Soil Compliance Statement for the proposed Quantum 1 Solar Energy Facility (SEF)

Tarlton, Gauteng Province, South Africa

June 2023

CLIENT

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Submitted to	savannah environmental
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Fieldwork	**Michael Douglas**  Michael Douglas is a soil scientist with experience in soil classification. Michael completed his BSc Honours in environmental science and geological science at the North-West University of Potchefstroom. Michael has been part of various agricultural potential, land capability and pedology studies as part of Environmental Impact Assessments and Basic Assessments.
Report Writer and Fieldwork	**Matthew Mamera**  Matthew Mamera is Cand. Sci Nat registered (116356) in natural and agricultural sciences with a recognition in soil science. Matthew is a soil and hydropedology specialist with experience in soil, pedology, hydropedology, water and sanitation management and land contamination and has field experience and numerous peer reviewed scientific publications in international journals. He is a holder of a PhD in Soil science, hydropedology, water and sanitation obtained at the University of the Free State, Bloemfontein. Matthew completed his M.Sc. in soil science, hydropedology and water management at the University of Fort Hare, Alice. Matthew is also a member of the Soil Science Society of South Africa (SSSSA).
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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Declaration

I, Matthew Mamera declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Dr Matthew Mamera

Soil Scientist

The Biodiversity Company

June 2023

1 Introduction

The Biodiversity Company (TBC) was commissioned to conduct a soil and agricultural potential assessment for the proposed Quantum 1 Solar Energy Facility (SEF).

South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing the construction and operation of a solar photovoltaic (PV) facility and associated infrastructure on Portion 285 (a portion of portion 19) of the Farm Vlakplaats 160, located approximately 7.2km west of Krugersdorp, within the Mogale City Local Municipality in the West Rand District Municipality in the Gauteng Province. The facility will have a contracted capacity of up to 10MW and will be known as Quantum 1 Solar Energy Facility.

A preferred development area with an extent of ~94.1479ha has been identified by South Africa Mainstream Renewable Power Developments (Pty) Ltd as technically suitable for the development of the Quantum 1 Solar Energy Facility. The facility will comprise the following infrastructure:

- Solar PV array comprising solar modules.
- Mounting System Technology
- Inverters and transformers.
- Low voltage cabling between the PV modules to the inverters.
- Overhead power lines
- Onsite substation, switching substation and laydown areas.
- Battery Energy Storage System (BESS) and associated infrastructure.
- Internal access roads.
- Fence around the project development areas.

The approach adopted for the assessments has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: “Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation”. The National Web based Environmental Screening Tool (DFFE, 2023) has characterised the agricultural theme sensitivity of the area as “Very High”.

This report aims to present and discuss the findings from the soil resources identified within the 50 m regulated area (GN 320). The report will also identify the soil suitability and land potential of these soils, the land uses within the assessment area and the risks associated with the proposed solar photovoltaic project.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.1 Scope of Work

The following scope of work is applicable:

- The feasibility of the proposed activities;
- Confirmation regarding the “Very High” sensitivities;

- The effects that the proposed activities will have on agricultural production in the area;
- A map superimposing the proposed footprint areas, a 50 m regulated area as well as the sensitivities pertaining to the screening tool;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation;
- The specialist's opinion regarding the approval of the proposed activities; and
- Any potential mitigation measures described by the specialist to be included in the management programme (for high sensitivity areas, if applicable).

2 Project Area

The project area is located 12 km west of the town Krugersdorp and 13 km East South of the town Magaliesburg, within the Gauteng Province. The proposed project area is exactly at the intersection between the N14 and R24 regional roads (see Figure 2-1). The surrounding land uses include agriculture, grazing, waterbodies, and informal settlement areas. The project area is used for agriculture, and the current use includes chicken farming.

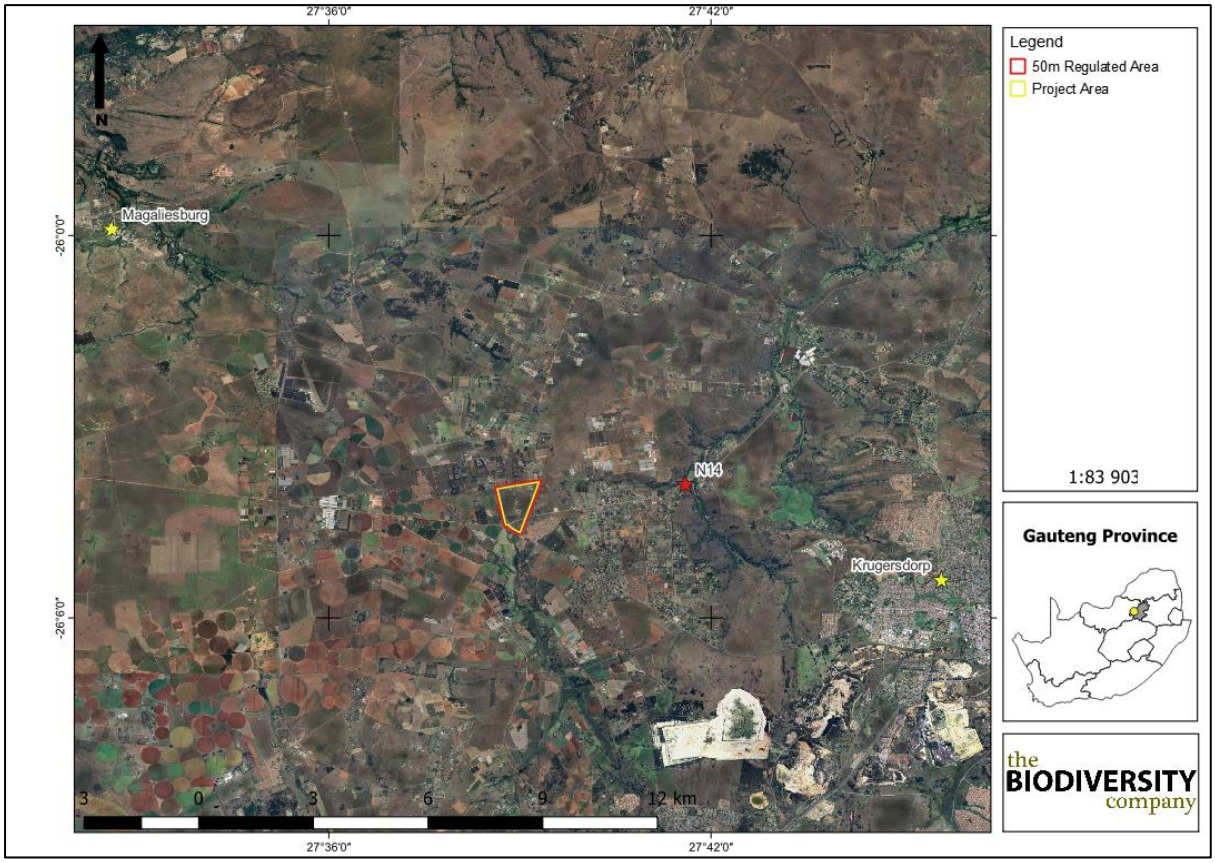


Figure 2-1 Locality map of the project area

3 Methodology

3.1 Desktop Assessment

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types. In addition, a Digital Elevation Model (DEM) as well as the slope percentage of the area was calculated by means of the NASA Shuttle Radar Topography Mission Global 1 arc second digital elevation data by means of QGIS and SAGA software.

3.2 Field Survey

An assessment of the soils present within the project area was conducted during the field survey in June 2023. The site was traversed on foot. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 1.3 m. Soil survey positions were recorded as waypoints using a handheld GPS. Soils were identified to the soil family level as per the "Soil Classification: A Taxonomic System for South Africa" (Soil Classification Working Group, 2018). Landscape features such as existing open trenches and garbage pits were also helpful in determining soil types and depth.

3.3 Land Capability

Given the nature of the compliance statement and the fact that baseline findings correlate with the screening tool's sensitivities, land capability was solely determined by means of the National Land Capability Evaluation Raster Data Layer (DAFF, 2017). Land capability and land potential will also briefly be calculated to match to that of the screening tool to ultimately determine the accuracy of the land capability sensitivity from DAFF, 2017.

Land capability and agricultural potential will briefly be determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

Land capability is divided into eight classes, and these may be divided into three capability groups. Table 3-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 3-1 Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing Land
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife

W - Wildlife		**MG - Moderate Grazing**	**MC - Moderate Cultivation**			
F- Forestry		**IG - Intensive Grazing**	**IC - Intensive Cultivation**			
LG - Light Grazing		**LC - Light Cultivation**	**VIC - Very Intensive Cultivation**			

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 3-2. The final land potential results are then described in Table 3-3.

Table 3-2 The combination table for land potential classification

Land capability class	Climate capability class							
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 3-3 The Land Potential Classes

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures, or rainfall. Non-arable

The land capability of the proposed footprint was compared to the National Land Capability which was refined in 2014- 2016. The National Land Capability methodology is based on a spatial evaluation modelling approach and a raster spatial data layer consisting of fifteen (15) land capability evaluation values (Table 3-4), usable on a scale of 1:50 000 – 1:100 000 (DAFF, 2017). The previous system is based on a classification approach, with 8 classes (Table 3-1).

Table 3-4 National Land Capability Values (DAFF,2017)

Land Capability Evaluation Value	Land Capability Description
1	Very low
2	
3	Very Low to Low
4	

Land Capability Evaluation Value	Land Capability Description
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	

3.4 Limitations

The following limitations are relevant to this agricultural potential assessment:

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m; and
- No heavy metals have been assessed nor fertility been analysed for the relevant classified soils.

4 Project Area

4.1 Climate

The project area falls within the Carleton Dolomite Grassland vegetation. This region experiences a warm-temperate climate characterized by summer rainfall, with an average annual precipitation (MAP) of 593 mm. The summer temperatures in this area are notably high, while winters are marked by the occurrence of severe and frequent frost (Mucina & Rutherford, 2006). The mean average temperature for the project area is 16.1 °C (see Figure 4-1).

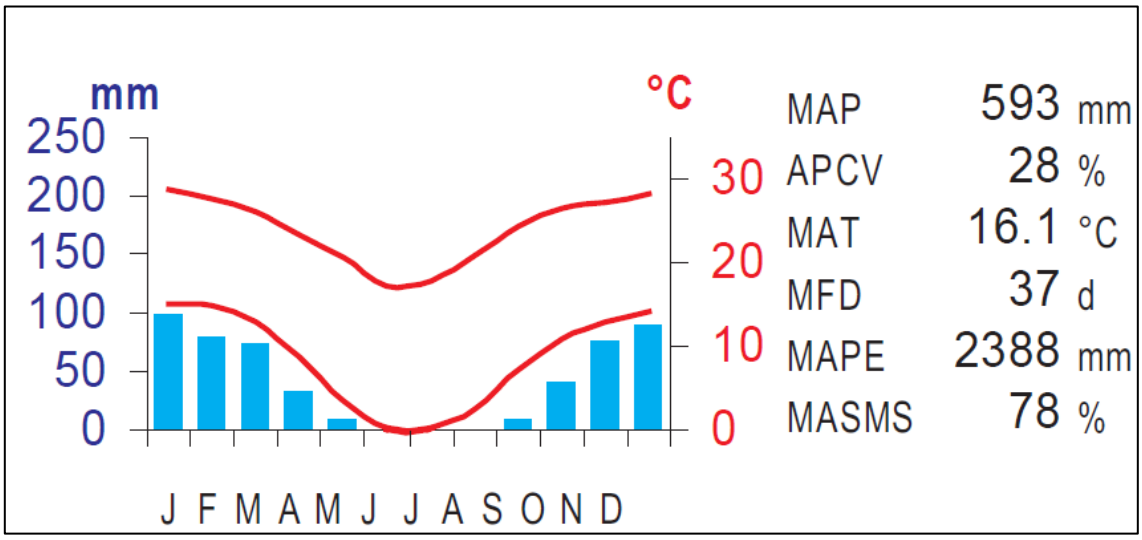


Figure 4-1 Summarised climate for the region (Mucina & Rutherford, 2006)

4.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ab4 land type as well as the Fa18 land type which is illustrated in Figure 4-2. The landscapes of this unit are primarily dominated by shallow Mispah and Glenrosa soil forms, which are characteristic of the Fa land type according to Mucina & Rutherford (2006). Occasionally, sporadic occurrences of deeper red to yellow apedal soils, representing the Ab land type, can also be observed in the area.

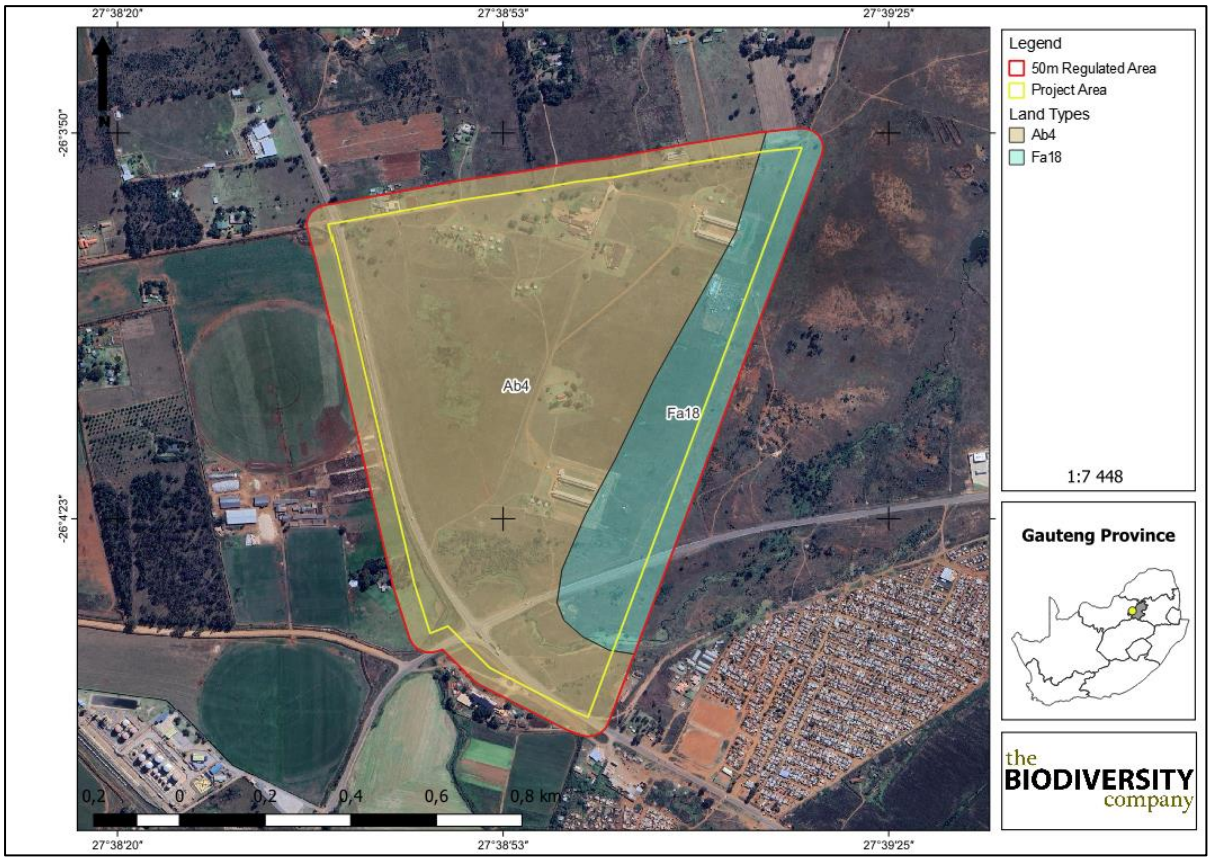


Figure 4-2 The land types associated with the project area.

The Ab4 land type terrain unit is illustrated in Figure 4-3. The various soil forms that are expected throughout these land types of terrain units are shown in Table 4-1. The Fa18 land type terrain unit is illustrated in Figure 4-4. The various soil forms that are expected throughout the Fa18 land types of terrain units are shown in Table 4-2.

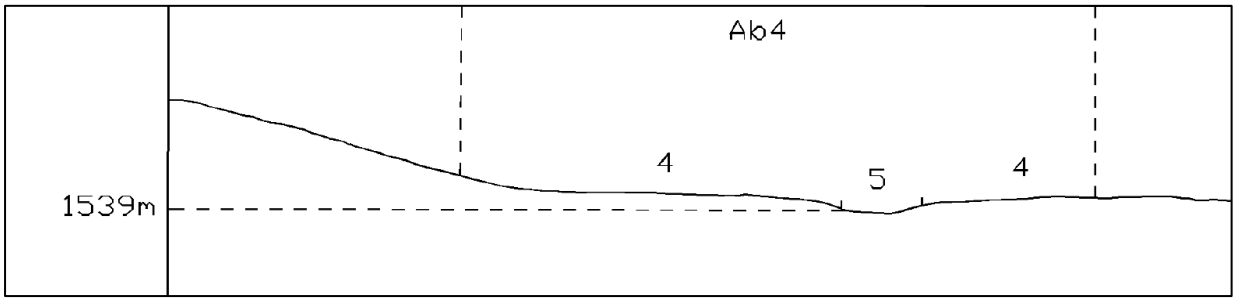


Figure 4-3 Illustration of the Ab4 land type terrain units (Land Type Survey Staff, 1972 - 2006)

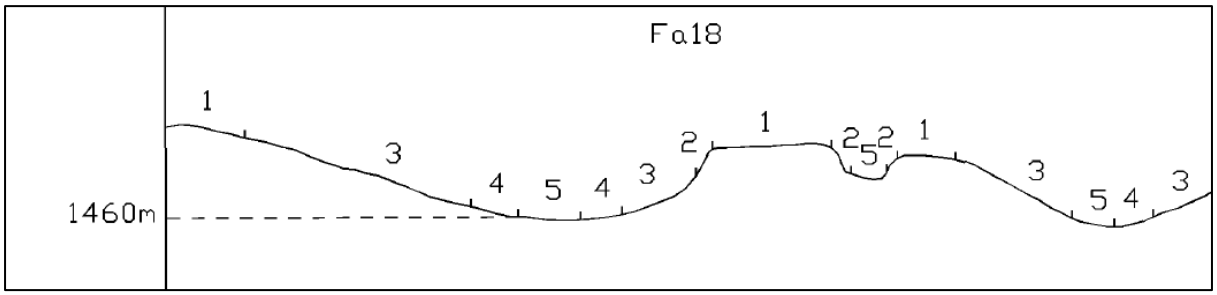


Figure 4-4 ***Illustration of the Fa18 land type terrain units (Land Type Survey Staff, 1972 - 2006)***

Table 4-1 ***Soils expected at the respective terrain units within the Ab4 land type (Land Type Survey Staff, 1972 - 2006)***

Terrain Units			
4 (96%)		**5 (4%)**	
Hutton	97%	Glenrosa	50%
Glenrosa	3%	Willowbrook	50%

Table 4-2 ***Soils expected at the respective terrain units within the Fa18 land type (Land Type Survey Staff, 1972 - 2006)***

Terrain Units									
1 (20%)		**2 (3%)**		**3 (60%)**		**4 (12%)**		**5 (5%)**	
Bare Rock	50%	Bare Rock	83%	Glenrosa	59%	Hutton	50%	Hutton	60%
Glenrosa	40%	Glenrosa	17%	Bare Rock	34%	Glenrosa	38%	Glenrosa	30%
Hutton	10%			Hutton	7%	Bare Rock	12%	Bare Rock	10%

According to Mucina & Rutherford (2006), the soil types found in the proposed project area find support from dolomite and chert found in the Malmani Subgroup of the Transvaal Supergroup.

4.3 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 4-5. Most of the regulated area is characterised by a slope percentage between 0 - 5% with some few irregularities in areas with slopes reaching 14%. This illustration indicates a uniform topography with occurrence of a few steep sloping areas being present. The Digital Elevation Model (DEM) of the project area (Figure 4-6) indicates an elevation of 1 560 to 1 582 Metres Above Sea Level (MASL).

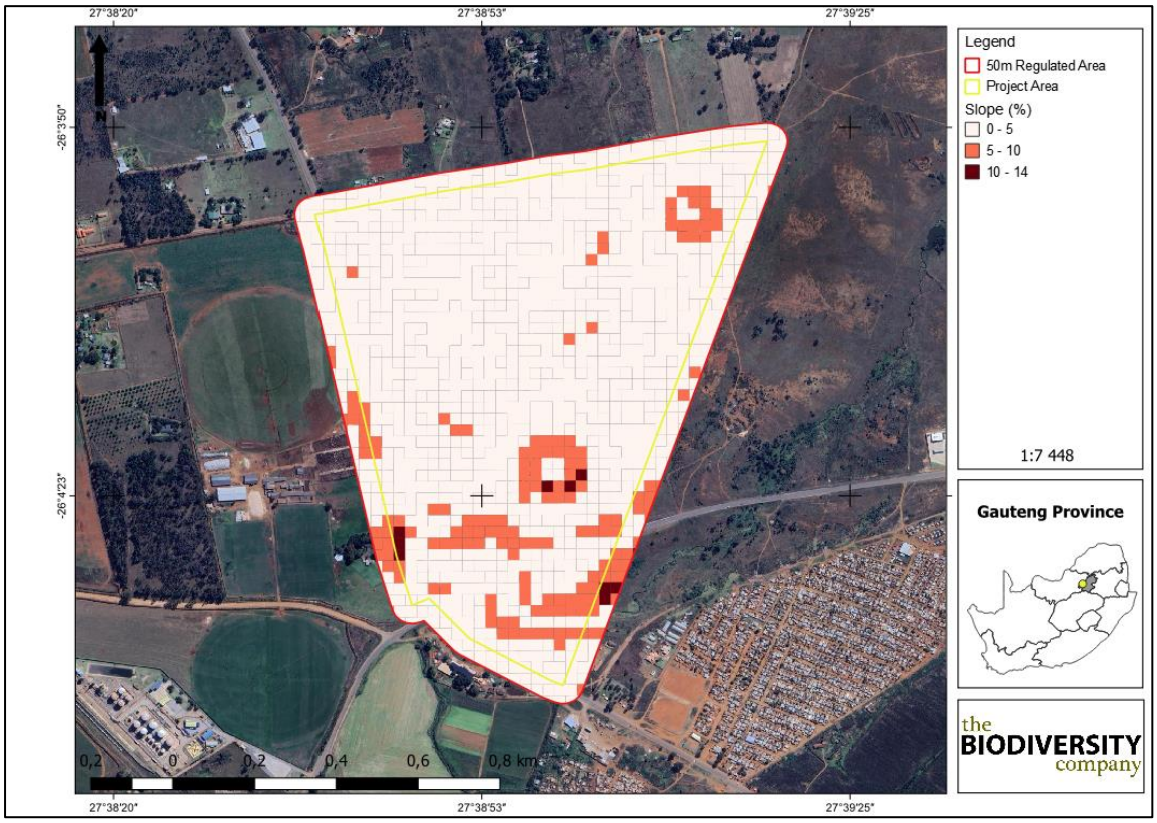


Figure 4-5 Slope percentage map for the project area

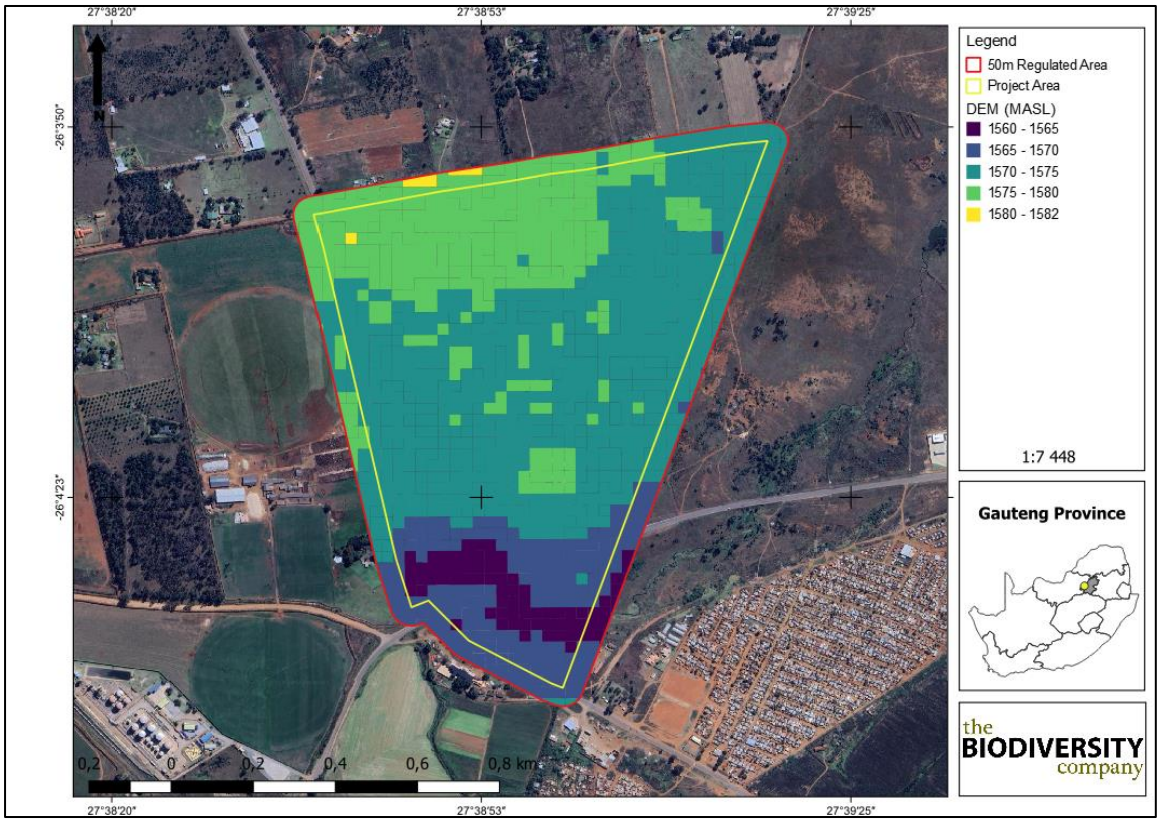


Figure 4-6 Digital Elevation Model of the project area (Metres Above Sea Level)

5 Results and Discussion

5.1 Baseline findings

Three soil forms were identified throughout the 50 m regulated area namely Hutton, Kimberley and Glenrosa, with the Glenrosa soil form being the most dominant form. Hard rock patches together with disturbed soil forms, due to building rubble, were also identified within the 50 m regulated area (GN 320[1]) as well as a stream which mostly indicates hydromorphic soil conditions due to seasonal or permanent water flows. These hydromorphic soils were mostly dominated by the Glenrosa soil form characterised with gleylithic conditions associated to water saturation (see Figure 5-3).

The Hutton and Kimberley soil forms are regarded to be most important in the study area as they demonstrate the most sensitive land capabilities. The Hutton soil form consists of an orthic topsoil horizon on top of a thick red apedal horizon. The Kimberley soil form has an orthic topsoil with a red apedal subsurface horizon with a soft carbonate horizon below. The different soil horizons are illustrated in Figure 5-1. The general landscape of the project area is seen in Figure 5-2.

The most sensitive land capability of the above mentioned soils has been determined to be class “II”. A climate capability level 8 has been assigned to the area given the low Mean Annual Precipitation (MAP) and the high Mean Annual Potential Evapotranspiration (MAPE) rates. By using the determined land capability for the most sensitive soil and the determined climate capability, a land potential of “L5” was calculated. According to Smith (2006), the “L5” land potential level is characterised by restricted potential. Regular and/or moderate to severe limitations are expected due to soil, slope, temperatures or rainfall.

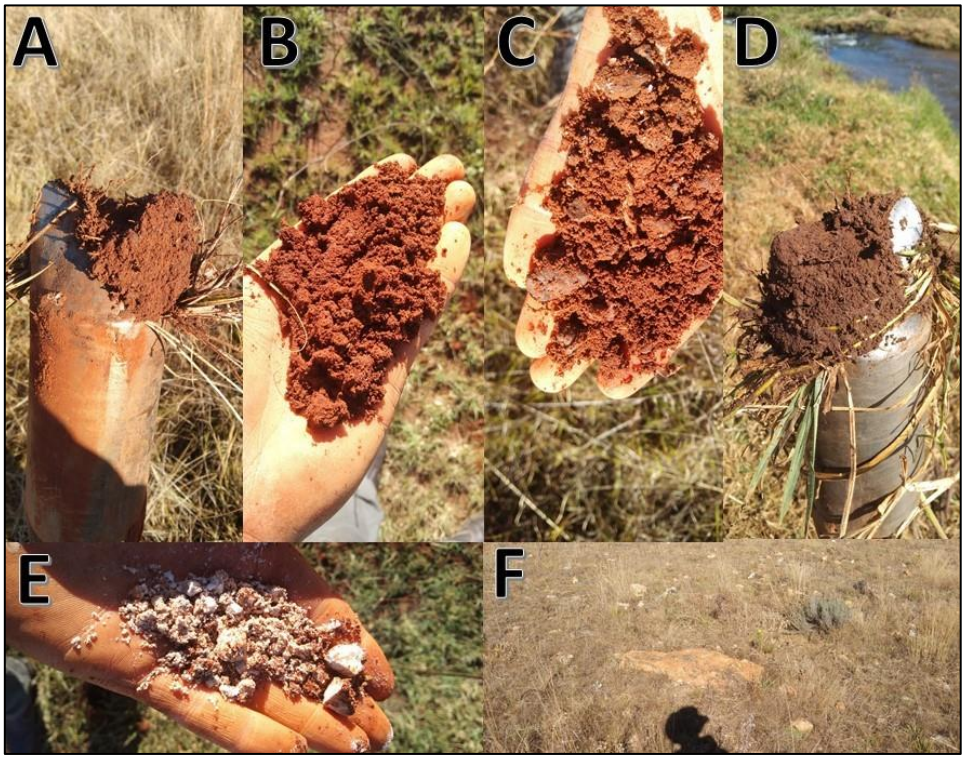


Figure 5-1 Soil forms found within the proposed project area; A) Orthic topsoil horizon; B) Red apedal horizon; C) Lithic subsurface horizon; D) Hydromorphic topsoil horizon; E) Soft carbonate horizon; D) Bare rock within the project area.

[1] Project components with 50 m regulated area superimposed to that of the agricultural sensitivities of the screening tool

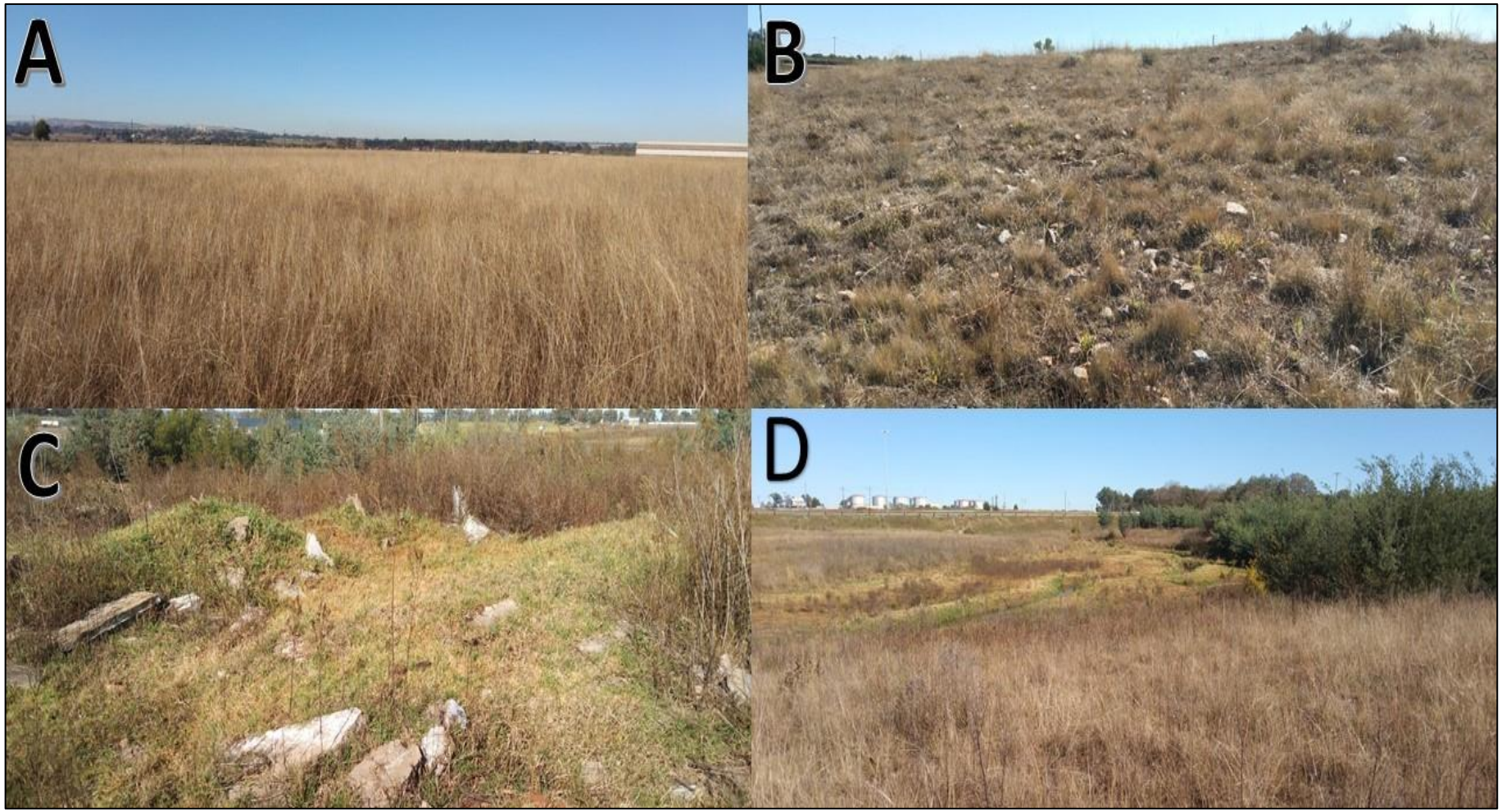


Figure 5-2 ***A-D) General landscape of the proposed project area showing old agriculture fields, disturbed soil forms due to building rubble and a stream holding hydromorphic soils running through the project area***

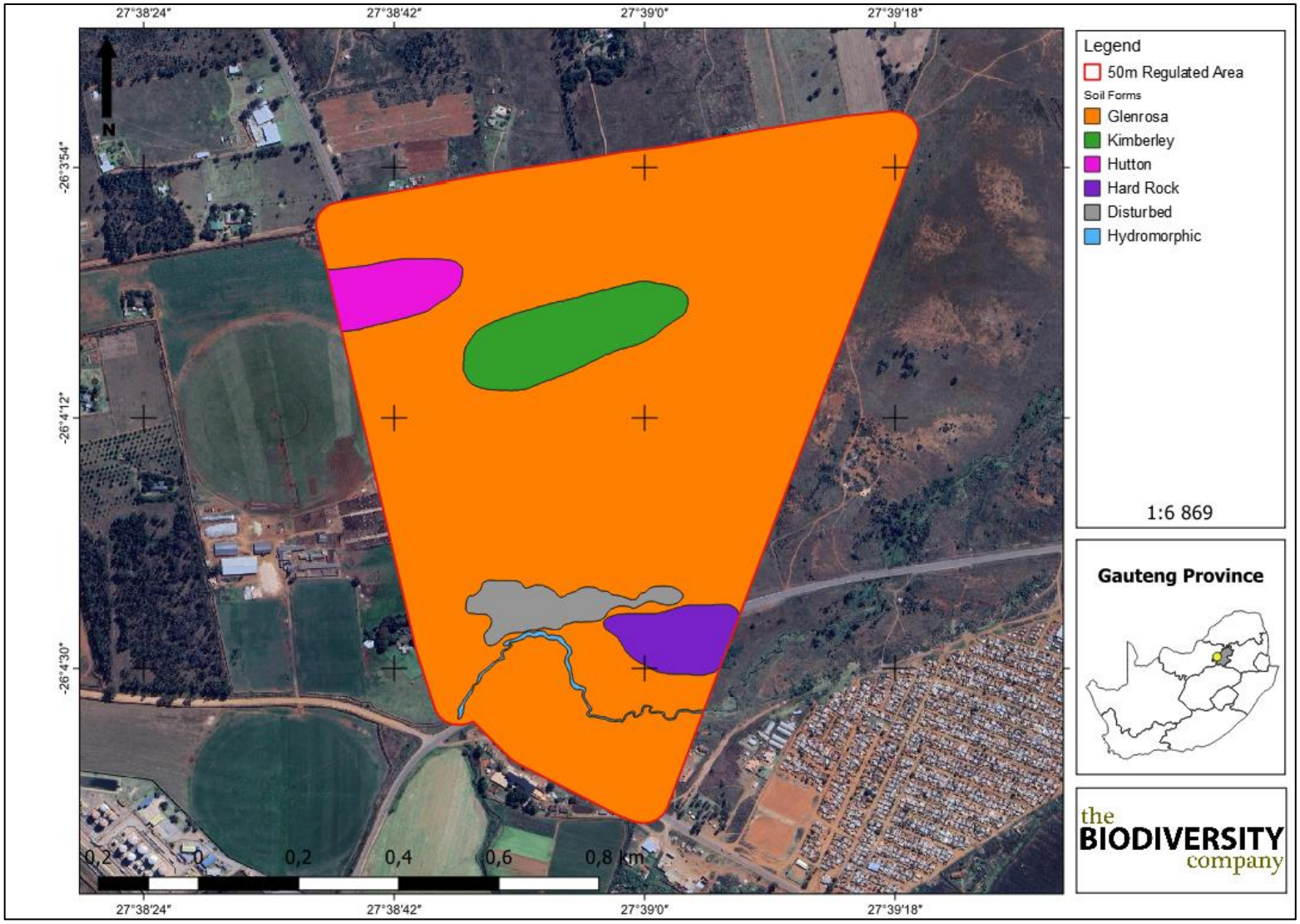


Figure 5-3 Dominant soil forms distribution identified in the project area.

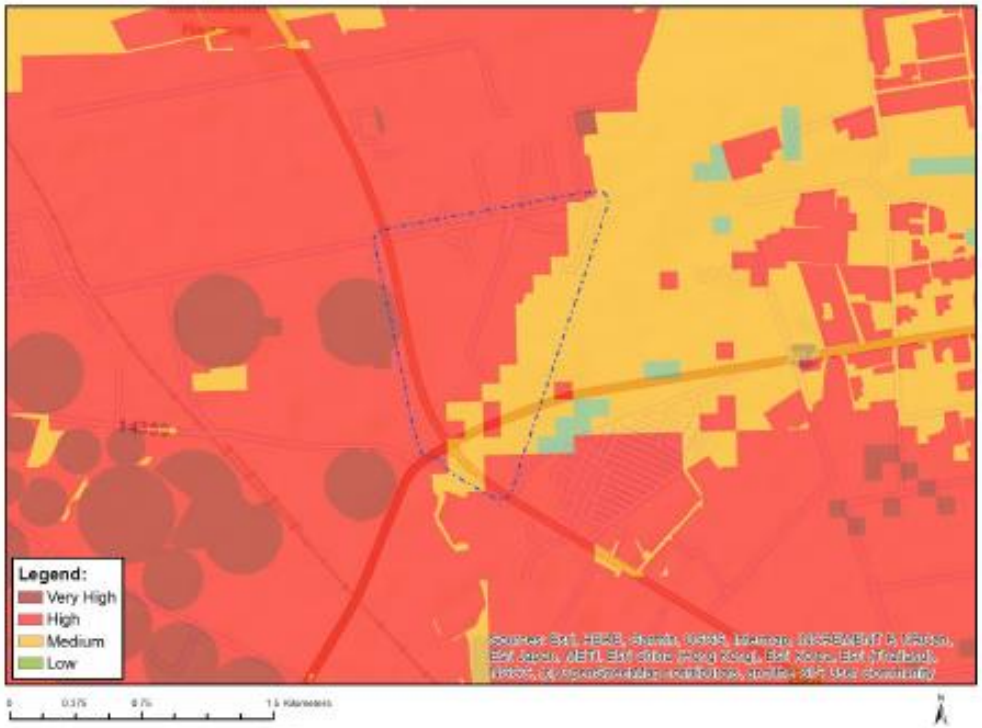
5.2 Sensitivity Verification

5.2.1 Screening Report – Quantum 1 Solar Power Plant

The following is deduced from the National Web-based Environmental Screening Tool Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Agriculture Theme Sensitivity indicates that the proposed project area falls within the 'Very High' agricultural sensitivity (Figure 5-4).

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;09. Moderate-High/10. Moderate-High
High	Annual Crop Cultivation / Planted Pastures Rotation;Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Pivot Irrigation;Land capability;09. Moderate-High/10. Moderate-High

Figure 5-4 Map of Relative Agricultural Theme Sensitivity for the Quantum 1 Solar Power Plant generated by the Environmental Screening Tool

5.2.2 Site Ecological Importance (SEI)

The following land potential level have been determined;

- Land potential level 5 (this land potential level is characterised by restricted potential. Regular and/or moderate to severe limitations due to soil, slope, temperatures or rainfall);
- Land potential level 6 (this land potential level is characterised by very restricted potential. Regular and/or moderate to severe limitations due to soil, slope, temperatures or rainfall). Non arable; and
- Land potential level 7 (this land potential level is characterised by low potential. Severe limitations due to soil, slope, temperatures or rainfall. Non-arable).

Fifteen land capabilities have been digitised by (DALRRD, 2017) across South Africa, of which five potential land capability classes are located within the proposed footprint area's assessment area, including;

- Land Capability 6 to 8 (Moderately low Sensitivity to Moderate Sensitivity); and
- Land Capability 9 to 10 (Moderately High Sensitivity).

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project focus area. Most of the proposed project area falls within the "Moderately High" sensitivity category (Figure 5-5). Few areas are categorised with "Moderately Low" to "Moderate" sensitivities. Land potential of the proposed area is illustrated in Figure 5-6.

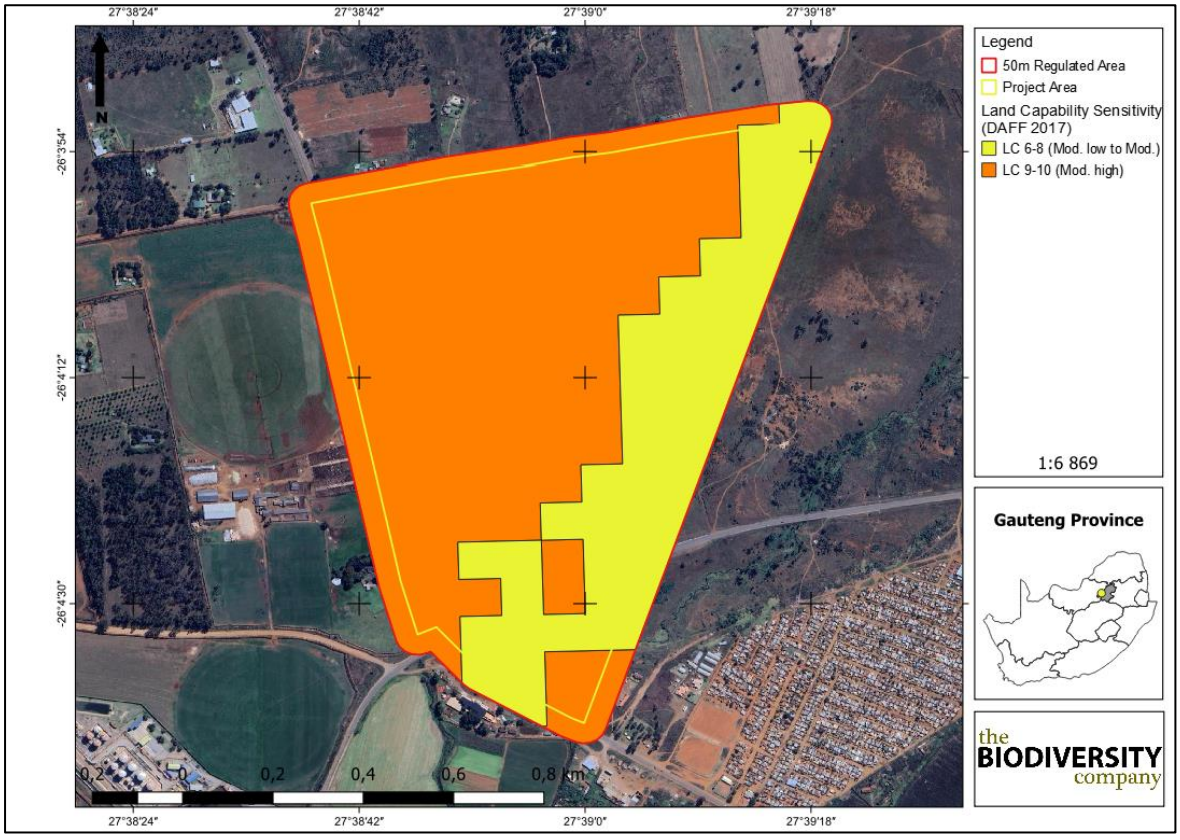


Figure 5-5 The land capability sensitivity (DAFF, 2017)

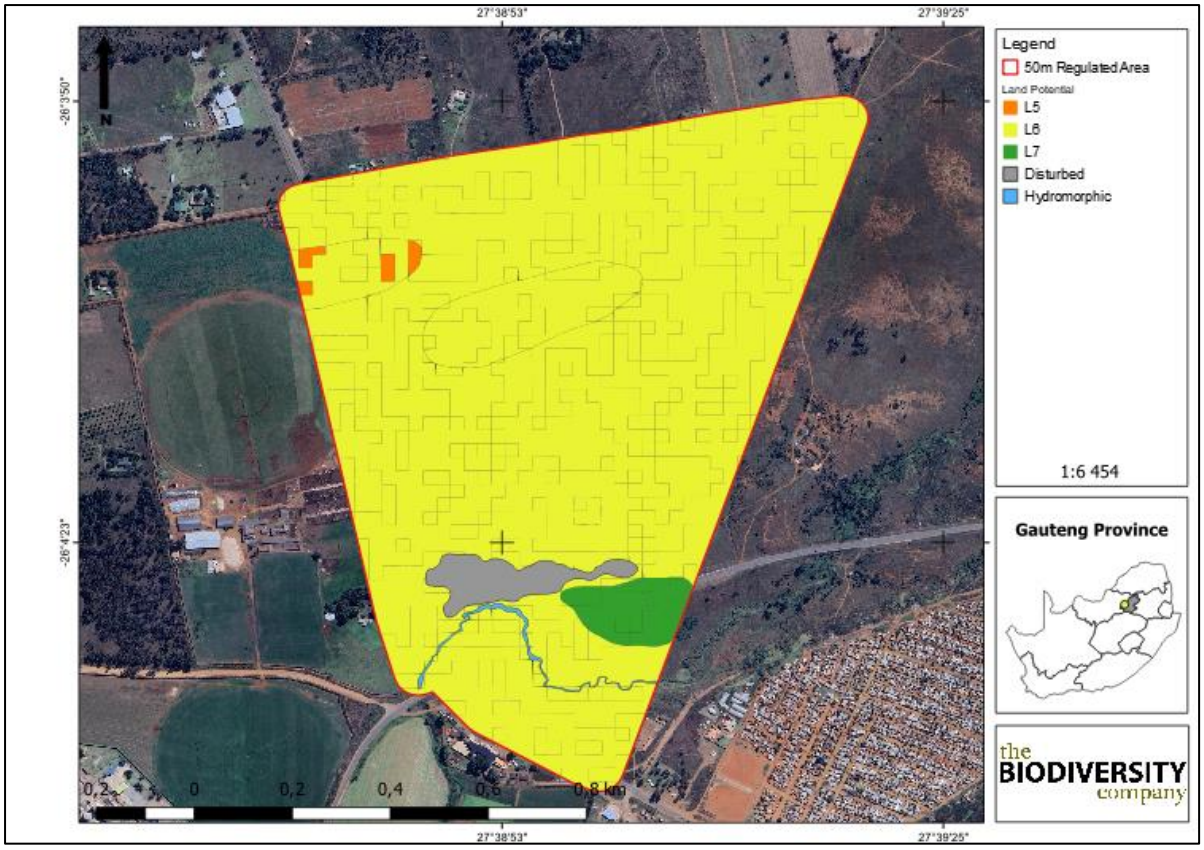


Figure 5-6 Land Potential within the 50m Regulated area of Quantum 1 project area.

These features were used to determine the sensitivity of resources relevant to this assessment. The land potential levels have been scored a sensitivity rating as per the EIMS methodology. The “L5” land potential areas were scored “Moderate sensitivity”, the “L6” land potential areas were determined to have “Moderately Low sensitivity” and “L7” land potential areas were scored “Low sensitivity” (see Figure 5-7).

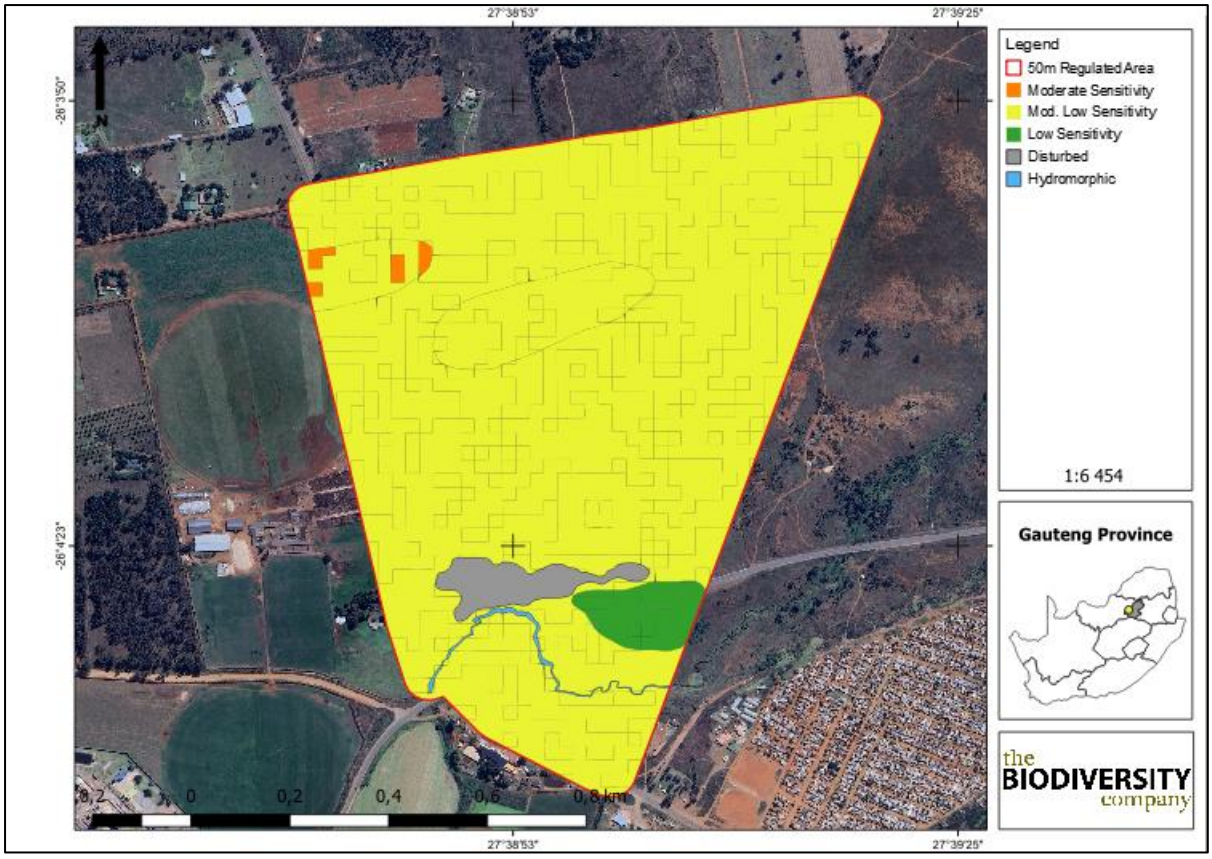


Figure 5-7 Overall sensitivity of Quantum 1 project area

The baseline soil findings and the DFFE (2023) agricultural theme concur with one another in few areas which were identified with “Moderate Low and Moderate” sensitivity. The specialist site-verified soil baseline findings dispute most areas which were identified as “Moderate High”. These areas are associated with soils like the Glenrosa soil form, with a poor land capability and potential for cropping activities. Such, soils are characterised with shallow profiles which can significantly limit the rooting depth of most agricultural crops.

In addition, some crop boundary areas have been identified by means of the DEA Screening Tool (2022) (see Figure 5-8). These areas have been classified as having “High” as well as “Very High” sensitivities. It is worth noting that these sensitivities are not associated with the potential of soil resources but rather the presence of crop field land uses hence there is no segregation of crop fields with a high agricultural potential. Moreover, these crop fields are in the periphery of the project area within the regulated area. By the use of aerial satellite imagery as well as field work observation, it is evident that there are no active crops present in the proposed project area.

Based on the specialist site verified soil baseline findings the area and the climatic restrictions in the area, the project site can overall be categorized as “Medium” sensitivity and that the project will have limited impacts on agricultural potential and activities (Figure 5-9). It therefore is the specialist recommendation that, the proposed project may be favourably considered as has been planned.

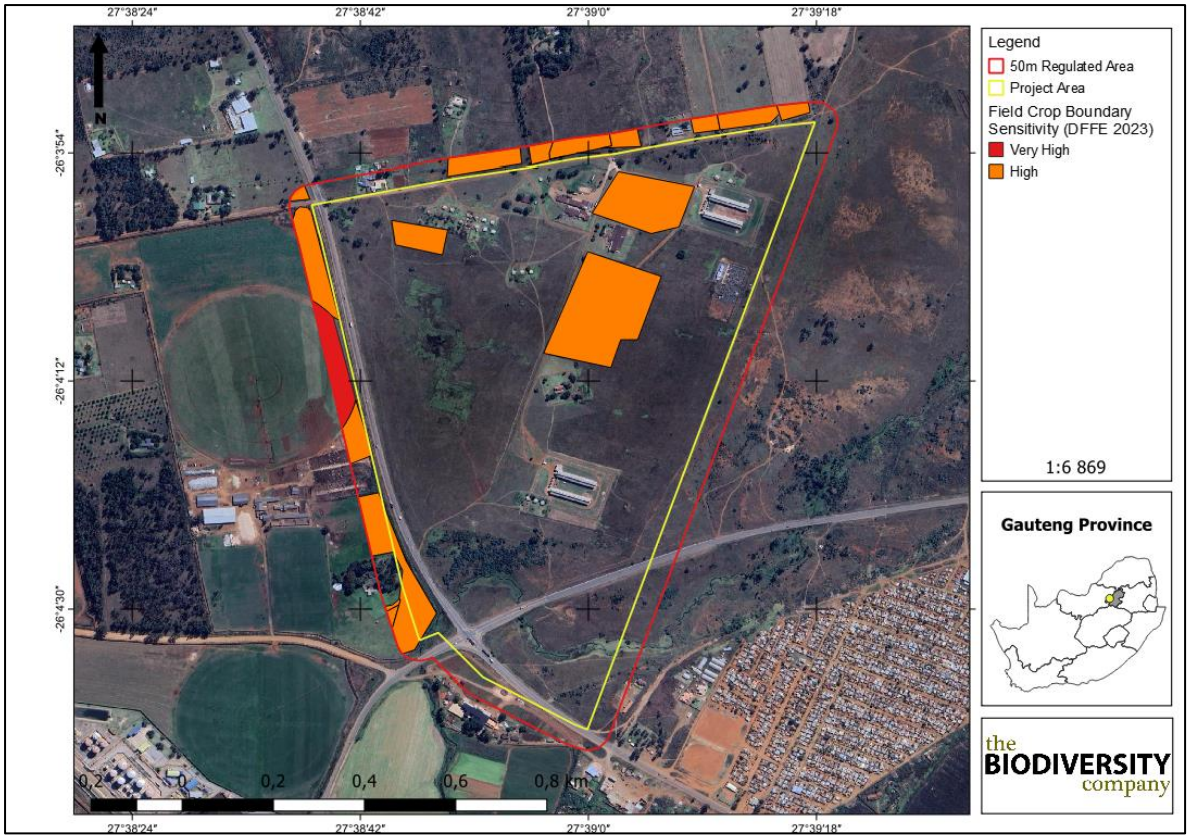


Figure 5-8 The Field Crop Boundary Sensitivity (DAFF, 2017)

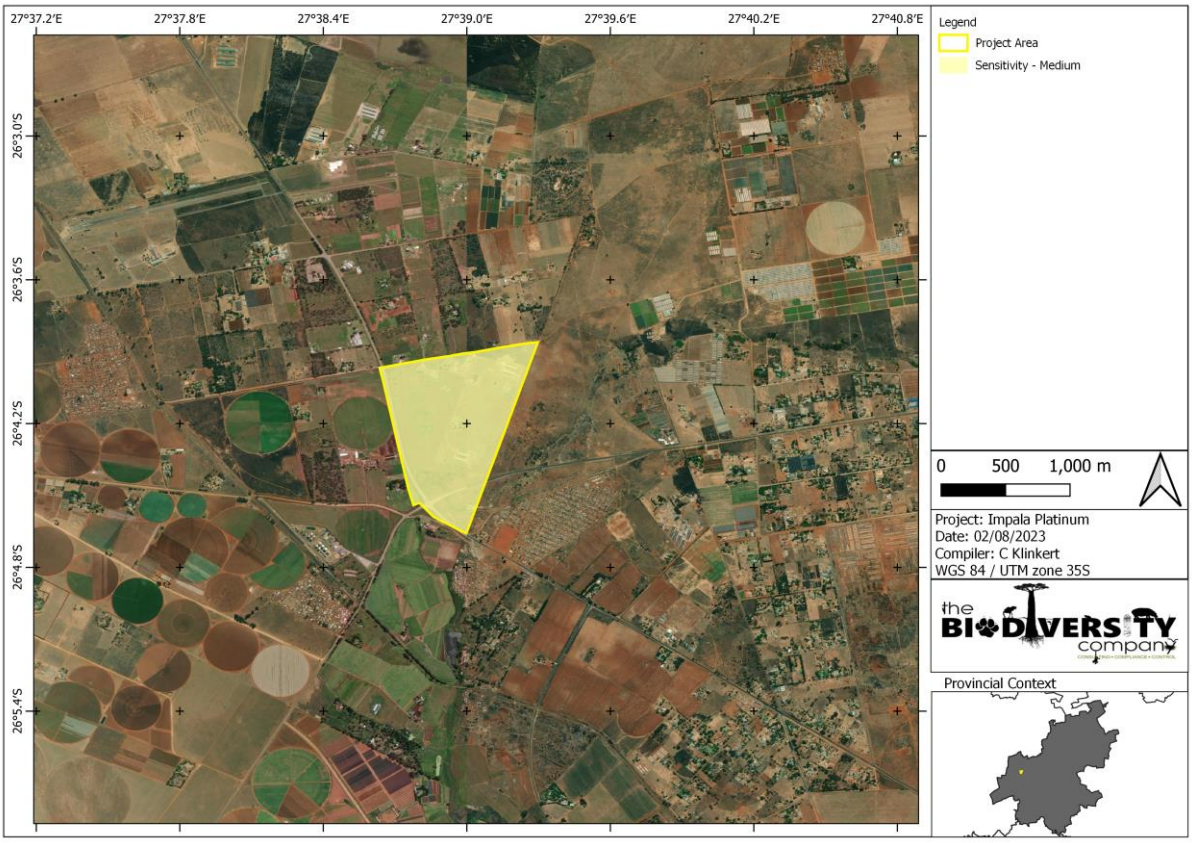


Figure 5-9 The overall senstivity

6 Conclusion

The most sensitive Hutton Soil form found in the proposed project area is characterised by a land potential “5” and ultimately a “Moderate” sensitivity. The dominant Glenrosa soil form is categorized by a land potential “6” and ultimately a “Moderately Low” sensitivity due to the poor climate present. The Kimberley soil form which was also identified within the project area consist of a “Moderately Low” sensitivity with Hard Rock outcrops present in the area having a “Low” sensitivity. The land capability sensitivity (DAFF, 2017) indicates land capabilities with “Moderately High” to “Moderately Low” sensitivities, which correlate with the findings from the baseline assessment to an extent. Overall, based on the specialist site-verified soil baseline findings, the project area is categorized with “Medium” sensitivity.

Furthermore, the available climate also limits crop production significantly. The climatic conditions are associated with low annual precipitation and high evapotranspiration potential demands of the area, which might not be favourable for most cropping practices.

Considering the low sensitivities associated with land potential resources, it is the specialist’s opinion that the proposed activities will have an acceptable impact on soil resources and that the proposed activities may proceed as have been planned as no loss of land capability is evident. It is also expected that no segregation of high production agricultural resources will occur.

Areas with active cultivated fields or high potential lands can be treated as no-go areas. Such areas were identified in the periphery of the project area. If needed, the stakeholders can also obtain consent for use of those areas or engage with the landowners for appropriate compensation for use of these areas for the project.

7 References

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