Agricultural Potential Assessment for the proposed Ripponn Wind Farm

Somerset East, Eastern Cape

March 2021

Client

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

Report Name	**Agricultural Potential Assessment for the proposed Ripponn Wind Farm**	
Submitted to	**Savannah Environment**	
Report Reviewer	**Andrew Husted**	
	Mr. Andrew Husted is an aquatic ecologist, specializing in freshwater systems and wetlands, who graduated with a MSc in Zoology. He, is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Mr Husted is an Aquatic, Wetland and Biodiversity Specialist with 12 years' experience in the environmental consulting field. In addition to his ecological working experience, Andrew has experience in agricultural and soil assessments, this includes the consideration of land uses and land cover.	
Report Writer	**Ivan Baker**	
	Ivan Baker is Cand. Sci Nat registered (119315) in environmental science and geological science. Ivan is a wetland and ecosystem service specialist, a hydropedologist and pedologist that has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom.	
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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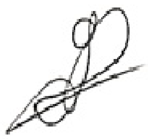
Declaration

I, **Ivan Baker** 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.



Ivan Baker

Soil Specialist

The Biodiversity Company

March 2021

1 Introduction

The Biodiversity Company was appointed to conduct a pedology (agricultural potential, land capability and land use) baseline and impact assessment for the proposed Ripponn Wind Farm. A site assessment was conducted in August 2020 to acquire baseline information regarding soil resources required for the Digital Soil Mapping exercise and to undertake the impact assessment for the project.

The approach adopted for the assessment 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".

This report aims to present and discuss the findings from the soil resources identified on-site, the agricultural and land potential of these resources, the land uses within the project area as well as the risks associated with the proposed wind farm.

2 Project Area

The project area is located immediately west of the N10 and approximately 40 km south of Somerset East, within the Eastern Cape province. The surrounding land uses include farming (crops and grazing), mountainous areas, watercourses and small portions characterised by built-up areas (residential areas, schools etc.) (see Figure 2-1 and Figure 2-2). The larger project area has been assigned for the entire wind farm, with this particular assessment only focussing on the Ripponn Wind Farm project area within which the development footprint/project infrastructure will be placed. The following components will be included in the proposed wind farm;

- 132kV power line;
- Balance of Plant (BoP);
- Access roads;
- On-site collector substation;
- Wind turbines; and
- A 400kV MTS.

It is worth noting that the 400kV MTS has already been thoroughly assessed in a separate agricultural potential assessment (TBC, 2021) and will therefore not be assessed as part of this assessment.

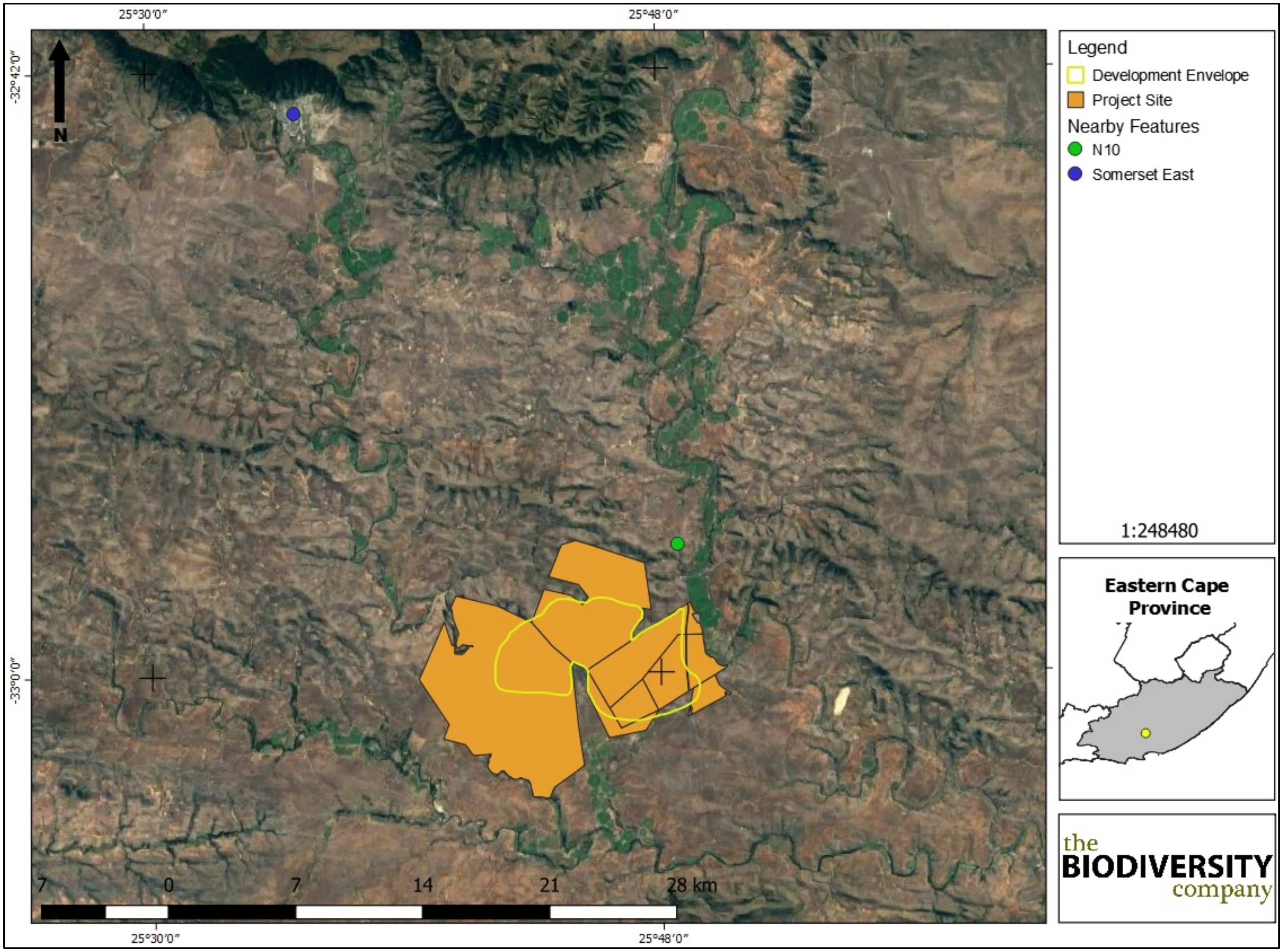


Figure 2-1 Locality map of the Ripponn Wind Farm

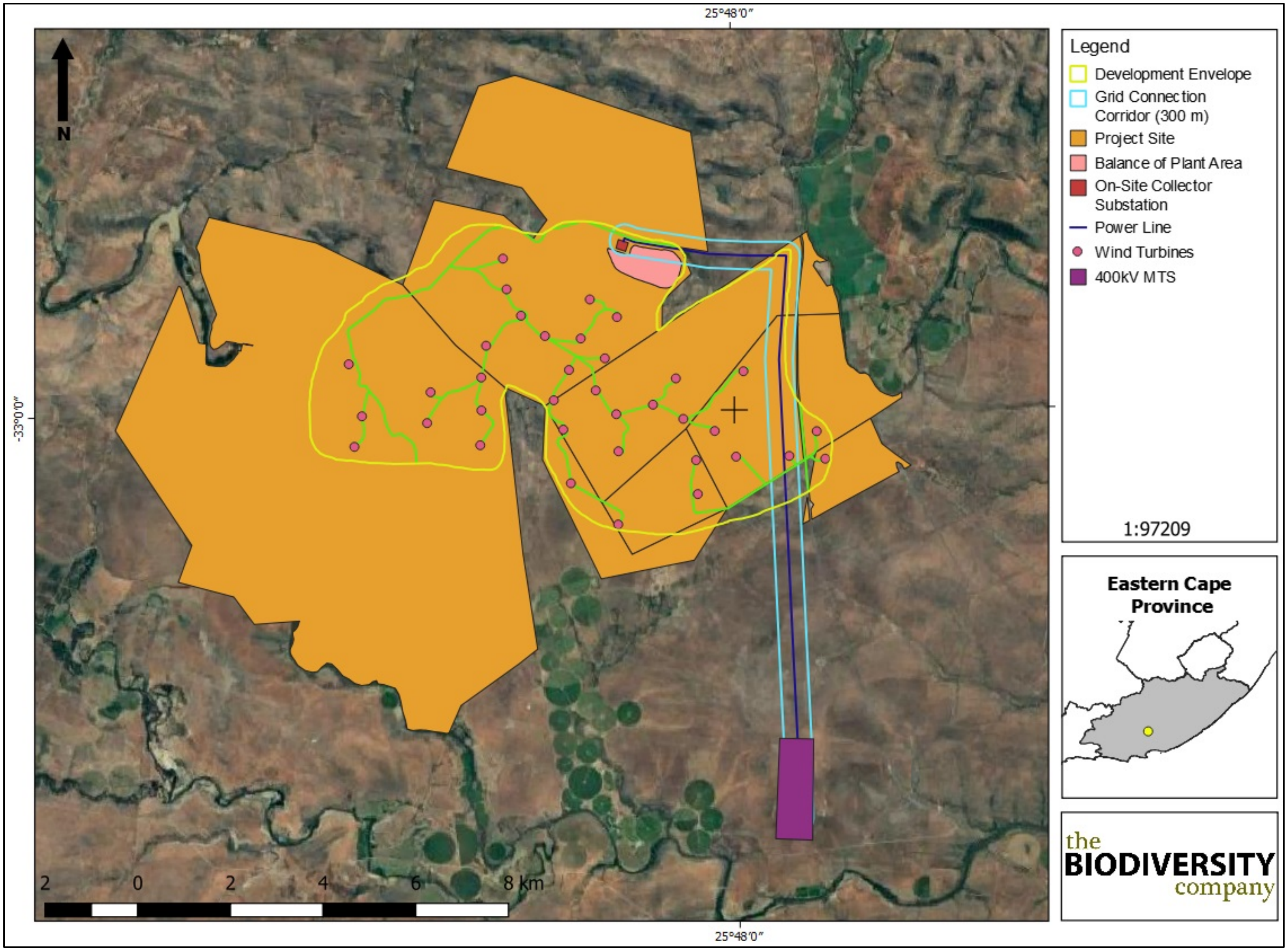


Figure 2-2 Project layout

3 Scope of Work

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- To conduct a soil assessment which includes a description of the physical properties which characterise the soil within the proposed area of development of the relevant portions of the affected properties;
- Using the findings from the soil assessment to determine the existing land capability/potential and current land use of the entire surface area of the relevant portions of the project area;
- To delineate soil resources by means of Digital Soil Mapping (DSM) methodologies;
- To determine the sensitivity of the baseline findings;
- The soil classification was done according to the Taxonomic Soil Classification System for South Africa, 1991. The following attributes must be included at each observation:
    - Soil form and family (Taxonomic Soil Classification System for South Africa, 1991);
    - Soil depth;
    - Estimated soil texture;
    - Soil structure, coarse fragments, calcareousness;
    - Buffer capacities;
    - Underlying material;
    - Current land use; and
    - Land capability.
- To complete an impact statement;
- Discussing the feasibility of the proposed activities;
- Confirmation that no agricultural segregation will take place and that all options have been considered to avoid segregation; and
- Recommend relevant mitigation measures to limit all associated impacts.

4 Limitations

The following limitations are relevant to this agricultural compliance statement;

- It has been assumed that the extent of the properties to be assessed together with the locations of the proposed wind turbines are correct and final;

- The combined size of the project areas (west and east) is in excess of 50 000 ha, which limits the coverage during the site assessment. It is well documented by the likes of van Zijl (2018) that terrain and the size of project areas renders soil sampling impractical. Therefore, Digital Soil Mapping (DSM) was used to delineate soil resources throughout the project areas with the use of targeted ground-truthed information;

- Inaccuracies in DSMs are inevitable. Therefore, a conservative approach has been taken in regard to delineations and sensitivities; and

- The handheld GPS used potentially could have inaccuracies up to 5 m. Any and all delineations therefore could be inaccurate within 5 m.

5 Expertise of the Specialists

5.1 Andrew Husted

Mr. Andrew Husted is an aquatic ecologist, specializing in freshwater systems and wetlands, who graduated with a MSc in Zoology. He, is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Mr Husted is an Aquatic, Wetland and Biodiversity Specialist with 12 years' experience in the environmental consulting field. In addition to his ecological working experience, Andrew has experience in agricultural and soil assessments, this includes the consideration of land uses and land cover.

5.2 Ivan Baker

Ivan Baker is Cand. Sci Nat registered (119315) in environmental science and geological science. Ivan is a wetland and ecosystem service specialist, a hydropedologist and pedologist that has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom.

6 Literature Review

6.1 Digital Soil Mapping

The use of the Land Type Survey (Land Type Survey Staff 1972-2006), Geographic Information Systems (GIS) and Digital Elevation Models (DEM) in collaboration with ground-truthed baseline information have helped refine the ability of predictive mapping, which has paved the way for DSM (van Zijl & Botha, 2016).

Tough terrain and large project areas often render soil sampling impractical, which emphasises the need for DSM. Van Zijl (2018) mentions that sparse observation densities are often used in such cases, ranging from 74-216 $ha.obs^{-1}$. The main advantage of DSM lies within the importance of the soil-environmental correlation, which can be used to map out the distribution of soils with relatively few sampling sites.

According to van Zijl (2018), two main methodologies may be used for DSM, including the expert knowledge approach as well as the land type disaggregation approach. The latter will form part of the methodology used for the basic assessment required for this particular study. The land type disaggregation approach includes the use of land type information to digitally map out the soil units as per the dominant soil forms associated with the terrain units.

The land type disaggregation approach is commonly used for Environmental Impact Assessments (EIAs) and has been well-documented in the past to be practical and time efficient. In addition to soil information derived from the Land Type Database (Land Type Survey Staff 1972-2006), the soil-environmental relationships observed during the site assessment will be used to improve the accuracy of the study, ultimately upholding the principle of (Botha, 2016), that in-field observations is an important addition to land type information.

6.2 Land Capability

According to Smith (2006), the capability of land concerns the wise use of land to ensure economical production on a sustained basis, under specific uses and treatments. The object of land classification is the grouping of different land capabilities, to indicate the safest option for use, to indicate permanent hazards and management requirements. These land capability classes decrease in capability from I to VIII and increase in risk from I to VIII. DAFF (2017) further defines land capability as "*the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of* ***climate, soil*** *and* ***terrain****.*

DAFF (2017) has further modelled the land capability on a rough scale for the entire of South Africa and has divided these results into 15 classes (see Table 6-1). Terrain, climate and soil capability was used as the building blocks for this exercise to ensure a national land capability data set.

Table 6-1 Land Capability (DAFF, 2017)

Land Capability Class (DAFF, 2017)	Description of Capability
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	

It is worth noting that this nation-wide data set has some constraints of its own. According to DAFF (2017), inaccuracies and the level of detail of these datasets are of concern. Additionally, the scale used to model these datasets are large (1:50 000 to 1:100 000) and is not suitable for farm level planning. Furthermore, it is mentioned by DAFF (2017) that these datasets should not replace any site-based assessments given the accuracies perceived.

7 Methodology

The methodology surrounding the site assessment is based on two large project areas to acquire baseline information. Given the size of these areas, a digital soil mapping approach was taken. The details surrounding this methodology is described in Apoendix D. The pedology assessment was conducted using the Provincial and National Departments of Agriculture recommendations. The assessment was broken into two phases. Phase 1 was a desktop assessment to determine the following:

- Historic climatic conditions;
- The base soils information from the land type database (Land Type Survey Staff, 1972 - 2006); and
- The geology for the proposed project site.

Phase 2 of the assessment was to conduct a soil survey to determine the actual agricultural potential. During this phase the current land use was also surveyed.

7.1 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.

7.2 Agricultural Potential Assessment

Land capability and agricultural potential will 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 7-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use and sensitivity increases from class I to class VIII (Smith, 2006).

Table 7-1 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**					

Land capability has been classified into 15 different categories by DAFF (2017) which indicates the national land capability category and associated sensitivity related to soil resources. Given the fact that ground truthing and DSM exercises have indicated anomalies in the form of high sensitivity soil resources (which was not indicated by the DAFF (2017) raster file), the ground-truthed baseline delineations and sensitivities were used for this assessment rather than that of DAFF (2017).

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 7-2. The final land potential results are then described in Table 7-3. These land potential classes are regarded as the final delineations subject to sensitivity, given the comprehensive addition of climatic conditions as those relevant to the DAFF (2017) land capabilities. The main contributors to the climatic conditions as per Smith (2006) is that of Mean Annual Precipitation (MAP), Mean Annual Potential Evaporation (MAPE), mean September temperatures, mean June temperatures and mean annual temperatures. These parameters will be derived from Mucina and Rutherford (2006) for each vegetation type located within the relevant project area. This will give the specialist the opportunity to consider micro-climate, aspect, topography etc.

Table 7-2 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 7-3 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

7.3 Climate Capability

According to Smith (2006), climatic capability is determined by taking into consideration various steps pertaining to the temperature, rainfall and Class A-pan of a region. The first step in this methodology is to determine the Mean Annual Precipitation (MAP) to Class A-pan ratio.

Table 7-4 Climatic capability (step 1) (Scotney et al., 1987)

Climatic Capability Class	Limitation Rating	Description	MAP: Class A-pan Class
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

In the event that the MAP: Class A-pan ratio is calculated to fall within the C7 or C8 class, no further steps are required, and the climatic capability can therefore be determined to be C7 or C8. In cases where the above-mentioned ratio falls within C1-C6, steps 2 to 3 will be required to further refine the climatic capability.

Step 2

Mean September temperatures;

- <10℃ = C6;
- 10 - 11℃ = C5;
- 11 - 12℃ = C4;
- 12 - 13℃ = C3; and
- >13℃ = C1.

Step 3

Mean June temperatures;

- <9℃ = C5;
- 9 - 10℃ = C4;
- 10 - 11℃ = C3; and
- 11 - 12℃ = C2.

7.4 Current Land Use

A generalised land-use will be derived for the larger project area considering agricultural productivity.

- Mining;
- Bare areas;
- Agriculture crops;
- Natural veld;
- Grazing lands;
- Plantation;
- Urban;
- Built-up;
- Waterbodies; and
- Wetlands.

- Forest;

8 Desktop Findings

8.1 Climate

The Ripponn project area is characterised by three vegetation types, namely the AT 11 (Great Fish Thicket), the AZi 6 (Southern Karoo Riviere) and the NKI 4 (Albany Broken Veld) vegetation types (see Figure 8-1). The climate diagrams for these three vegetation types are illustrated in Figure 8-2 to Figure 8-4.

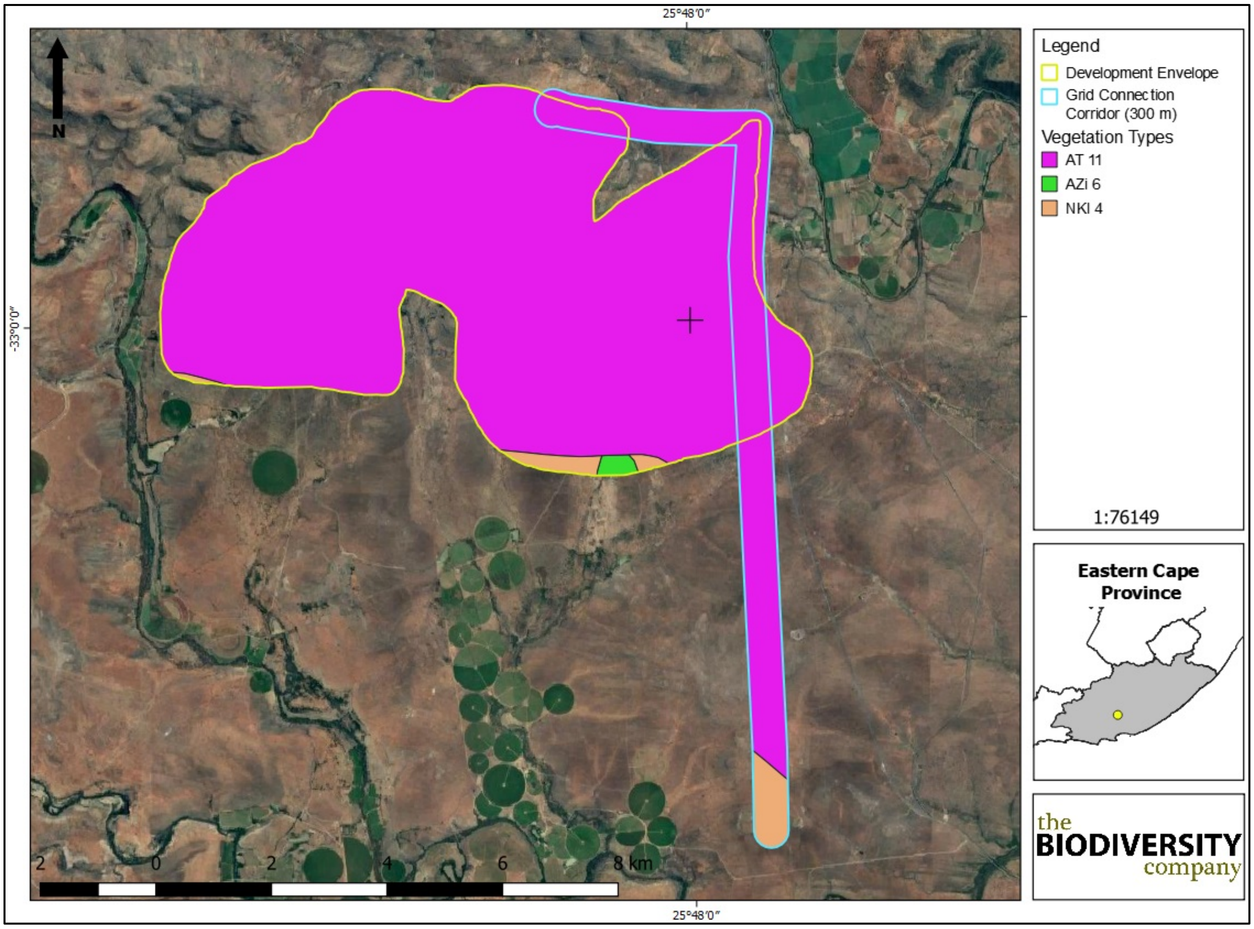


Figure 8-1 Vegetation types for the Ripponn Wind Farm

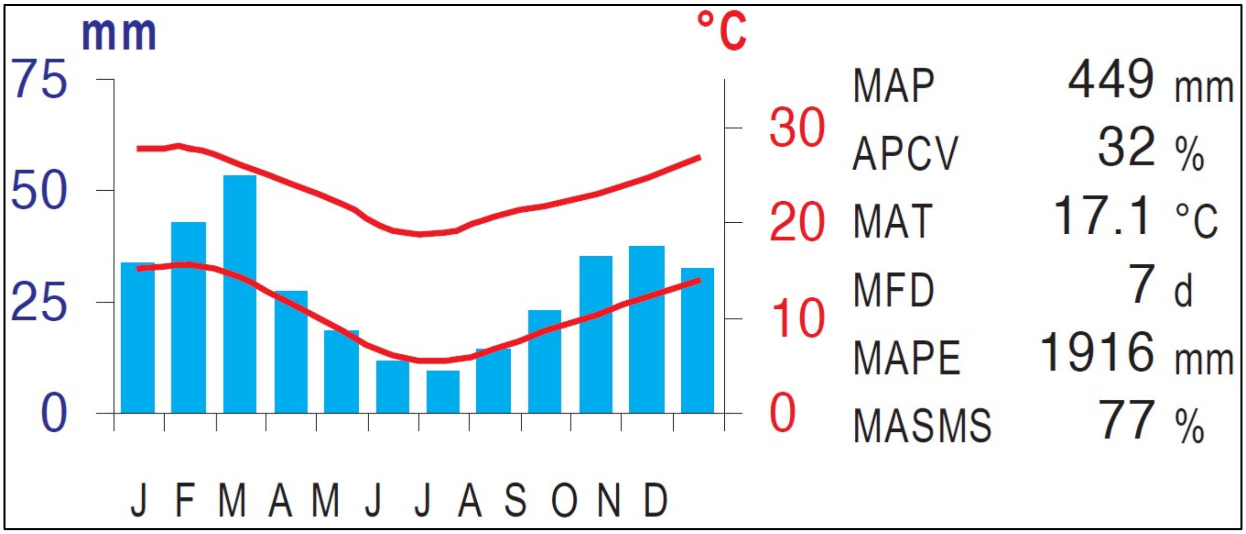


Figure 8-2 Climate for the Great Fish Thicket AT 11) vegetation type (Mucina & Rutherford, 2006)

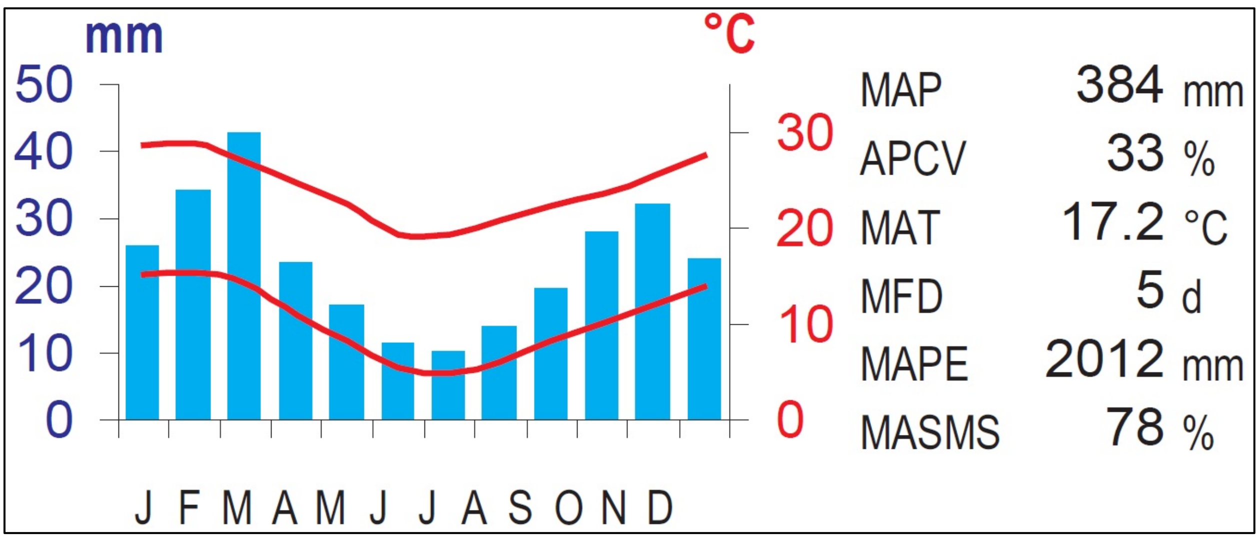


Figure 8-3 Climate for the Albany Broken Veld Thicket (NKI 4) vegetation type (Mucina & Rutherford, 2006)

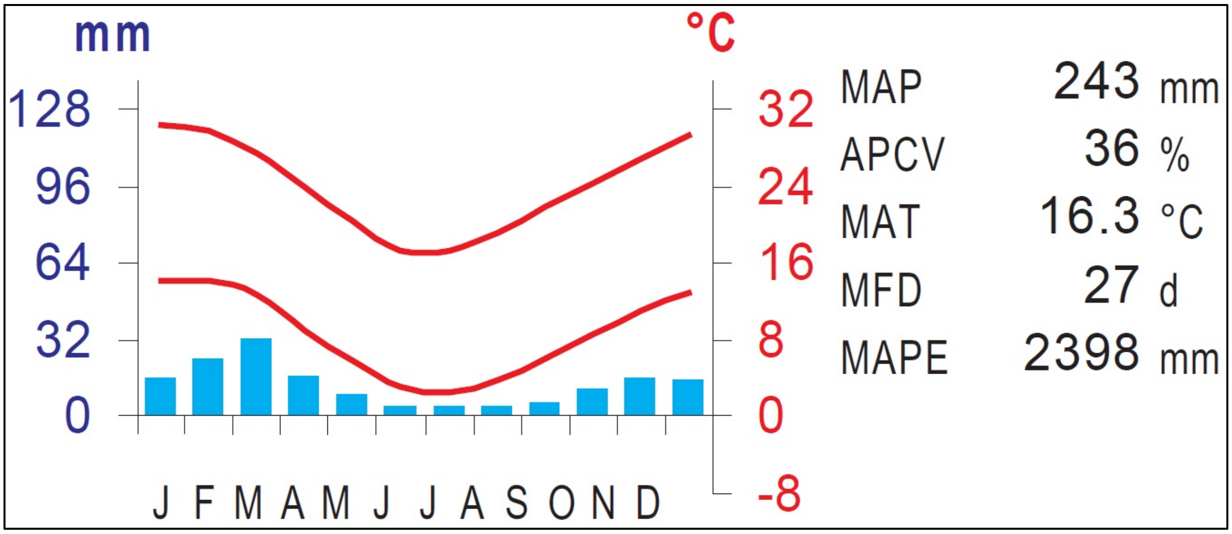


Figure 8-4 Climate for the Southern Karoo Riviere (AZi 6) vegetation type (Mucina & Rutherford, 2006)

8.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within the Fc 169, Fc 176, Ag 29, Ia 120 and the Ia 82 land types. The Fc land type consists of Glenrosa and/or Mispah soil forms with the possibility of other soils occurring throughout. Lime is rare or absent within this land type in upland soils but generally present in low-lying areas. The Ia land type consists of miscellaneous land classes with deep undifferentiated soil deposits. The Ag land type is characterised by freely drained Red or Yellow-Brown Apedal soils with red soils being dominant. These soils are characterised by a high base status and is likely to be less than 300 mm deep.

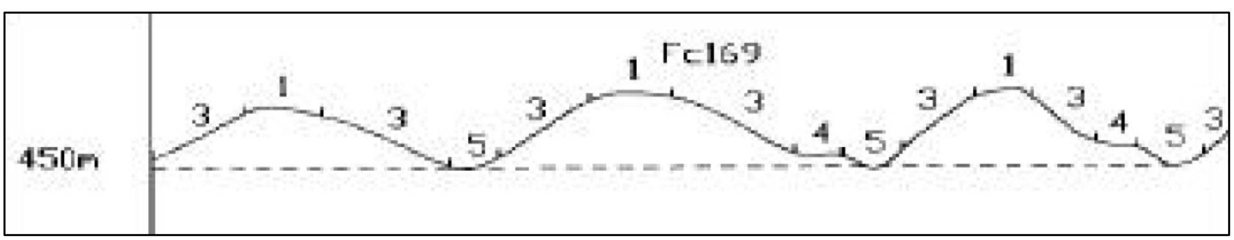


Figure 8-5 Illustration of land type Fc 169 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 8-1 Soils expected at the respective terrain units within the Fc 169 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (15%)		3 (75%)		4 (5%)		5 (5%)	
Glenrosa	70	Glenrosa	50	Glenrosa	50	Oakleaf	50
Bare Rock	10	Mispah	20	Swartland	25	Valsrivier	40
Mispah	10	Swartland	15	Hutton	10	Dundee	10

Hutton	10	Hutton	10	Bare Rock	5		
		Valsrivier	5	Mispah	5		
				Valsrivier	5		

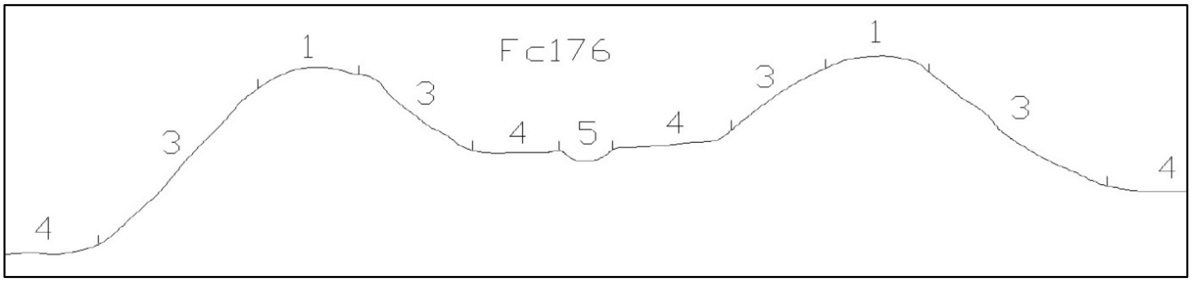


Figure 8-6 Illustration of land type Fc 176 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 8-2 Soils expected at the respective terrain units within the Fc 176 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units							
1 (15%)		**3 (60%)**		**4 (20%)**		**5 (5%)**	
Mispah	50	Hutton	40	Hutton	40	Oakleaf	50
Hutton	25	Mispah	30	Mispah	20	Valsrivier	20
Glenrosa	25	Glenrosa	15	Oakleaf	20	Dundee	15
		Oakleaf	10	Glenrosa	15	Hutton	10
		Valsrivier	3	Valsrivier	5	Sterkspruit	5
		Sterkspruit	2				

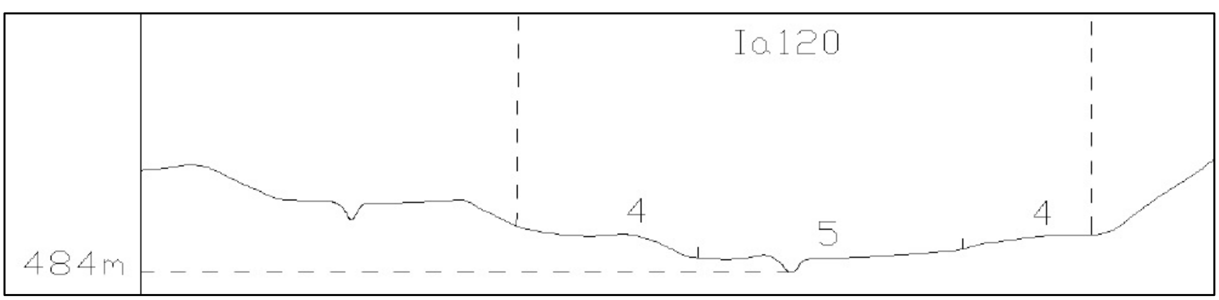


Figure 8-7 Illustration of land type Ia 120 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 8-3 Soils expected at the respective terrain units within the Ia 120 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units			
4 (30%)		**5 (70%)**	
Oakleaf	30%	Oakleaf	60%

Clovelly	25%	Clovelly	10%
Hutton	22%	Hutton	10%
Valsrivier	10%	Dundee	10%
Mispah	8%	Valsrivier	5%
		Mispah	5%

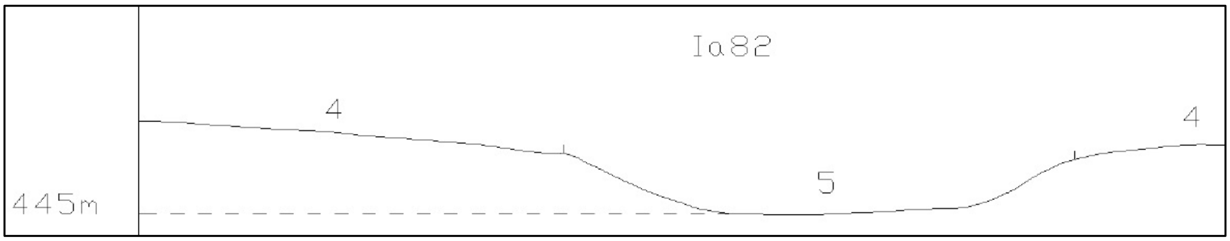


Figure 8-8 Illustration of land type Ia 82 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 8-4 Soils expected at the respective terrain units within the Ia 82 land type (Land Type Survey Staff, 1972 - 2006)

Terrain Units			
4 (35%)		**5 (65%)**	
Oakleaf	75%	Oakleaf	80%
Hutton	15%	Dundee	10%
Valsrivier	5%	Valsrivier	5%
Swartland	5%	Swartland	5%

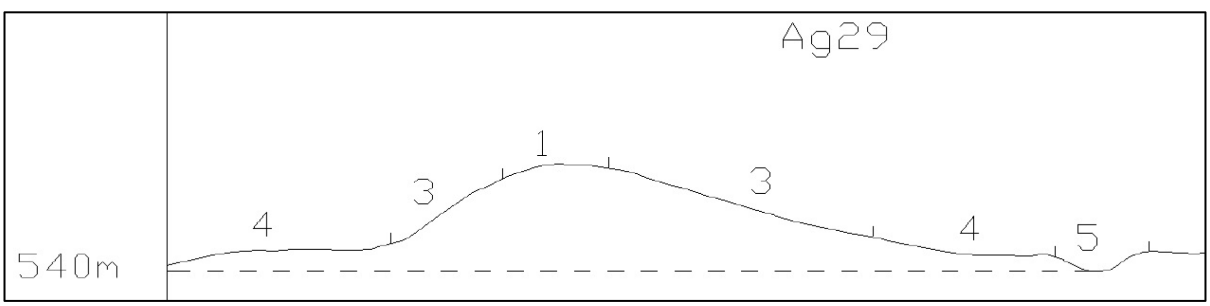


Figure 8-9 Illustration of the Ag 29 land type terrain units (Land Type Survey Staff, 1972 - 2006)

Table 8-5 Soils expected at the respective terrain units within the Ag 29 land type (Land Type Survey Staff, 1972 - 2006)

Terrain units							
1 (5%)		**3 (15%)**		**4 (75%)**		**5 (5%)**	
Glenrosa	45%	Hutton	50%	Hutton	60%	Oakleaf	60%

Hutton	45%	Glenrosa	30%	Swartland	15%	Dundee	20%
Mispah	10%	Mispah	10%	Glenrosa	10%	Valsrivier	15%
		Oakleaf	5%	Oakleaf	10%	Hutton	5%
		Swartland	5%	Mispah	5%		

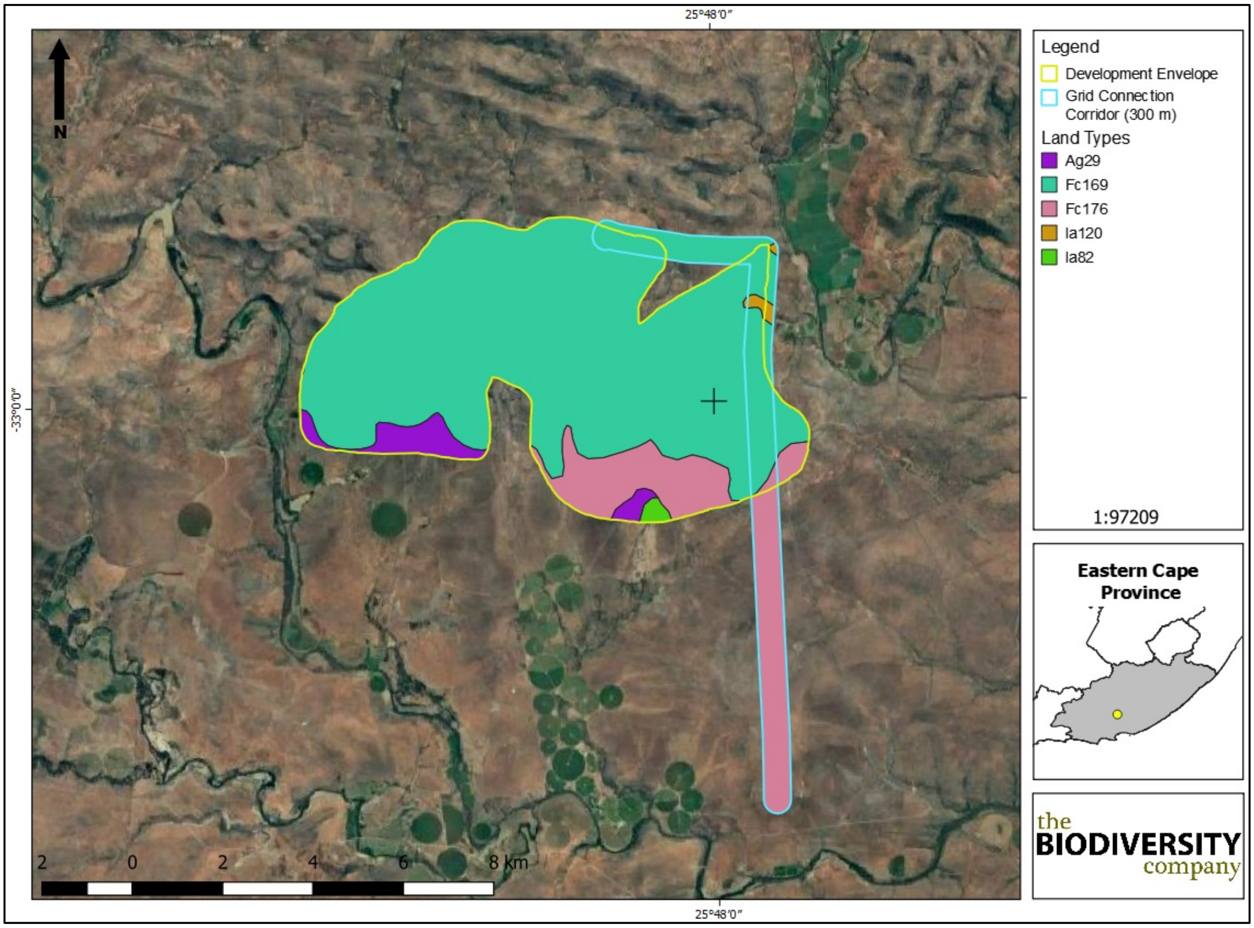


Figure 8-10 Land types present within the Ripponn Wind Farm project area

8.3 Terrain

The slope percentage of the project area has been calculated and is illustrated in Figure 8-11. Most of the project area is characterised by a slope percentage between 0 and 10%, with some smaller patches within the project area characterised by a slope percentage up to 67%. This illustration indicates a non-uniform topography with a high concentration of mountainous areas and ridges. The elevation of the project area (Figure 8-12) indicates an elevation of 509 – 772 Metres Above Sea Level (MASL).

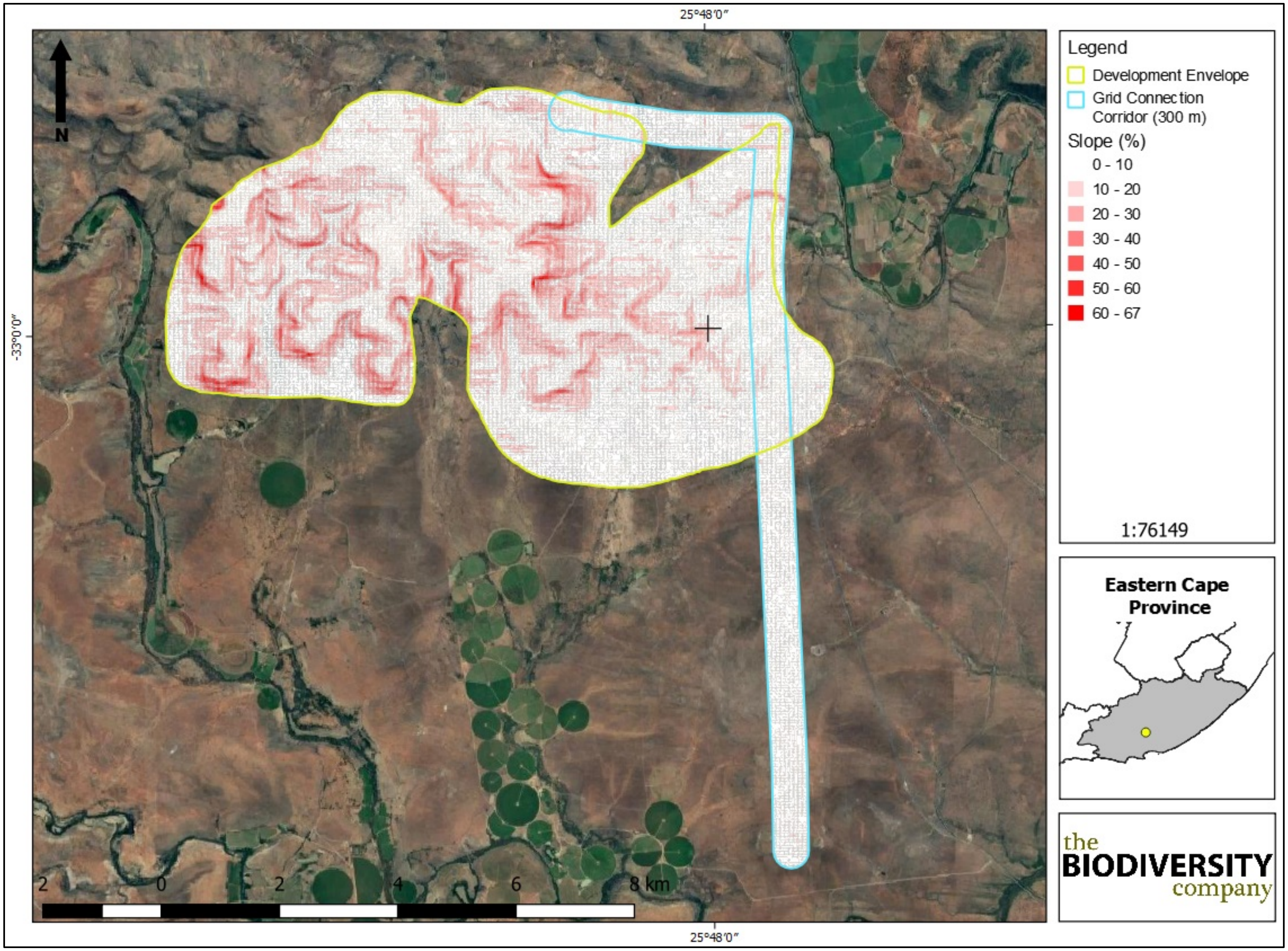


Figure 8-11 Slope percentage map for the project area

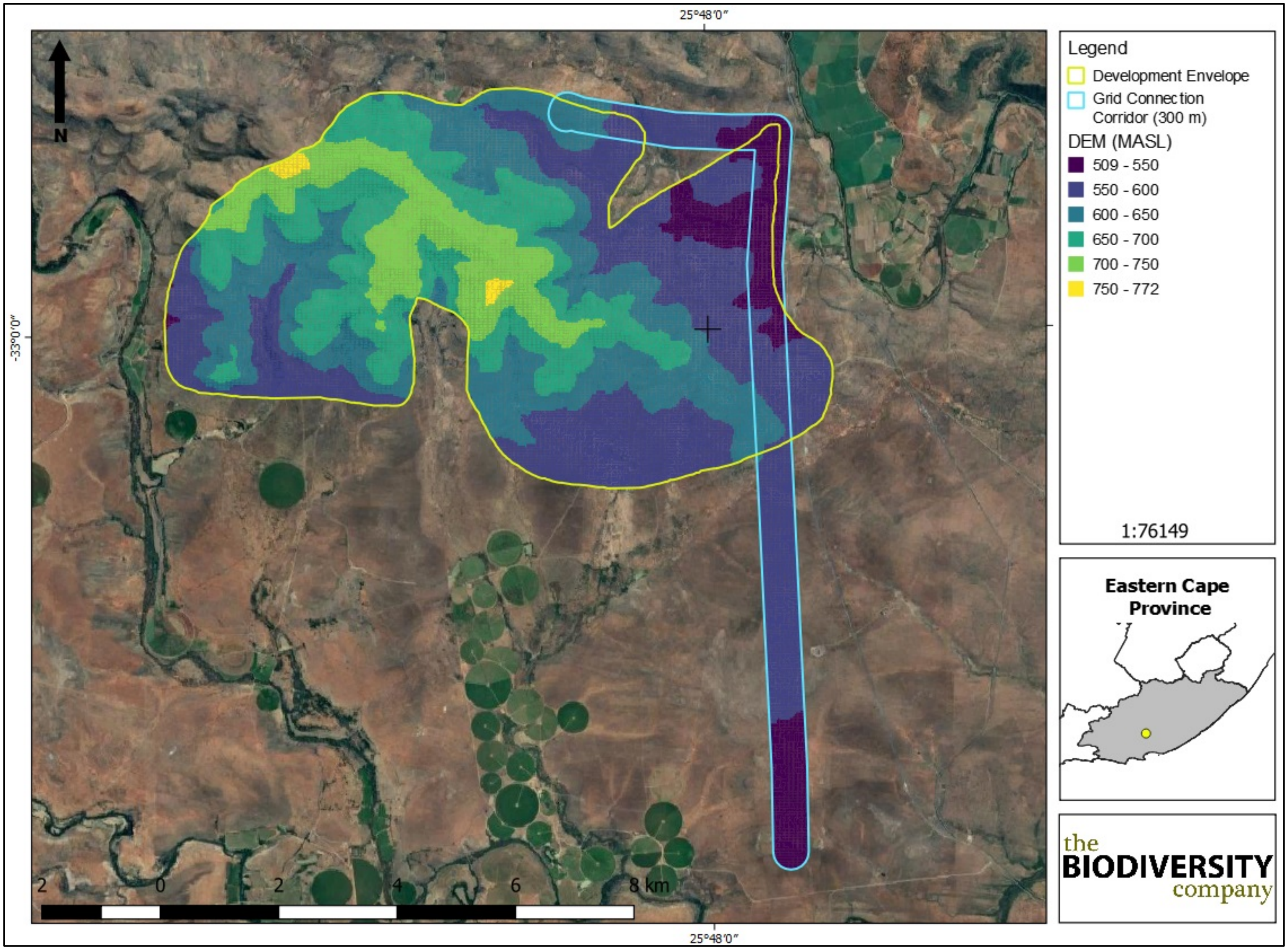


Figure 8-12 Elevation of the project area (metres above sea level)

9 Results and Discussion

The following sections include results from field observations as well as the digital soil mapping exercise relevant to the agricultural potential of the project area.

9.1 Description of Identified 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 following diagnostic horizons were identified during the site assessment:

- Orthic topsoil;
- Lithocutanic horizon;
- Pedocutanic horizon;
- Neocutanic horizon; and
- Hard rock horizon.

9.1.1 Orthic Topsoil

Orthic topsoils 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).

9.1.2 Lithocutanic Horizon

For the Lithocutanic horizon, i*n situ* weathering of rock underneath topsoil results in a well-mixed soil-rock layer. The colour, structure and consistency of this material must be directly related to the parent material of the weathered rock. The Lithocutanic horizon is usually followed by a massive rock layer at shallow depths. Hard rock, permeable rock and horizontally layered shale usually is not associated with the weathering processes involved with the formation of this diagnostic horizon.

9.1.3 Hard Rock Horizon

The hard rock layer disallows infiltration of water or root systems and occur in shallow profiles. Horizontally layered, hard sediments without evidence of vertical seems fall under this category.

9.1.4 Pedocutanic Horizon

A Pedocutanic horizon has a well-developed blocky structure as well as a high concentration of clay due to illuvial processes leaching clay particles to the horizon. For red Pedocutanic horizons, an abrupt transition between the sub soil horizon and the topsoil can be expected.

9.1.5 Neocutanic Horizon

The Neocutanic horizon is associated with recent depositions and unconsolidated soils. Any soil form can develop out of a Neocutanic horizon, depending on the climatic and topographical conditions). Some properties pertaining to other diagnostic soil horizons will be present within a Neocutanic horizon but will lack main properties necessary to classify the relevant soil type (Soil Classification Working Group, 2018).

9.2 Description of Soil Forms and Soil Families

During the site assessment various soil forms were identified. These soil forms have been delineated and are illustrated in Figure 9-1 and is described in Table 9-1 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 9-2.

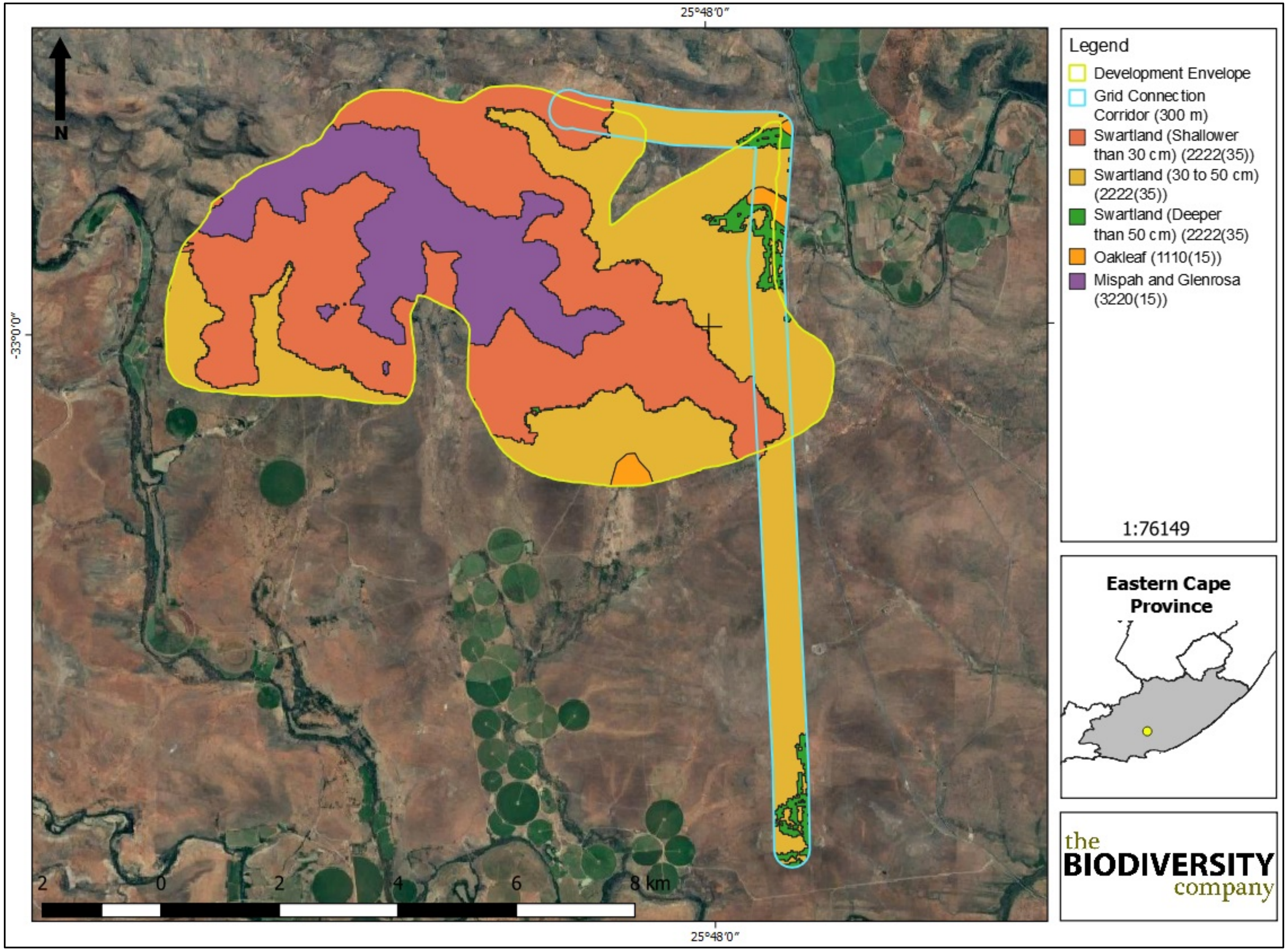


Figure 9-1 Soil delineations within the project area

Table 9-1 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 %**
Mispah and Glenrosa 3220(15)	0-300	0-15	None	>30	None	N/A				N/A			
<30 cm Swartland 2222(35)	0-300	15-35	None	20-30	None	N/A				N/A			
30-50 cm Swartland 2222(35)	0-300	15-35	None	0	None	300 to 500	0-15	None	0	N/A			
>50 cm Swartland 2222(35)	0-300	15-35	None	0	None	300 to >1200	0-15	None	0	N/A			
Oakleaf 1110(15)	0-300	0-15	None	0	None	300 to >1200	0-15	None	0	N/A			

Table 9-2 Description of soil family characteristics

Soil Form/Family	Topsoil Colour	Colour and presence of vertic properties	Occurrence of Lime	Extent of Lithic Weathering	Colour of Neocutanic Horizon	Textural Contrast of Neocutanic Horizon
Swartland 2222(35)	Grey/Bleached	Brown with Vertic Properties	Calcareous Pedocutanic	Geolithic		
Mispah and Glenrosa 3220(15)	Grey/Bleached		Calcareous in Lithic/Hard Rock	Geolithic		
Oakleaf 1110(15)	Dark				Brown	Aluvic

9.3 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.

9.3.1 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 Figure 9-2 and Table 7-4).

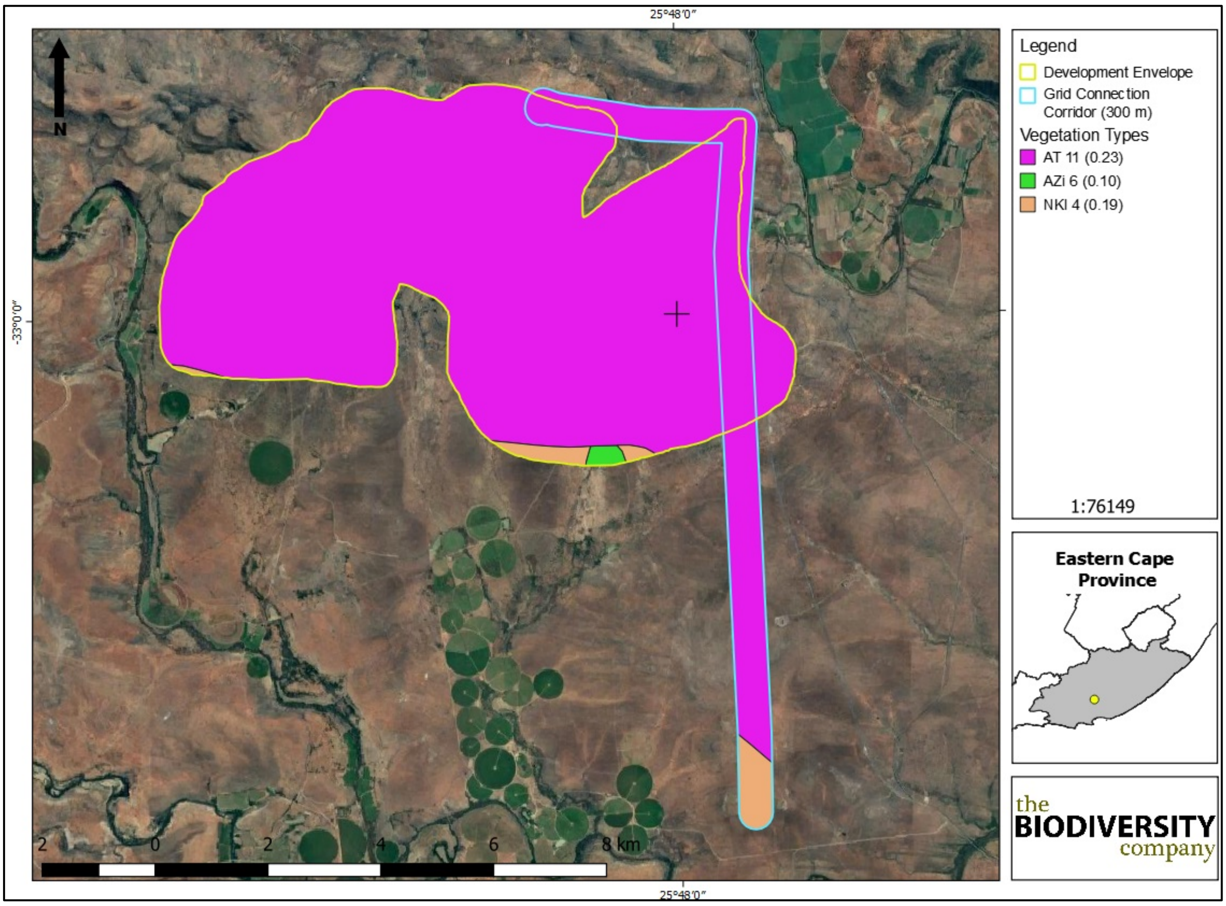


Figure 9-2 Veg type Mean Annual Precipitation/Class A-Pan ratios

Table 9-3 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	0.50-0.75	

		season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.		
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	**AT 11, AZi 6 and NKI 4**

According to Smith (2006), the climatic capability of a region is only refined past the first step (Table 7-4) 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” during the first step for the entire project area, no further refinements will therefore be made.

9.3.2 Land Capability

The land capability has been determined by using the guidelines described in “The farming handbook” (Smith, 2006). The delineated soil forms were clipped into the four different slope classes (0-3%, 3-7%, 7-12% and >12%) to determine the land capability of each soil form. These land capabilities were then grouped together in three different land capability classes (land capability 3, 4 and 6). As per example, the Swartland (between 30 and 50 cm in depth) soil form will classify as a Land Capability (LC) 3 within the first slope class (0-3%), a LC3 in the second class (3-7), a LC4 within the third class (7-12%) and a LC6 in the fourth (>12%) slope class (see Table 9-4).

It is however worth noting, that even though the slope percentage of an area plays a considerable role in the formation and morphology of soil forms, the slope class is not the only parameter used to determine land capability. All parameters listed in Table 9-2 are also used to calculate land capability together with slope percentage. Key parameters used to determine the land capability include topsoil texture, depth and the permeability class of a soil form. The land capabilities for the project area are described in Table 9-5 and illustrated in Figure 9-4.

Table 9-4 Land capability calculations as per the slope classes relevant to the project area for the Swartland soil form (between 30 and 50 cm in depth)

Soil Form	Slope Class	Calculated Land Capability
Swartland (between 30 and 50 cm)	0-3%	LC3
	3-7%	LC3
	7-12%	LC4
	>12%	LC6

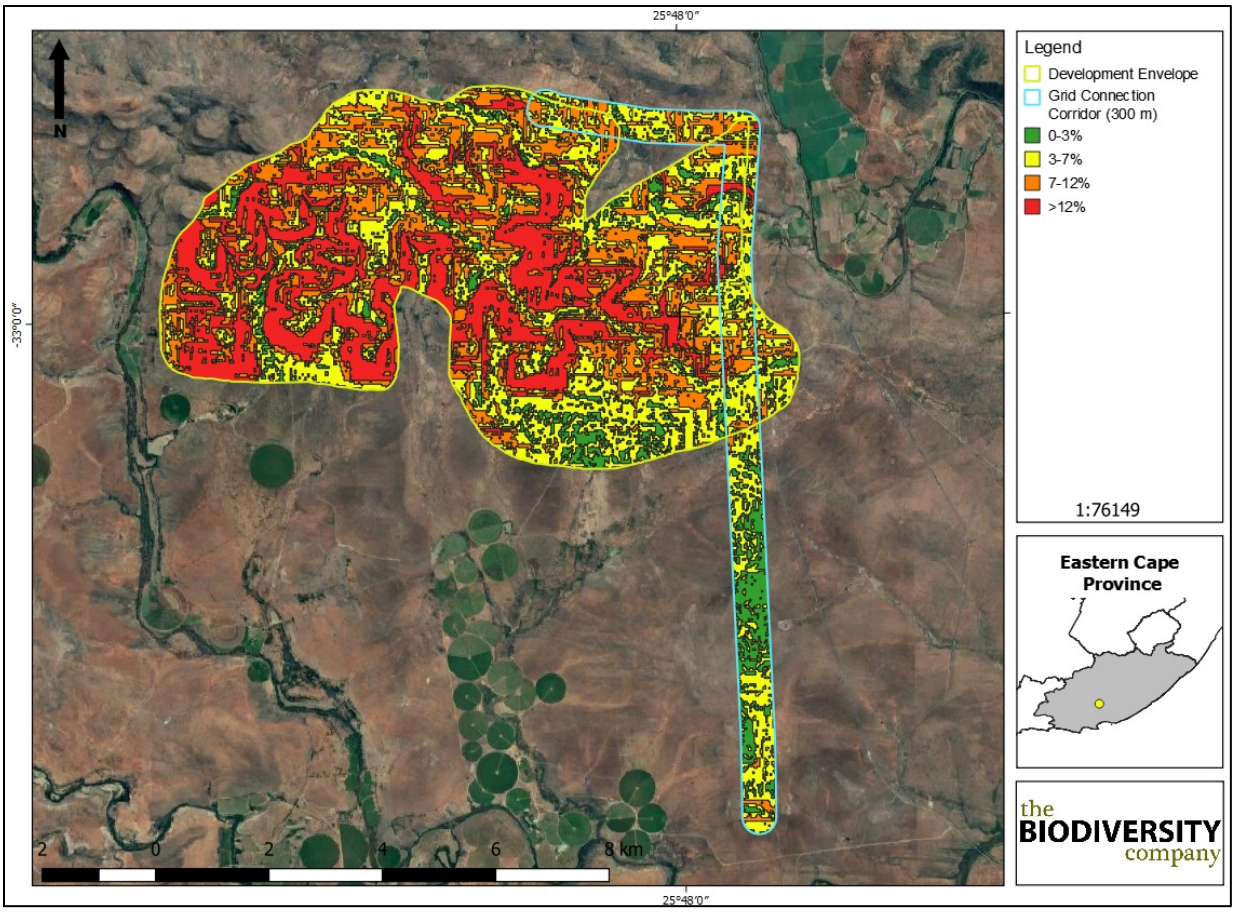


Figure 9-3 Four slope classes relevant to the land capability calculation methodology

Table 9-5 Land capability for the soils within the project area

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage Within Project Area	Land Capability Group	Sensitivity
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	28.9	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	14.3	Arable	Moderate
6	Limitations preclude cultivation. Suitable for perennial vegetation	Protection measures for establishment, e.g. sod-seeding	Veld, pastures and afforestation	56.8	Grazing	Low

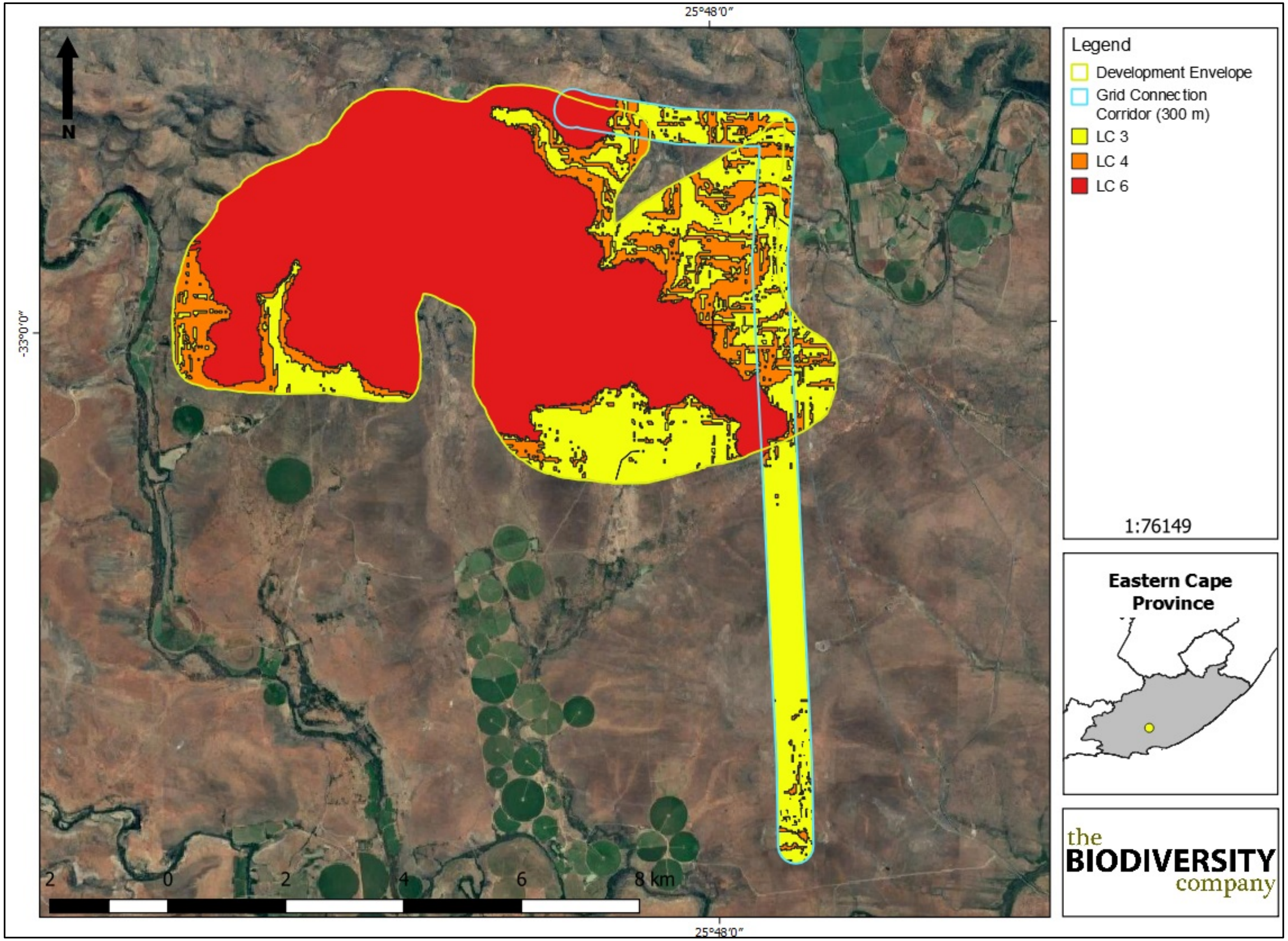


Figure 9-4 Land capability classes for the project area

9.3.3 Land Potential

The methodology in regard to the calculations of the relevant land potential levels are illustrated in Table 9-6 and Table 9-7. From the three land capability classes, two land potential levels have been determined by means of the Guy and Smith (1998) methodology. Land capability III and IV have been reduced to a land potential level L6 with the land capability class 6 being reduced to a land potential level 7 due to the poor climatic capability (see Figure 9-5).

Table 9-6 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 9-7 Land potential for the soils within the project area (Guy and Smith, 1998)

Land Potential	Percentage	Description of Land Potential Class	Sensitivity
6	43.2	**Very restricted potential.** Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low
7	56.8	**Low potential**. Severe limitations due to soil, slope, temperatures or rainfall. Non-arable.	Low

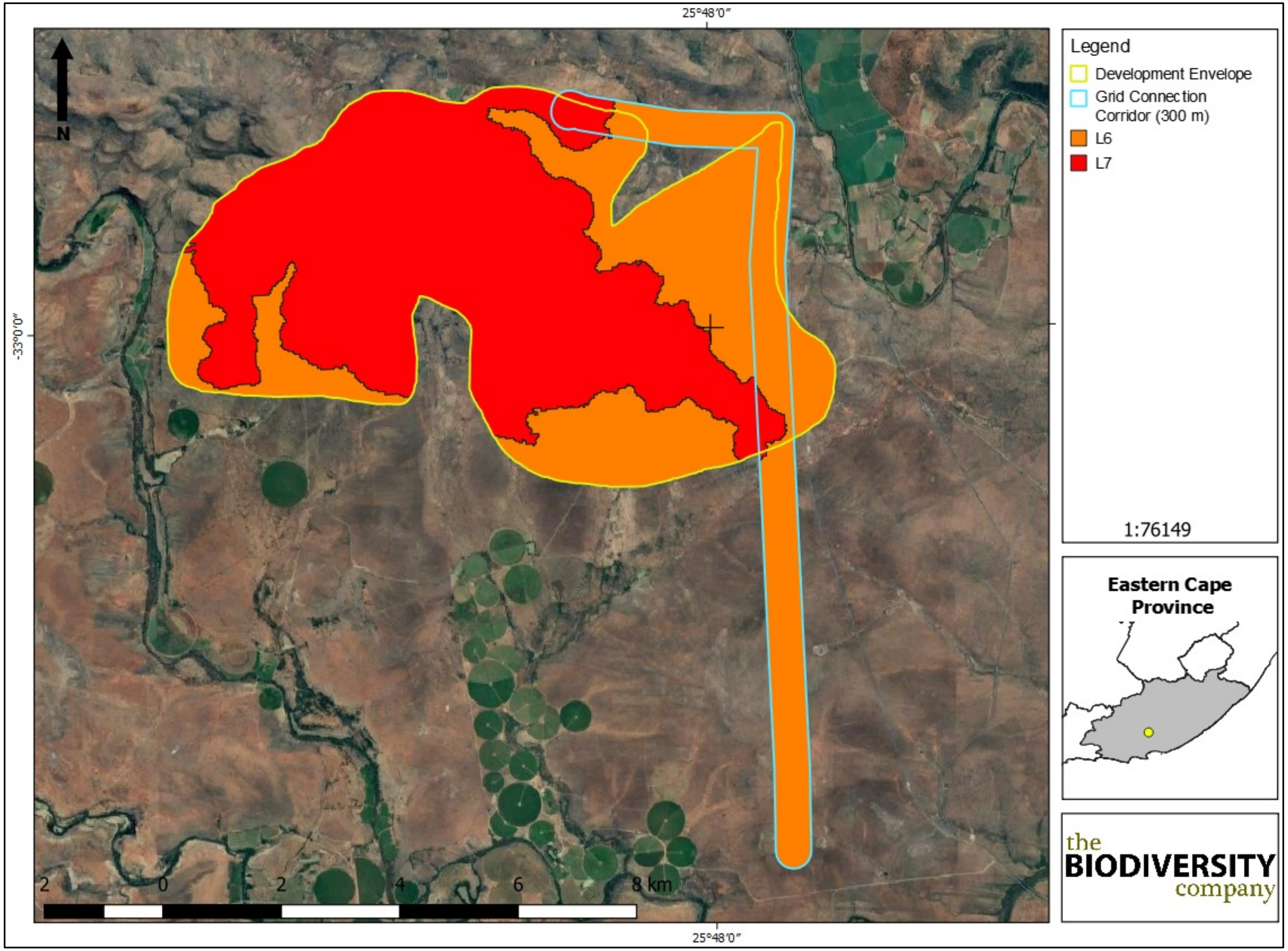


Figure 9-5 Land potential determined for the project area

9.4 Current Land Use

Five different land uses have been identified within the proposed project area, namely "Crop Fields", "Built-Up Areas", "Dams", "Grazing" and "Public Roads" (Figure 9-6). The crop field areas have been provided by the DAFF (2017) national agricultural theme screening tool.

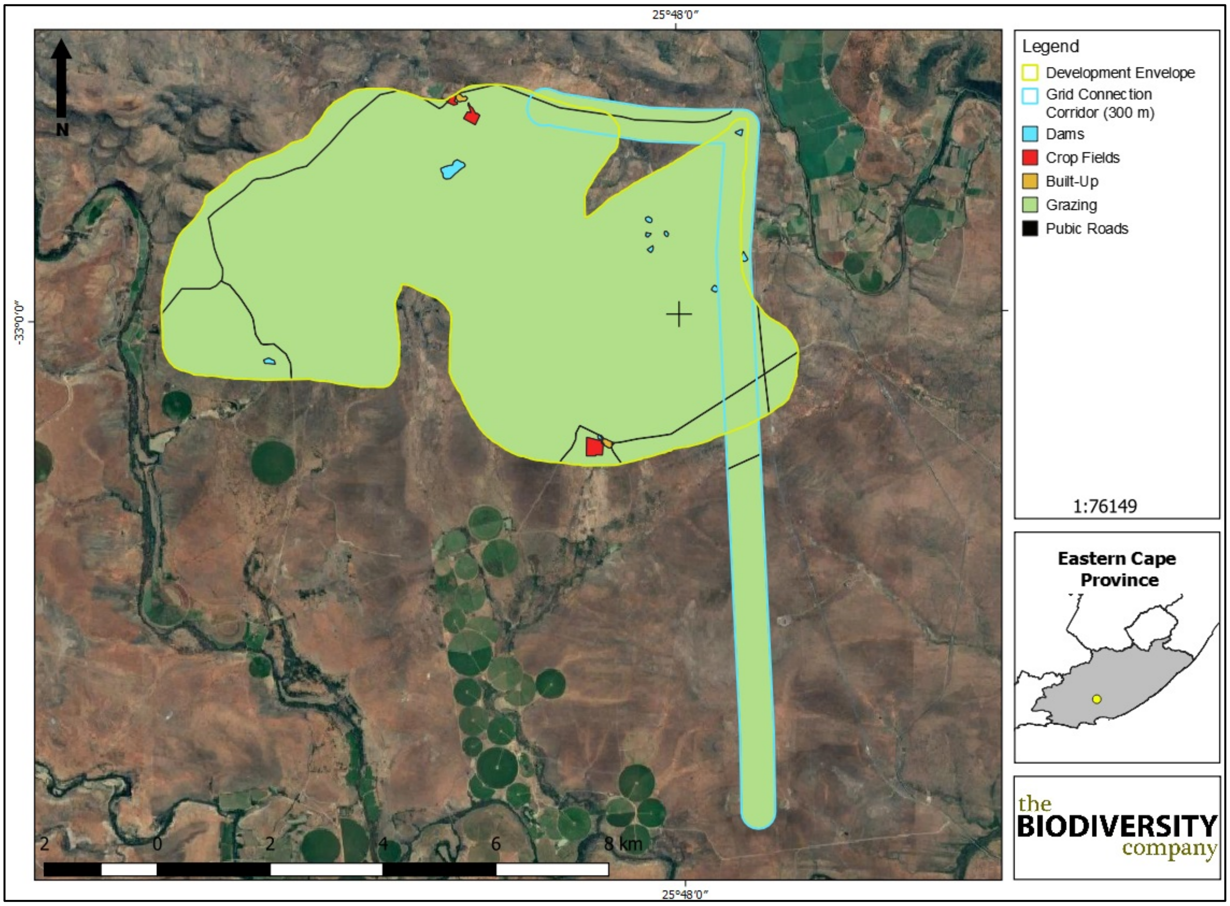


Figure 9-6 Different land uses within the proposed project area

10 Sensitivity Assessment

The agriculture theme sensitivity as indicated in the screening report indicates a combination of “Low”, “Moderate” and “Moderately High” sensitivities (Figure 10-1). Additionally, various crop field areas characterised by “High” sensitivities were identified by means of the DEA screening tool. These patches are located at the northern and-southern-most boundaries of the development envelope.

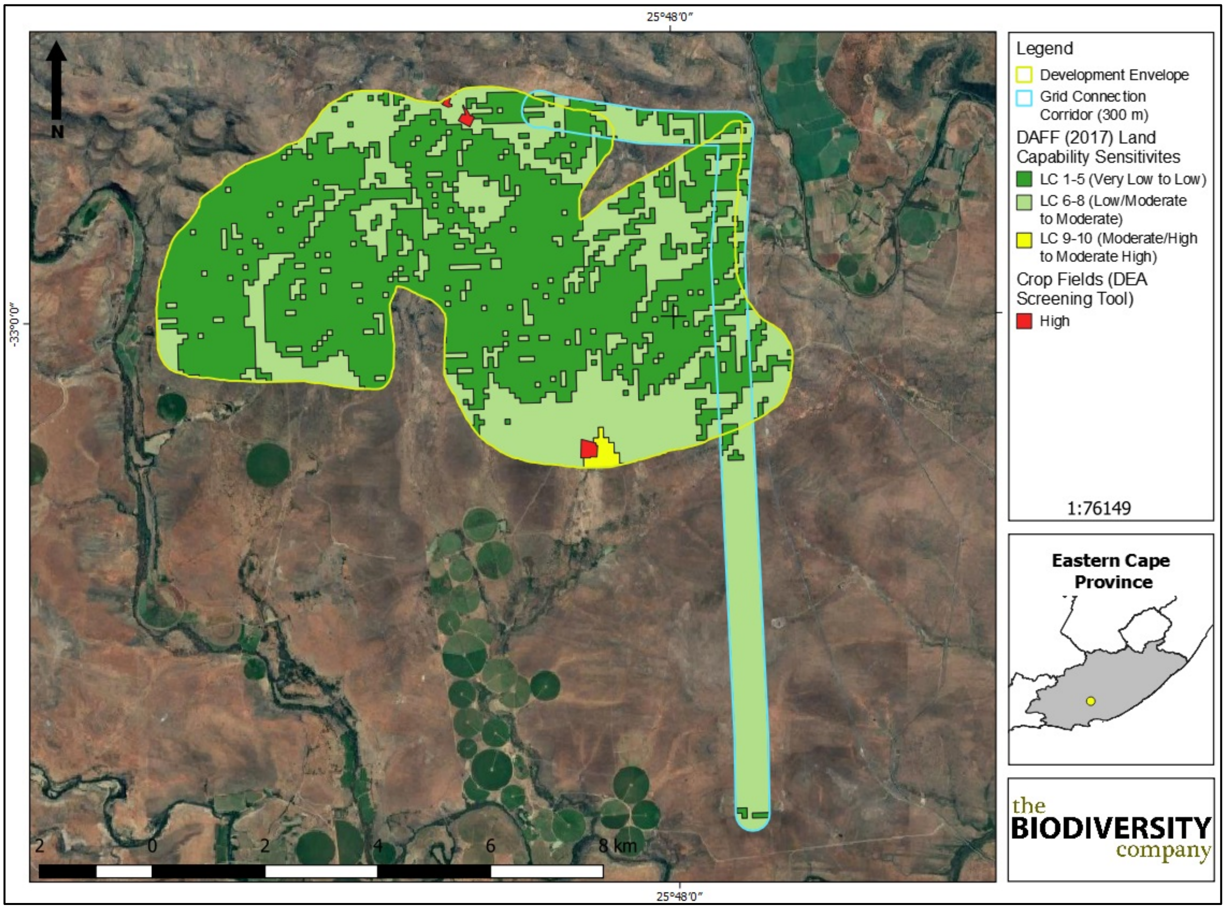


Figure 10-1 DAFF (2017) land capability sensitivity

As per the terms of reference for the project, GIS sensitivity maps are required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area. The sensitivity scores identified during the field survey for the identified land potential levels are illustrated in Figure 10-2. The land potentials determined from baseline findings (see Table 9-7) was used to describe the sensitivity of natural resources within the project area.

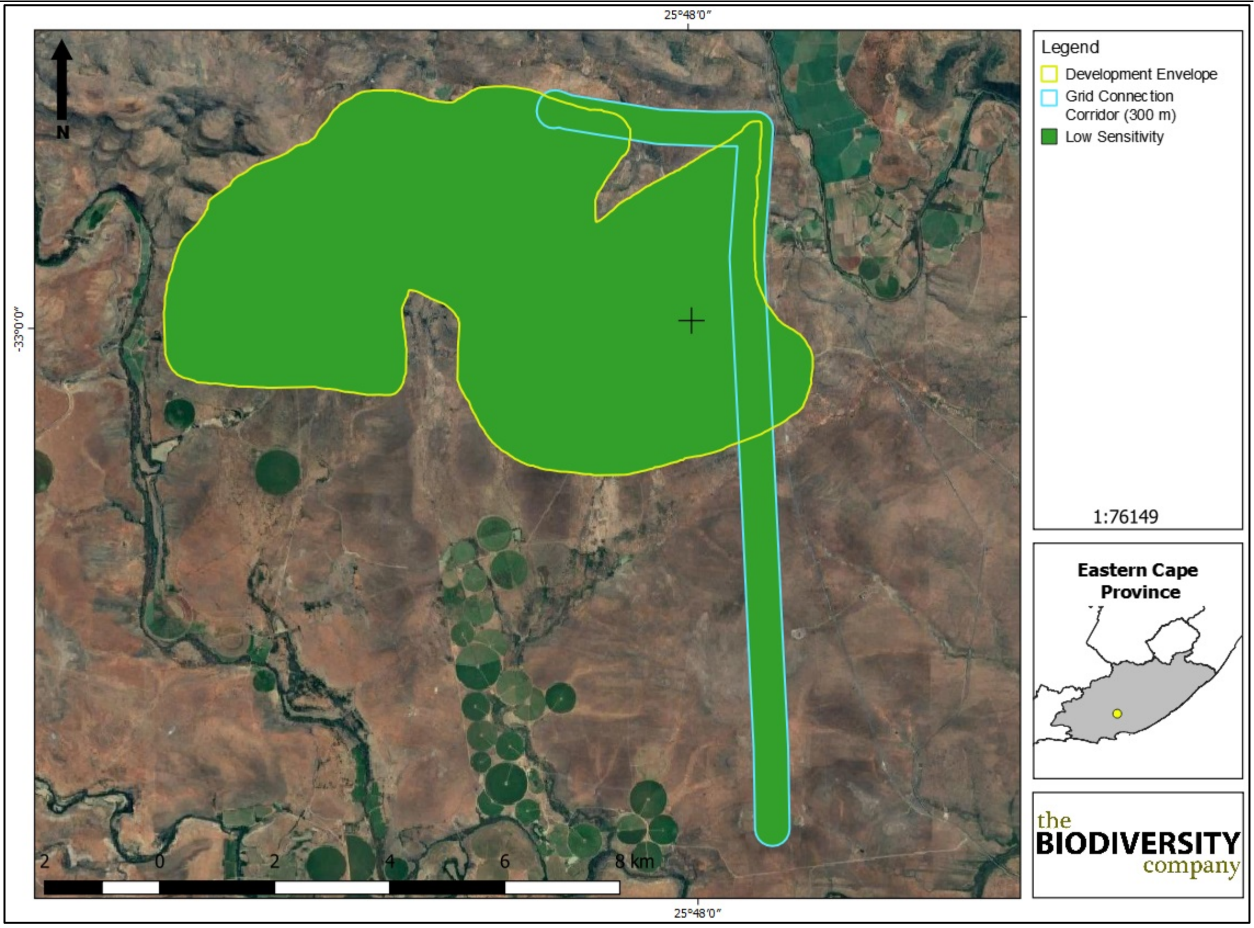


Figure 10-2 Agriculture sensitivity of the project area

11 Impact Statement

All proposed activities are expected to be long term (> 15 years) and have been considered "permanent" on this basis, which renders the decommissioning phase irrelevant. According to the illustration in Figure 11-1, all of the components associated with the Ripponn Wind Farm are located on "Low" sensitivity land potential areas, including;

- Construction and operation of the wind turbines;
- Construction and operation of the Balance of Plant (BoP) area;
- Construction and operation of the power line area;
- Construction and operation of the on-site collector substation; and
- Construction and operation of the access roads.

Only a small portion of the proposed access road will be located within proximity to "High" sensitivity crop fields. It is however worth noting that this portion of the access road will be located on an existing dirt road, which eliminates the potential impacts towards sensitive receptors.

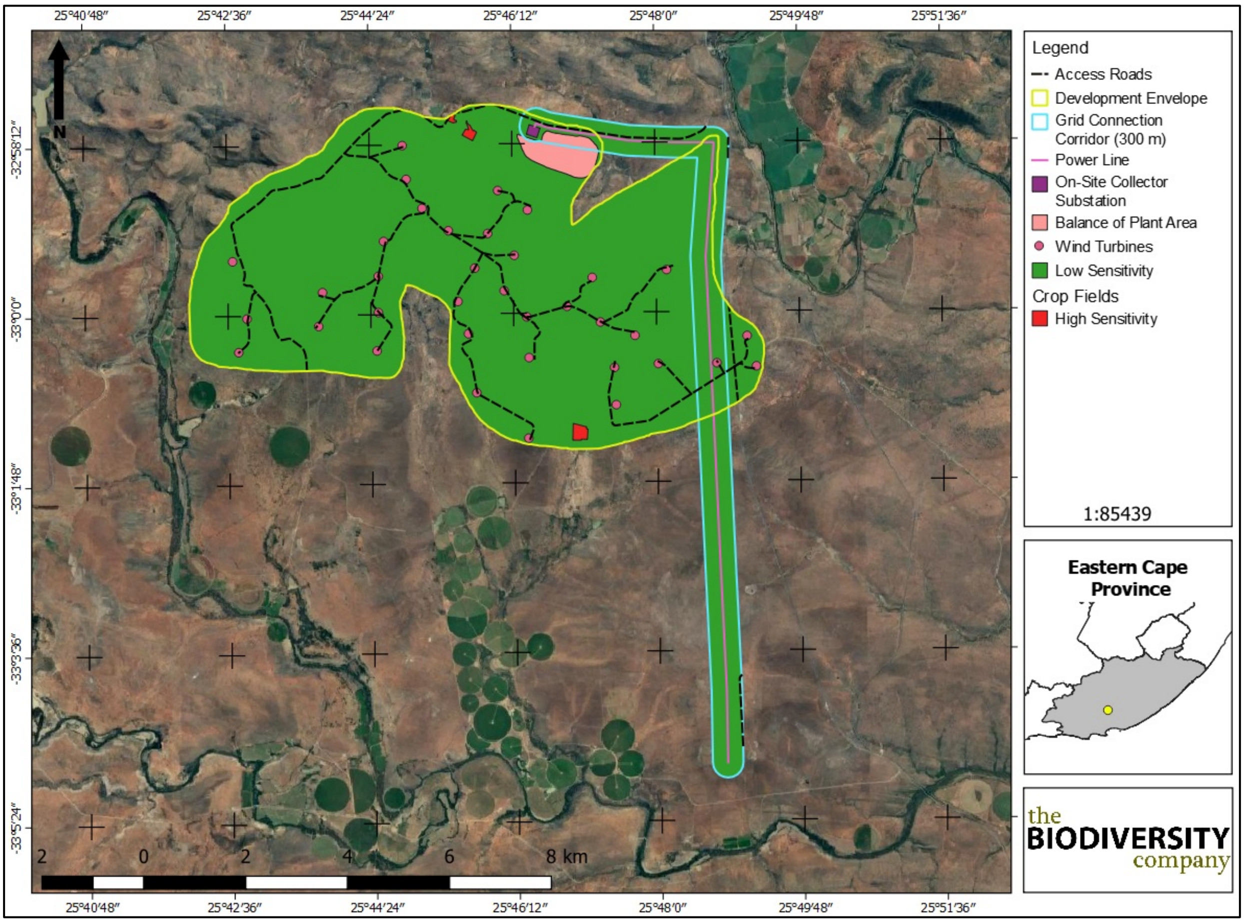


Figure 11-1 Proposed activities within project area

11.1 Balance of Plant and On-Site Collector Substation

The impact statement of the BoP and the on-site collector substation has been combined given the association with similar sensitivities (low sensitivities).

It is the specialist's opinion that the construction and operation of the proposed substation and BoP will have an acceptable impact on the agricultural production capability of the area given the fact that only "Low" sensitivities are associated with these component's footprint areas.

11.2 Wind Turbines

Out of the 36 wind turbines proposed for the Ripponn development envelope, all are located within "Low" sensitivity areas. It is the specialist's opinion that the proposed wind turbines will have an acceptable impact on the agricultural production capability of the area given the fact that only "Low" sensitivities are associated with the footprint areas.

11.3 Linear Activities (Access Roads and Power Line)

The proposed access roads and power line are located within "Low" sensitivity land potential resources. One small portion of the proposed access road will be located within close proximity to "High" sensitivity crop fields. It is however worth noting that this road already is in existence, which eliminates any direct impacts towards sensitive receptors (assuming that the roads won't be widened by more than 2 m on each side). It is the specialist's opinion that the proposed linear activities will have an acceptable impact on the agricultural production capability of the area given the fact that only "Low" sensitivities are associated with the footprint areas.

11.4 Cumulative Impact Statement

Cumulative impacts within the Ripponn Wind Farm project area and its surroundings have been determined to be low. The general condition of the soil resources is predominantly natural. Aside from isolated areas of erosion, limited developments and accompanied anthropogenic activities, no significant degradation of the area is notable. Additionally, considering the low sensitivity of the soil resources in the area, it is the specialist's opinion that no significant impacts are expected in the foreseeable future.

Table 11-1 Impact assessment related cumulative impacts

Nature: Loss of Land Capability and Agricultural Potential		
	Loss of land capability	
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low (2)	Low (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate

Irreplaceable loss of resources?	No	No
Can impact be mitigated	Yes	
Mitigation	Mitigation is possible, but very little will be relevant given the fact that very few impacts on a "Low" sensitivity soil resource is anticipated.	
Residual Impacts	Very few residual impacts are expected.	

11.5 Specialist Opinion

It is the specialist's opinion that the baseline findings concur with the land capabilities identified by means of the DAFF (2017) desktop findings in regard to land capability sensitivities. No "High" land capability sensitivities were identified within proximity to any of the proposed activities. Considering the lack of sensitivity and the measures put in place in regard to stormwater management and erosion control, it is the specialist's opinion that all activities will have an acceptable impact on agricultural productivity. Furthermore, no measures in regard to moving components in their micro-setting were required to avoid or minimise fragmentation and disturbances of agricultural activities.

12 Recommendations and Mitigation

12.1 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 roads are to be used 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;
- Proper invasive plant control must be undertaken quarterly; and
- 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.

12.2 Restoration of Vegetation Cover

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

12.2.1 Ripping Compacted Areas

All areas outside of the footprint areas 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).

12.2.2 Revegetate Degraded Areas

Vegetation within the footprint areas will be cleared to accommodate the excavation activities coupled with the proposed footprint areas' 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 amount of seed should be limited to ensure that competition between plants are 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.*

12.3 Specialist Recommendation

The proposed activities may proceed as have been planned without the concern of loss of high sensitivity land capabilities or agricultural productivity

13 Conclusion

Various soil forms were identified within the Ripponn Wind Farm project area, namely Swartland, Glenrosa, Mispah and Oakleaf. These soil forms were determined to be associated with three different land capabilities, namely LCIII, LCIV and LCVI. These land capability classes were then further refined to land potential levels by comparing land capability of climatic capabilities of the project area. Two land potential levels were then calculated, namely L6 and L7.

These land potential levels were used to determine the sensitivities of soil resources. Together with sensitive agricultural fields determined by means of the DEA screening tool, only "Low" sensitivities were determined with a scattered patches of "High" sensitivity crop fields. It is worth noting that no development is expected to have an impact on these areas. 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 should proceed as have been planned.

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Appendix C- Western Sites Soil Observations

			Topsoil			Subsoil			Restricting Layer	Geographic Information
Observation	**Transect**	**Soil Form**	**Type**	**Depth (cm)**	**Texture**	**Type**	**Depth (cm)**	**Texture**	**Depth (cm)**	**TMU**
W1	-	Glenrosa	Orthic	5	Granular	Lithic	15	Granular	20	1
W2	-	Sterkspruit	Orthic	5	Granular	Prismacutanic	115	Angular	-	5
W3	-	Swartland	Orthic	10	Granular	Pedocutanic	35	Sub Angular	45	3
W4	-	Swartland	Orthic	5	Granular	Pedocutanic	30	Sub Angular	35	5
W5	-	Mispah	Orthic	15	Granular	-	-	-	15	1
W6	1	Swartland	Orthic	5	Granular	Pedocutanic	50	Sub Angular	55	5
W7	1	Swartland	Orthic	5	Granular	Pedocutanic	40	Sub Angular	45	4
W8	1	Mispah	Orthic	5	Granular	-	-	-	5	3
W9	1	Mispah	Orthic	15	Granular	-	-	-	15	3
W10	-	Glenrosa	Orthic	5	Granular	Lithic	10	Sub Angular	15	1
W11	-	Swartland	Orthic	7	Granular	Pedocutanic	20	Angular	27	3
W12	-	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Angular	-	4
W13	2	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Sub Angular	-	5
W14	2	Mispah	Orthic	5	Granular	-	-	-	5	5
W15	2	Mispah	Orthic	10	Granular	-	-	-	10	3
W16	3	Mispah	Orthic	5	Granular	-	-	-	5	1
W17	3	Mispah	Orthic	5	Granular	-	-	-	5	1
W18	3	Swartland	Orthic	5	Granular	Pedocutanic	15	Sub Angular	20	3

W19	3	Swartland	Orthic	5	Granular	Pedocutanic	20	Sub Angular	25	4
W20	-	Valsrivier	Orthic	10	Granular	Pedocutanic	110	Sub Angular	-	4
W21	4	Mispah	Orthic	5	Granular	-	-	-	5	5
W22	4	Glenrosa	Orthic	5	Granular	Lithic	10	Angular	15	1
W23	4	Glenrosa	Orthic	5	Granular	Lithic	10	Sub Angular	15	3
W24	4	Valsrivier	Orthic	13	Granular	Pedocutanic	107	Sub Angular	-	4
W25	-	Mispah	Orthic	5	Granular	-	-	-	5	1
W26	-	Mispah	Orthic	5	Granular	-	-	-	5	3
W27	-	Swartland	Orthic	10	Granular	Pedocutanic	30	Sub Angular	33	4
W28	-	Mispah	Orthic	10	Granular	-	-	-	10	1
W29	-	Swartland	Orthic	10	Granular	Pedocutanic	30	Sub Angular	40	4
W30	-	Swartland	Orthic	5	Granular	Pedocutanic	25	Sub Angular	30	3
W31	5	Swartland	Orthic	5	Granular	Pedocutanic	60	Sub Angular	65	5
W32	5	Swartland	Orthic	5	Granular	Pedocutanic	40	Sub Angular	45	4
W33	5	Swartland	Orthic	5	Granular	Pedocutanic	30	Sub Angular	35	3
W34	5	Swartland	Orthic	7	Granular	Pedocutanic	20	Sub Angular	27	3
W35	5	Valsrivier	Orthic	15	Granular	Pedocutanic	110	Sub Angular	-	5
W36	-	Sterkspruit	Orthic	15	Granular	Prismacutanic	110	Angular	-	5
W37	6	Swartland	Orthic	5	Granular	Pedocutanic	25	Sub Angular	30	3
W38	6	Swartland	Orthic	10	Granular	Pedocutanic	20	Sub Angular	30	3
W39	6	Glenrosa	Orthic	10	Granular	Lithic	15	Sub Angular	35	1
W40	6	Glenrosa	Orthic	5	Granular	Lithic	10	Sub Angular	15	3

W41	6	Glenrosa	Orthic	10	Granular	Lithic	15	Sub Angular	25	4
W42	6	Oakleaf	Orthic	15	Granular	Neocutanic	115	Sub Angular	-	4
W43	-	Swartland	Orthic	10	Granular	Pedocutanic	25	Sub Angular	45	1
W44	-	Swartland	Orthic	5	Granular	Pedocutanic	20	Granular	35	1
W45	-	Glenrosa	Orthic	5	Granular	Lithic	10	Sub Angular	15	3
W46	-	Sterkspruit	Orthic	10	Granular	Prismacutanic	110	Angular	-	5
W47	-	Valsrivier	Orthic	10	Granular	Pedocutanic	110	Sub Angular	-	5
W48	-	Swartland	Orthic	5	Granular	Pedocutanic	30	Sub Angular	55	3
W49	-	Swartland	Orthic	10	Granular	-	-	-	10	1
W50	-	Oakleaf	Orthic	15	Granular	Neocutanic	105	Granular	-	5
W51	-	Glenrosa	Orthic	10	Granular	Lithic	15	Granular	25	3
W52	-	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Sub Angular	-	5
W53	7	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Sub Angular	-	4
W54	7	Glenrosa	Orthic	5	Granular	Lithic	15	Sub Angular	20	3
W55	7	Glenrosa	Orthic	5	Granular	Lithic	10	Subangular	15	1
W56	7	Mispah	Orthic	5	Granular	-	-	-	5	3
W57	7	Glenrosa	Orthic	10	Granular	Lithic	10	Sub Angular	20	1
W58	-	Glenrosa	Orthic	10	Granular	Lithic	15	Sub Angular	25	3
W59	-	Sterkspruit	Orthic	15	Granular	Prismacutanic	105	Angular	-	5
W60	-	Glenrosa	Orthic	10	Granular	Lithic	10	Granular	20	3
W61	-	Swartland	Orthic	5	Granular	Pedocutanic	15	Sub Angular	25	3
W62	-	Mispah	Orthic	5	Granular	-	-	-	5	1

W63	-	Glenrosa	Orthic	5	Granular	Lithic	15	Sub Angular	20	3
W64	-	Glenrosa	Orthic	5	Granular	Lithic	15	Sub Angular	20	3
W65	-	Mispah	Orthic	10	Granular	-	-	-	10	1
W66	-	Mispah	Orthic	10	Granular	-	-	-	10	1
W67	-	Mispah	Orthic	10	Granular	-	-	-	10	1
W68	-	Swartland	Orthic	5	Granular	Pedocutanic	10	Sub Angular	25	1
W69	-	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Sub Angular	-	4
W70	8	Swartland	Orthic	5	Granular	Pedocutanic	20	Angular	30	4
W71	8	Swartland	Orthic	5	Granular	Pedocutanic	10	Sub Angular	25	3
W72	8	Mispah	Orthic	10	Granular	-	-	-	10	1
W73	8	Swartland	Orthic	5	Granular	Pedocutanic	17	Granular	30	3
W74	-	Valsrivier	Orthic	15	Granular	Pedocutanic	105	Sub Angular	-	5
W75	-	Swartland	Orthic	15	Granular	Pedocutanic	20	Sub Angular	25	4
W76	-	Swartland	Orthic	10	Granular	Pedocutanic	20	Sub Angular	30	3
W77	-	Swartland	Orthic	5	Granular	Pedocutanic	30	Sub Angular	35	4
W78	-	Swartland	Orthic	10	Granular	Pedocutanic	50	Sub Angular	70	4
W79	-	Swartland	Orthic	15	Granular	Pedocutanic	50	Sub Angular	85	4
W80	-	Swartland	Orthic	20	Granular	Pedocutanic	40	Sub Angular	75	5

Appendix D- Site Assessment Methodology

14.1 Digital Soil Mapping

The following sections are relevant to the DSM approach used for this assessment.

14.1.1 Terrain Analyses

The first step in creating a digital soil map for a large project area is to conceptualise the landscape. To achieve this objective the national land type dataset was overlain over both project areas as seen in Figure 14-1 and Figure 14-2 respectively. The land type dataset partitions South Africa into homogenous land units. A specific land type therefore indicates specific soils found within that land type.

Figure 14-1 illustrates the land types found in the Eastern project area which contained a total of 8 different land types. Fa, Fb and Fc land types are dominated by Mispah and Glenrosa soils, with or without lime rich soils depending on the specific land type. It must be noted that the land type database was and should be used as an indication of possible soils present in the landscape. Large variation however occurs between actual soil observations and the land type soils.

Both project areas were subjected to an additional comprehensive terrain analyses which included profile curvature, slope curvature, planform curvature and digital elevation analyses using the Soil Land Inference Model (SoLIM). Figure 14-3 and Figure 14-4 illustrates an example of the type of terrain analyses generated for the Western and Eastern project areas respectively.

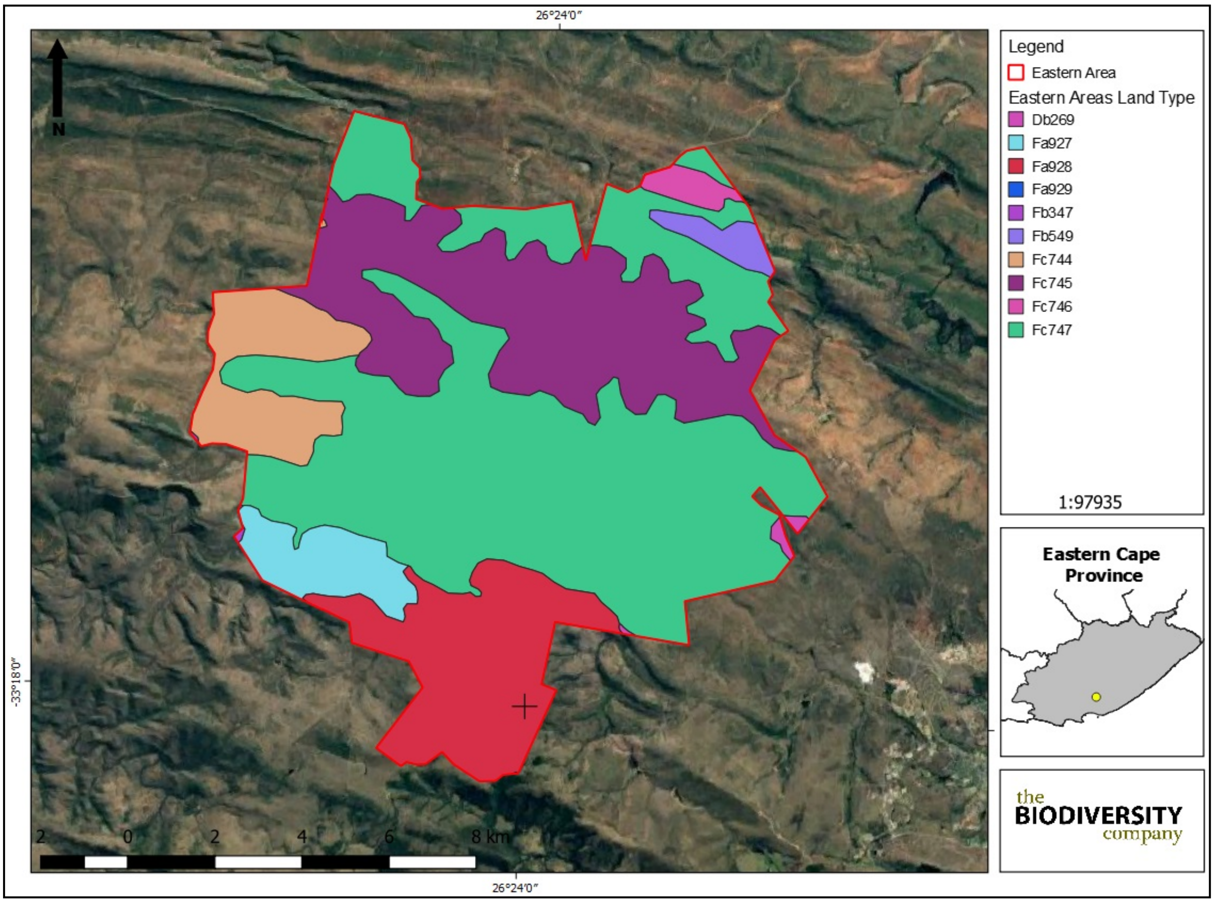

Figure 14-1 Land types located within the Eastern portion of the Wind Farm project areas

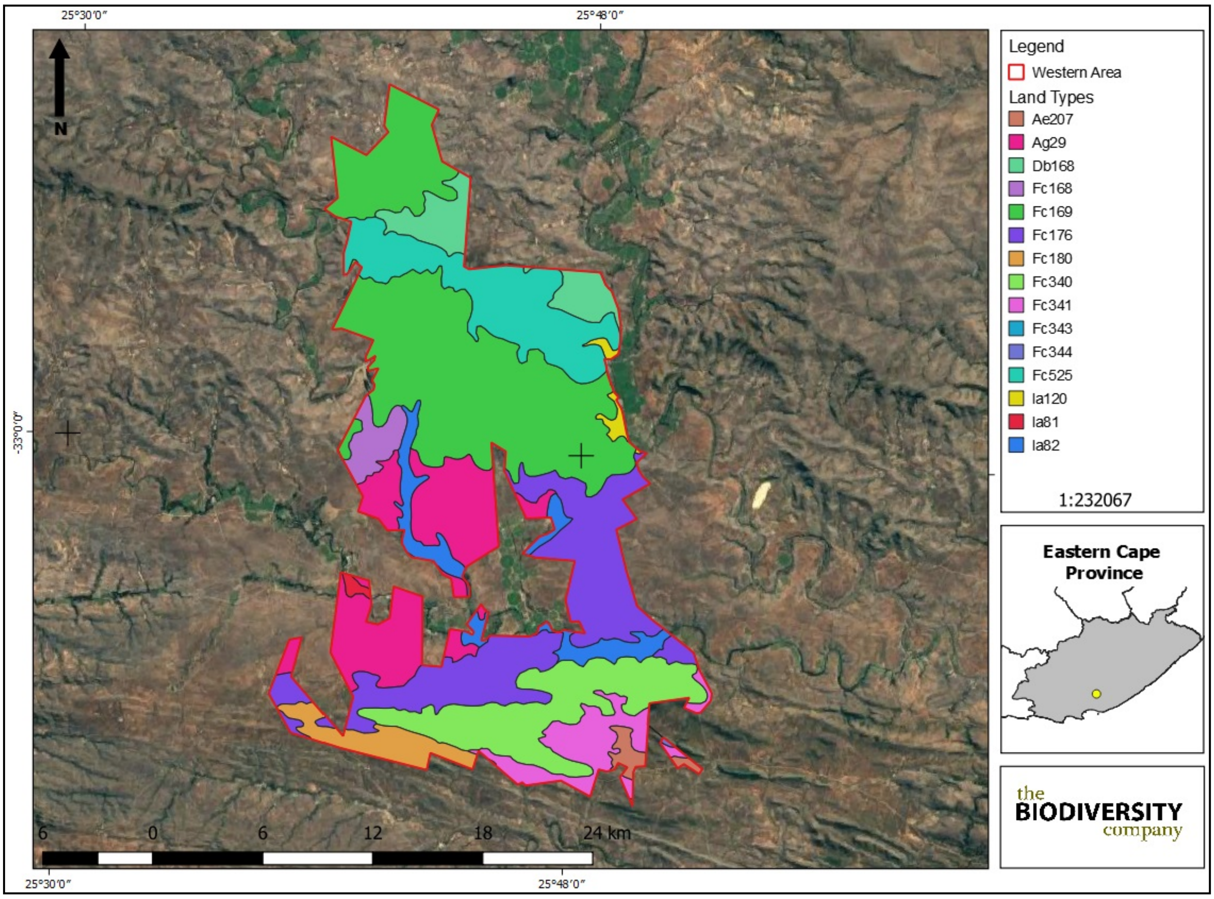

Figure 14-2 Land types located within the Western portion of the Wind Farm project areas

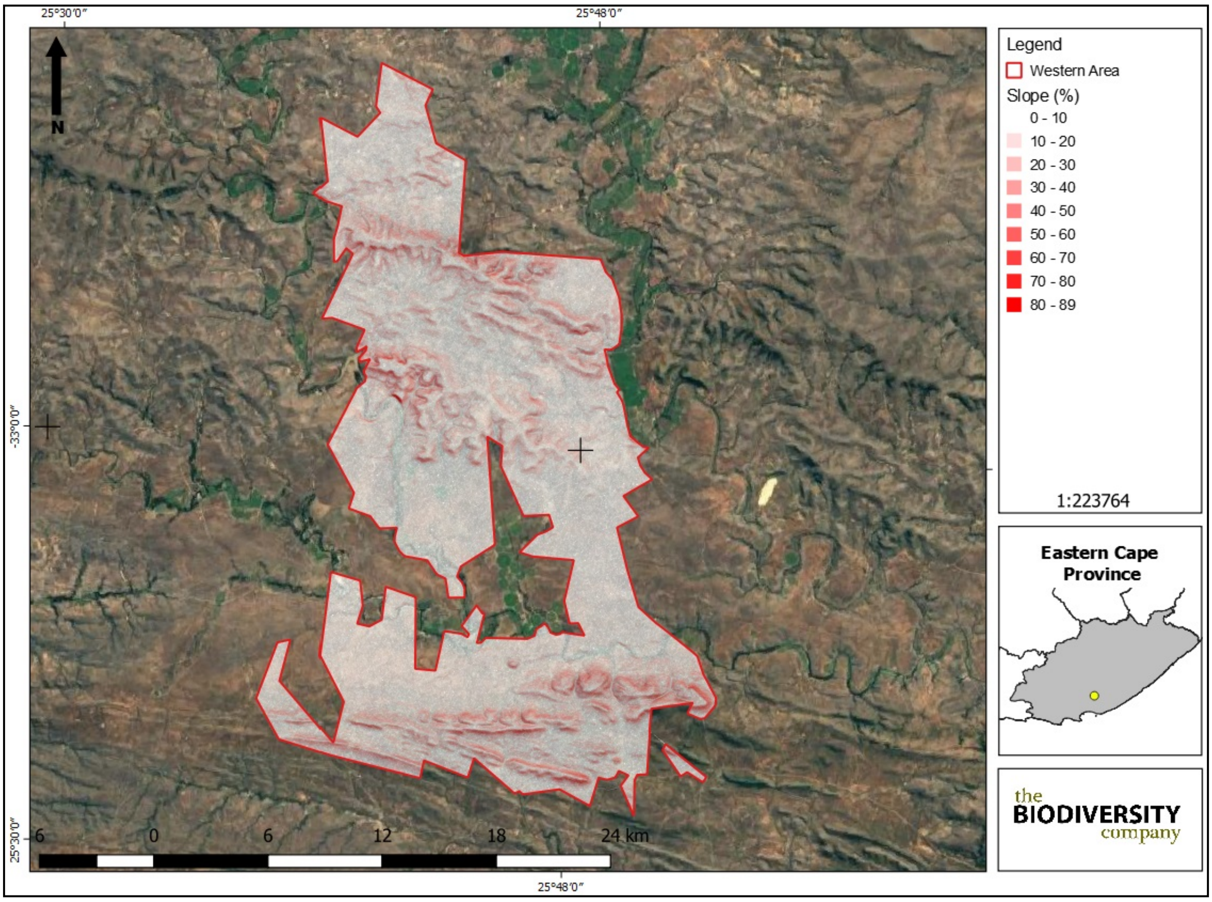

Figure 14-3 Slope analyses of the Western project area

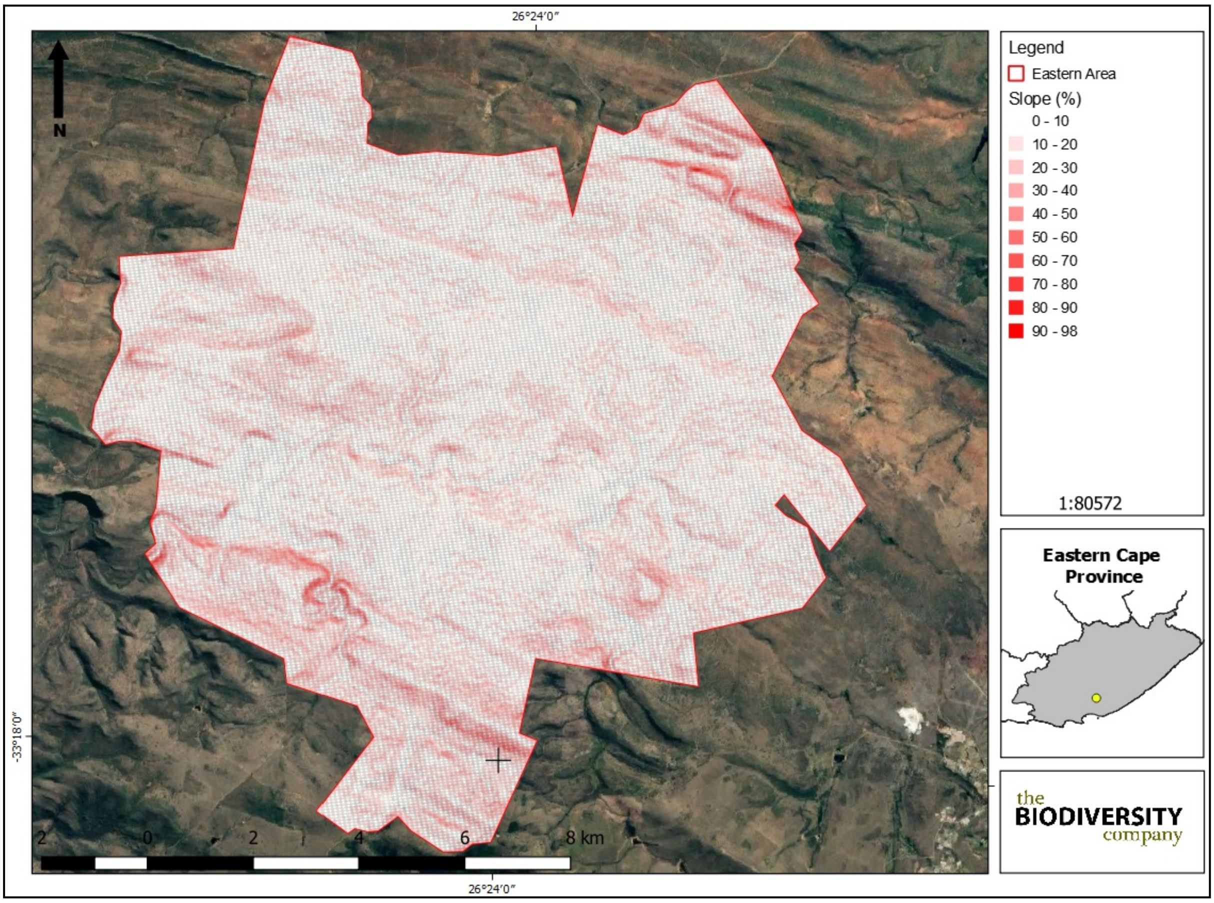

Figure 14-4 Slope analyses of the Eastern project area

The western landscape contains 15 different land types with Fc land types once again dominating the landscape. An Ag land type also occurs which is indicative of shallow freely drained soils less than 30 cm deep. The Little Fish River also flows through the Western project area, where alluvial soils dominate the river terraces.

The land type database therefore indicates a large amount of shallow Mispah and Glenrosa soils present within the western and eastern landscapes. Each land type is further partitioned into different terrain morphological units (TMUs) namely TMU 1 (Hillcrest), TMU 3 (Mid slope), TMU 4 (Foot slope) and TMU 5 (Valley bottom). The land type database then proposes the possibility in percentage of certain soils occurring within a specific TMU. The shallow Mispah and Glenrosa soils were therefore indicated to be located within the TMU 1 and TMU 3 positions. The concave TMU 4 and TMU 5 positions were indicated to contain a wide variety of deeper soils ranging from Neocutanic subsoils to more clayey Prisma cutanic and Pedocutanic subsoils.

Once the complete terrain analyses of each study was generated, a purposive sampling method was chosen for both project areas.

14.1.2 Sampling Method

The specific sampling method used is based on the TMUs present within the two project areas. As one of the key soil forming factors, topography plays a large role in how and where different soils form in a landscape. Therefore, soil observations were made at TMU 1, TMU 3, TMU 4 and TMU 5 positions given the difference in profile curvature, slope and planform curvature values.

Soil observations were made in a transect fashion as well as single random observations. The transect method enabled the researcher to gain valuable insight into the soil sequence found within a specific catena. Various transects from various land types enabled the researcher to understand the distribution of different soils within the project areas as a whole, based on the above-mentioned parameters. The single random observation sites served as a valuable in-field validation method for the transects. If a random observation differed at a certain TMU from the transects, further observations and considerations were required to conceptualise the catena sequence.

14.1.3 Soil Observations

A study of the soils present within the project area was conducted during a field visit from the 3rd to the 15th of August 2020. The site was traversed by vehicle and 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 1,2 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 were also helpful in determining soil types and depth.

At each observation site the GPS coordinates were noted as well as the soil family, transect number and TMU position. Additionally, the topsoil and subsoil type, depth and texture were all noted as well as the depth of the restricting layer if present.

A total of 53 soil observations were made in the Eastern project area, which mostly consisted of random soil observations at each TMU as well as 6 major hillslope transects. A total of 80 observations were made in the Western project area with a total of 8 major hillslope transects dissected. As these two project areas do not differ greatly in various soil forming factors such as topography, climate, and organisms, key soil forming principles could be extrapolated from one project area to the next. All coordinates, physical parameters and soil morphological information relevant to all soil observations are listed from Appendix A to Appendix D.