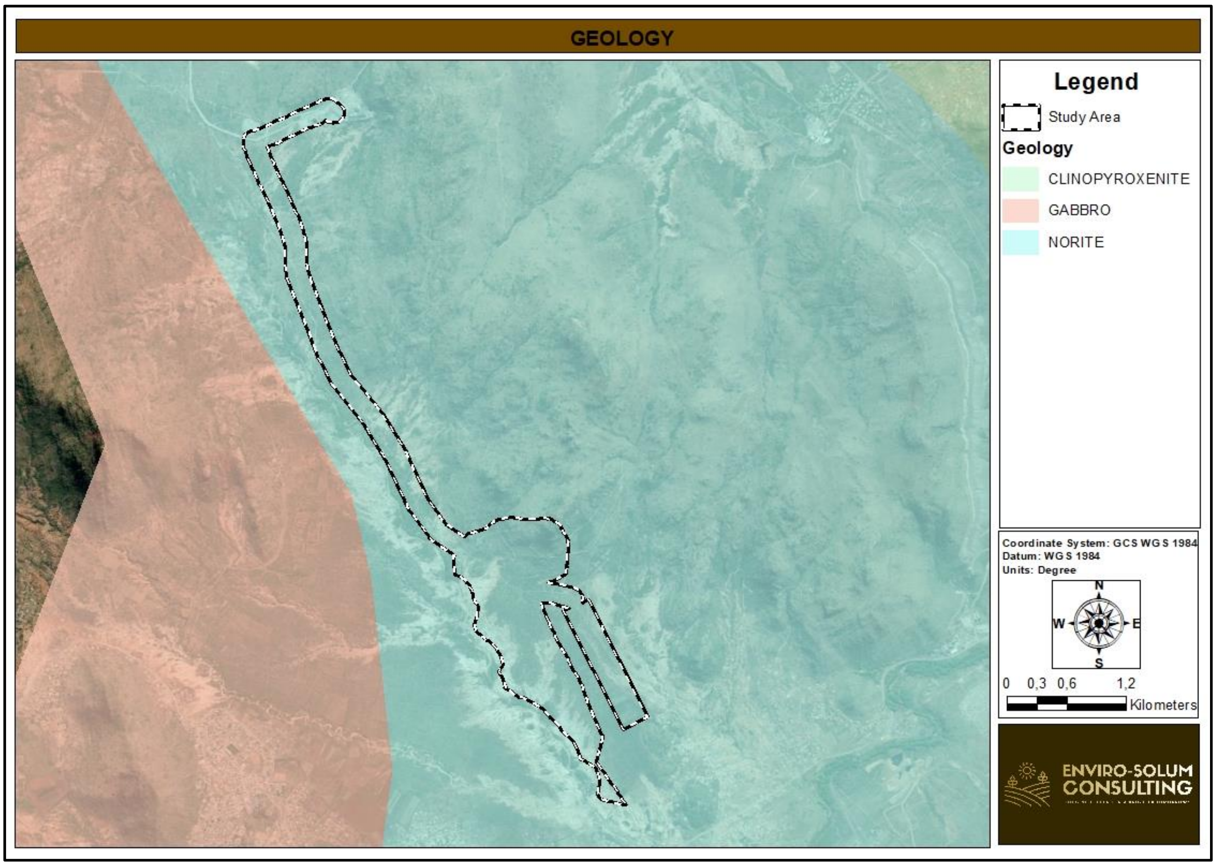

Figure 5: Geological formations associated with the study area.

3.3 Soil Depth

The majority of the study area is characterised by soil depths between 450 mm and 750 mm. This soil depth is considered suitable for various crops, and deeper soils can hold more plant nutrients and water than shallow soils with similar textures. The remaining portions of the study area are characterised by soils with a depth of less than 450 mm. This shallower depth implies that these soils are severely limited to agricultural use, with plant roots confined to a small volume of soil that cannot provide adequate anchorage, water and nutrients. Shallow soils with root-restrictive layers can be profitably used for cropping under sustainable and/or intensive management. Figure 6 illustrates the soil depth associated with the study area.

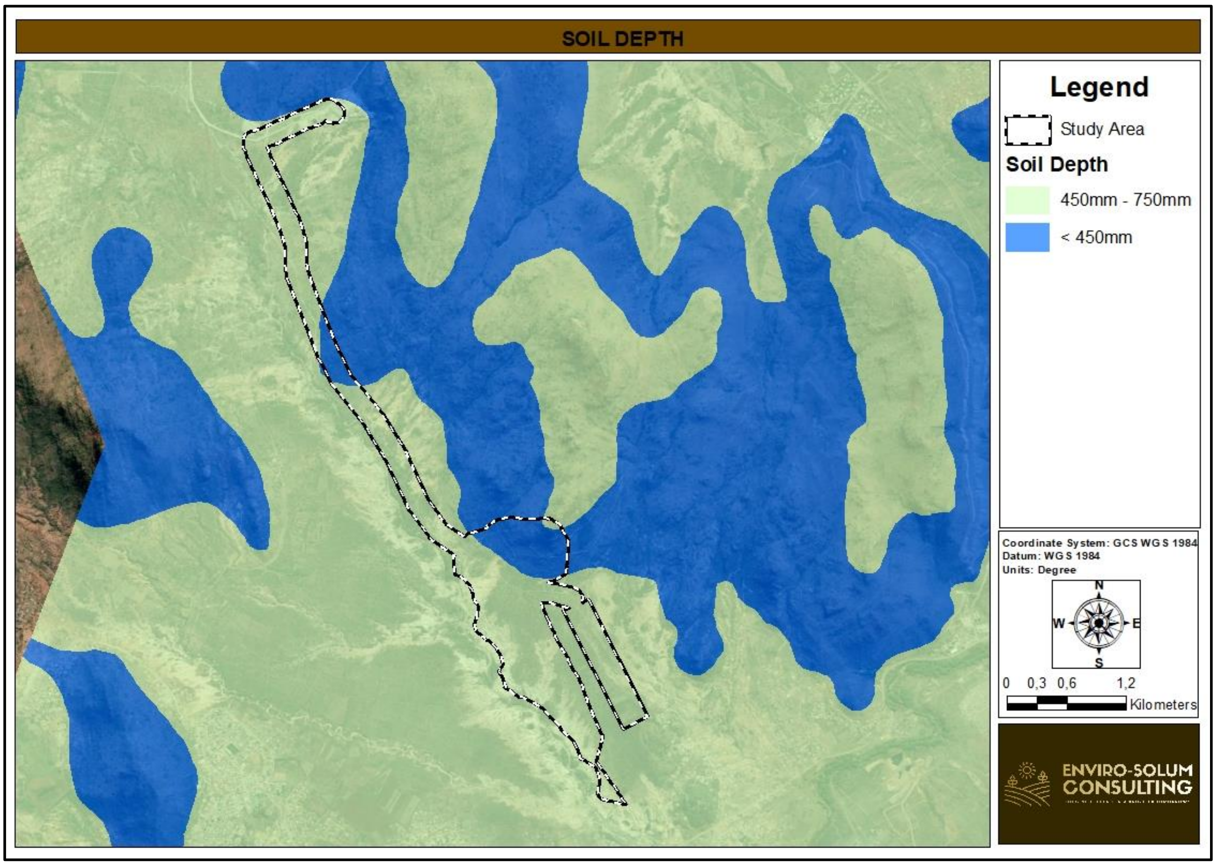

Figure 6: Soil depth percentage associated with the study area.

3.4 Soil pH

The soil pH associated with the soils occurring within the entire study area ranges between 7.5 and 8.4, which is considered slightly alkaline to alkaline. The high soil pH can be attributed to other factors, which include but are not limited to:

- Drier climate, limiting leaching and soil weathering;
- Parent material; and
- Soil texture.

This pH range can still be considered acceptable. However, phosphorus fixation by calcium is a common occurrence in alkaline soils and thus may not be available for plant uptake. Figure 7 below depicts the soil pH associated with soils within the study area.

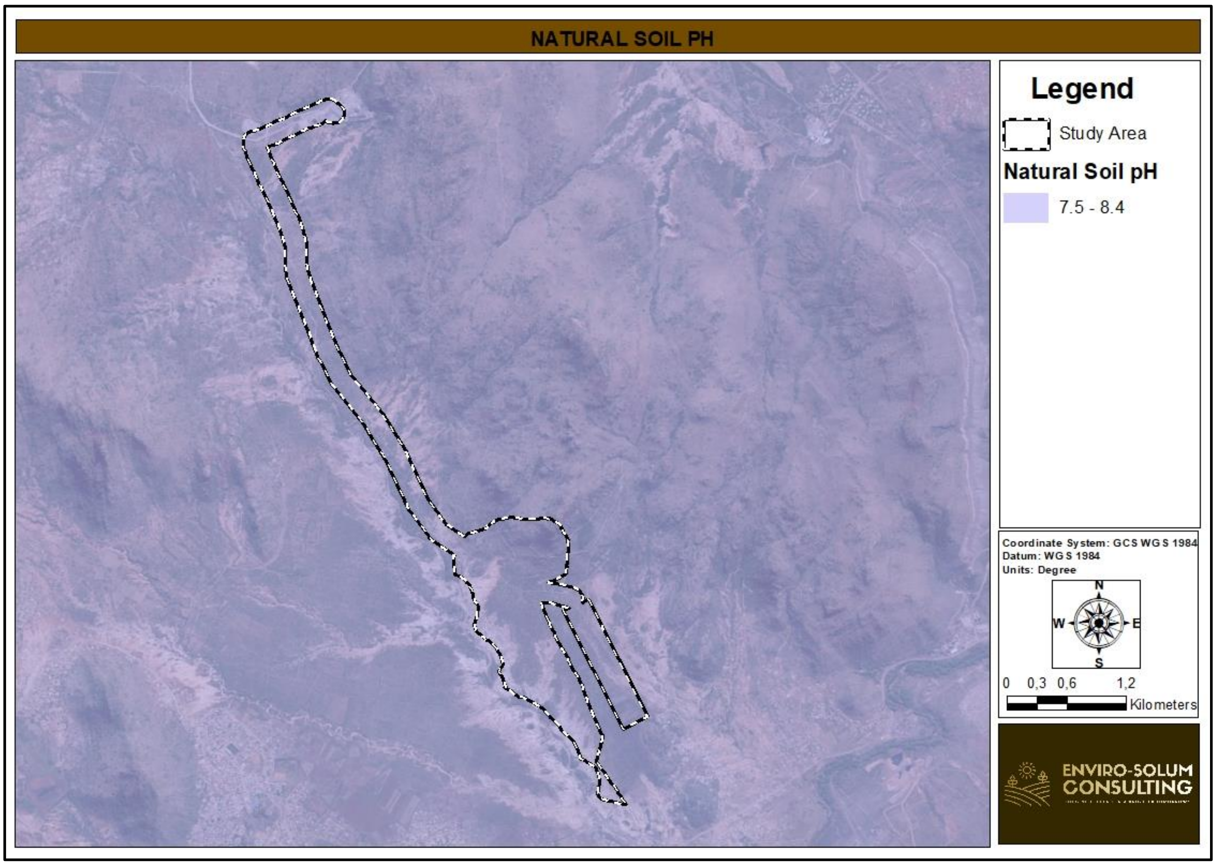

Figure 7: Soil pH associated with the project area.

3.5 Soil and Terrain (SOTER) Dominant Soils

The SOTER Database indicates that the majority of the study area is characterised by calcic vertisols and, to a lesser extent, dominated by lithic leptosols. Calcic vertisols are characterised by high clay and the presence of lime. These soils typically represent serious management constraints in terms of cultivation. As these soils are prone to waterlogging due to their slow infiltration rates and may hinder root penetration, thus limiting the choice of crops to be cultivated. However, these soils tend to be very fertile and typically occur in extensive level plains where reclamation and mechanical cultivation can be envisaged. The lithic leptosols are severely limited to agricultural use, with plant roots confined to a small volume of soil that cannot provide adequate anchorage, water and nutrients. These soils with root-restrictive layers can be profitably used for cropping under sustainable and/or intensive management or left for extensive grazing and wood chopping. Figure 8 below illustrates the SOTER dominant soils associated with the study area.

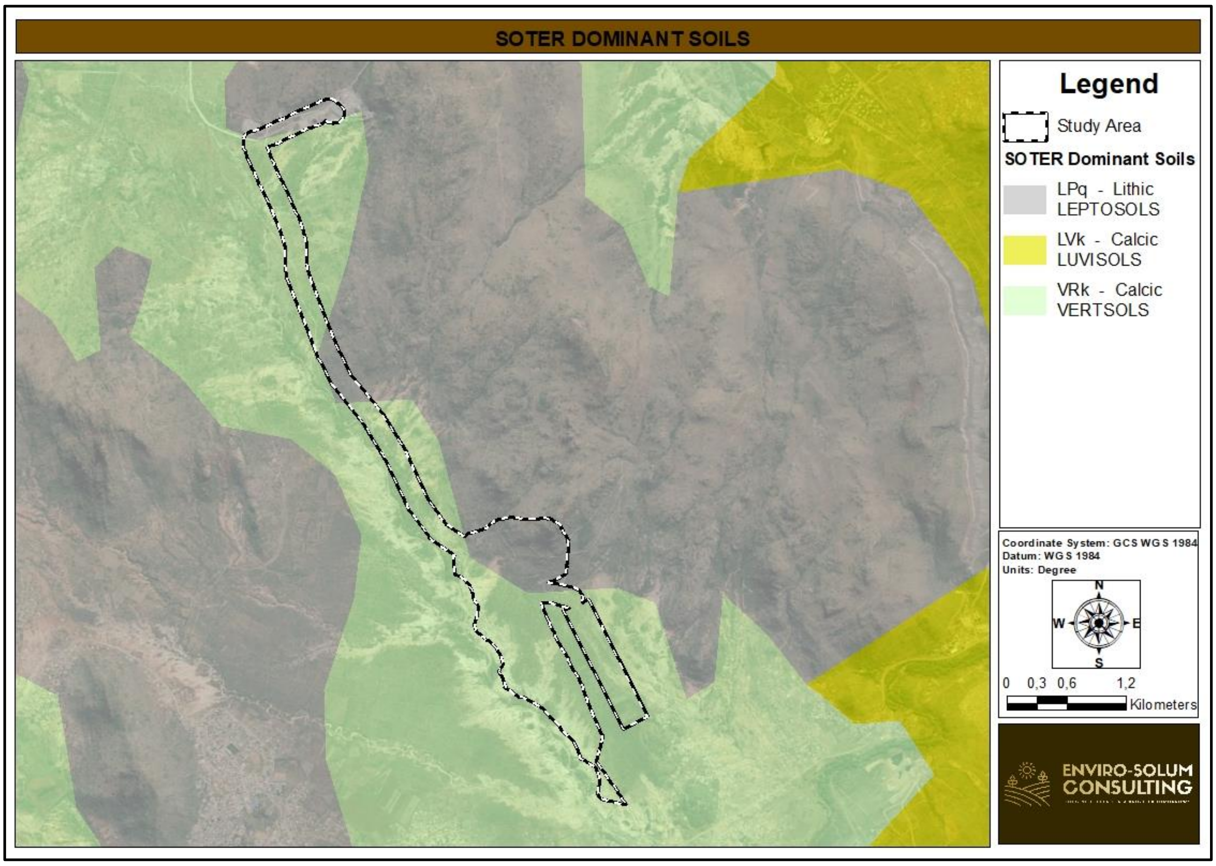

Figure 8: SOTER dominant soils associated with the study area.

3.6 LANDTYPE CLASSES

According to the land type survey staff (1972–2006), the majority of the study area is dominated by the Ea88 landtype and, to a lesser extent, dominated by the Ib31. The Ea landtype is characterised by dark and red coloured structured and high base status. These soils form a considerable agricultural potential, but adapted management is a precondition for sustained production. The Ib landtype is characterised by miscellaneous young land classes that include alluvial depressions and rock-dominated landscapes. These landtypes comprise soils that are severely limited to agricultural use, with plant roots confined to a small volume of soil that cannot provide adequate anchorage, water, and nutrients. Figure 9 below depicts the landtypes classes associated with the study area.

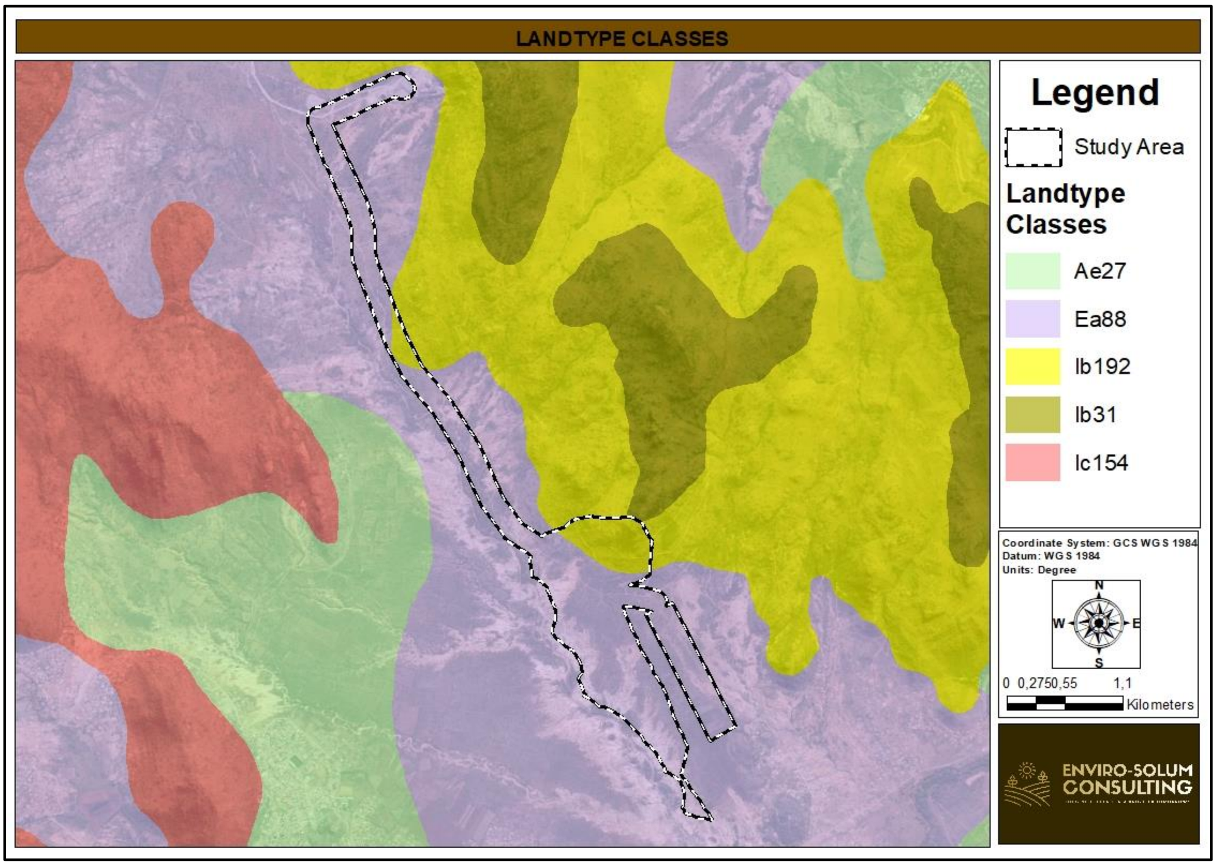

Figure 9: Landtype classes associated with the study area.

3.7 Desktop Land Capability

The majority of the study area is characterised by moderate potential arable land of Class (II) capability. The remaining portions are characterised by non-arable soils of Class (VIII) that are highly suited for grazing, woodland, or wildlife. Figure 10 below shows the desktop land capability associated with the study area.

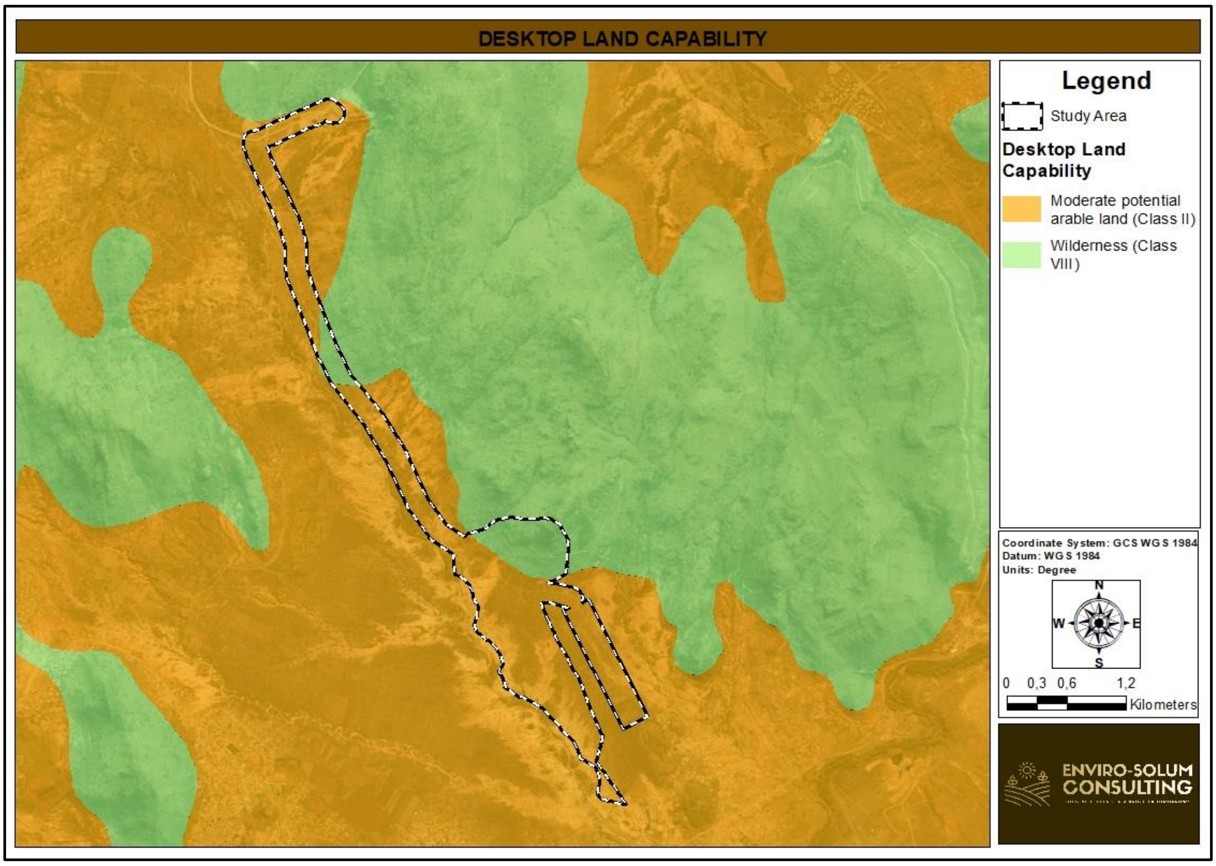

Figure 10: Desktop land capability associated with the study area.

3.8 DESKTOP SOIL POTENTIAL

The majority of the study area is characterised by soils of intermediate suitability for agriculture where climate permits. The remaining portions are characterised by soils not suited for arable agriculture but suitable for forestry or grazing where climate permits. Figure 11 below depicts the desktop soil potential associated with the study area.

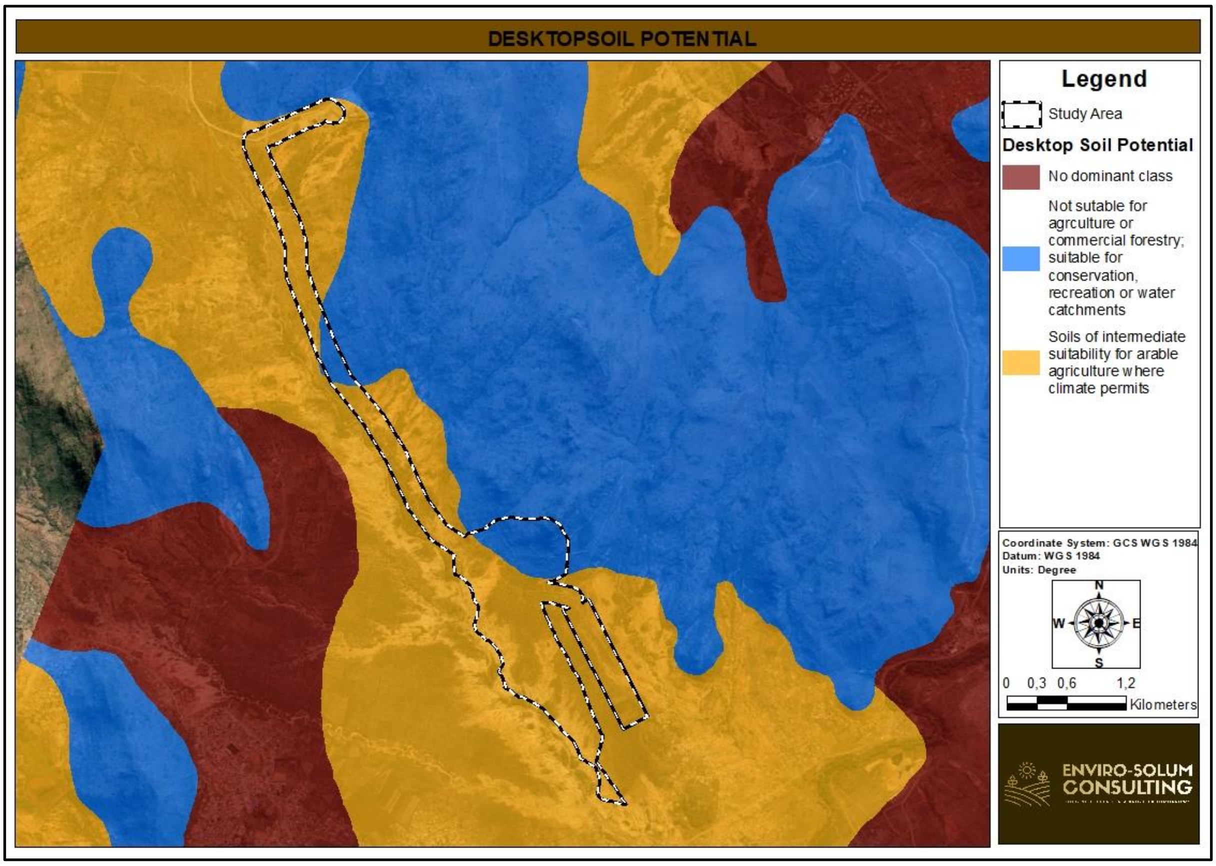

Figure 11: Soil potential associated with the study area.

4. PRELIMINARY FIELD VERIFIED RESULTS AND DISCUSSIONS

4.1 LAND USES WITHIN THE STUDY AREA

The study area is largely characterised by woody vegetation associated with the bushveld. It is also largely vacant and associated with wilderness land use. Residential areas are located in the south of the study area, and mining-related activities were observed in the north of the study area. No agricultural activities, such as cultivation and cattle farming, were observed within the study area. Signs of land degradation were observed within the study area in the form of erosion gullies formed by preferential flow paths which resulted in the washing down of silts and sediments to lower-lying areas. Figure 12 depicts the different land uses identified within the study area.

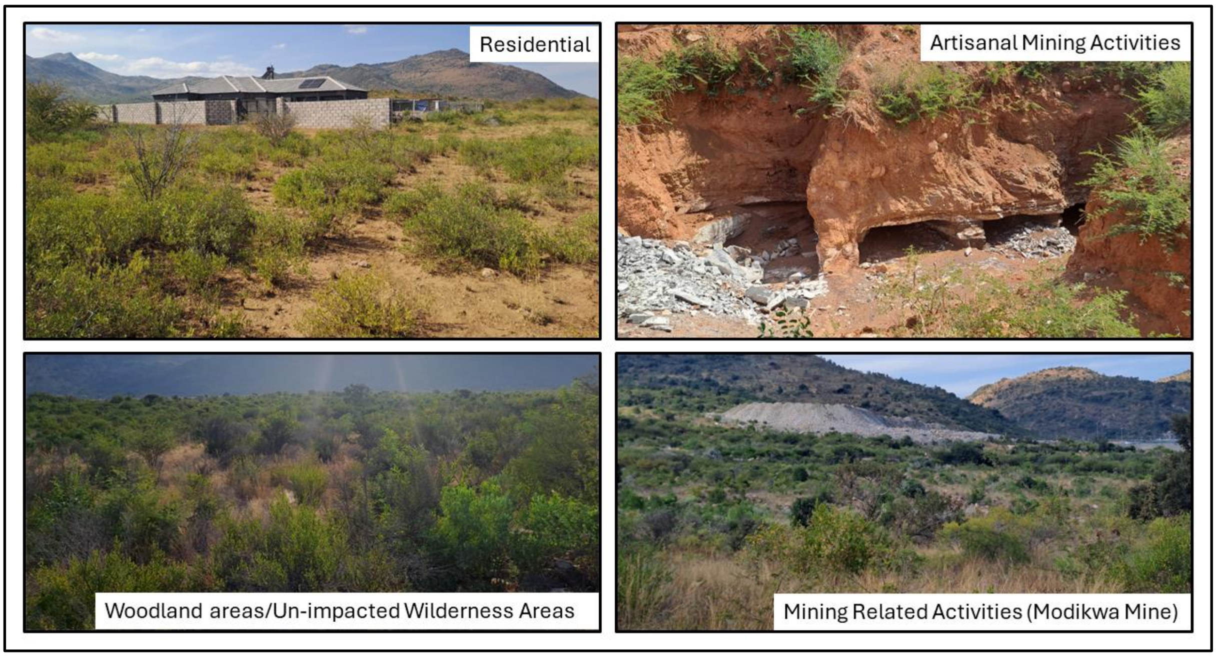

Figure 12: Land uses associated with the study area.

4.2 Soil Forms in the Study Area

The study area is primarily characterised by soils of Mispah/Glenrosa, Coega, and Rocky Outcrops formation in the crest. In the midslope positions, the soils of the Bonheim/Abbotspoort and the Inhoek/Dundee formations were identified in the valley bottom. Table 4 presents summary tables depicting the area of coverage of each specified soil form for the study area. Whereas Figures 17 and 18 depicts the spatial distribution of the soils identified within the study area.

4.1.1 Mispah/Glenrosa, Coega and Rocky Outcrops

The Glenrosa/Mispah and Coega soil formations are typically shallow. The shallow depth can be attributed to limited rock weathering and convex topographical conditions at the crest or scarp of the landscape, instances resulting in soil removal and, in some instances, leaving rocky outcrops behind. These types of soils are usually avoided for intensive use and thus left for grazing, forestry, and wildlife land uses unless intense management strategies are used. The Glenrosa/Mispah soil forms are classified under the Grazing (Class VI) land capability class as they are primarily suited for perennial vegetation and have limitations that preclude cultivation. Whereas the rocky outcrops are classified under Grazing (Class VII) due to the lack of soil material and situated along steep slope, thus not favoring agricultural cultivation. Figure 13 below illustrates the shallow nature of the Glenrosa/Mispah, Coega and rocky outcrops soil forms.

Figure 13: View of the identified shallow Glenrosa/Mispah, Coega and rocky outcrops soil forms.

4.1.2 Bonheim/Abbotspoort

These soils are deep, dark-coloured, clayey and structured with pedocutanic and neocutanic characteristics. These soils are characterised by strongly structured, dark clay horizons, with swell-shrink processes due to the high smectitic clay content. The soils swell or shrink in response to the changes in water content, thus causing the soils to crack extensively when dry and become sticky when wet. These soils are suited for crop cultivation under intensive management practices due to the high clay content and strong structure and are prone to waterlogging conditions (highly impermeable when wet). The Bonheim/Abbotspoort soils are classified under the Arable (ClassIV) land capability class due to severe limitations, low arable potential and a high erosion hazard. Figure 14 below shows the Bonheim/Abbotspoort soil form.

Figure 14: View of the identified Bonheim/Abbotspoort soil form.

4.1.3 Inhoek/Dundee

The Inhoek/Dundee soil form is associated with watercourses due to the alluvial deposition, especially on low-lying terrain positions. These soils are characterised by little evidence of pedogenic horizonation and consist of unconsolidated fluvial or lacustrine sediments. These soils generally have a significant component of vertical flow (although often slowly permeable), leading to the accumulation of water over time. An upward flow of water can be expected in these soils due to evapotranspiration and capillary rise. Consequently, these soils are classified as being of low agricultural value and classified under the Watercourse (Class V) land capability classification. Figure 15 depicts the identified Inhoek/Dundee soil form.

Figure 15: View of the identified Inhoek/Dundee soil form.

4.1.4 Witbank

These soils are usually disturbed by anthropogenic influences such as intentional transportation and severe physical disturbance. The diagnostic horizons are no longer arranged in any discernible order or recognisable horizonation as expected in natural soil, sometimes rendering them unsuitable for any cultivation. Figure 16 below depicts the disturbed soils associated with the Witbank formation.

Figure 16: View of the identified Witbank soils.

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

Study Area					
Soil Forms	**Area (Ha)**	**Percentage (%)**	**Land Capability Class – According to (Smith, 2006)**	**Agricultural Potential**	**DAFF (2016) Classification**
Bonheim/Abbotspoort	111,19	35,9	Arable (Class IV)	Moderate	8. Moderate
Coega	5,18	1,7	Grazing (Class VI)	Low	4. Very Low to Low
Inhoek/Dundee	55,45	17,9	Watercourse (Class V)	Very Low	2. Very Low
Mispah/Glenrosa	70,13	22,6	Grazing (Class VI)	Low	5. Low
Rocky Outcrop	52,81	17,0	Grazing (Class VII)	Very Low	3. Very Low to Low
Witbank	15,29	4,9	Wilderness (VIII)	Very Low	1. Very Low
Total Enclosed	**310,06**	**100**			

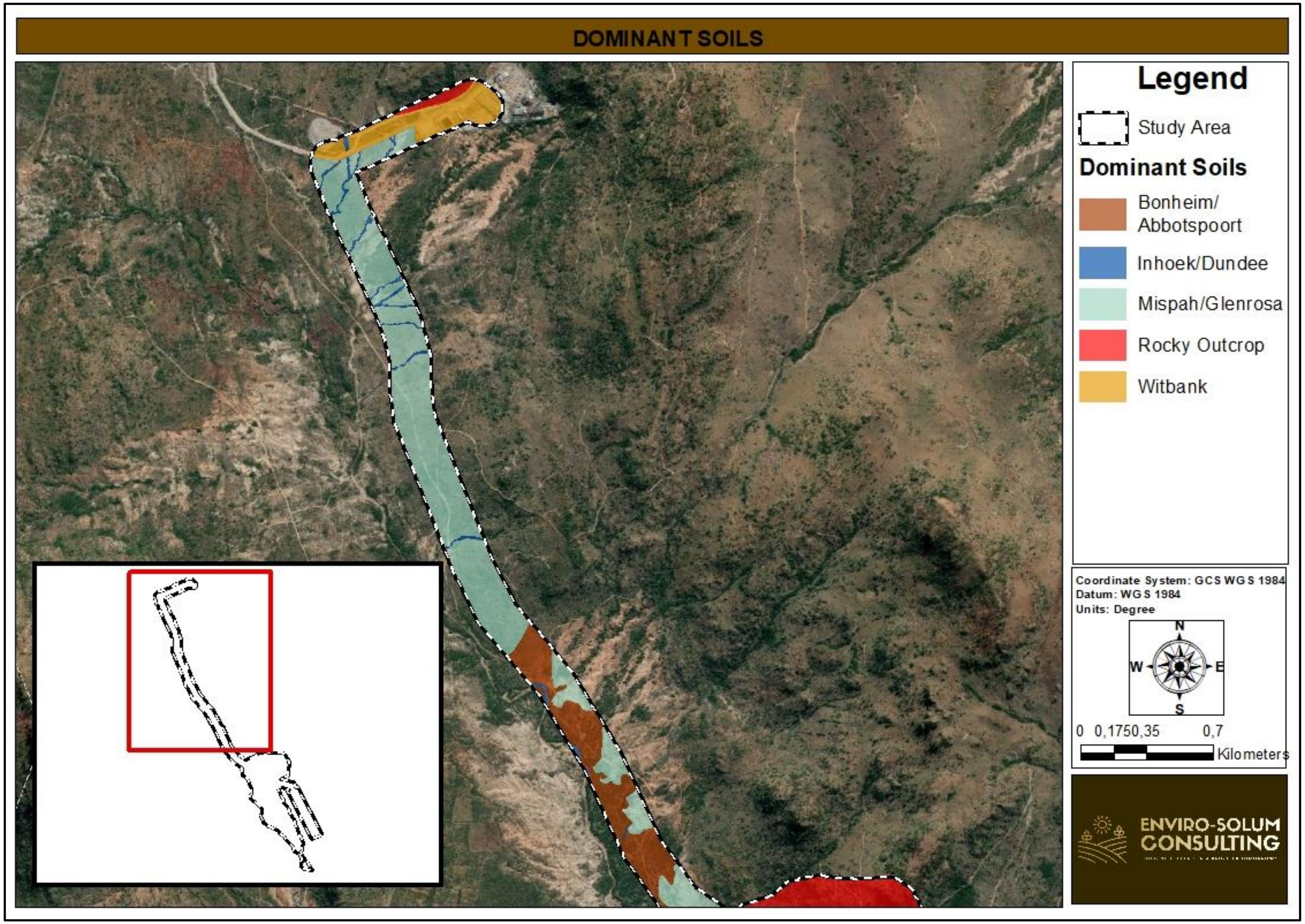

Figure 17: Dominant soils form within the northern portion of the study area.

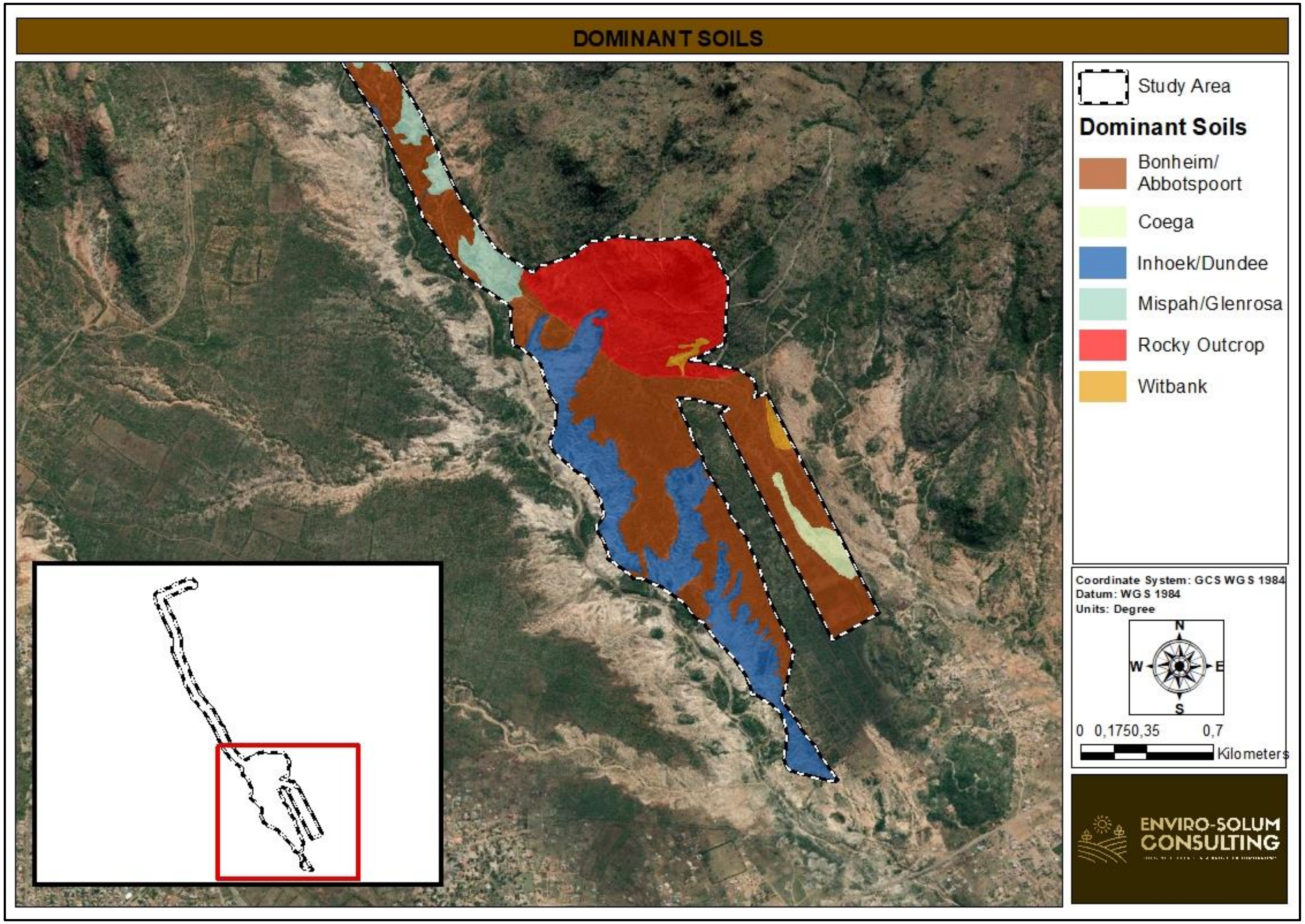

Figure 18: Dominant soils associated with the southern portion of the study area

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 in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Figures 19 to 22 below depict the land capabilities, while Figures 23 and 24 depicts the agricultural potential.

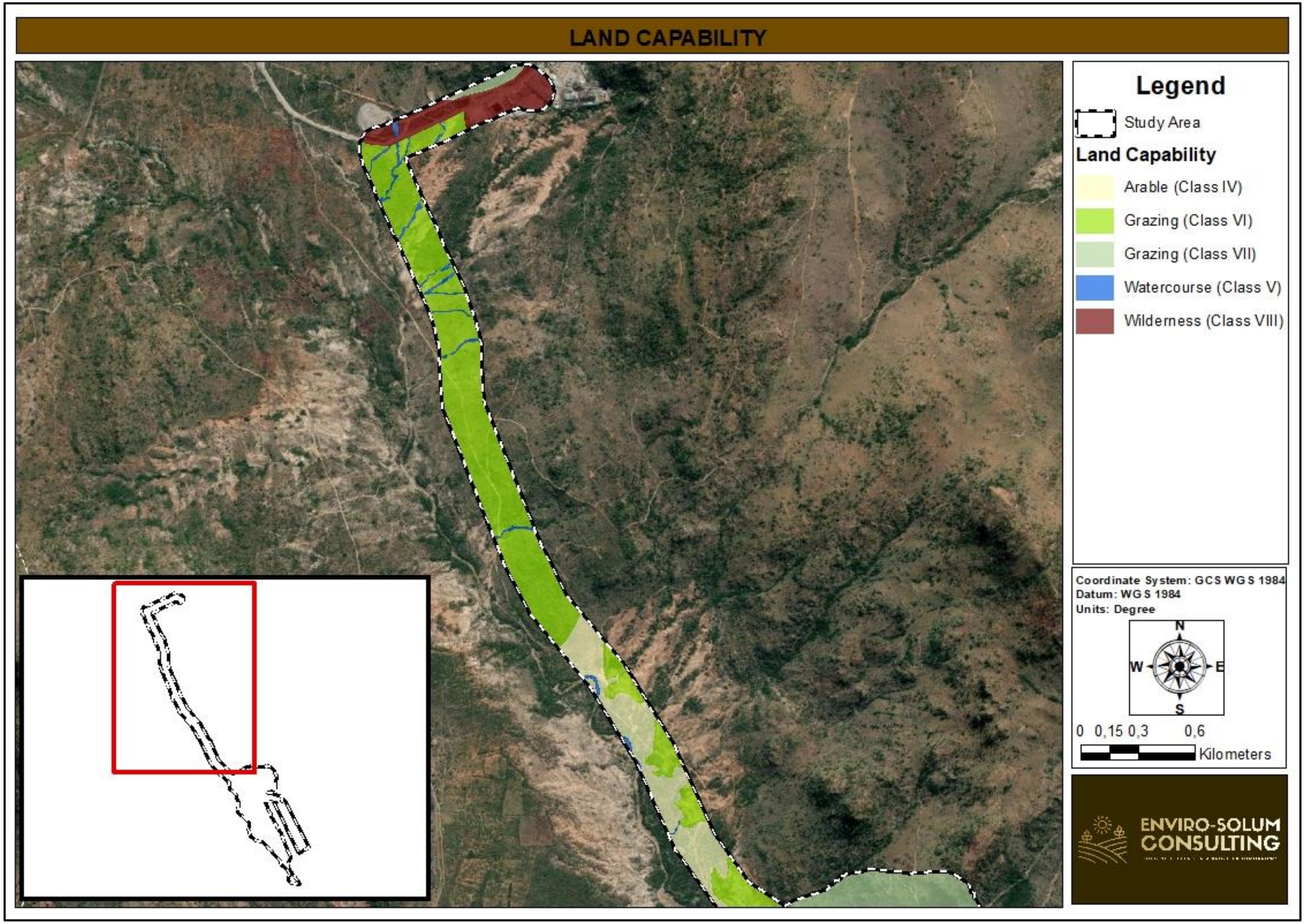

Figure 19: Map depicting land capability associated with the northern portion of the study area.

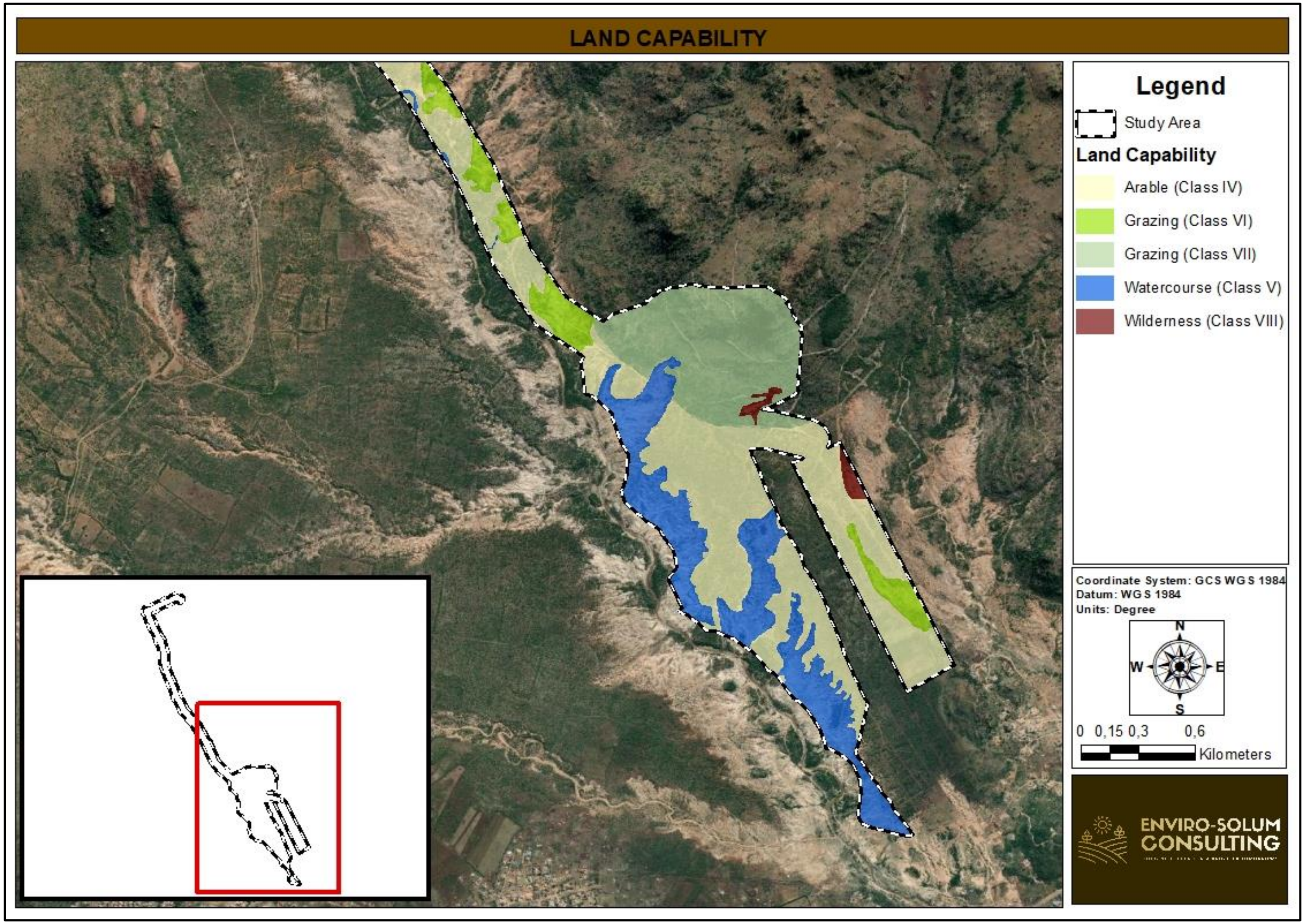

Figure 20: Map depicting land capability of soils associated with the southern portion of the study area.

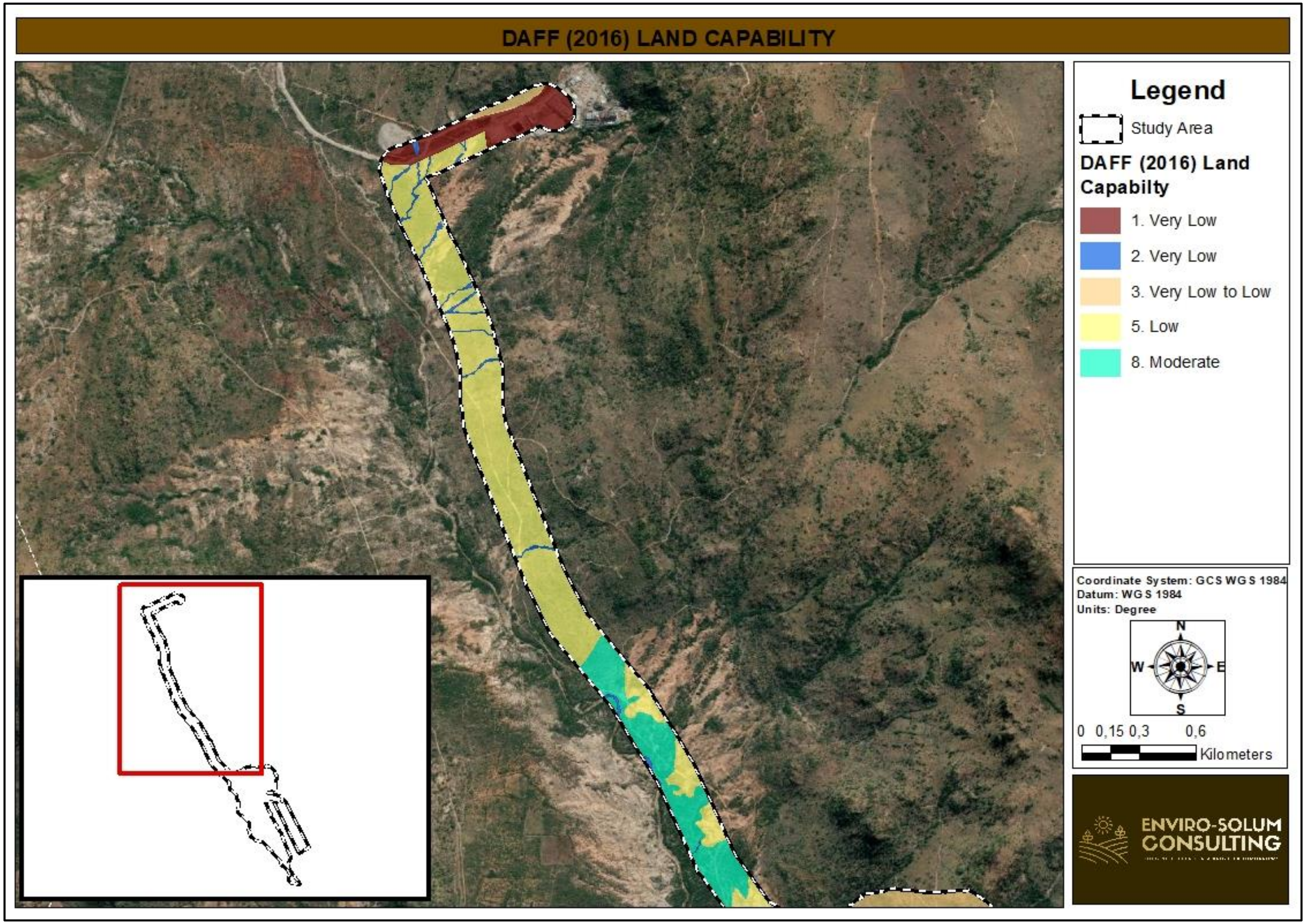

Figure 21: Land capability (DAFF, 2017) of the soil forms associated with the northern portion of the study area.

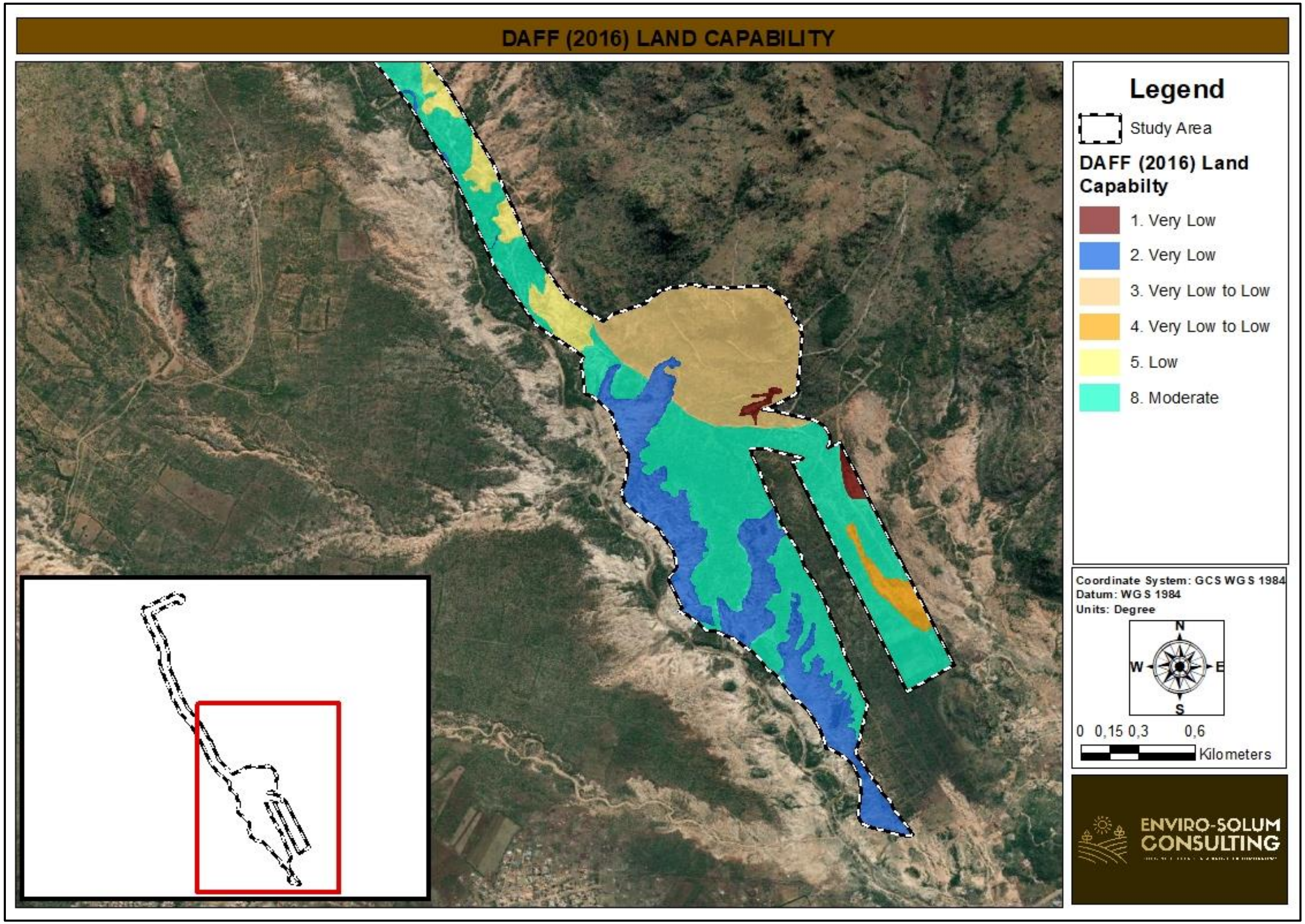

Figure 22: Land capability (DAFF, 2017) of the soil forms associated with the southern portion of the study area.

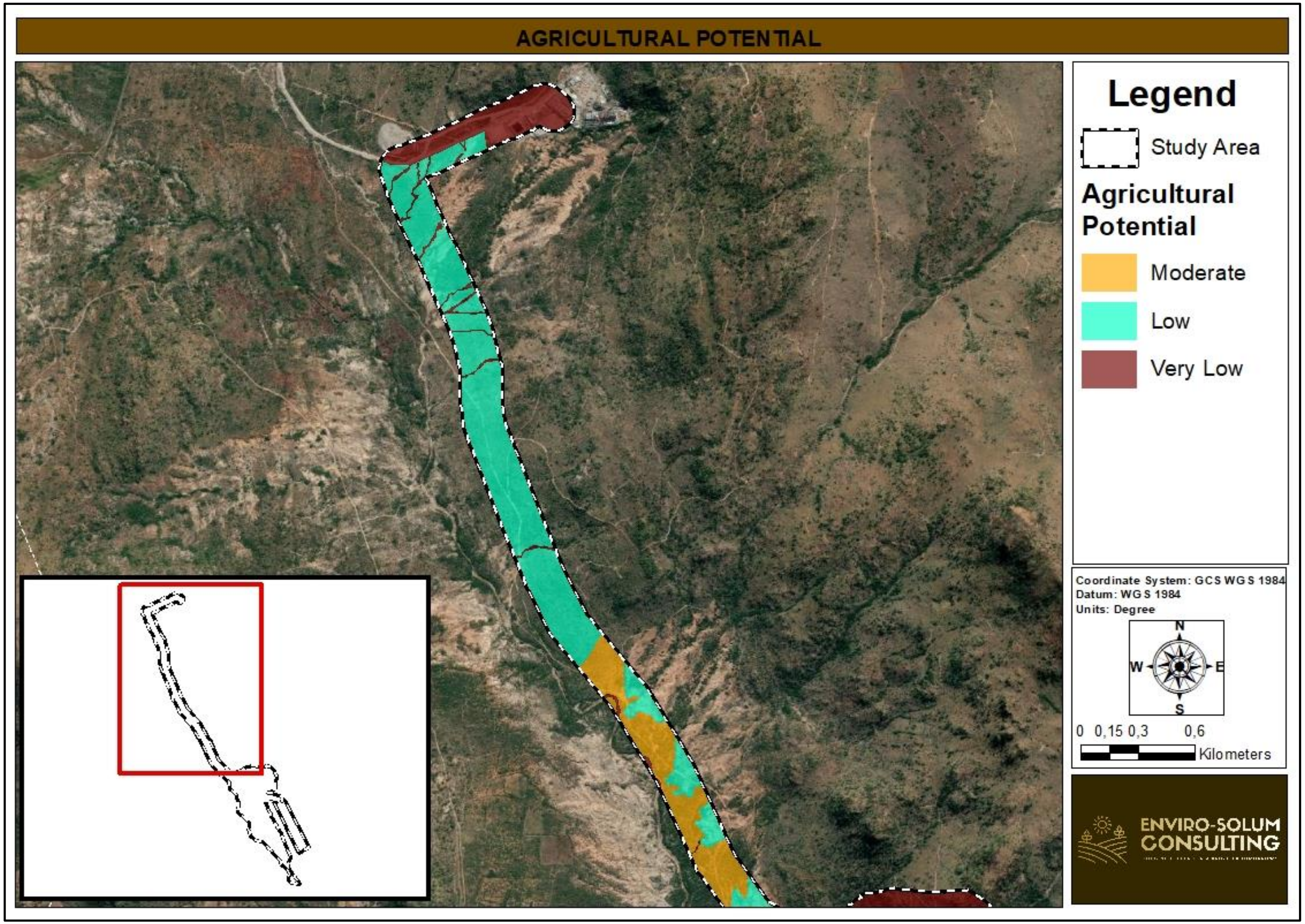

Figure 23: Agricultural potential for soils associated with the soils occurring within the northern portion of the study area.

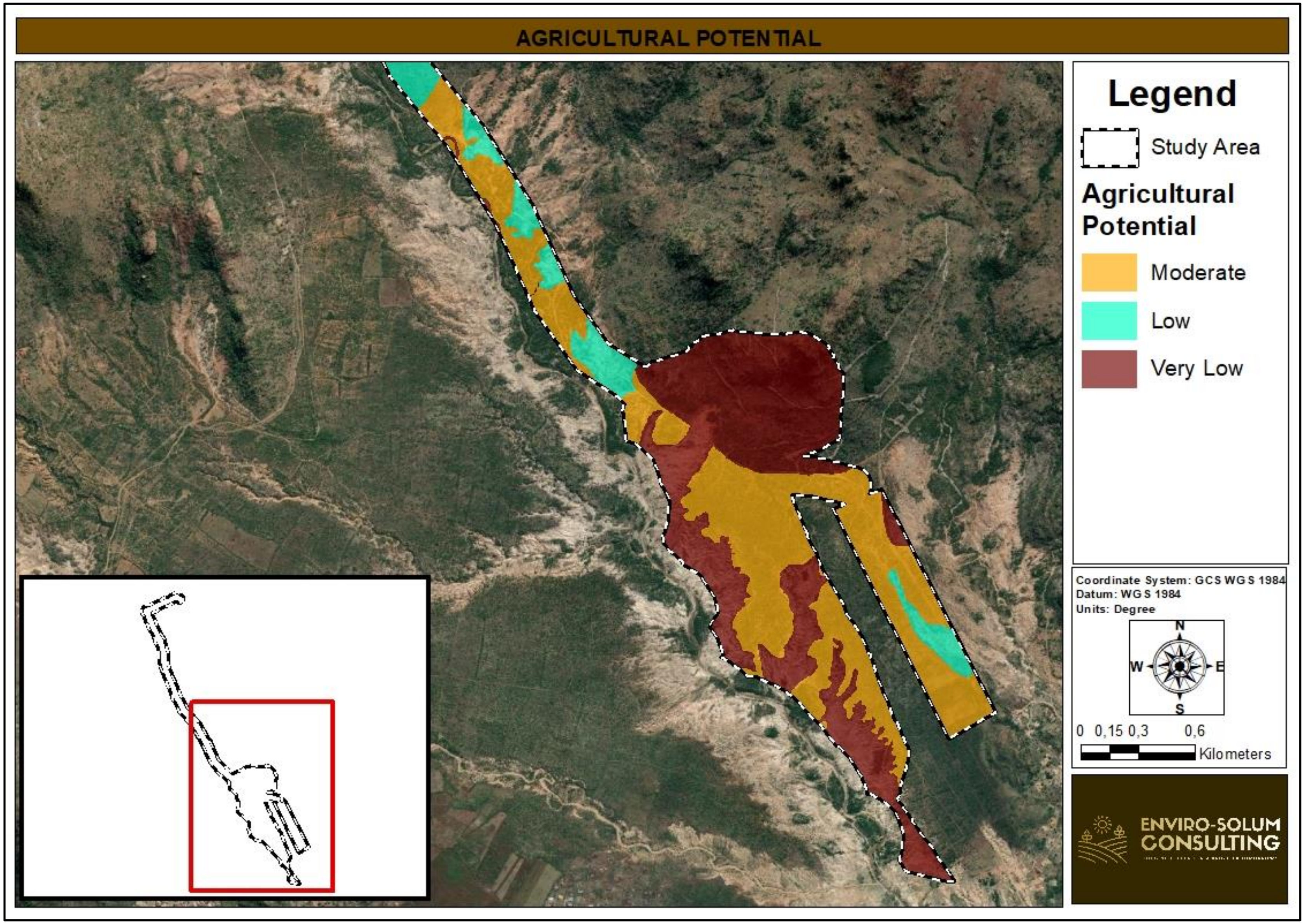

Figure 24: Agricultural potential for soils associated with the soils occurring within the southern portion of the study area.

5. IMPACT ASSESSMENT

5.1 ASSESSMENT METHODOLOGY

According to the NEMA regulations (2014), all the impact assessments should provide quantified scores that 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 and place the consequences of the proposed development before the competent authority.

For each main project phase, the existing and potential future impacts (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).

Section 5.2 below presents the significance of the impacts that may occur due to the proposed open-cast, waste rock dump activities and the associated access road and a description of the mitigation required to limit the identified adverse impacts on the identified soils on site.

5.2 IMPACT ASSESSMENT PER PROJECT PHASE

5.2.1 Construction Phase

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

- Earthworks (where necessary) will include vegetation clearing from the surface and stripping topsoil (soil excavation) for foundation preparation where the proposed infrastructure will be placed. These activities are the most disruptive to natural soil horizon distribution and will impact on the current soil hydrological properties and functionality of soil if not mitigated properly;

- Frequent movement of heavy machinery increasing the likelihood of soil contamination from petroleum, oil, and grease substances;
- Other activities in this phase that will impact on soil are the handling and storage of building materials and different kinds of waste. This will have the potential to result in soil pollution when not managed properly.

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

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

Soil compaction will be a measurable deterioration caused by heavy vehicles commuting on the existing roads and any newly constructed access road to increase access to the MPM South 3 open cast and associated WRD.

5.2.2 Operational Phase

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

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

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

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

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

Soil compaction will be a measurable deterioration that will occur as a result of the movement of vehicles on the soil surfaces (including access roads).

The change in land use will result in the loss of current land capability and use, as current agricultural practices will cease for the duration of the proposed activities.

5.2.3 Closure and Decommissioning Phase

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

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

- Transporting materials away from the site will compact the soil of the existing roads, and fuel and oil spills from vehicles may result in soil chemical pollution.

- Earthworks will include redistribution of inert waste materials to fill the ponds and ditches and add topsoil to the soil surface. These activities will not further impact land use and capability but may increase soil compaction.
- Other activities in this phase that will impact soil are handling and storing materials and different kinds of waste generated, as well as accidental spills and leaks with decommissioning activities. When not managed properly, these activities can potentially result in soil pollution.

5.3 IMPACT SUMMARY TABLES

The impact summary tables for the impact on loss of land capability, soil erosion, soil compaction, and soil contamination are presented in Tables 5 to 8 and Tables 9 to 12 below for the open cast areas and the proposed plant road, respectively.

Table 5: Rating of impacts for the loss of land capability and associated mitigation measures for all project phases for the **open cast areas and the associated WRD**.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Clearing vegetation and levelling soils where necessary, such as bulk earthworks for the open cast and waste rock dumps and temporary laydown areas potentially encroaching on soils with a moderate agricultural potential.							
WOM		Neg	3	3	8	4	56
WM		Neg	2	2	6	3	30
Mitigation Measures							
To minimise edge effects, the project operations must be kept within the demarcated footprint areas as far as practically possible.							
All topsoil stockpiles shall be maintained weed-free throughout the construction and operation phase, permanently demarcated, and located in defined no-go areas. Weeds appearing on the stockpiled topsoil should be removed by hand.							
Separate stockpiling of different soils to obtain the highest post-mining land capability.							
Stockpiled soils should be stored for a maximum of 3-5 years. In addition, concurrent rehabilitation should strongly be considered to reduce the duration of stockpile storage to ensure that the quality of stored soil material does not deteriorate excessively, especially with regards to leaching and acidification.							
Construction vehicle movement should be limited to within the project perimeter fence to avoid unnecessary compaction of adjacent soils.							
The dumping of waste materials next to or on the stockpiles should be prohibited. Contamination by fly-rock from blasting and the pumping out of contaminated waters from the pit are all hazards faced by stockpiles that should be minimised.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational Phase							
Operation of the open cast mine and frequent soil disturbances resulting in land capability loss.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
No Corrective Measures		Neg	3	4	6	4	52
Corrective Measures		Neg	2	4	4	3	30
Mitigation Measures							
Maintenance vehicles should be checked for leakages of hydrocarbons before commencement of maintenance activities.							
Regular dust suppression on roads and during construction, particularly during windy conditions.							
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit potential soil erosion.							
Use geotextiles and contours to prevent soil erosion and revegetate exposed soil surfaces where possible.							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removing the supporting infrastructure and backfilling the open cast pit, as well as transferring waste materials to disposal, recycling, and/or treatment facilities, as applicable (where re-use is not possible).							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with erosion and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring and revegetation.							
Dismantled equipment should be recycled, and non-recyclable material should be appropriately landfilled by an approved service provider.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Any portions of the site with compacted soil should be decompacted, and any excavations backfilled with soil to restore the site for future use.							

Table 6: Rating of impacts for soil erosion and associated mitigation measures for all project phases for the **open cast areas and the associated WRD**.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Clearing vegetation and levelling soils where necessary, such as bulk earthworks for the open cast and waste rock dumps and temporary laydown areas, could potentially increase runoff and soil erosion.							
WOM		Neg	3	2	6	5	55
WM		Neg	2	4	4	3	30
Mitigation Measures							
To minimise edge effects, the project operations must be kept within the demarcated footprint areas as far as practically possible.							
No site-clearing activities should take place during periods of heavy rainfall.							
Access roads should be sloped at a lower gradient. Access roads should be inclined at a lower gradient to reduce runoff-induced erosion.							
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.							
Water needs to be considered for dust suppression, and binding agents like molasses should be considered for unsealed roads and dust suppression.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Access roads should be aligned with the existing road as much as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Potential frequent movement of digging machinery within loose and exposed soils, leading to excessive erosion.							
No Corrective Measures		Neg	2	4	6	4	48
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible.							
Bare soils within the access roads can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast.							
All disturbed areas adjacent to the proposed development areas should be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission.							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removing the supporting infrastructure and backfilling the open cast pit, as well as transferring waste materials to disposal, recycling, and/or treatment facilities, as applicable (where re-use is not possible).							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with erosion and dust control as required or returned to agricultural use.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Establish natural drainage patterns as pre-construction through recontouring and revegetation.							
Dismantled equipment should be recycled, and non-recyclable material should be appropriately landfilled by an approved service provider.							
Any portions of the site with compacted soil should be de-compacted, and any excavations backfilled with soil to restore the site for future use.							

Table 7: Rating of impacts on soil compaction and associated mitigation measures for all project phases for the **open cast areas and the associated WRD**.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Heavy vehicle traffic within and around the study area and potentially compacting the soil during the construction phase.							
WOM		Neg	2	2	8	5	50
WM		Neg	2	4	4	3	30
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
No site clearing activities should take place during periods of heavy rainfall.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Soil Compaction is usually greatest when soils are moist, so soils should be stripped when their moisture content is as low as possible. If they have to be moved when wet, a shovel and truck should be used, as bowlscrapers create excessive compaction when moving wet soils.							
Heavy equipment movement over replaced soils should be minimised.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Potential frequent movement of digging machinery within loose and exposed soils, leading to excessive compaction.							
No Corrective Measures		Neg	2	4	6	5	60
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil compaction.							
Minimize compaction during the stockpile phase by keeping stockpile soil loose and limit stockpile height to 4-5 meters height, to limit internal soil compaction (Coaltech: chamber of mines, 2007).							
Decommissioning Phase							
Potential future decommissioning activities will likely involve dismantling and removing the supporting infrastructure and backfilling the open cast pit, as well as transferring waste materials to disposal, recycling, and/or treatment facilities, as applicable (where re-use is not possible).							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation to help with soil compaction, runoff, erosion and dust control as required or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring, revegetation, and ripping soils to alleviate soil compaction.							
Dismantled equipment should be recycled, and non-recyclable material should be appropriately landfilled by an approved service provider.							
Any portions of the site with compacted soil should be de-compacted, and any excavations backfilled with soil to restore the site for future use.							

Table 8: Rating of impacts on soil contamination and associated mitigation measures for all project phases for the **open cast areas and the associated WRD**.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Potential leaching of hydrocarbon chemicals into the soils from construction vehicles leads to the alteration of the soil's chemical status as well as contamination of groundwater. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.							
WOM		Neg	2	2	6	4	40
WM		Neg	2	1	4	4	28

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Mitigation Measures							
The project operations be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Vehicle and equipment maintenance should be carried out in designated, appropriate facilities fitted with spillage containment, floors, and sumps to capture fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean-up.							
Operational and Maintenance Phase							
Direct chemical spills on soils from construction vehicles, or other construction equipment used.							
No Corrective Measures		Neg	2	4	6	4	48
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Ensure proper handling and storage of hazardous chemicals and materials (e.g., fuel, oil, cement, concrete, reagents, etc.) as per their corresponding Safety Data Sheets.							
Vehicle and equipment maintenance should be carried out in designated, appropriate facilities fitted with spillage containment, floors, and sumps to capture fugitive oils and greases.							
Implementing regular site inspections for materials handling and storage.							
Development of detailed procedures for spill containment and soil clean-up.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Decommissioning Phase							
Potential decommissioning activities will likely involve dismantling on-site buildings, equipment, and facilities. During this period, there will be heavy vehicular traffic, thus increasing the likelihood of soil contamination.							
No Corrective Measures		Neg	2	2	6	3	30
Corrective Measures		Neg	1	1	4	3	18
Mitigation Measures							
The study area should be revegetated with indigenous vegetation as required to help with soil compaction, runoff, erosion, and dust control or returned to agricultural use.							
Establish natural drainage patterns as pre-construction through recontouring, revegetation, and ripping soils to alleviate soil compaction.							
Dismantled equipment should be recycled, and an approved service provider should appropriately landfill non-recyclable material.							
Any portions of the site with compacted soil should be decompacted, and any excavations should be backfilled with soils to restore the site for future use.							

Table 9: Rating of impacts for the loss of land capability and associated mitigation measures for all project phases for the **proposed plant road**.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Clearing vegetation and levelling soils where necessary, such as bulk earthworks for the open cast and waste rock dumps and temporary laydown areas potentially encroaching on soils with a moderate agricultural potential.							
WOM		Neg	2	2	6	4	40
WM		Neg	2	1	4	3	21
Mitigation Measures							
The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities within the infrastructure footprint as far as practically possible.							
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.							
Construction vehicle movement should be limited to within the project perimeter fence to avoid unnecessary compaction of adjacent soils.							
Always strip a suitable time before the placement or construction of the hydrogen plant facilities to avoid soil loss and contamination.							
Access roads should be aligned to the existing road as far as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Operation and maintenance of the plant road; constant traffic and frequent soil disturbances resulting in land capability loss.							
No Corrective Measures		Neg	3	4	4	3	33
Corrective Measures		Neg	1	4	3	3	24

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Mitigation Measures							
Maintenance vehicles should be checked for leakages of hydrocarbons before commencement of maintenance activities.							
Regular dust suppression on roads and during construction, particularly during windy conditions.							
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit potential soil erosion.							
Use geotextiles and contours to prevent soil erosion and revegetate exposed soil surfaces where possible.							

Table 10: Rating of impacts for soil erosion and associated mitigation measures for all project phases for the **proposed plant road.**

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Site clearing, removal and associated disturbances to soils, leading to, increased runoff, erosion and consequent loss of land capability in cleared areas.							
WOM		Neg	3	2	5	4	40
WM		Neg	2	1	4	3	21
Mitigation Measures							
The project operations must be kept within the demarcated footprint areas as far as practically possible to minimise edge effects.							

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
No site-clearing activities should take place during periods of heavy rainfall.							
Access roads should be sloped at a lower gradient. Access roads should be inclined at a lower gradient to reduce runoff-induced erosion.							
Use geotextiles and contours to control soil erosion and revegetate exposed soil surfaces where possible.							
Water needs to be considered for dust suppression, and binding agents like molasses should be considered for unsealed roads and dust suppression.							
Access roads should be aligned with the existing road as much as practically possible to avoid further agricultural impact and unnecessary soil disturbance.							
Operational and Maintenance Phase							
Operation and maintenance of the plant road; constant traffic and frequent capability soil; soil disturbances resulting in increased soil erosion.							
No Corrective Measures		Neg	2	4	6	3	36
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Disturbed areas adjacent to the footprint should be revegetated with indigenous grass mix to limit potential soil erosion.							
Use geotextiles and contours to prevent soil erosion and revegetate exposed soil surfaces where possible.							

Table 11: Rating of impacts on soil compaction and associated mitigation measures for the **proposed plant road**.

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

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Corrective Measures		Neg	1	4	4	3	27
Mitigation Measures							
Loosening of the soil through ripping and discing prior to the stripping process is recommended to break up crusting							
Unnecessary trafficking and movement over the areas targeted for construction must be avoided, especially heavy machinery							
Disturbed areas adjacent to the footprint area should be revegetated with indigenous grass mix to limit potential soil compaction.							
Access roads should be inspected and maintained as necessary.							

Table 12: Rating of impacts on soil contamination and associated mitigation measures for all project phases for the proposed plant road.

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Leaching of hydrocarbon chemicals into the soils from maintenance equipment leads to alteration of the soil chemical status as well as contamination of groundwater. Potential hazardous and non-hazardous waste disposal, including waste material spills and refuse deposits into the soil.							
WOM		Neg	2	2	5	4	36
WM		Neg	2	1	4	4	28
Mitigation Measures							

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

6. IMPACT STATEMENT AND SCREENING TOOL VERIFICATION

The study area is largely characterised by soils of duplex character, such as the Bongeim/Abbotspoort, which account for 35.9% of the area. This is followed by shallow soils and rocky outcrops, which account for 41.3% of the area. The remaining soils are associated with watercourses and disturbed areas and account for 17.9% and 4.9% of the area, respectively.

The findings of this assessment suggest that the relevant soil and climatic limiting factors within the proposed project area for land capability and land use potential include the following:

- Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss based on the climatic conditions associated with the study area. To cultivate successfully, additional or supplementary irrigation will have to be utilised.
- High clay content of the Bonheim/Abbotspoort soil forms will likely restrict root growth, and poor internal drainage may render the soils waterlogged during the rainy season. However, these soils tend to be highly fertile due to the less propensity to leach.
- Shallow effective rooting depth due to shallow indurated bedrock of the Mispah/Glenrosa, Coega and rocky outcrops soil forms. As such, these soils are not considered able to contribute significantly to agricultural production on a national or provincial scale.
- Susceptibility to erosion of Mispah/Glenrosa soils form as they are located in moderately sloping areas.

The type of soils identified within the study area render it largely suitable for grazing and wildlife purposes due to the dominance of the shallow soils and rocky outcrops. The soils of moderate potential, such as the Bonheim/Abbotspoort, will require extensive management strategies to be cultivated due to the inherent soil properties associated with these soils. However, the loss of moderate potential agricultural soils and the permanent change in land use (for the lifespan of the Modikwa south3 open cast and associated infrastructure) will be localised within the study area. It is the opinion of the specialist that the unmitigated scenario poses a threat to the sustainability of the moderate potential soils, which could be utilised for agricultural purposes. Therefore, integrated mitigation measures must be implemented accordingly to minimise the potential loss of these valuable soils, considering the need for sustainable development. It is far preferable to incur a minimal loss of potential agricultural land with marginal cultivation potential based on inherent soil properties than to lose agricultural land that has a higher potential and that is much scarcer to the proposed development elsewhere in the country. Figure 25 below indicates that the study area does not fall under the protected agricultural area (PAA, 2021), likely due to the soils associated with the study area, as well as the climatic conditions and the lack of available options for irrigation water in the immediate surroundings of where the moderate potential soils were identified.

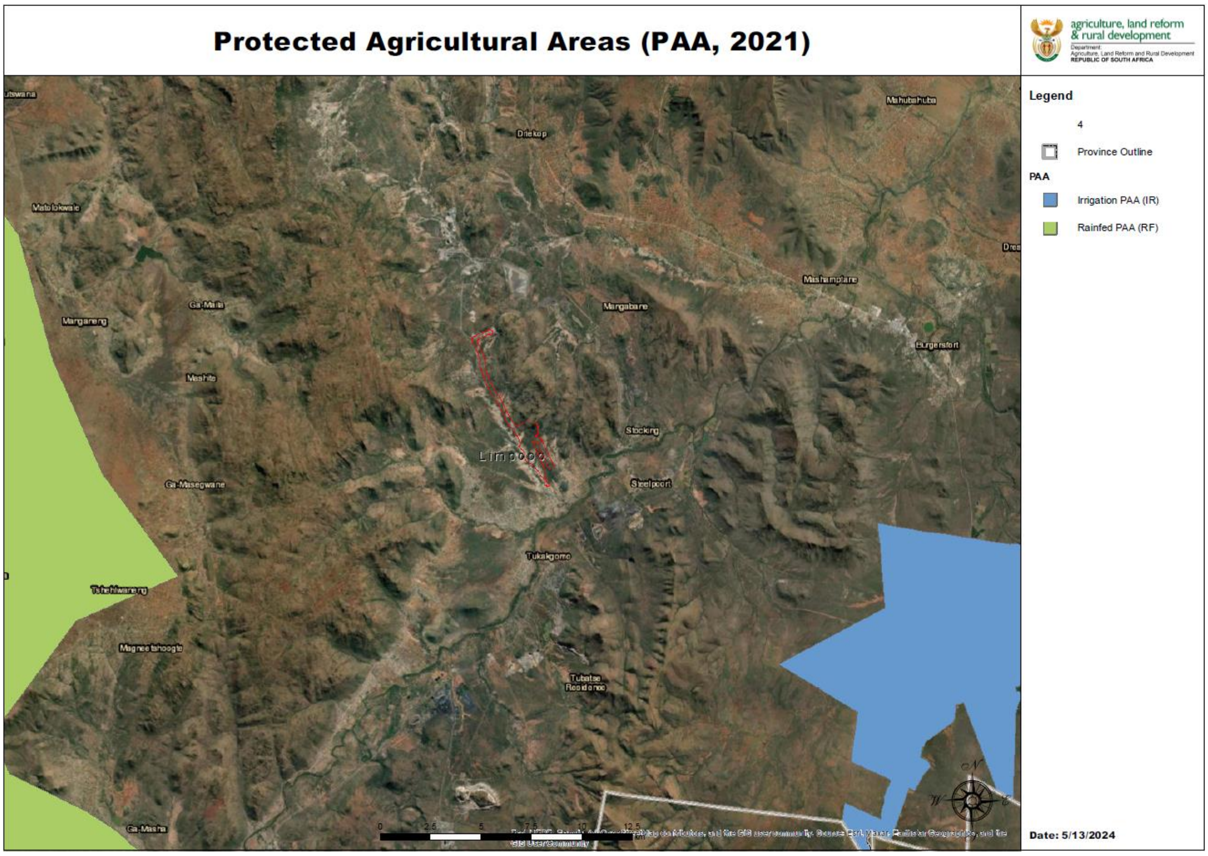

Figure 25: Protected agricultural areas.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of High sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment, this was found to have a less significant impact as presented on the screening tool due to the dominant soil forms that are not high-potential agricultural soils due to various limitations, including shallower depth and requiring intensive management strategies to cultivate. The land capability of the surrounding soils as well as the agricultural potential, are Low to moderate due to adequate climatic conditions (i.e., rainfall, temperature) and appropriate slope, which allows for intensive commercial agricultural practices.

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.

6.1 GROSS AGRICULTURAL INCOME FROM THE STUDY AREA

During the time of the assessment, no agricultural activities were observed within the study area, and thus, no gross agricultural income could be calculated.

7. CONCLUSION

Enviro-Solum Consulting was appointed to conduct a soil, land use and land capability assessment as part of the Environmental Authorisation (EA) for the proposed South 3 Opencast Mine and associated support infrastructure. The area wherein the proposed development is to take place will be located approximately 2km north of the R555 road and approximately 5km west of the steelpoort town, within the Fetakgomo Tubatse Municipality, Limpopo, South Africa.

The study area falls within the humid subtropical climate zone, characterised by hot and humid summers and cool to mild winters. A deep current of tropical air dominates the humid subtropics at the time of high sun, and daily intense (but brief) convective thundershowers are common but lack any predictability. The entire study area is characterised by rainfall ranging between 401 and 600 mm. The study area can, therefore, be described as water-stressed. While the range of planting dates is limited for supporting rain-fed agriculture under these conditions, a limited range of adapted crops can receive good yields if planted on time.

The study area is primarily characterised by soils of Mispah/Glenrosa, Coega, and Rocky Outcrops formation in the crest. In the midslope positions, the soils of the Bonheim/Abbotspoort and the Inhoek/Dundee formations were identified in the valley bottom

.

The type of soils identified within the study area render it largely suitable for grazing and wildlife purposes due to the dominance of the shallow soils and rocky outcrops. The soils of moderate potential, such as the Bonheim/Abbotspoort, will require extensive management strategies to be cultivated due to the inherent soil properties associated with these soils. However, the loss of moderate potential agricultural soils and the permanent change in land use (for the lifespan of the Modikwa south3 open cast and associated infrastructure) will be localised within the study area. It is the opinion of the specialist that the unmitigated scenario poses a threat to the sustainability of the moderate potential soils, which could be utilised for agricultural purposes. Therefore, integrated mitigation measures must be implemented accordingly to minimise the potential loss of these valuable soils, considering the need for sustainable development. It is far preferable to incur a minimal loss of potential agricultural land with marginal cultivation potential based on inherent soil properties than to lose agricultural land that has a higher potential and that is much scarcer to the proposed development elsewhere in the country. The study area does not fall under the protected agricultural area (PAA, 2021), likely due to the soils associated with the study area, as well as the climatic conditions and the lack of available options for irrigation water in the immediate surroundings of where the moderate potential soils were identified.

The screening tool analysis was conducted, which presented the findings as the impact on agricultural resources being of High sensitivity in terms of agricultural potential. Based on the outcomes of the field assessment, this was found to have a less significant impact as presented on the screening tool due to the dominant soil forms that are not high-potential agricultural soils due to various limitations, including shallower depth and requiring intensive management strategies to cultivate. The land capability of the surrounding soils as well as the agricultural potential, are Low to moderate due to adequate climatic conditions (i.e., rainfall, temperature) and appropriate slope, which allows for intensive commercial agricultural practices.

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

Tshiamo Setsipane

13 May 2024

APPENDIX B: IMPACT ASSESSMENT METHODOLOGY

The assignment of significance ratings has been undertaken based on the experience of the EIA team, as well as through research. Subsequently, mitigation measures were identified and considered for each impact, and the assessment was . The assessment is repeated to determine the significance of the residual impacts (the impact remaining after the mitigation measure has been implemented).

Status of Impact

The impacts are assessed as either having a:

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

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

Neutral effect on the environment.

Extent of the Impact

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

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

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

(**4**) National, or

(**5**) International.

Duration of the Impact

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

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

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

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

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

(**5**) Permanent.

Magnitude of the Impact

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

(**0**) none,

(**2**) Minor,

(**4**) Low,

(**6**) Moderate (environmental functions altered but continue), (**8**) High (environmental functions temporarily cease) or

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

Probability of Occurrence

The likelihood of the impact occurring is indicated as either:

(**0**) None (the impact will not occur),

(**1**) improbable (probability very low due to design or experience)

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

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

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

(5) Definite.

Significance of the Impact

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

S=(E+D+M) P

The significance ratings are given below.

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

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

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

Assessment Of Impacts

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

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

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

High	>60
Medium	>30 - 60
Low	<30

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Construction Phase:							
Mitigation Measures							
Operational Phase							
Mitigation Measures							

APPENDIX C: CURRICULUM VITAE OF SPECIALISTS

CURRICULUM VITAE OF TSHIAMO SETSIPANE

PROFESSIONAL EXPERIENCE

Soil Science Consultant

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

EDUCATION

- M.Sc. (Agric): Soil Science **01/2016– 03/2019**
  - Dissertation: Characterisation of hydropedological processes and properties of a sandstone and a tillite hillslope, Kwa-Zulu Natal, South Africa.
  - Graduated *Cum-Laude*.
- B.Sc. (Agric) Honours: Soil Science **01/2014 – 11/2014**
  - Majored in soil fertility, soil physics, soil geography and soil chemistry.
  - Research Project: Soil as an indicator of soil water regime.
- B.Sc. (Agric): Soil Science and Agrometeorology **2010 – 11/2013**

  - Majored in soil science and agrometeorology.
  - Minored in agronomy and plant pathology.

PROFESSIONAL MEMBERSHIP AND AFFILIATION

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