SOIL AND AGRICULTURAL ASSESSMENT REPORT FOR THE PROPOSED BUFFELSPOORT SOLAR PHOTOCOLTAIC (PV) ENERGY FACILITY

Mooinooi, North-West Province

June 2022 (updated September 2022)

CLIENT

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Report Name	**SOIL AND AGRICULTURAL ASSESSMENT REPORT FOR THE PROPOSED BUFFELSPOORT SOLAR PHOTOCOLTAIC (PV) ENERGY FACILITY**
Submitted to	savannah environmental
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	Matthew Mamera is a Cand. Sci Nat registered (116356) in natural and agricultural sciences recognized 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. Matthew completed his M.Sc. in soil science, hydropedology and water management at the University of Fort Hare, Alice. He is also a holder of a PhD in soil science, hydropedology, water and sanitation obtained at the University of the Free State, Bloemfontein. Matthew is also a member of the Soil Science Society of South Africa (SSSSA).
Report Writer / Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.
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.

Matthew Mamera

Soil Pedologist

The Biodiversity Company

September 2022

1 Introduction

The Biodiversity Company was appointed by Savannah Environmental (Pty) Ltd (Savannah) to undertake a soil and agricultural potential assessment for the proposed Buffelspoort Solar Photovoltaic (PV) Energy Facility on Portions 75 and 134 of the Farm Buffelspooort 343 JQ, and its associated infrastructure (hereafter referred to as the "Project") (Figure 1-1). The Project Site is located approximately 6 km west of Mooinooi town, within jurisdiction of the Rustenburg Local Municipality and the Bojanala Platinum District Municipality in the North-West Province. The surrounding land uses include residential, commercial, farming lands and predominantly mining and processing activities (Platinum Group Metals (PGMS), chrome, platinum, palladium and rhodium).

A Project Area of Influence (PAOI) was created to incorporate the proposed Buffelspoort ESIA development footprint, Substation as well as the Buffelspoort OHL and represents the total area assessed (Figure 1-2).

This assessment was conducted in accordance with the amendments to the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the published Government Notices (GN) 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" (Reporting Criteria).

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 and enable informed decision making. This report aims to also present and discuss the findings from the soil resources identified within the 50 m regulated are, the soil suitability and land potential of these soils, the land uses within the regulated area and also the risk associated with the proposed Project.

1.1 Project Description

The proposed Project will have a generation capacity of up to 40 MW. The purpose of the Solar PV Energy Facility will be to supply power to a private off-taker by connecting the Facility via a newly proposed ~2.5 km long 88kV single circuit overhead power line that will be routed over Privately owned properties from the onsite Facility substation to the point of interconnection, north of the N4. The construction of the Solar PV Energy Facility aims to enable the private off-taker to diversify their energy mix and to reduce their reliance on Eskom supplied power and is a conscious effort for the off-taker to contribute to their sustainability targets and reduce their carbon footprint. A grid connection corridor which varies in width from 200 m to 300 m and is up to 2.5 km in length has been identified for the assessment and suitable placement of the grid connection infrastructure. This corridor will provide for the avoidance of sensitive environment areas and technical constraints. A Development Footprint of up to ~77 ha has been identified within the Project Site (~223 ha) by the Buffelsproort Solar Project (Pty) Ltd for the development pf the Buffelspoort Solar PV Energy Facility.

The infrastructure associated with the Buffelspoort Solar PV Energy Facility will include the following:

- Solar PV arrays comprising PV panels and mounting structures;
- Inverters and transformers;
- Cabling between the arrays;
- Onsite facility substation;

- 88kV single circuit overhead power line for the distribution of the generated power, which will be connected to an existing 88kV substation, just north of the proposed project site;
- Battery Energy Storage System (BESS) – to be initiated at a later stage than the Solar PV Energy Facility;
- Temporary laydown area;
- Operations and Maintenance (O&M) building, which will include a site security office, warehouse, storage area and workshop;
- Main access road (existing – to be upgraded with hard surface) and internal (new) gravel roads; and
- Fence around the site, including an access gate and security point.

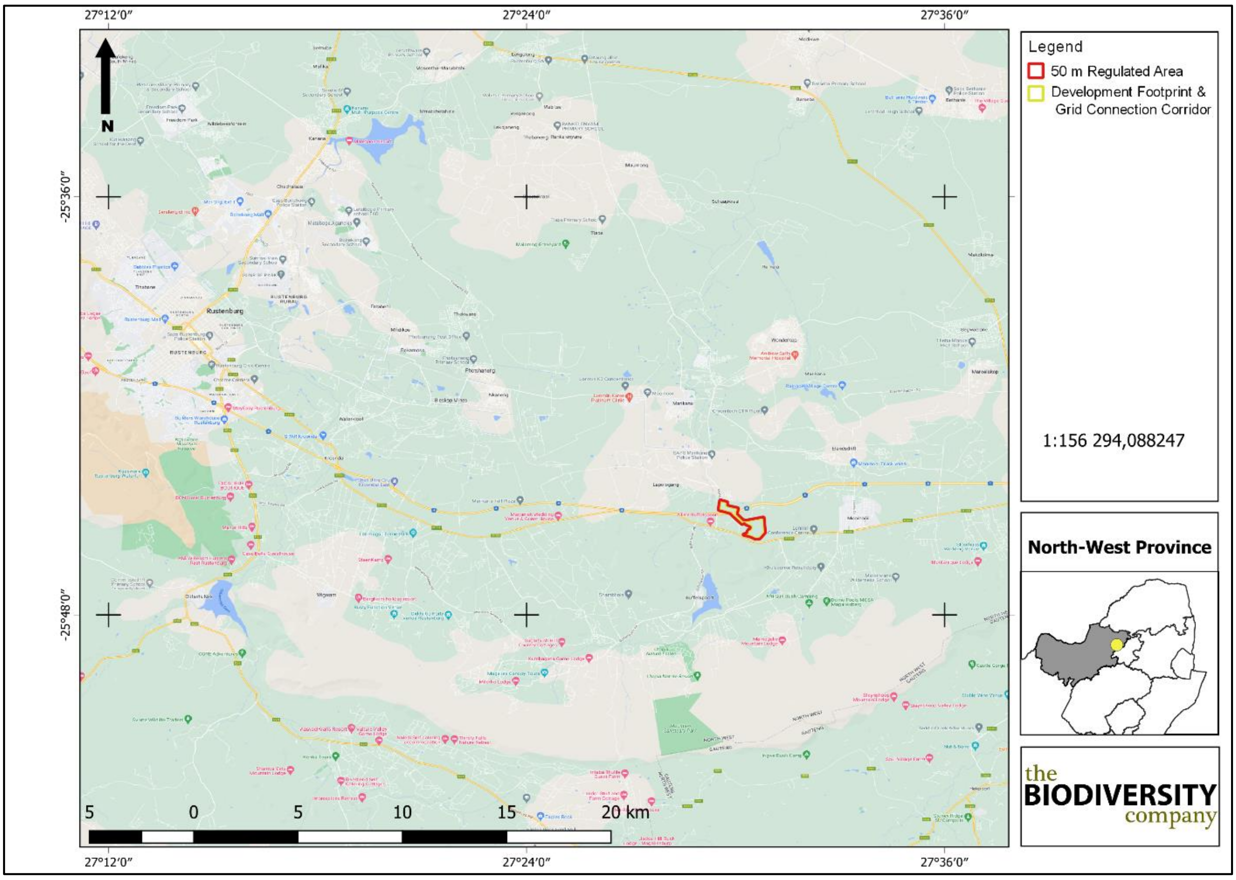

Figure 1-1 The location map of the proposed Project Site

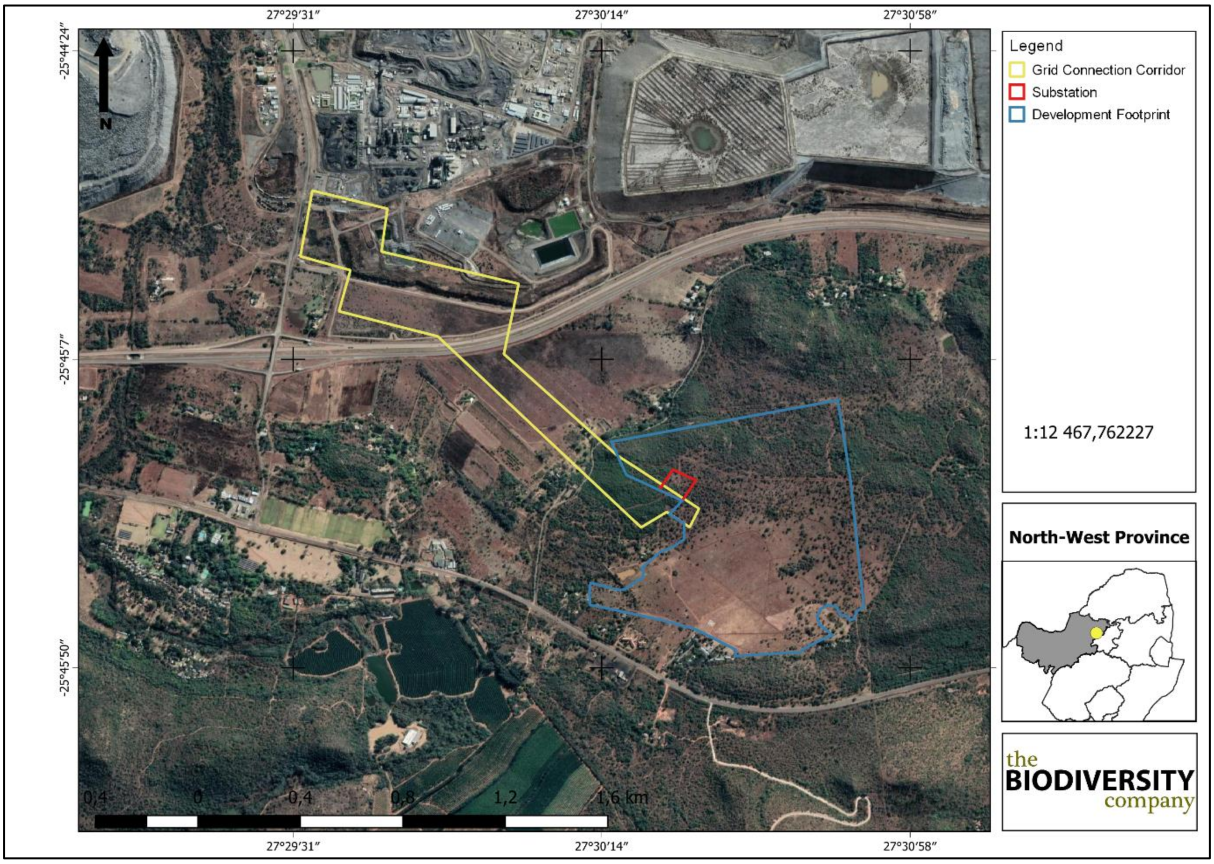

Figure 1-2 The PAOI on a local scale

1.2 Scope of Work

According to the National Web based Environmental Screening Tool, the proposed development is located within a "Medium" sensitivity land capability area. The protocols for minimum requirements (DEA, 2020) stipulates that in the event that a proposed development is located within "Low" or "Medium" sensitivities, an agricultural compliance statement will be sufficient. It is worth noting that according to these protocols, a site inspection will still need to be conducted to determine the accuracy of these sensitivities. After acquiring baseline information pertaining to soil resources within the 50 m regulated areas, it is the specialist's opinion that the soil forms and associated land capabilities concur with the sensitivities stated by the screening tool. Therefore, only an agricultural compliance statement will be compiled. This includes:

- The feasibility of the proposed activities;
- Confirmation about the "Low" and "Medium" 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 EMPr.

2 Expertise of the Specialists

2.1 Andrew Husted

Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.

2.2 Matthew Mamera

Matthew Mamera is a Cand. Sci Nat registered (116356) in natural and agricultural sciences, 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 scientific publications in international peer reviewed journals. Matthew completed his MSc in soil science, hydropedology and water management at the University of Fort Hare, Alice. He is also a holder of a PhD in soil science, hydropedology, water and sanitation obtained at the University of the Free State, Bloemfontein. Matthew is also a member of the Soil Science Society of South Africa (SSSSA).

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 Project 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 a field survey in June 2022. 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 1,5 m. Soil survey positions were recorded as waypoints using a handheld Global Positioning System (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 were also helpful in determining soil types and depth.

3.3 Erosion Potential

Erosion has been calculated by means of the (Smith, 2006) methodology. The steps in calculating the Fb ratings relevant to erosion potential is illustrated in Table 3-1 with the final erosion classes illustrated in Table 3-2.

Table 3-1 Fb ratings relevant to the calculating of erosion potential (Smith, 2006)

Step 1- Initial value, texture of topsoil horizon				
Light (0-15% clay)		**Medium (15-35% clay)**		**Heavy (>35% clay)**
Fine sand	Medium/coarse sand	Fine Sand	Medium/coarse sand	All sands
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment value (permeability of subsoil)				

Slightly restricted	Moderately restricted	Heavily restricted
-0.5	-1.0	-2.0
	Step 3- Degree of leaching (excluding bottomlands)	
Dystrophic soils, medium and heavy textures	Mesotrophic soils	Eutrophic or calcareous soils, medium and heavy textures
+0.5	0	-0.5
	Step 4- Organic Matter	
Organic topsoil		Humic Topsoil
+0.5		+0.5
	Step 5- Topsoil limitations	
Surface crusting		Excessive sand/high swell-shrink/self-mulching
-0.5		-0.5
	Step 6- Effective soil depth	
Very shallow (<250 mm)		Shallow (250-500 mm)
-1.0		-0.5

Table 3-2 Final erosion potential class

Erodibility	Fb Rating (from calculation)
Very Low	>6.0
Low	5.0 - 5.5
Moderate	3.5 – 4.5
High	2.5 – 3.0
Very High	<3.0

3.4 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 (8) classes, and these may be divided into three (3) capability groups. Table 3-3 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 3-3 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 3-4. The final land potential results are then described in Table 3-5.

Table 3-4 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 3-5 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

3.5 Limitations

- The information contained in this report is based on auger points taken and observations on site. There may be variations in terms of the delineation of the soil forms across the area;

- Due to the size of the proposed area only the key areas where infrastructure is located were focused on, the remaining areas were predominantly delineated through means of desktop; and
- The GPS used for delineations is accurate to within five meters. Therefore, the delineation plotted digitally may be offset by at least five meters to either side.

4 Description of Project Site

4.1 Soil and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the Project Site is characterised by the Bc 8 and the Ea 3 land types. The Bc 8 and Ea 3 land types mostly consist of Rensburg, Dundee, Arcadia, Hutton, and/Oakleaf soil forms according to the SA soil classification working group (1990) with the possibility of other soils occurring throughout. Dystrophic and mesotrophic red soils are widespread upland with occasional shallow and rocky profiles. The Bc land types are also characterised with red eutrophic soils. Eutrophic soils are defined as soils that have 15 cmol (+) kg^{-1} and above exchangeable basic cations. The Ea land type is associated with low chroma dark soils mostly vertic and melanic soils with occurrence of some red structured diagnostic horizons in the terrains. Lime is rare or absent within this land types in upper terrain soils but present in low-lying areas. The terrain units and expected soils for the Bc 8 land type is presented in Figure 4-1 and Table 4-1; Ea 3 land type is illustrated in Figure 4-2 and

Terrain Units							
1 (2%)		3 (8%)		4 (85%)		5 (5%)	
Bare Rocks	50%	Mispah	50%	Hutton	40%	Rensburg, Dundee	60%
Mispah	50%	Bare Rocks	44%	Avalon	18%	Mispah	10%
		Hutton	6%	Clovelly	7%	Katspruit	10%
				Shortlands	6%	Arcadia	10%
				Bare Rocks	6%	Shortlands	6%
				Katspruit	5%	Bare Rocks	4%
				Arcadia	1%		

Table 4-2 respectively.

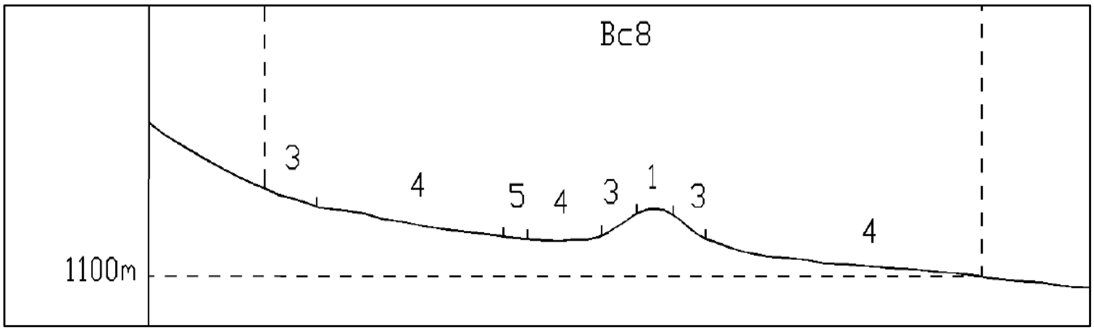

Figure 4-1 Illustration of land type Bc 8 terrain unit (Land Type Survey Staff, 1972 – 2006)

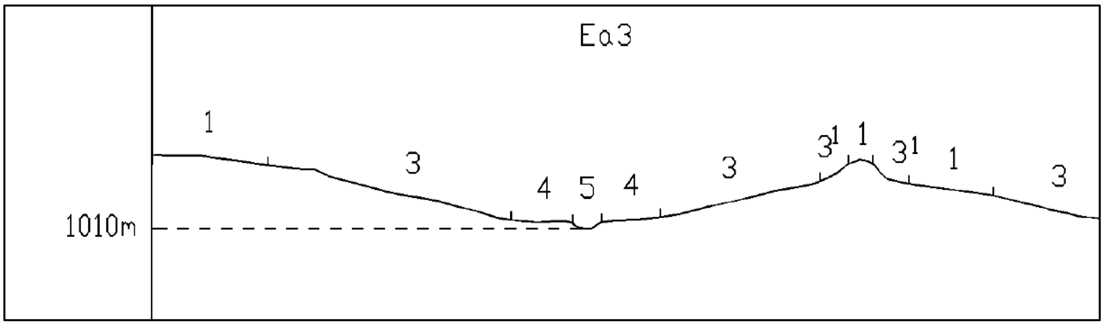

Figure 4-2 Illustration of land type Ea 3 terrain unit (Land Type Survey Staff, 1972 – 2006)

Table 4-1 Soils expected at the respective terrain units within the Bc 8 land type (Land Type Survey Staff, 1972 – 2006)

Terrain Units							
1 (2%)		**3 (8%)**		**4 (85%)**		**5 (5%)**	
Bare Rocks	50%	Mispah	50%	Hutton	40%	Rensburg, Dundee	60%
Mispah	50%	Bare Rocks	44%	Avalon	18%	Mispah	10%
		Hutton	6%	Clovelly	7%	Katspruit	10%
				Shortlands	6%	Arcadia	10%
				Bare Rocks	6%	Shortlands	6%
				Katspruit	5%	Bare Rocks	4%
				Arcadia	1%		

Table 4-2 Soils expected at the respective terrain units within the Ea 3 land type (Land Type Survey Staff, 1972 – 2006)

Terrain Units											
1 (30%)		**1 (1) (0.5%)**		**3 (44.5%)**		**3(1) (1%)**		**4 (15%)**		**5 (9%)**	
Arcadia	70 %	Bare Rocks	80%	Arcadia	76%	Bare Rocks	70%	Arcadia	89%	Oakleaf	67%
Bare Rocks	14 %	Mispah	9%	Bare Rocks	10%	Mispah	30%	Hutton	3%	Arcadia	22%
Mispah	9%			Mispah	6%			Shortlands	3%	Shortland s	6%
Hutton	4%			Hutton	4%			Swartland	3%	Hutton	5%
Shortlands	3%			Shortlands	3%						
				Glenrosa	4%						
				Swartland	1%						

4.2 Terrain

The slope percentage of the Project Site has been calculated and is illustrated in Figure 4-3. Most of the regulated area is characterised by a slope percentage between 0 and 10%, with some smaller patches characterised by a slope percentage reaching 45%. This illustration indicates a non-uniform topography in scattered areas, with the majority of the area being characterised by a gentle slope. The DEM of the Project Site (Figure 4-4) indicates an elevation of 1 205 to 1 283 Metres Above Sea Level (MASL).

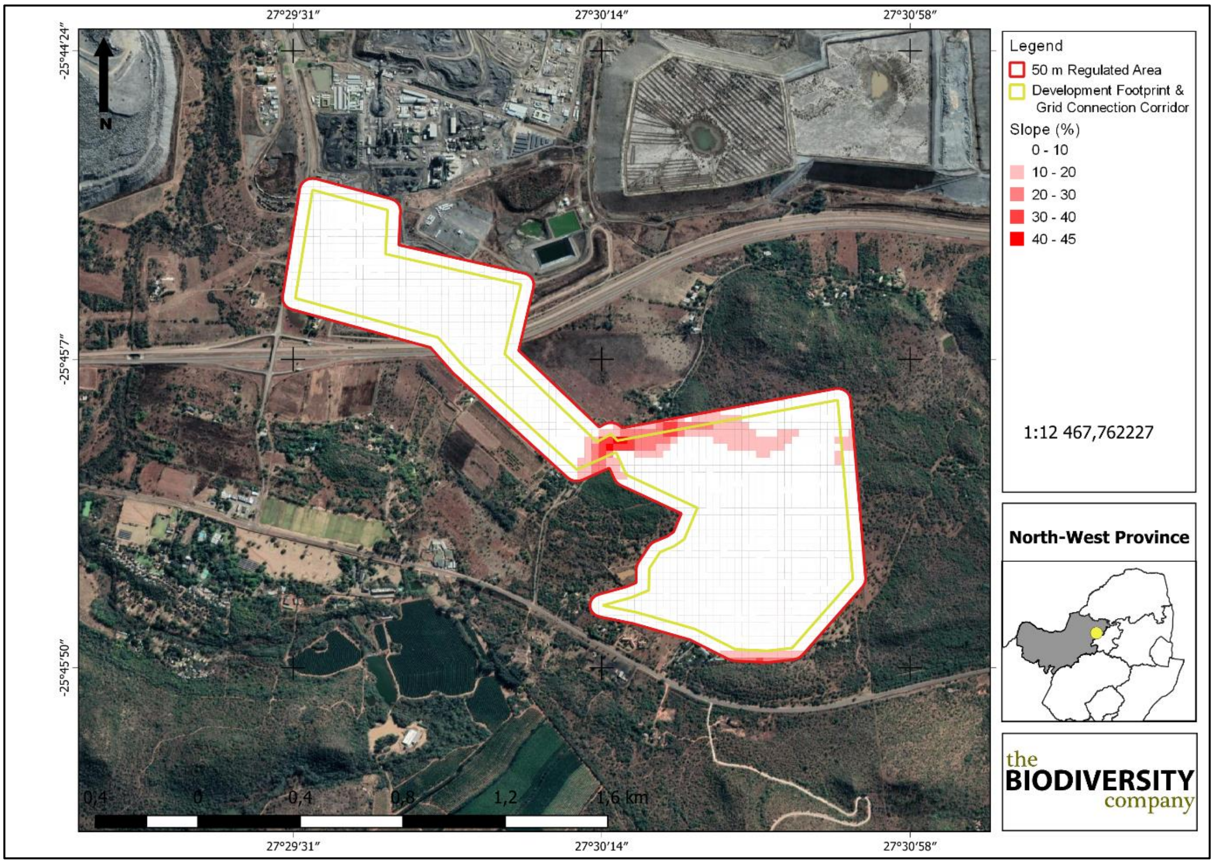

Figure 4-3 The slope percentage calculated for the Project Site

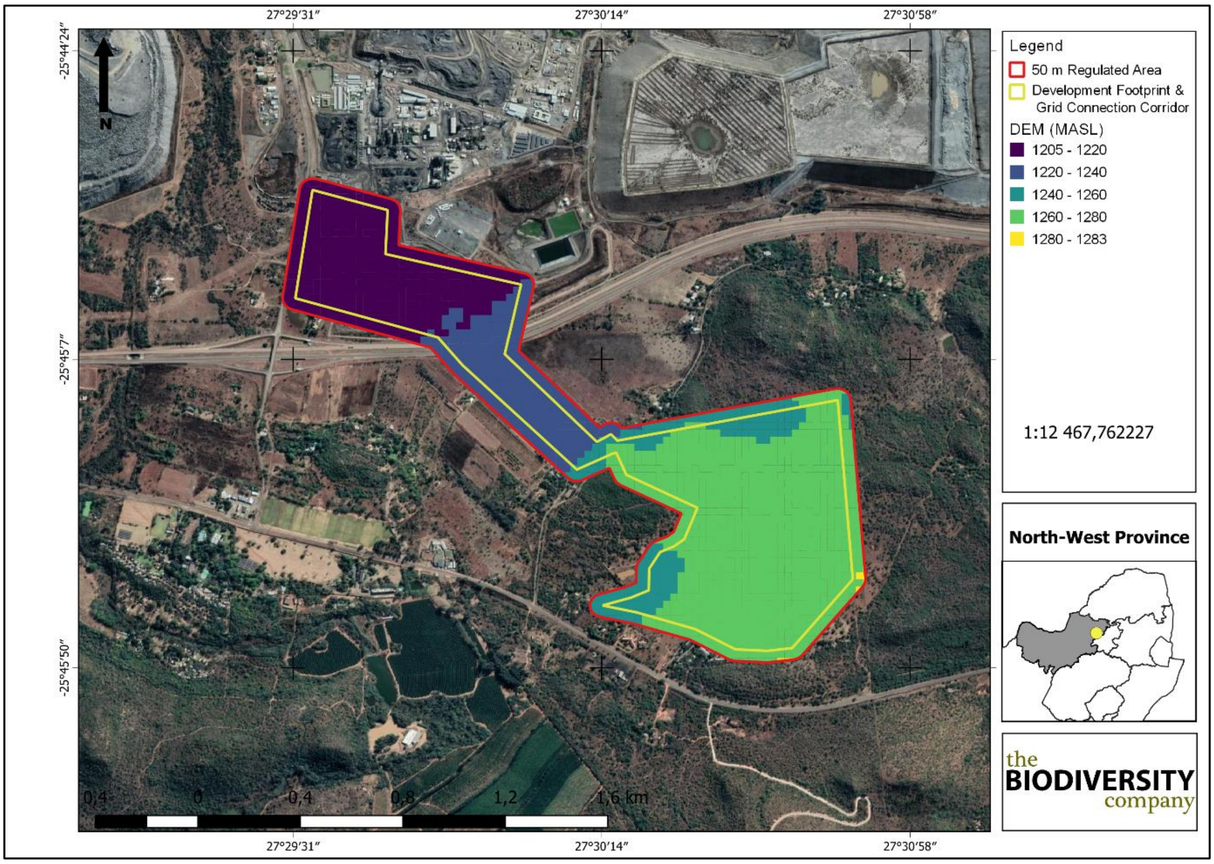

Figure 4-4 The DEM generated for the Project Site

5 Results and Discussion

5.1 Description of Soil Profiles and Diagnostic Horizons

Soil profiles were studied up to a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. The most sensitive soil forms have been considered (see Figure 5-1). The following diagnostic horizons were identified during the site assessment (also see Figure 5-2):

- Orthic topsoil;
- Lithic horizon;
- Gleyic horizon;
- Neocutanic horizon;
- Red apedal horizon; and
- Hard rock horizon.

5.1.1 Orthic Topsoil

Orthic topsoil are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one Orthic A topsoil to another (i.e., colouration, structure etc) (Soil Classification Working Group, 2018).

5.1.2 Lithic Horizon

Lithic horizon consists of friable soil-like morphology that resulted from pedogenic alteration, ranging from strong weathering of the underlying country rock to partially weathering of the hard rock fragments. The subsoil may express a gleying characteristics in a form of iron mineral reduction, when subjected to saturation conditions.

5.1.3 Gleyic Horizon

Gleyic diagnostic horizon consists of low chroma peds displaying grey and light-yellow colours. The morphology of the horizon indicates less reduction and apparently shorter durations of water saturation than the gley horizon. The horizon also exhibits lesser extent of gleying as compared to the gley horizon.

5.1.4 Neocutanic Horizon

The horizon is a young weakly-structed subsurface layer with variations in the soil matrix. The horizon is commonly associated to the processes of transportation of materials usually colluvial or alluvial origins in the valley bottoms or flats terrains and river terraces that have been subjected to an intermediate stage of pedogenic changes. The color differences in the neocutanic horizon are usually caused by illuvial material that coats weak structural units.

5.1.5 Red Apedal Horizon

The red apedal diagnostic soil horizon has no well-formed peds, but rather small porous aggregates. The poor structure associated with this diagnostic profile is a result of weathering processes under well drained oxidising conditions. Iron-oxide precipitations form on the outside of soil particles (hence the red colour) and non-swelling clays dominate the clay particles. This diagnostic soil horizon is widely spread across South Africa and can be associated with any parent material expected (Soil Classification Working Group, 1991).

5.1.6 Hard Rock Horizon

Hard rock horizon comprises of hard rock characterised with primarily physical weathering ranging from fractured and solid rock lacking soil development between the fractures. The underlain parent material includes igneous, sedimentary and metamorphic rocks. The horizon restricts most root penetrations of plants except for some selected annual trees and shrubs which can grow through the fractured sections in specialized ecological niche environments.

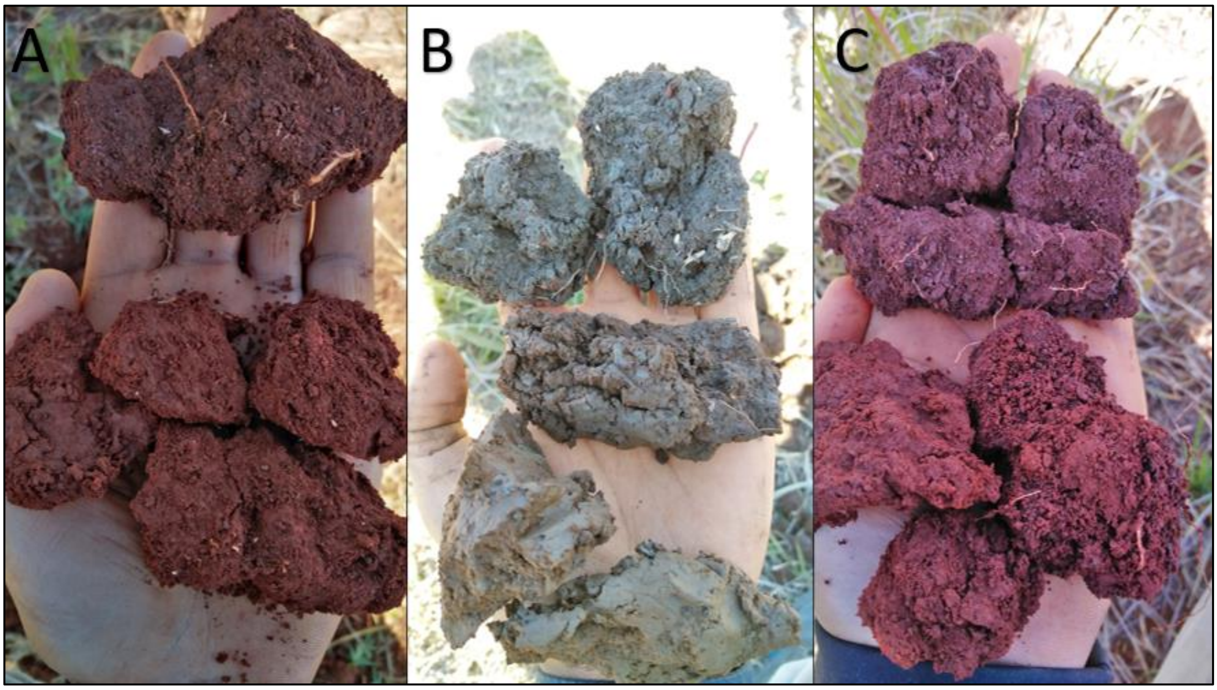

Figure 5-1 ***Sensitive soil forms identified during the site assessment. A) Vaalbos form with an orthic topsoil on top of a red apedal, underlain by a hard rock; B) Tukulu soil form with an orthic topsoil on top of a neocutanic subsoil, underlain by a gleyic subsoil; and C) Hutton soil form with an orthic topsoil on top of a thick red apedal subsoil horizon.***

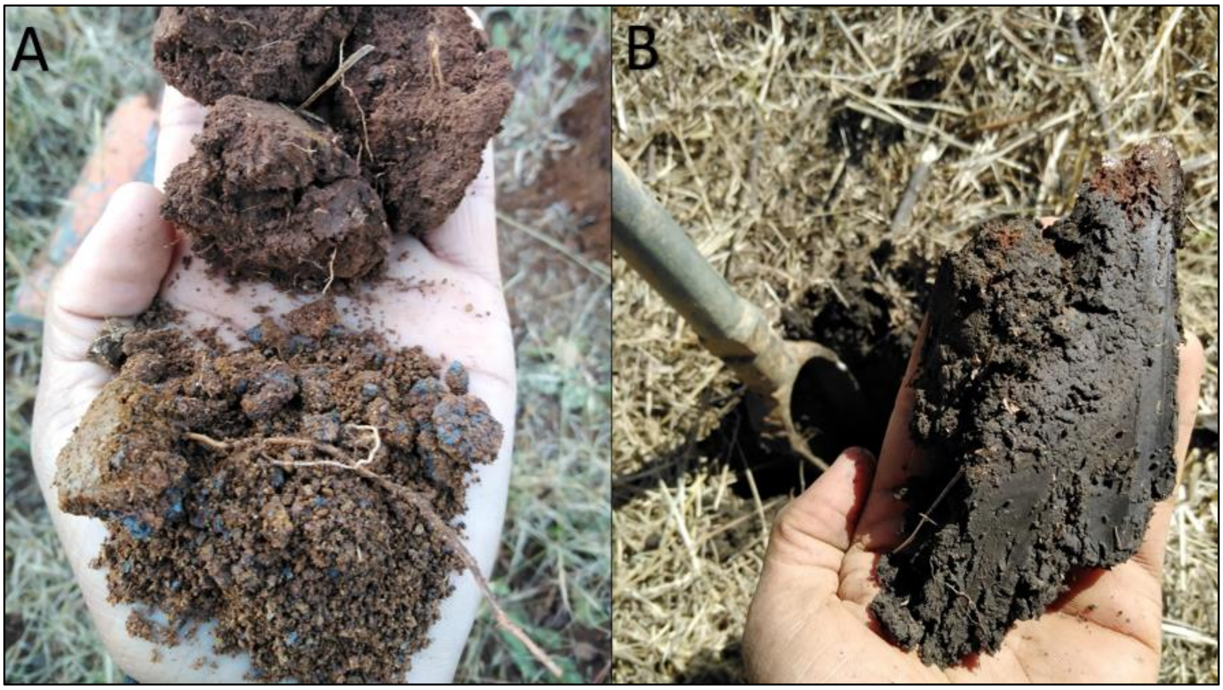

Figure 5-2 ***Dominant soil forms identified during site assessment. A) Glenrosa and B) Mispah soil forms.***

5.2 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified. These soil forms are described in Table 5-1 according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock. The soil forms are followed by the soil family and in brackets the maximum clay percentage of the topsoil. Soil family characteristics are described in Table 5-2.

Table 5-1 Summary of soils identified within the project area

	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	**Clay (%)**	**Signs of wetness**	**Rock %**	**Surface crusting**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**
Vaalbos 2222(15)	0-200	0-15	None	0	None	200-600	15-35	None	1	(+)600	0-15	None	100
Hutton 1220(15)	0-300	0-15	None	0	None	300-1200	15-35	Present	0	N/A			
Mispah 1120(15)	0-300	15-35	Present	20	None	300-1 200 (+)	0-15	None	100	N/A			
Tukulu 1120(15)	0-100	0-15	Present	0	None	350- 600	15-35	Present	0	600-1200	>35	Present	10
Glenrosa 2110(15)	0-100	15-35	None	20	None	100-200	0-15	None	70	(+)200	0-15	None	100

Table 5-2 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Base Status	Textural Contrast
Vaalbos 1221(15)	Chromic Topsoil	Mesotrophic	Luvic
Hutton 1220(15)	Chromic Topsoil	Mesotrophic	Luvic
Mispah 1220(15)	Dark Topsoil	Eutrophic	Aluvic
Tukulu 1120(15)	Grey Topsoil	Dystrophic	Luvic
Glenrosa 2110(15)	Chromic Topsoil	Mesotrophic	Aluvic

5.3 Agricultural Potential

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions.

The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

5.4 Climate Capability

The climatic capability has been determined by means of the Smith (2006) methodology, of which the first step includes determining the climate capability of the region by means of the Mean Annual Precipitation (MAP) and annual Class A pan (potential evaporation) (see Table 5-3).

Table 5-3 Climatic capability (step 1) (Scotney et al., 1987)

Central Sandy Bushveld region				
Climatic Capability Class	**Limitation Rating**	**Description**	**MAP: Class A pan Class**	**Applicability to site**
C1	None to Slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.	0.75-1.00	
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.	0.50-0.75	
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.	0.47-0.50	
C4	Moderate	Moderately restricted growing season due to the occurrence of low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.	0.44-0.47	
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.	0.41-0.44	
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops that frequently experience yield loss.	0.38-0.41	
C7	Severe to Very Severe	Severely restricted choice of crops due to heat and moisture stress.	0.34-0.38	
C8	Very Severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.	0.30-0.34	✔

According to Smith (2006), the climatic capability of a region is only refined past the first step if the climatic capability is determined to be between climatic capability 1 and 6. Given the fact that the climatic capability has been determined to be “C8” for the project area, no further steps will be taken to refine the climate capability.

5.5 Land Capability

The land capability was determined by using the guidelines described in "The farming handbook" (Smith, 2006). The delineated soil forms were clipped into the five different slope classes (0-10%, 10-20%, 20-30%, 30-40 and >45%) to determine the land capability of each soil form. Accordingly, the most sensitive soil forms associated with the project area are restricted to land capability 2 and 3 classes.

Table 5-4 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
2	Slight limitations. High arable potential. Low erosion hazard	Adequate run-off control	Annual cropping with special tillage or ley (25%)	Arable	High
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	Arable	High

5.6 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 5-5 and Table 5-6. From the two land capability classes, two land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability II and III have been reduced to a land potential level "L5" and "L6" due to climatic limitations.

Table 5-5 Land potential from climate capability vs land capability (Guy and Smith, 1998)

Land Capability Class	Climatic Capability Class							
	C1	C2	C3	C4	C5	C6	C7	C8
LC1	L1	L1	L2	L2	L3	L3	L4	L4
LC2	L1	L2	L2	L3	L3	L4	L4	L5*
LC3	L2	L2	L2	L2	L4	L4	L5	L6*
LC4	L2	L3	L3	L4	L4	L5	L5	L6
LC5	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
LC6	L4	L4	L5	L5	L5	L6	L6	L7
LC7	L5	L5	L6	L6	L7	L7	L7	L8
LC8	L6	L6	L7	L7	L8	L8	L8	L8

*Land potential level applicable to climatic and land capability

Table 5-6 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Description of Land Potential Class	Sensitivity
5	**Restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
6	**Very restricted potential**: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
Disturbed	N/A	None

5.7 Erosion Potential

The erosion potential of the identified soil forms has been calculated by means of the (Smith, 2006) methodology. In some cases, none of the parameters are applicable, in which case the step was skipped.

5.7.1 Vaalbos

Table 5-7 illustrates the values relevant to the erosion potential of the Vaalbos soil forms. The final erosion potential score has been calculated at 3.5, which indicates a "Moderate" potential for erosion.

Table 5-7 Erosion potential calculation for the Vaalbos soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	**4.0**	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		**0**		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)			**Shallow (<250-500 mm)**	
-1.0			-0.5	

5.7.2 Hutton

Table 5-8 illustrates the values relevant to the erosion potential of the Hutton soil forms. The final erosion potential score has been calculated at 3.5, which indicates a "Moderate" potential for erosion.

Table 5-8 Erosion potential calculation for the Hutton soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	**4.0**	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0

Step 3- Degree of Leaching (Excluding Bottomlands)		
Dystrophic Soils, Medium and Heavy Textures	**Mesotrophic Soils**	**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5	0	-0.5
Step 4- Organic Matter		
Organic Topsoil		**Humic Topsoil**
+0.5		+0.5
Step 5- Topsoil Limitations		
Surface Crusting		**Excessive Sand/High Shrink/Self-Mulching**
-0.5		-0.5
Step 6- Effective Soil Depth		
Very Shallow (<250 mm)		**Shallow (<250-500 mm)**
-1.0		-0.5

5.7.3 Mispah

Table 5-9 illustrates the values relevant to the erosion potential of the Mispah soil forms. The final erosion potential score has been calculated at 2.0, which indicates a "Very High" potential for erosion.

Table 5-9 Erosion potential calculation for the Mispah soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	4.5	5.0	6.0
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		-1.0		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil				**Humic Topsoil**
+0.5				+0.5
Step 5- Topsoil Limitations				
Surface Crusting				**Excessive Sand/High Shrink/Self-Mulching**
-0.5				-0.5
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)				**Shallow (250-500 mm)**
-1.0				-0.5

5.7.4 Tukulu

Table 5-10 illustrates the values relevant to the erosion potential of the Tukulu soil forms. The final erosion potential score has been calculated at 3.5, which indicates a "Moderate" potential for erosion.

Table 5-10 Erosion potential calculation for the Tukulu soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	**4.0**	4.5	5.0	**6.0**
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		**-1.0**		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		0		-0.5
Step 4- Organic Matter				
Organic Topsoil			**Humic Topsoil**	
+0.5			+0.5	
Step 5- Topsoil Limitations				
Surface Crusting			**Excessive Sand/High Shrink/Self-Mulching**	
-0.5			-0.5	
Step 6- Effective Soil Depth				
Very Shallow (<250 mm)			**Shallow (<250-500 mm)**	
-1.0			-0.5	

5.7.5 Glenrosa

Table 5-11 illustrate the values relevant to the erosion potential of the Glenrosa soil forms. The final erosion potential score has been calculated at 2.5, which indicates a "High" potential for erosion.

Table 5-11 Erosion potential calculation for the Glenrosa soil forms

Step 1- Initial Value, Texture of Topsoil				
Light (0-15% Clay)		**Medium (15-35% Clay)**		**Heavy (>35% Clay)**
3.5	4.0	**4.5**	5.0	**6.0**
Step 2- Adjustment Value (Permeability of Subsoil)				
Slightly Restricted		**Moderately Restricted**		**Heavily Restricted**
-0.5		**-1.0**		-2.0
Step 3- Degree of Leaching (Excluding Bottomlands)				
Dystrophic Soils, Medium and Heavy Textures		**Mesotrophic Soils**		**Eutrophic or Calcareous Soils, Medium and Heavy Textures**
+0.5		**0**		-0.5

Step 4- Organic Matter	
Organic Topsoil	**Humic Topsoil**
+0.5	+0.5
Step 5- Topsoil Limitations	
Surface Crusting	**Excessive Sand/High Shrink/Self-Mulching**
-0.5	-0.5
Step 6- Effective Soil Depth	
Very Shallow (<250 mm)	**Shallow (<250-500 mm)**
-1.0	-0.5

6 Sensitivity Verification

The following land potential level has been determined;

- Land potential level 5 - this land potential level is characterised by a restricted potential. Regular and/or moderate to severe limitations occur due to soil, slope, temperatures or rainfall.
- Land potential level 6 - this land potential level is characterised by a very restricted potential. Regular and/or severe limitations occur due to soil, slope, temperatures or rainfall. Non arable.

Fifteen (15) land capabilities have been digitised by (DAFF, 2017) across South Africa, of which ten (10) potential land capability classes are located within the proposed footprint area's assessment corridor, including;

- Land Capability 1 to 5 (Very Low to Low Sensitivity);
- Land Capability 6 to 8 (Low/Moderate to Moderate Sensitivity) and;
- Land Capability 9 to 10 (Moderate High Sensitivity).

The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the Project Site, which predominantly covers "Moderately Low" to "Moderate" sensitivities. Smaller patches are characterised by sensitivities up to "Moderately High" (Figure 6-1). Furthermore, various crop field boundaries were identified by means of the DEA Screening Tool (2022), which indicated that the grid connection corridor is predominantly characterised by "High" sensitivity crop fields (see Figure 6-2). It is mainly recommended that high sensitivity crop field be avoided. However, in the event that relocating of the Project Site is not feasible, stakeholders should undertake an evaluation of possible agreement with the landowners prior to any development in those areas.

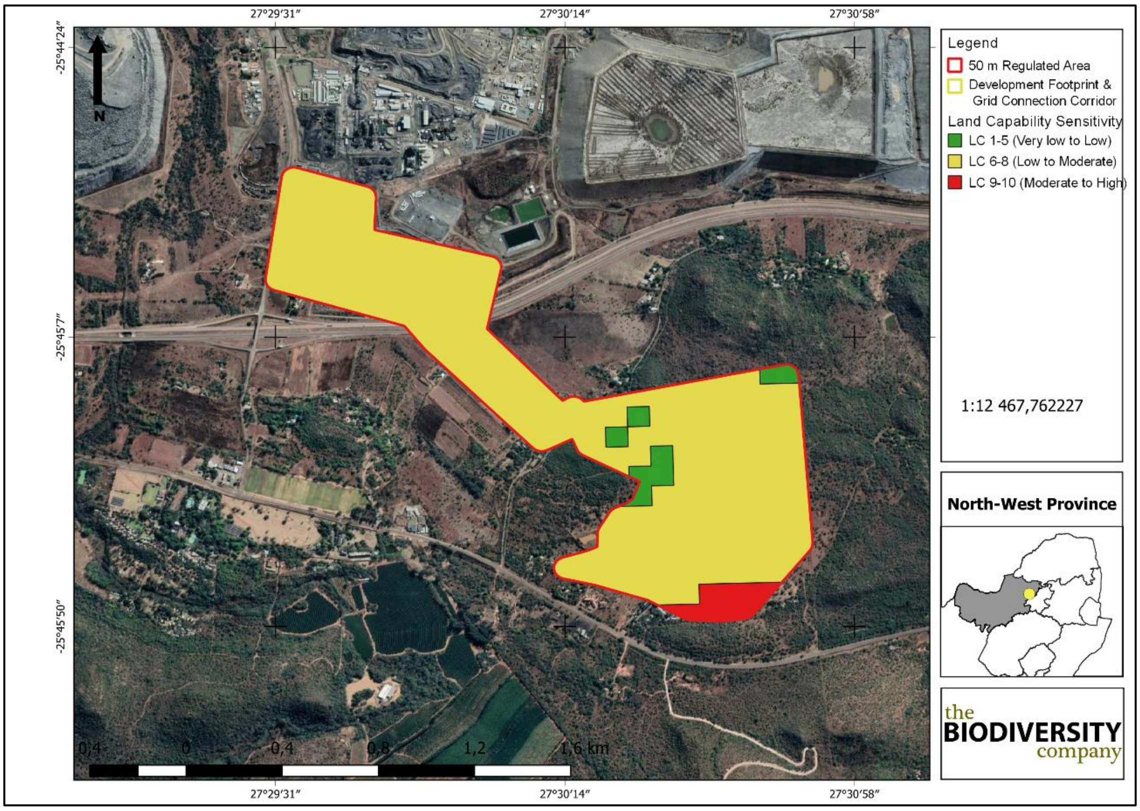

Figure 6-1 The land capability sensitivity (DAFF, 2017)

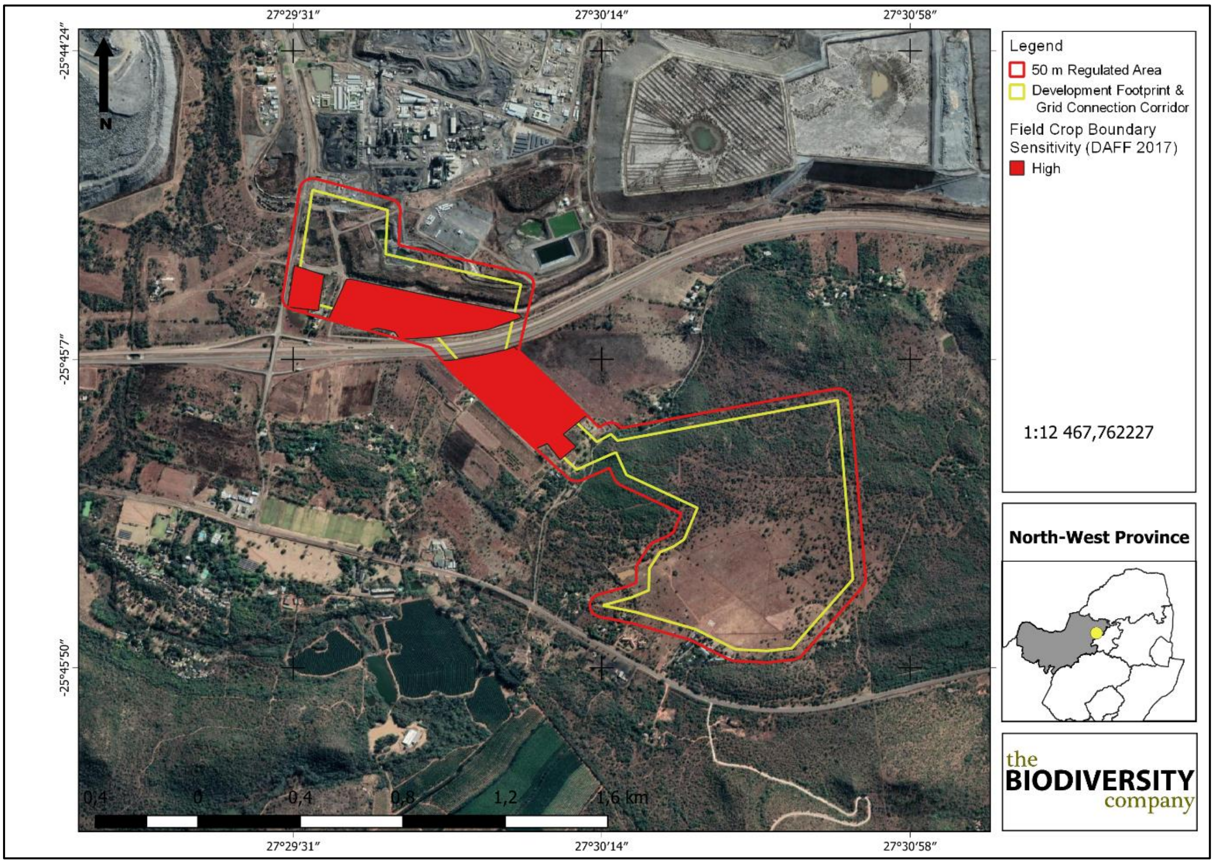

Figure 6-2 Crop boundary sensitivity (DEA Screening Tool, 2022)

7 Impact Assessment

The impacts were assessed in terms of the construction, operational and decommissioning phases. Mitigation measures were only applied to impacts deemed relevant.

7.1 Anticipated Activities

The following activities associated with the proposed Buffelspoort Solar PV Energy Facility will take place.

The Project Site is proposed to accommodate the following infrastructure:

- Solar PV arrays comprising PV panels and mounting structures;
- Inverters and transformers;
- Cabling between the arrays;
- Onsite facility substation;
- 88Kv single circuit single circuit overhead power line for the distribution of the generated power, which will be connected to an existing 88kV Substation just north of the proposed project site;
- Battery Energy Storage System (BESS) – to be initiated at a later stage than the Solar PV Energy Facility;
- Temporary laydown area;
- Operations and maintenance (O&M) building, which will include a site security office, warehouse storage area and workshop;

- Main access road (existing – to be upgrade with hard surface) and internal (new) gravel road; and
- Fencing around the site, including an access gate and security point.

7.1.1 Unplanned Events

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need management. Table 7-1 is a summary of the findings of an unplanned event assessment from an agricultural potential perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 7-1 Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spills into the surrounding environment	Contamination of soil as well as water resources associated with spillage.	A spill response kit must be available at all times. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.

7.1.2 Planning Phase Impacts

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This would include preparations and desktop work, final micro-siting of the project infrastructure, and consultation with various contractors involved with a diversity of proposed project related activities going forward.

7.2 Solar PV Energy Facility

7.2.1 Construction Phase

The proposed development will result in the stripping of topsoil and alterations to the existing land uses. The changes in the land use will be from agricultural to renewable development (or transformed). The proposed activities will impact on areas expected to be of high agricultural production (in some areas), with some aspects affecting covers “Moderately Low” to “Moderate” sensitivity areas. It is possible that suitable agricultural land could become fragmented, resulting in these smaller portions no longer being deemed feasible to farm.

During the construction phase, foundations will be cleared with topsoil often being stripped and stockpiled. Access roads will be created with trenches being dug for the installation of relevant cables/pipelines. Construction of substation sites will take place together with the erection of transmission lines where relevant. Contractor and laydown yards will also be cleared with construction material being transported to laydown yards. Potential erosion is expected during the construction phase due to some erodable soils within the footprint assessment area, such as the Vaalboos and Tukulu soil forms. The removal vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. Erosion of the area could result in further loss of topsoil, and soil forms suitable for agriculture.

Table 7-2 Impact assessment related to the loss of the land capability during the construction phase of the proposed Buffelspoort Solar PV Energy Facility project.

Nature: Loss of land capability		
	Without mitigation	With mitigation
Extent	Local area (3)	Footprint & surrounding areas (2)
Duration	Moderate Term (3)	Moderate Term (3)

Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Low (2)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Residual Impacts:		
Limited residual impacts will be associated with these activities, assuming that all prescribed mitigation measures be strictly adhered to.		

7.2.2 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Medium – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative".** The following specific measures are intended to secure a low residual risk:

- Avoidance of all high agricultural production land and other actively cultivated areas, where avoidance is not feasible stakeholder engagement should occur to negotiate an agreement with the affected landowners;
- Make use of existing roads or upgrades tracks before new roads are constructed. The number and width of internal access routes must be kept to a minimum;
- A stormwater management plan must be implemented for the development. The plan must provide input into the road network and management measures;
- PV mounting foundations and associated infrastructure must be (preferably) located in already disturbed areas that are not actively cultivated; and
- Rehabilitation of the area must be initiated from the onset of the project. Soil stripped from infrastructure placement can be used for rehabilitation efforts; and
- An alien invasive plant species and control programme must be implemented from the onset of the project.

7.2.1 Operational Phase

During the operational phase, limited impacts are foreseen. Concrete areas will be equiped with drains to reduce soil erosion on exposed areas. Only the footprint area will be disturbed to minimise soil and vegetation disturbance of the surrounding area. Revegetation will be carried out on exposed surrounding areas to avoid surface erosion. Maintenace of vegetation, solar PV infrastructure structure will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour.

7.2.1.1 Infrastructure

The operational phase of the renewable project (Constructed Infrastructure) includes anthropogenic movement and activities. The relevant infrastructure will be occupied by professionals throughout the lifetime of the operation. Besides compaction and erosion caused by increased traffic and surface water run-off for the area, few aspects are expected to be associated with this phase. The spread of alien invasive species will be a risk, predominantly adjacent to developed areas (edge effect).

Table 7-3 Impact assessment related to the loss of land capability during the operational phase of the proposed Buffelspoort Solar PV Energy Facility project.

Nature: Loss of land capability		
	Without mitigation	With mitigation
Extent	Footprint & surrounding areas (2)	Footprint & surrounding areas (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Moderate (6)	Minor (1)
Probability	Probable (3)	Low (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Residual Impacts:		
Limited residual impacts will be associated with these activities, assuming that all prescribed mitigation measures be strictly adhered to.		

7.2.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Medium – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative".** Further general mitigation is however detailed as the impacts were identified as low.

7.2.2 Cumulative Impacts

The cumulative impacts have been scored "Medium," indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

Table 7-4 Impact assessment related to the loss of land capability due to cumulative impacts of the proposed Buffelspoort Solar PV Energy Facility project.

Nature: Loss of land capability		
	Without mitigation	With mitigation
Extent	Regional (4)	Local area (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (42)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Residual Impacts:		

Limited residual impacts will be associated with these activities, assuming that all prescribed mitigation measures be strictly adhered to.

7.2.1 Mitigation

Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as **"Medium – Negative"** and the post- mitigation significance rating being scored as **"Low – Negative".** Further general mitigation is however detailed as the impacts have been deemed low.

8 General Mitigation

General mitigations will ensure the conservation of all soil resources, regardless of the sensitivity of resources and the intensity of impacts.

- Only the proposed access area and roads should be disturbed to reduce any unnecessary compaction;
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks;
- All excess soil (soil that are stripped and stockpiled to make way for foundations) must be stored, continuously rehabilitated to be used for rehabilitation of eroded areas; and
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.

8.1 Restoration of Vegetation Cover

Restoring vegetation cover is the first step to successful rehabilitation. Vegetation cover decreases flow velocities and minimises erosion.

8.1.1 Ripping Compacted Areas

All areas outside of the Project Site that will be degraded (by means of vehicles, laydown yards etc.) must be ripped where compaction has taken place. According to the Department of Primary Industries and Regional Development (Agriculture and Food) (2017), ripping tines must penetrate to just below the compacted horizons (approximately 300 – 400 mm) with soil moisture being imminent to the success of ripping. Ripping must take place within 1-3 days after seeding, and also following a rain event to ensure a higher moisture content.

To summarise;

- Rip all compacted areas outside of the developed areas that have been compacted;
- This must be done by means of a commercial ripper that has at least two rows of tines; and
- Ripping must take place between 1 and 3 days after seeding and following a rainfall event (seeding must therefore be carried out directly after a rainfall event).

8.1.2 Revegetate Degraded Areas

Vegetation within the footprint areas will be cleared to accommodate the excavation activities coupled with the proposed Project site's foundations. This impact will degrade soil resources, ultimately decreasing the land capability of resources and increasing erosion. According to Russell (2009), areas characterised by a loss of soil resources should be revegetated by means of vegetation with vigorous growth, stolons or rhizomes that more or less resembles the natural vegetation in the area.

It is recommended that all areas surrounding the development footprint areas that have been degraded by traffic, laydown yards etc. must be ripped and revegetated by means of indigenous grass species.

Mixed stands or monocultures will work sufficiently for revegetation purposes. Mixed stands tend to blend in with indigenous vegetation species and are more natural. Monocultures however could achieve high productivity. In general, indigenous vegetation should always be preferred due to various reasons including the aesthetical presence thereof as well as the ability of the species to adapt to its surroundings.

Plant phase plants which are characterised by fast growing and rapid spreading conditions. Seed germination, seed density and seed size are key aspects to consider before implementing revegetation activities. The number of seed should be limited to ensure that competition between plants is kept to a minimum. During the establishment of seed density, the percentage of seed germination should be taken into consideration. *E curvula* is one of the species recommended due to the ease of which it germinates. This species is also easily sown by means of hand propagation and hydro seeding.

The following species are recommended for rehabilitation purposes;

- *Eragrostis teff;*
- *Cynodon species* (Indigenous and altered types);
- *Chloris gayana;*
- *Panicum maximum;*
- *Digitaria eriantha;*
- *Anthephora pubescens; and*
- *Cenchrus ciliaris.*

8.2 Specialist Recommendation

The final results indicate ""Low" post-mitigation significance score ratings for the proposed components. It is therefore clear that the proposed activities are expected to have a low impact on land potential resources. It is worth noting that some "High" sensitivity crop field areas were identified by means of the DEA Screening tool (2022), it is recommended these are to be avoided throughout the life of the operation. If avoidance is not feasible, stakeholder engagement must undertake an agreement with the landowners for high crop field land use areas where necessary.

9 Conclusion and Impact Statement

Three main sensitive soil forms were identified within the Project Site, namely the Vaalbos, Hutton and Tukulu soil forms. The land capability sensitivities (DAFF, 2017) indicate land capabilities with "Low" and "Moderate high" sensitivities, which correlates with the findings from the baseline assessment. The Project Site is associated with both the arable and no-arable lands.

The Project Site is associated with both the arable and non-arable soils. However, the available climatic conditions of low annual rainfall and high evapotranspiration potential severely limits crop production significantly resulting in land capabilities with "Low" and "Moderate high" sensitivities. The land capabilities associated with the Project Site are suitable for cropping and grazing, which corresponds with the current land use.

It is the specialist's opinion that the proposed Project will have no impacts on the agricultural production ability of the land. The overhead powerline is proposed to transect some of the high sensitivity crop fields identified. These crop fields were identified as high sensitivity by the DEA screening tool (2022). In this case, moving the powerline to avoid high sensitivity crop fields is not feasible. Therefore, the associated stakeholders should undertake an agreement with the landowners prior to the project development. Therefore, the proposed Buffelspoort Solar PV Energy Facility may be favourably considered.

10 References

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