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Agricultural Agro-Ecosystem Assessment for the proposed Scafell Cluster Grid Connections

Submitted by TerraAfrica Consult cc

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22 September 2021

DOCUMENT AND QUALITY CONTROL

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Draft for Comment	Mariné Pienaar	Report Author		22/09/2021

Specialist Declaration

I, Mariné Pienaar , 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 48 and is punishable in terms of section 24F of the Act.

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Mariné Pienaar

TerraAfrica Consult CC

22 September 2021

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1. Introduction

Terra-Africa Consult cc was appointed by SLR Consulting (South Africa) (Pty) Ltd (SLR) to conduct the Agricultural Agro-Ecosystem Assessment for the proposed grid connections of the Scafell Cluster project. The Scafell Cluster project site is located around 19 km north-east of Parys and 19 km west of Sasolburg (refer to Figure **1**) and falls within Ward 7 of the Ngwathe Local Municipality of the Free State Province. Access to the grid connection areas are provided via unnamed gravel roads that connect to the Boundary Road at the Vaal Eden intersection.

The project will consist of four PV facilities that range in their contracting capacity between 75MWac and 150MWac as well as four grid connections. The report is part of the studies required for the Basic Assessment process required for the Environmental Authorisation (EA) of renewable energy projects. The applicant of the project is South Africa Mainstream Renewable Power Developments (Pty) Ltd.

The proposed grid connections consist of four on-site substations (each located within the project site of a PV facility) as well as 132kV power lines that will connect each of these substations to the Scafell Main Transmission Substation (MTS) (see Figure **2**). All the corridors assessed are 150 m wide and between 0.9 and 3.0 km long. For each of the project grid connection corridors, two alternative layouts are provided by the applicant for consideration of the environmental sensitivities. The four grid connection projects are referred to as:

- Damlaagte Grid Connection
- Scafell Grid Connection
- Vlakfontein Grid Connection
- Ilikwa Grid Connection

The site falls within an area that has been identified as the Central Strategic Transmission Corridor, a node for the development and expansion of large-scale electricity and grid connection infrastructure, i.e., power lines and substations, etc.

2. Details of the specialist

Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10. Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand. She has consulted in the subject fields of soil, agriculture, pollution assessment and land use planning for the environmental sector of several African countries including Botswana, Mozambique, Democratic Republic of Congo, Liberia, Ghana and Angola. She has also consulted on the soil and agricultural assessment of a gas infrastructure project in Afghanistan. Her contact details are provided in Appendix 1 attached.

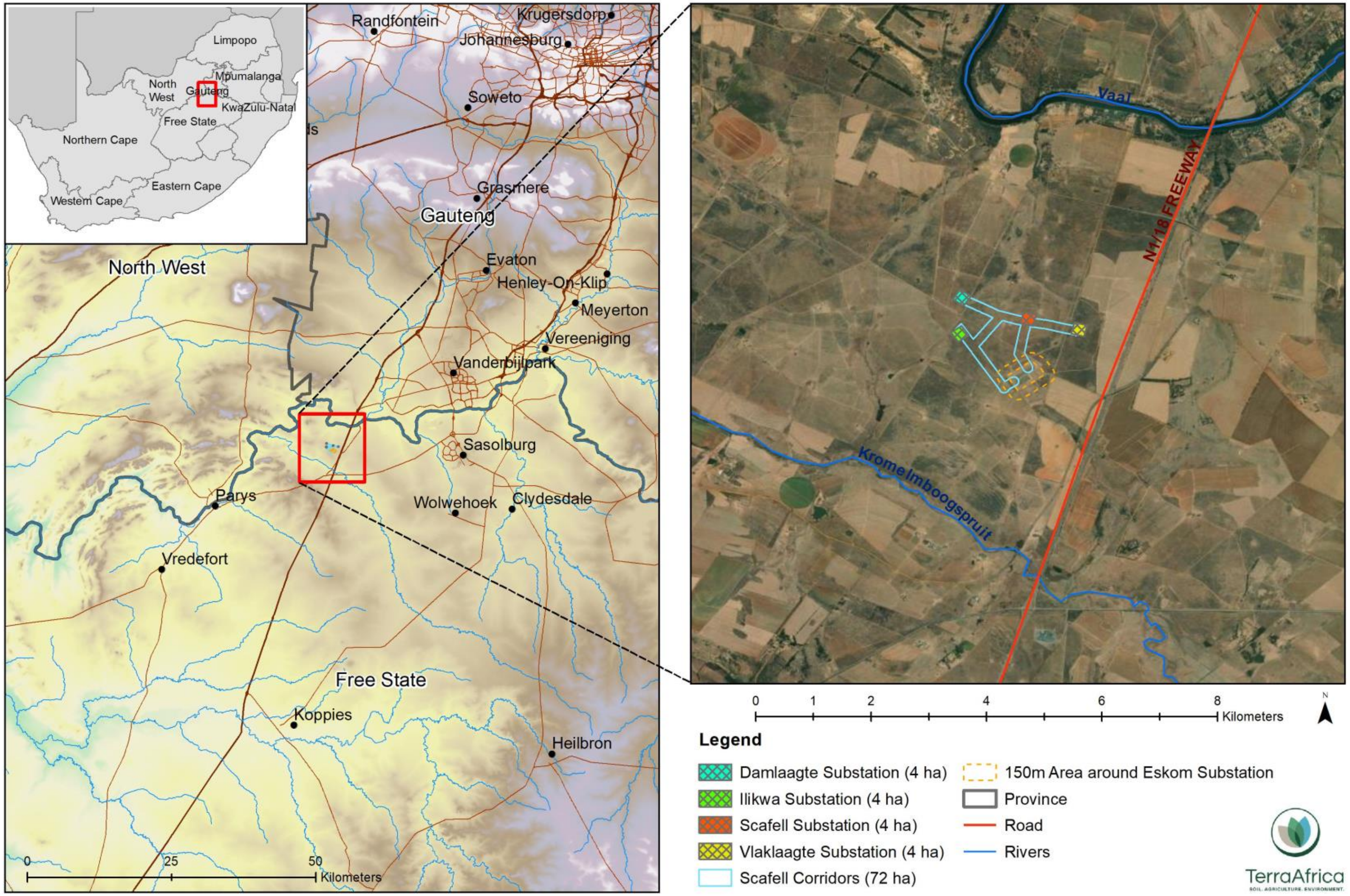

Figure 1 Locality of the proposed Scafell Cluster grid connection corridors

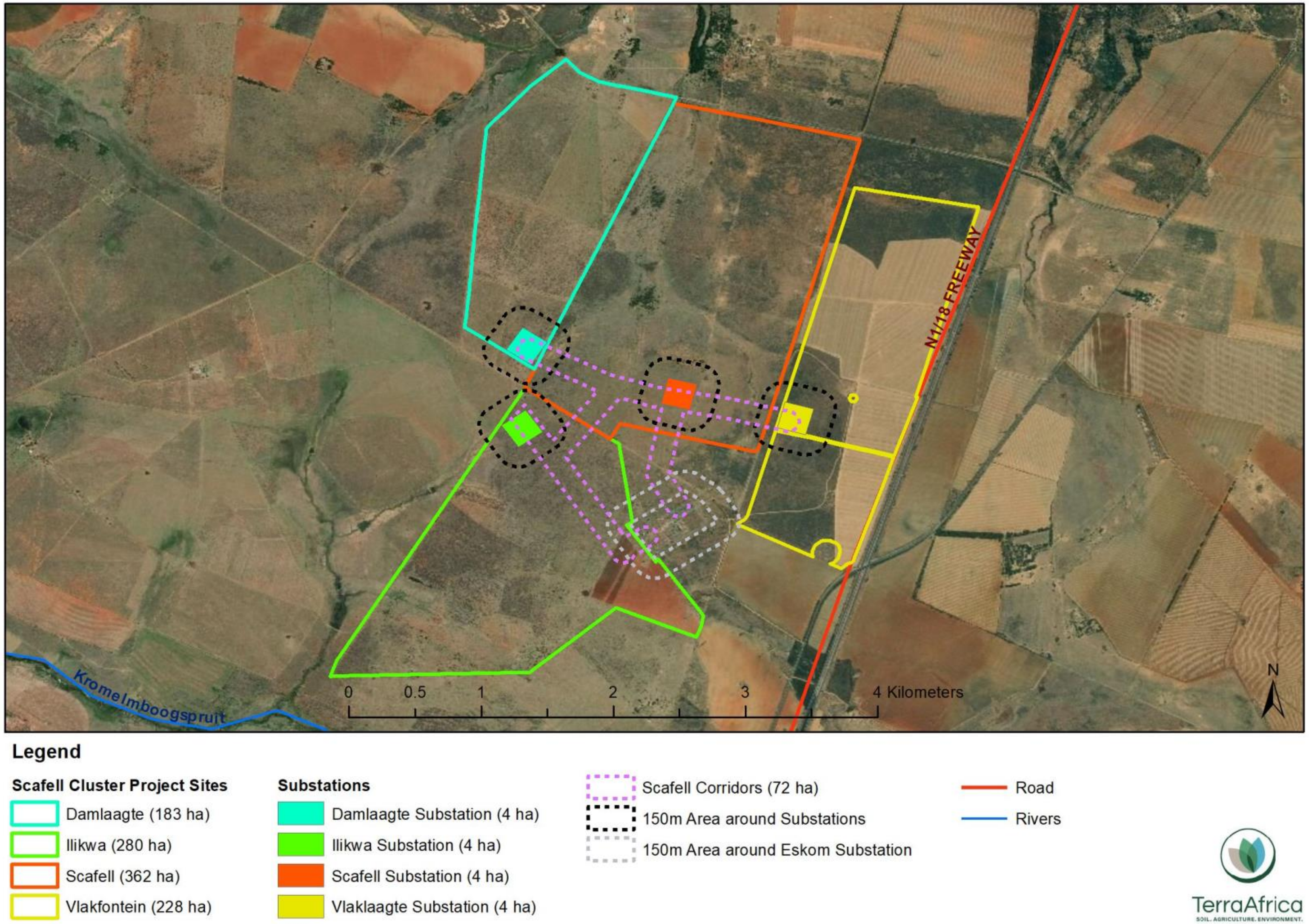

Figure 2: Position of the Scafell grid connection corridors in relation to the other project sites of the proposed Scafell Cluster project

3. Purpose and objectives of the assessment

The overarching purpose of the Agricultural Agro-Ecosystem Specialist Assessment (from here onwards also referred to as the Agricultural Assessment) that will be included in the final Environmental Impact Assessment Report, is to ensure that the sensitivity of the site to the proposed land use change (from agriculture to renewable energy generation) is sufficiently considered. Also, that the information provided in this report, enables the Competent Authority to come to a sound conclusion on the impact of the proposed project on the food production potential of the site.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the Environmental Impact Assessment report for the proposed Scafell Solar PV Facility.

According to GN320, the Agricultural Agro-Ecosystem Assessment that is submitted must meet the following requirements:

- It must identify the extent of the impact of the proposed development on the agricultural resources.
- It has to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.

The following checklist is supplied as per the requirements of GNR 320, detailing where in the report the various requirements have been addressed:

GNR 320 requirements of an Agricultural Agro-Ecosystem Statement (High to Very High Sensitivity)	**Reference in this report**
Details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vitae;	Page ii and Appendix 1
A signed statement of independence by the specialist;	Page ii
The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 6.2
A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant;	Section 6.2
A map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;	Section 5, Figure **12**

An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development;	Section 10
An indication of possible long term benefits that will be generated by the project in relation to the benefits of the agricultural activities on the affected land;	Section 10.2
Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc.;	Section 12
Information on the current agricultural activities being undertaken on adjacent land parcels;	Section 9.4
A motivation must be provided if there were development footprints that were identified as having a "medium" or "low" agriculture sensitivity and that were not considered appropriate;	Sections 11.1 and 11.2
Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;	Section 11
A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development;	Section 14
Any conditions to which this statement is subjected;	Sections 12 and 14
Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr);	Section 13
A description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 7
Calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development (including supporting infrastructure);	**Error! Reference source not found.**
Confirmation whether the development footprint is in line with the allowable development limits set in Table 1 above, including where applicable any deviation from the set development limits and motivation to support the deviation, including: a) Where relevant, reasons why the proposed development footprint is required to exceed the limit; b) Where relevant, reasons why this exceedance will be in the national interest; and c) Where relevant, reasons why there are no alternative options available including evidence of alternatives considered; and	Section 11.3, **Error! Reference source not found.**
A map showing the renewable energy facilities within a 50km radius of the proposed development.	Section 13, **Error! Reference source not found.**

4. Legislative framework for the assessment

The report follows the protocols as stipulated for the Agricultural Assessment in Government Notice 320 of 2020 (GN320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (No. 107 of 1998) (from here onwards referred to as NEMA). It replaces the previous requirements of Appendix 6 of the Environmental Impact Assessment Regulations of NEMA.

In addition to the specific requirements for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity:

- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. This Act requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Section 3 of the Subdivision of Agricultural Land Act 70 of 1970 may also relevant to the development.
- In addition to this, the National Water Act (Act 36 of 1998) deals with the protection of water resources, including wetlands. This legislation is considered for the purpose of identifying hydric soils with wetland functionality within the study area (should it be present).

5. Assumptions, uncertainties and information gaps

The following assumptions and limitations are associated with this report:

- It is assumed that the grid infrastructure of each grid connection project, will remain within the corridors provided (depending on which alternative is chosen for each project).

No other information gaps or uncertainties are identified.

6. Methodology

6.1 Desktop analysis of satellite imagery and other spatial data

The most recent aerial photography of the area available from Google Earth was obtained. The satellite imagery was analysed prior to the site visit to determine any areas of existing impacts and land uses within grid connection corridors and the surrounding areas. It was also scanned for any areas where crop production and farming infrastructure may be present. To get a comprehensive overview of the natural resources that contribute to the agro-ecosystem of the proposed project site, the following spatial data was analysed:

- The climate capability data layer that is part of the land capability data layer (a sub-set) that shows the climate capability evaluation values of an area (DALRRD, 2016). The data used as input for the climate capability layer was obtained from the South African Atlas of Agro-Hydrology and Climatology (Schulze, 2007).
- The National Land Capability Evaluation Raster Data Layer was obtained from the DAFF to determine the land capability classes of the project area according to this system. The data was developed using a spatial evaluation modelling approach (DAFF, 2017).
- The long-term grazing capacity for South Africa 2018 was analysed for the area and surrounding area of the project assessment zone. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Free State Field Crop Boundaries (November 2019) was analysed to determine whether the proposed project assessment zone falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming.
- Land type data for the project assessment zone 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 entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units.

6.2 Site assessment

The grid connection corridors were first visited on 3 and 4 March (autumn) and then again between 21 and 24 June 2021 (winter). The site assessment included a soil classification survey, the collection of soil samples as well as the collection of photographic evidence about the current land uses. The season has no effect on the outcome of the assessment. The soil profiles were examined to a maximum depth of 1.5 m or the point of refusal using a hand-held soil auger. Observations were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018).

For soil mapping of the areas assessed in detail, the soils were grouped into classes with relatively similar soil characteristics. Photographic evidence of soil properties, current land uses and other evidence were taken with a digital camera.

6.3 Analysis of samples

Six topsoil samples were collected at four of the survey points. The soil was stored and sealed in a clean sampling bag and submitted to Eco-Analytica Laboratory in Potchefstroom (part of North West University) for analysis. Samples were analysed for the following parameters:

- pH (using potassium chloride);
- Major cationic plant nutrients (calcium, magnesium, potassium, sodium) using ammonium acetate;
- Plant-available phosphorus (using Bray 1 extract); and
- Texture (using the three-sieve technique to determine the particle size distribution).

6.4. Agricultural income and employment

The development area, is used for extensive livestock farming only and has been used for this purpose at least the last five years, as was evident by the analysis of historical aerial imagery. Therefore, the spatial data layer of the long-term grazing capacity of the area (DAFF, 2018), was used for the calculations of the potential agricultural gross income of the land as well as the agricultural employment opportunities that it provides.

6.5. Impact assessment methodology

Below are the tables with the steps followed to do the impact rating according to the methodology prescribed by SLR.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.

	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
			EXTENT				
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/ National
			VL	**L**	**M**	**H**	**VH**
INTENSITY = VL							
DURATION	Very long	**VH**	Low	Low	Medium	Medium	High
	Long term	**H**	Low	Low	Low	Medium	Medium
	Medium term	**M**	Very Low	Low	Low	Low	Medium
	Short term	**L**	Very low	Very Low	Low	Low	Low
	Very short	**VL**	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	**VH**	Medium	Medium	Medium	High	High
	Long term	**H**	Low	Medium	Medium	Medium	High
	Medium term	**M**	Low	Low	Medium	Medium	Medium
	Short term	**L**	Low	Low	Low	Medium	Medium
	Very short	**VL**	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	**VH**	Medium	High	High	High	Very High
	Long term	**H**	Medium	Medium	Medium	High	High

	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
			INTENSITY = H				
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
			INTENSITY = VH				
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VVH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

7. Baseline description

7.1 Climate

The modelled climate data for Sasolburg (as modelled and presented by Meteoblue, 2021) was used to describe the climate of the grid connection areas as Sasolburg is located 19km away. The climate data is depicted in Figure 3.

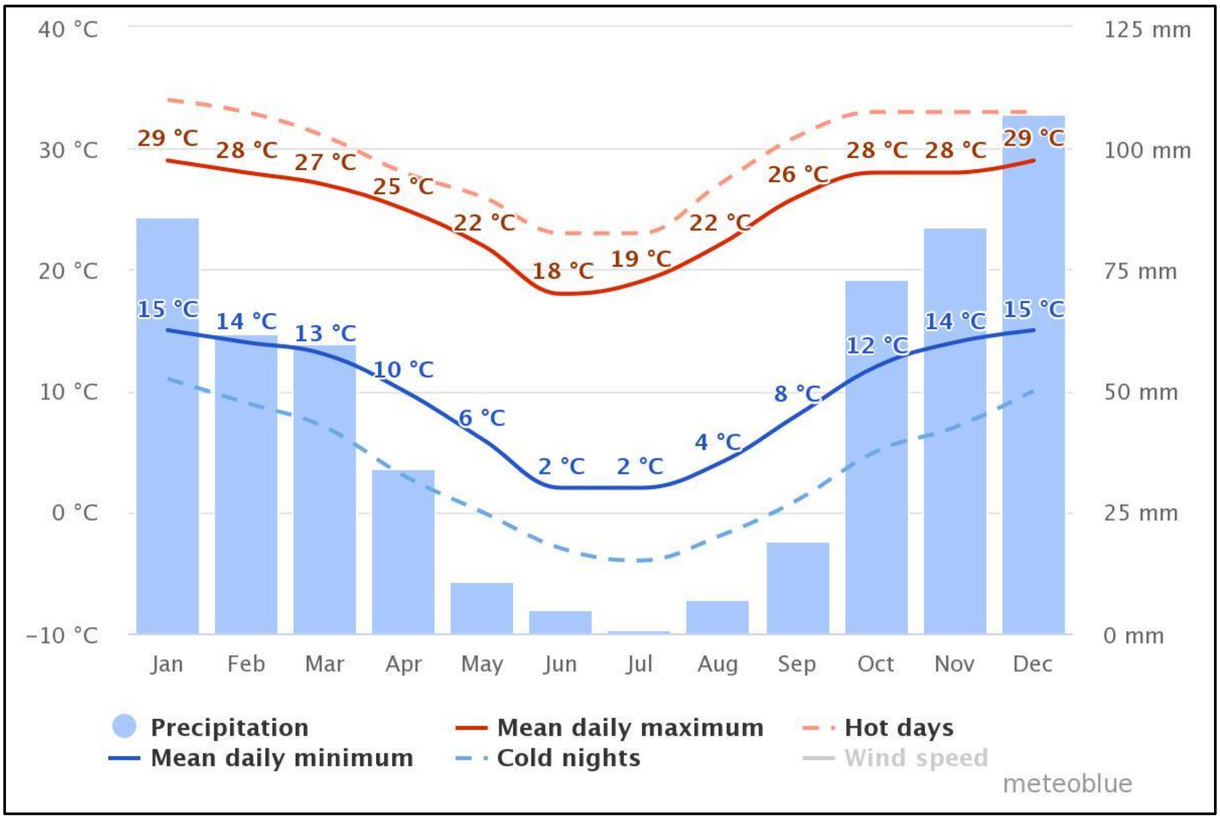

Figure 3 Climate data for Sasolburg (source: Meteoblue, 2021)

The mean daily maximum temperatures for Sasolburg ranges between 18°C June and 29°C in summer (the hottest months are December and January). The mean daily minimum temperatures range between 2°C in June and July and 15°C in December and January. The area has summer rainfall with the onset of the dry winter months from May through to September. The highest precipitation is in December with an average of 107 mm, with the months of November and January having the second highest average precipitation rate of 84 and 86 mm, respectively. The lowest average precipitation rate is from June to August with monthly averages of 1 to 7 mm.

The Department of Agriculture, Forestry and Fisheries (2017) compiled an updated description of the agricultural suitability of South African climatic conditions, accompanied by a raster data layer of the entire country. The description of climate capability refers to a definition by Strydom (2014) that defines it as the "capability of a geographic area to grow an agricultural crop under existing climatic conditions" (DAFF, 2017). The climate capability includes three parameters i.e., moisture supply capacity, physiological capacity, and climatic constraints. The climate capability classes range from 1 (the lowest or worst) to 9 (the highest or best climate for agricultural production).

According to the climate capability raster data, all the grid connection areas have Moderate (Class 05) climate capability (refer to Figure 5). This indicates that the climate of the area is suitable for rainfed crop production although the area also experiences climate limitations such as periods of drought during the summer months, frost during winter months and the possibility of hail that presents hazards to rainfed crop production. This classification is in alignment with the modelled climate data shown in Figure 3.

7.2 Land type classification

Following the land type data, all the grid connection corridors of the Scafell Cluster project, consist of Land Type Ba39 (Figure 6). Land Type Ba39 consists of five terrain units (refer to Figure 4) with approximately 50% of the total land type area consisting of mid-slopes (Terrain unit 3). The mid-slopes have slight slope (2 to 6%) and long slope lengths of 1000 to 1500 m. The dominant soil form of the mid-slopes is the Hutton form and soil depths range between 0.9 and 1.1 m. The mid-slopes also include soil of the Avalon form that is underlain by soft plinthite at depths of 0.8 to1.0 m. Approximately 11% of the mid-slopes consist of shallow Mispah soils which are between 0.1 and 0.2 m deep.

The second most prevalent terrain form are crests (Terrain unit 1) that consists of a mixture of rock, shallow topsoil on rock (the Mispah form) and deeper red apedal soils of the Hutton form. Around 10% of the total land type area consists of toe-slopes (Terrain unit 4) consisting of a large variety of soil forms such as the Avalon, Glenrosa, Westleigh, Sterkspruit, Glencoe, Wasbank and Clovelly forms. The valley bottoms (Terrain unit 5) are characterised by soil with higher clay content and stronger structure. Soil forms include hydric soils of the Willowbrook and Rensburg forms as well as soil with a thick vertic horizon (Arcadia form).

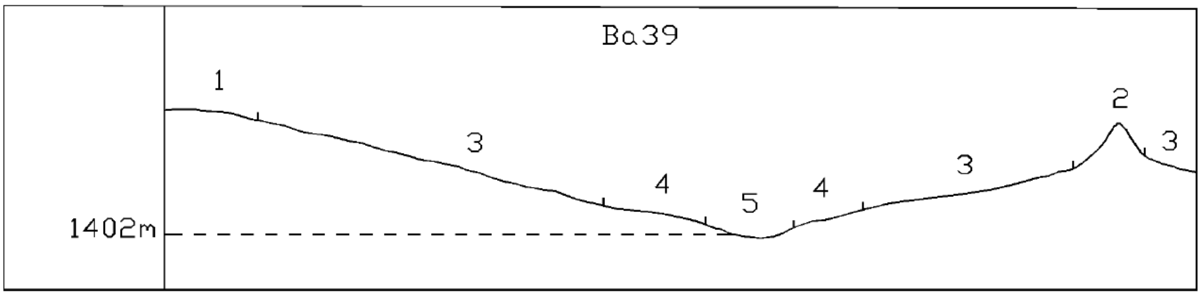

Figure 4 Terrain form sketch of Land Type Ba39

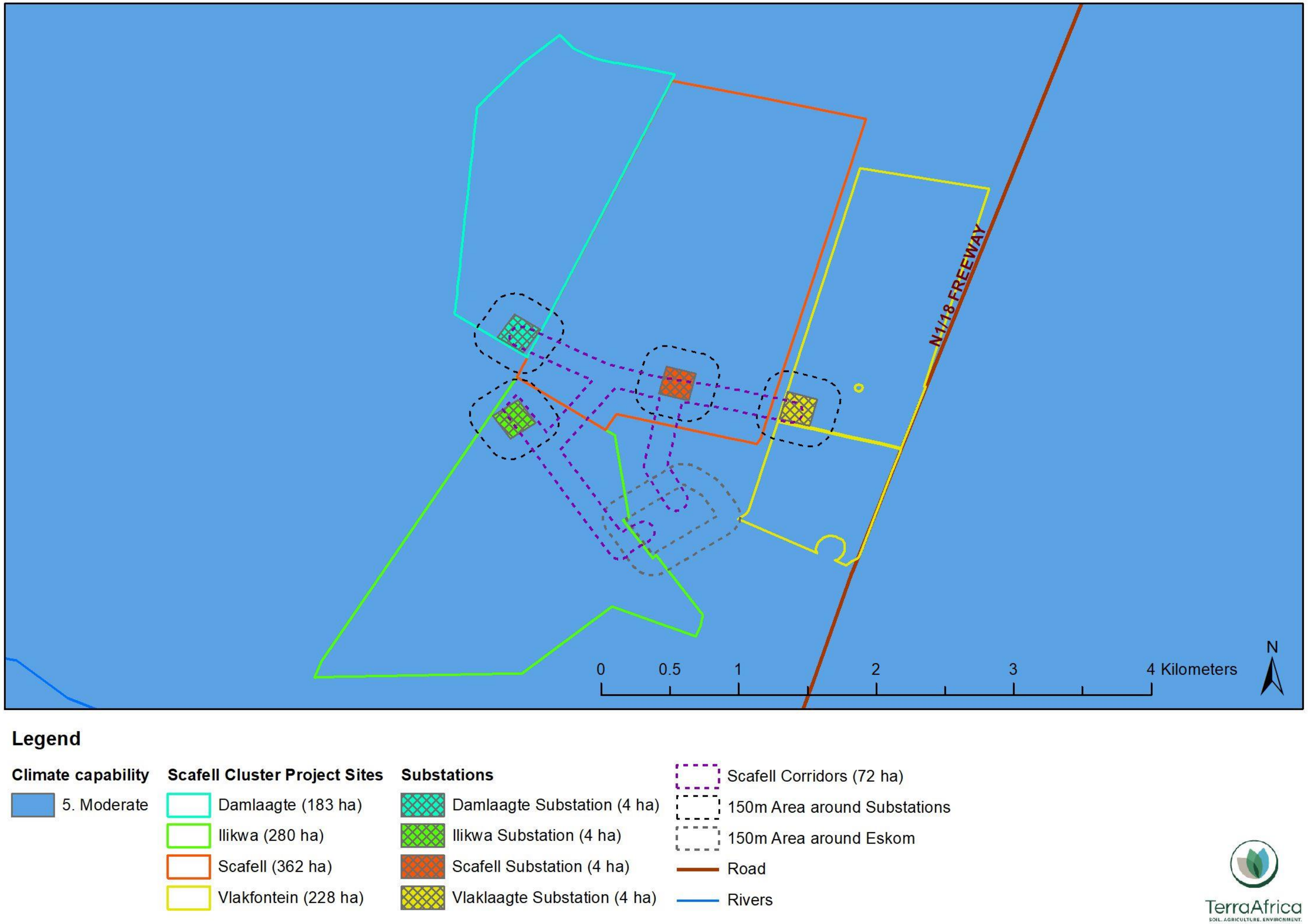

Figure 5 Climate capability rating of the Scafell grid connection corridors

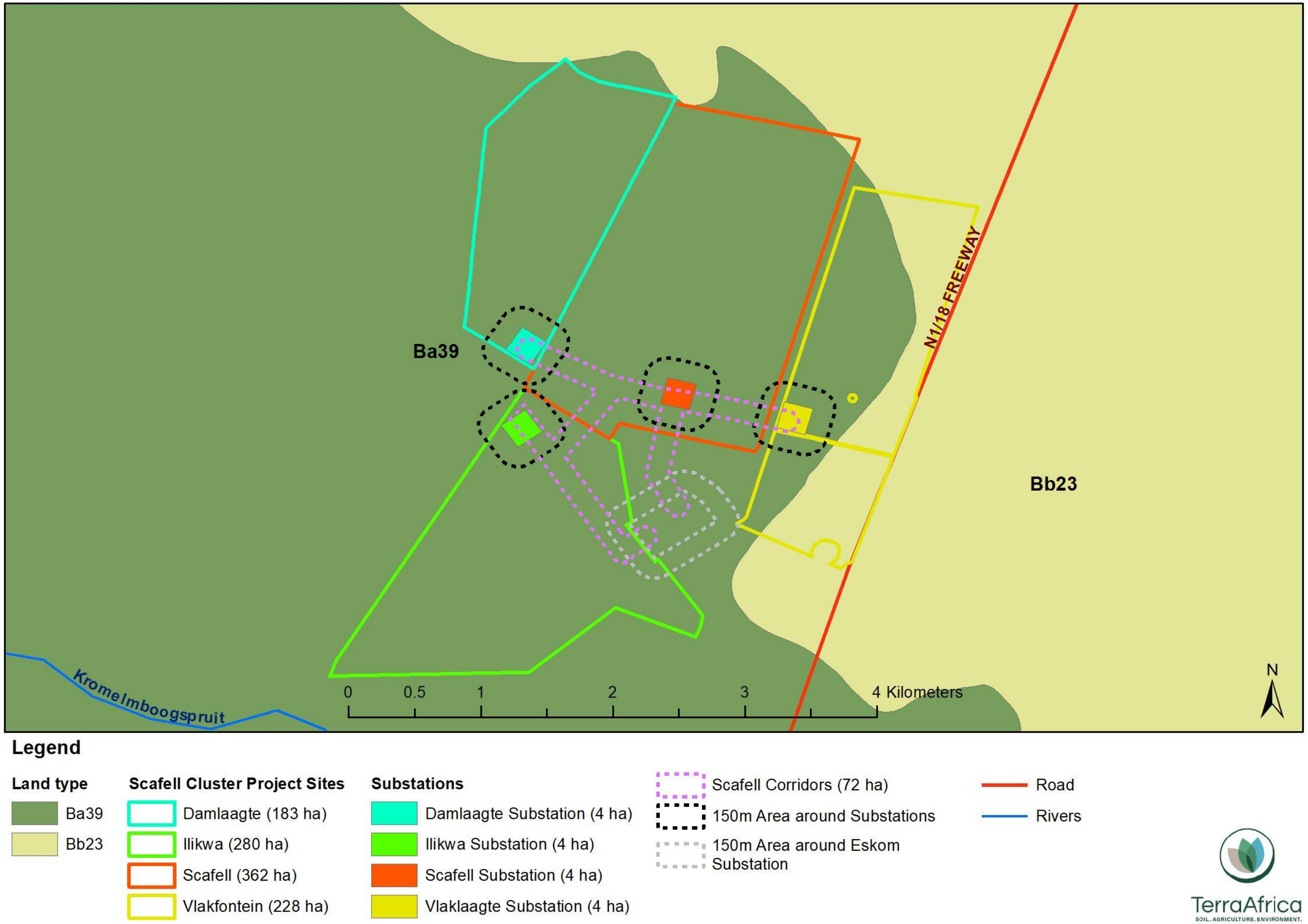

Figure 6 Land type map of the Scafell Cluster grid connection corridors

7.3 Soil properties

7.3.1 Soil forms

Seven different soil forms are present within the Scafell project site (see Figure 7). The area of each soil form as well as the horizon organisation and depths, are summarised in Table 1. Below follows a description of each of these soil forms. The Technosols are described separately.

Table 1 Summary of the soil properties of the soils at the Scafell project site

Soil form	Family	Depth (m)	Grid connections where soil form is present
Avalon	2210	Orthic (0.2m) Yellow-brown apedal (0.8) Soft plinthite (0.1)	Scafell
Clovelly	2211	Orthic (0.2m) Yellow-brown apedal (0.7) Lithic (1.1)	Ilikwa, MTS grid corridor
Glenrosa	2110	Orthic (0.15) Lithic (0.30)	Damlaagte,Scafell, Ilikwa, Vlakfontein, MTS corridor
Mispah	2120	Orthic (0.15) Fractured rock / Rock	Damlaagte, Scafell
Technosols	2111	Different degrees of disturbance	Vlakfontein
Westleigh	1120	Orthic (0.2) Soft plinthite (0.5 to 1.0) Gleyic (1.5)	Scafell

Avalon:

The Avalon soils are present within the Scafell grid connection corridor. These soils consist of orthic topsoil that are chromic and 0.2 m deep. The topsoil overlies yellow-brown apedal subsoil that reaches depths of 0.4 to 1.0 m. The yellow-brown apedal subsoil is underlain by soft plinthic material that is between 0.2 and 0.6 m thick. The Avalon soils within the Scafell grid connection corridor has moderate agricultural potential and is suitable for both crop production. It can also be used for livestock grazing.

Clovelly:

The Clovelly soils are present in the southern parts of the MTS corridor and the Ilikwa grid connection corridor. The Clovelly form has chromic orthic topsoil overlying yellow-brown apedal subsoil. The average thickness of the topsoil ranges between 0.2 m while the yellow-brown apedal horizon is 0.6 m deep. The yellow-brown colours of the apedal horizon is mostly uniform throughout the profiles with no abrupt colour transition. The yellow-brown apedal horizon is underlain by lithic material (consisting of country rock in different stages of weathering) at a depth of 0.6 m and deeper. The Clovelly soil form is suitable for crop production and has moderate agricultural potential within the grid connection corridors. The Clovelly soils can also be used for livestock farming and pasture production.

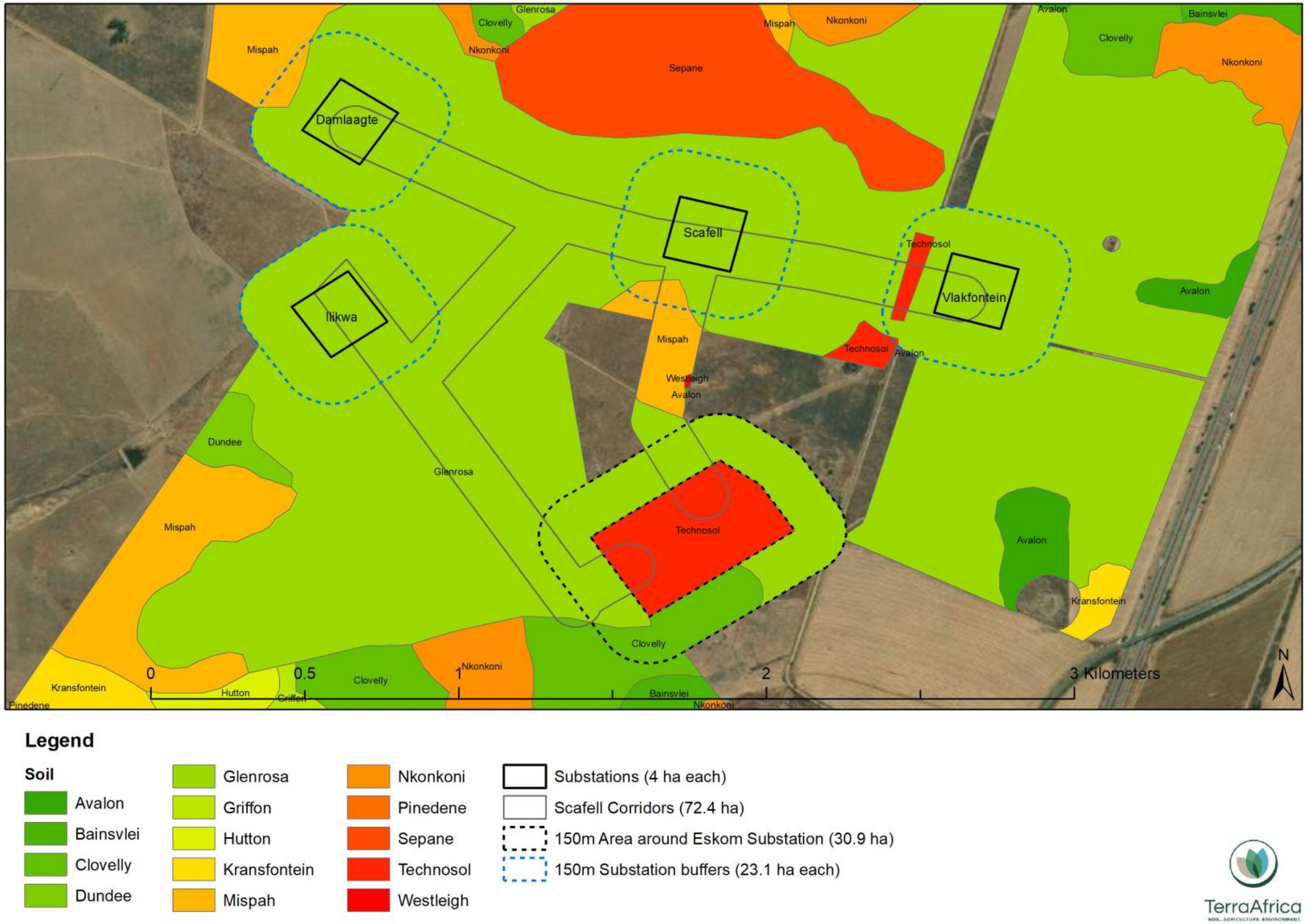

Figure 7 Soil classification map of the Scafell Cluster grid connections

Glenrosa:

The Glenrosa soils form the largest part of all the grid connections. These soils contain saprolithic rock between soil particles (see Figure 8). The topsoil of the Glenrosa soils is chromic topsoil the lithic B horizons are non-calcareous. The depths of the Glenrosa rarely exceeded 0.3 m. The saprolithic material present in the subsoil horizon of the Glenrosa soils limit the water-holding capacity and effective depth of the soil. The area of the Glenrosa soils within the grid connections are considered suitable for livestock farming and not for rainfed crop production.

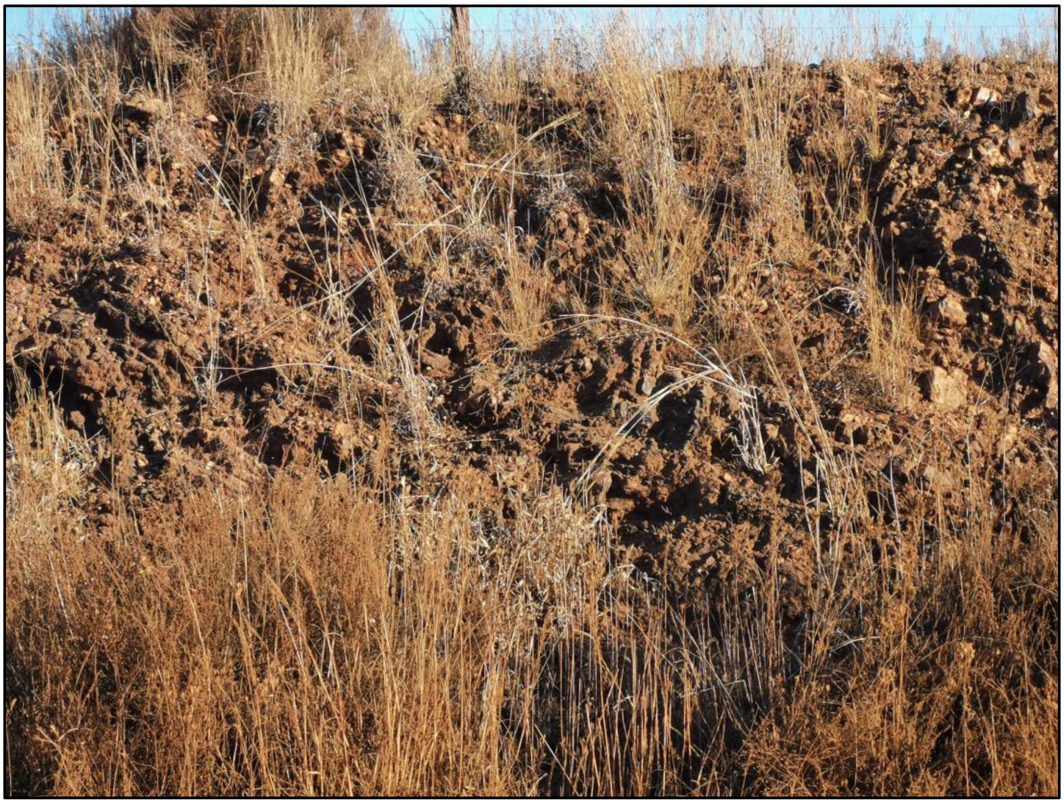

Figure 8 Exposed Glenrosa profile showing soil particles that washed in between layers of saprolithic rock

Mispah:

The Mispah soils have been classified within the Scafell and Damlaagte grid connection corridors. The Mispah soils consist of orthic topsoil overlying hard rock. The hard rock can either be solid or fractured rock. The production of the soil is limited by shallow soil depth and the presence of rock makes cultivation difficult. The area of Mispah soils have suitability for livestock grazing but not for rainfed crop production.

Technosols:

Technosols fall within the Anthropogenic System that was included in the latest version of the South African Soil Classification System (Soil Classification Working Group, 2018). Technosols are defined as material from mining, industrial, construction or industrial activities and also describe areas where natural soils have been disturbed to the extent that it is a new material with new properties.

A small area of Technosols have been identified within the Vlakfontein grid corridor. The Technosols consist of a mixture of ex in-situ natural soils that are stockpiled on the surface and covered with black plastic in different stages of weathering (see Figure 9). A small area also included small excavation pits but this area had danger tape around it and signboards that indicate it is a dangerous area and no access is allowed. It is therefore uncertain what the properties of the Technosols in this area are.

Figure 9 Photographic evidence of the Technosols within the Scafell project site

7.4 Land capability and agricultural potential

7.4.1 Land capability

The land capability as determined by Department of Agriculture, Land Reform and Rural Development (DALRRD) through a spatial delineation process, was shown by overlying the boundaries of the grid connection corridors, on the land capability raster data (DALRRD, 2016). The results are depicted in Figure 10. According to DALRRD (2016), land capability is defined as the most intensive long-term use of land for the purpose of **rainfed farming** determined by the interaction of climate, soil and terrain.

The largest part of the grid connection corridors consist of land with Moderate (Class 08) land capability and land with Low-Moderate (Class 07) land capability. The grid corridor of the MTS has a small area of land with Moderate-High (Class 09) along the south-eastern part.

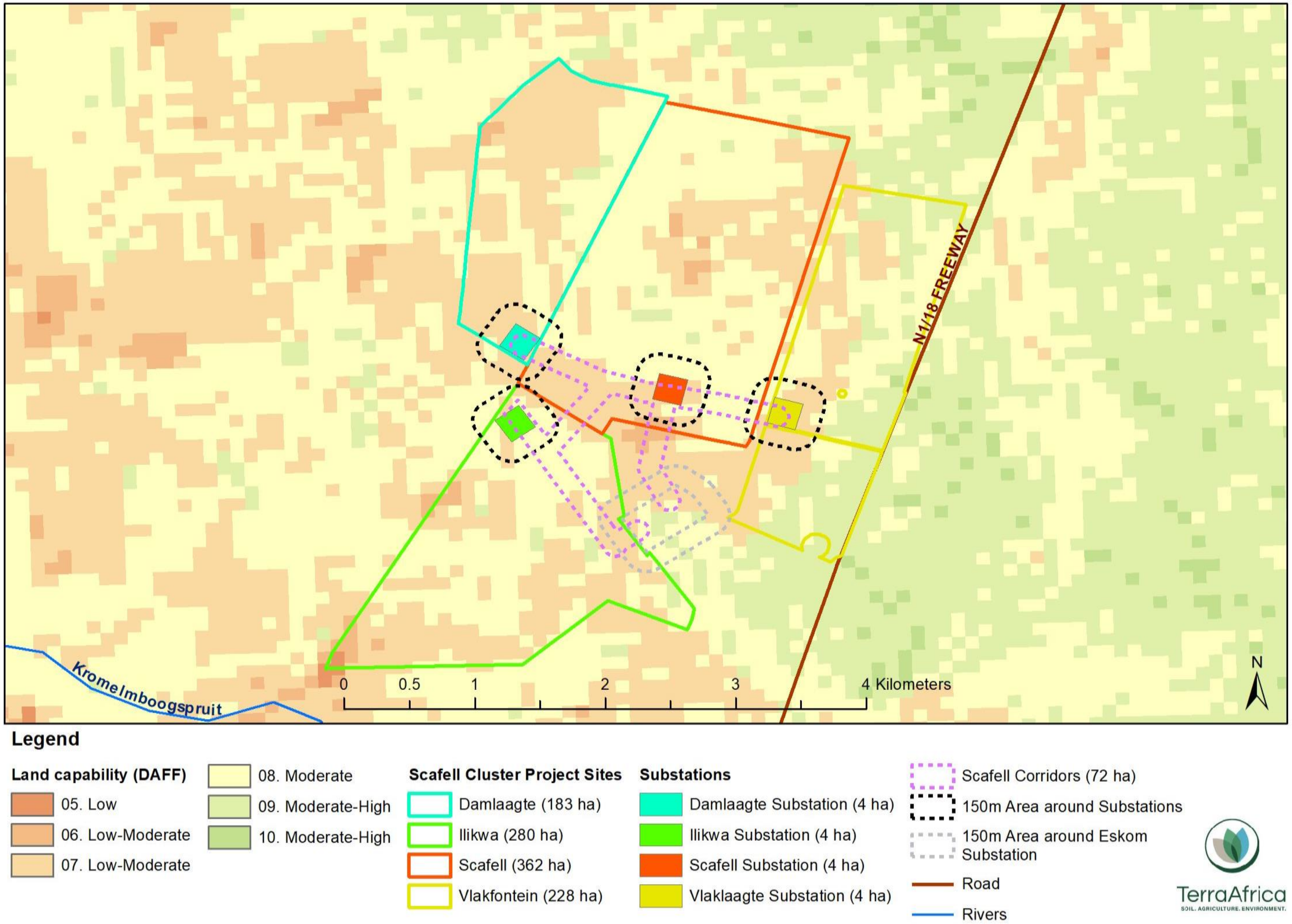

Figure 10 Land capability map of the Scafell Cluster grid connections (DALRRD, 2016)

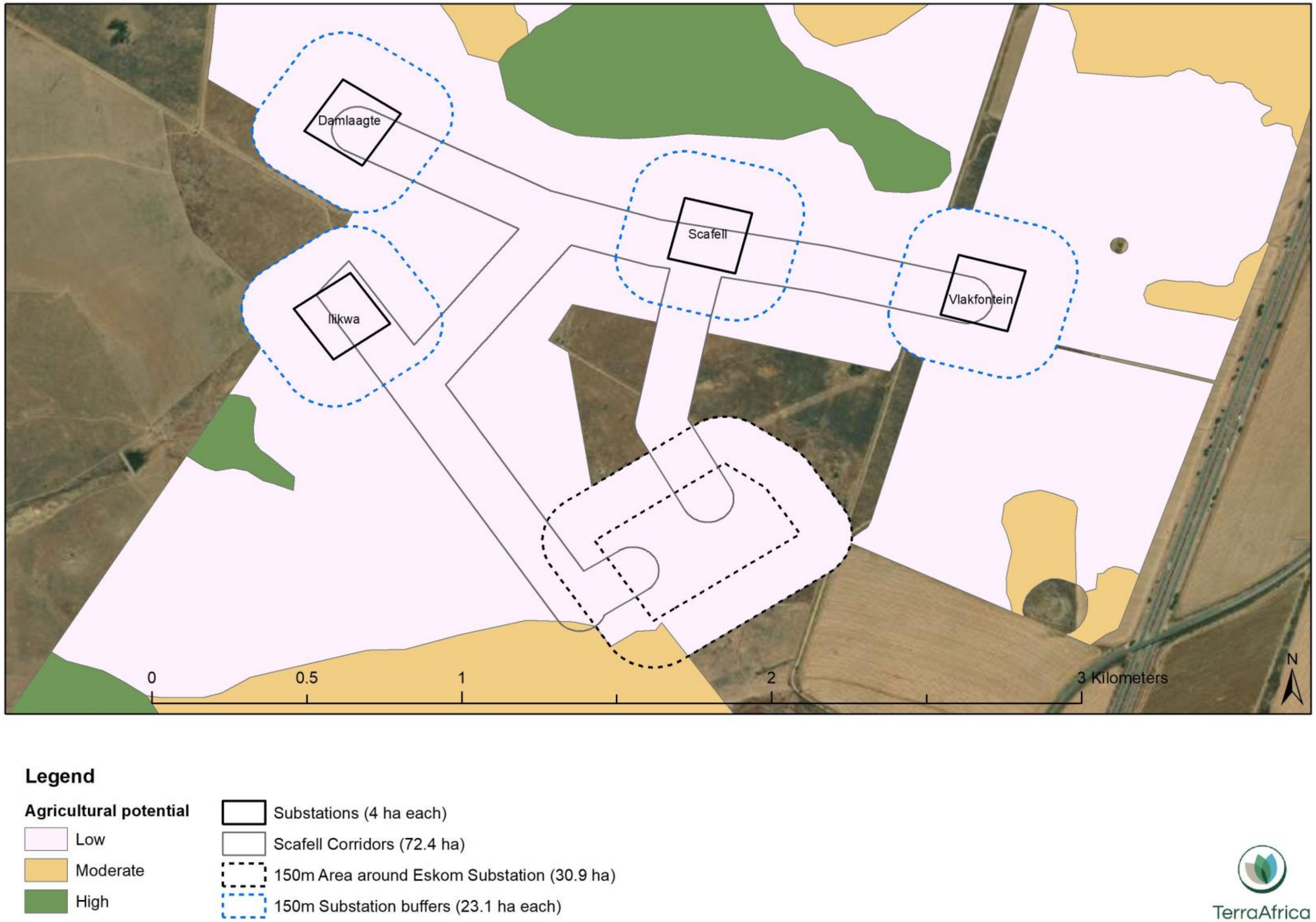

Figure 11 Agricultural potential of the Scafell Cluster grid connections

7.4.2 Agricultural potential

Agricultural potential is defined as a measure of potential productivity per unit area and unit time achieved with specified management inputs and for a given crop or veld type and level of management, largely determined by the interaction of soil climate and terrain (DALRRD, 2016). For the proposed grid connection corridors, the agricultural potential was derived from the soil classification of the site and its potential for rainfed production of grain crops, especially maize.

Following the soil classification and analysis, it was concluded that the grid connection corridors have Moderate and Low agricultural potential for the rainfed production of grain crops (see Figure 11). Almost the entire area of the grid connections consist of land with Low agricultural potential and only the most southern tip of the MTS corridor has Moderate agricultural potential.

8 Agricultural sensitivity of the site

For the purpose of the assessment, the areas considered for the different grid connection corridors, were screened for agricultural sensitivity using the National Environmental Screening Tool (www.screening.environment.gov.za). The screening report for each grid connection corridor was generated by SLR on 30 July 2021. The requirements of GN320 stipulates that a 50 m buffered development envelope must be assessed with the screening tool. While the total areas considered for the layout alternatives of each grid connection corridor, the corridors will only be 150 m wide. The screening tool maps therefore meet the requirement of a 50 m buffered area that must be reflected.

Following the consideration of all the baseline and desktop data discussed in the sections above, the classification of the agricultural sensitivity of the different grid connection alternatives, are compared to the agricultural sensitivity maps of the screening tool. The results are summarised in Table 2.

Table 2 Summary of the impact of the development footprint on the agricultural sensitivity of the site

Grid connection project	Agricultural sensitivity (Alternative 1)	Agricultural sensitivity (Alternative 2)	Preferred alternative	Agricultural sensitivity rating according to the screening tool
Damlaagte	Medium & Low	Medium & Low	Alternative 1	High & Medium
Scafell	Medium & Low	Medium & Low	Alternative 1	High & Medium
Scafell	Medium & Low	Medium & Low	Alternative 1	High & Medium
Vlakfontein	Medium & Low	Medium & Low	Alternative 1	High & Medium

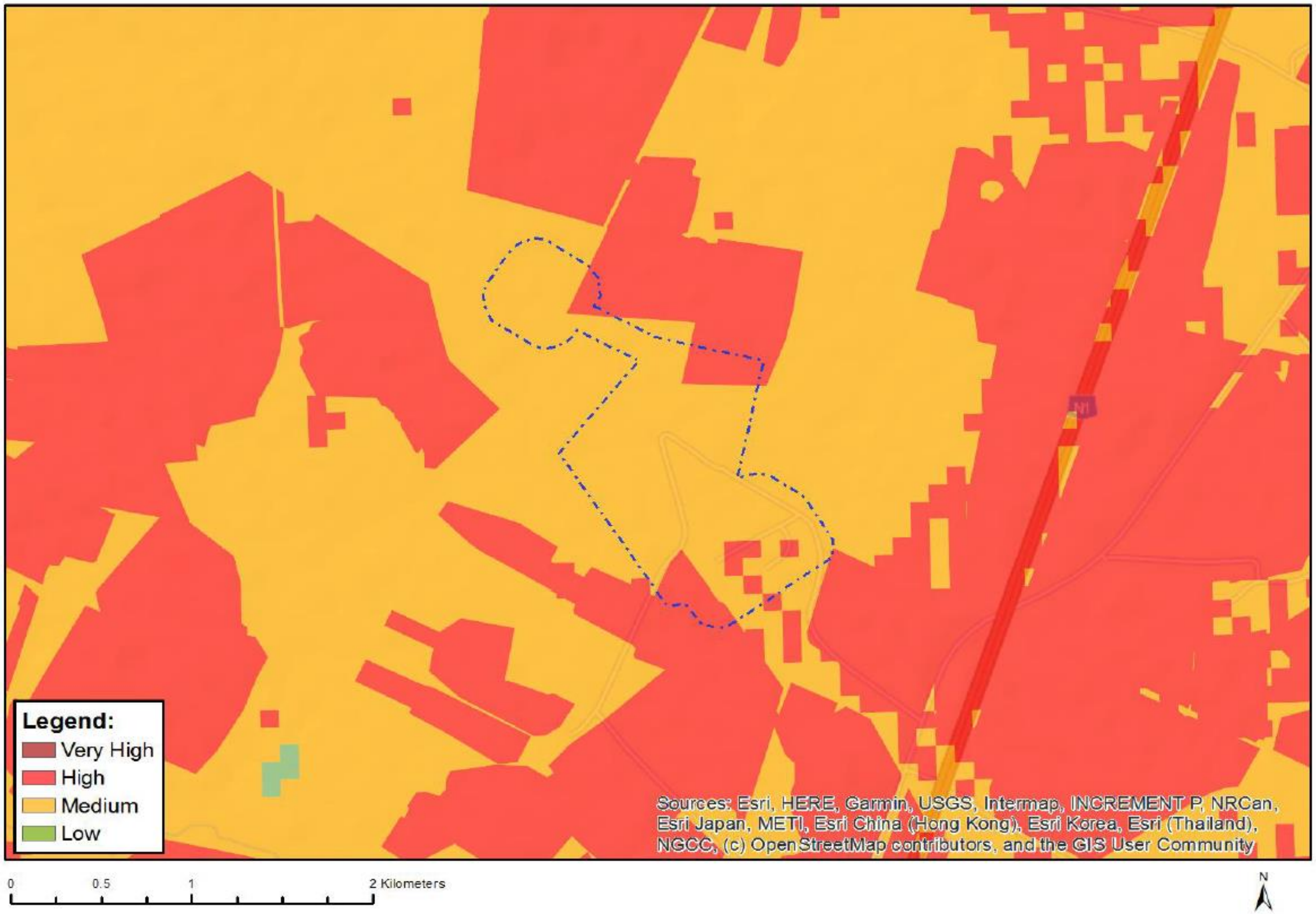

Figure 12 Relative Agricultural Sensitivity from DFFE's Screening Tool of the Damlaagte grid connection area (generated by SLR, 30 July 2021)

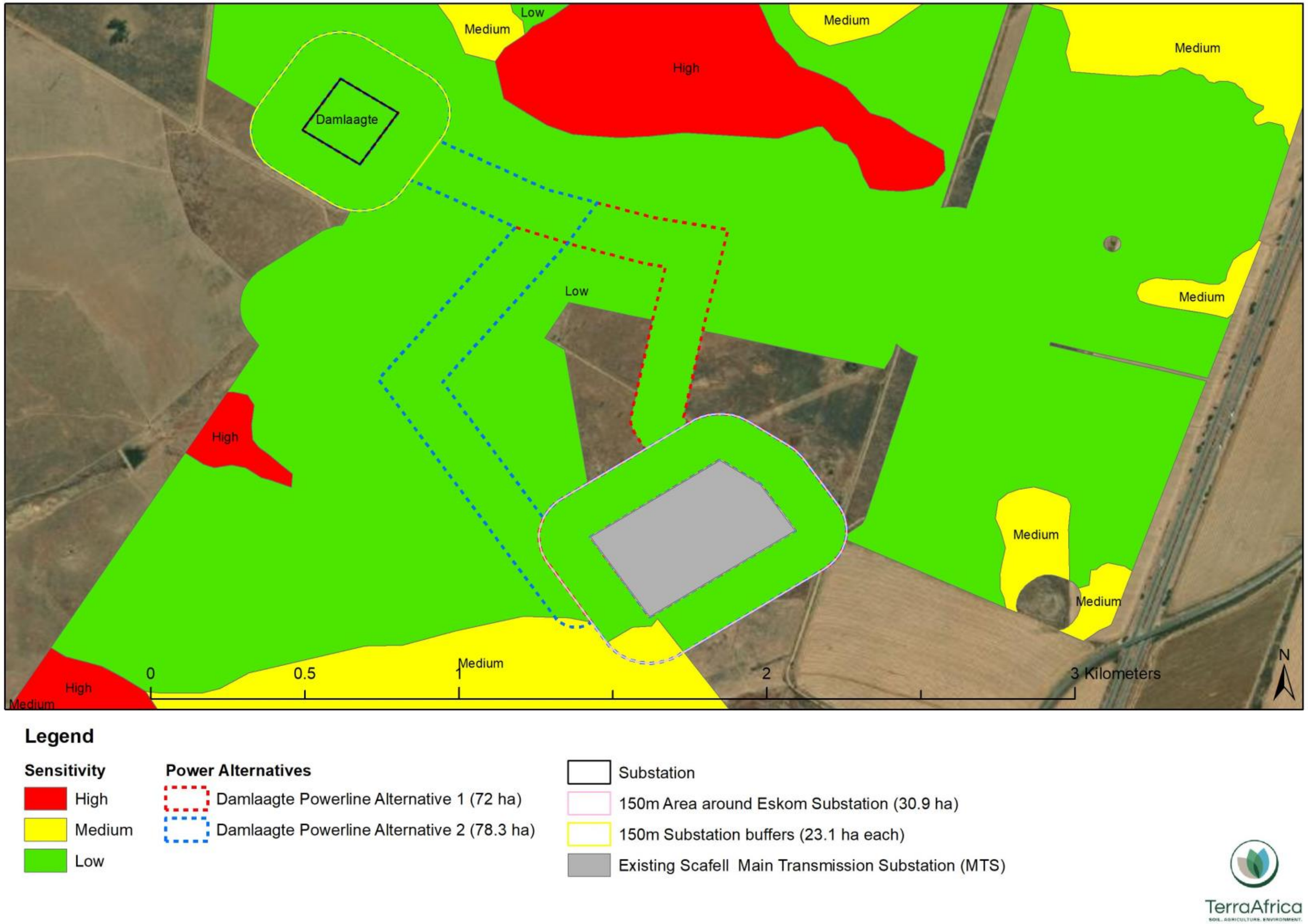

Figure 13 Sensitivity rating of the Damlaagte grid connection alternatives

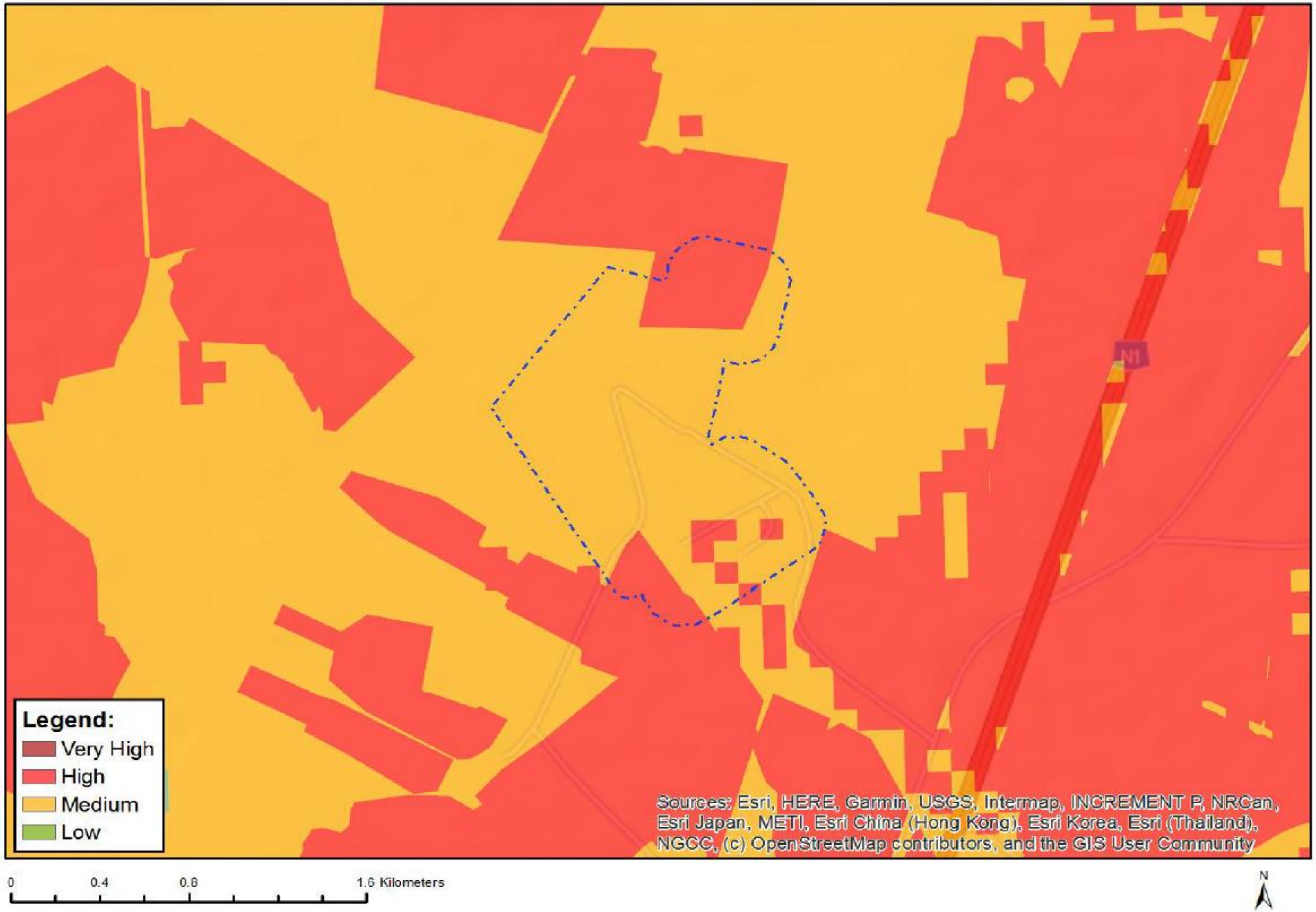

Figure 14 Relative Agricultural Sensitivity from DFFE's Screening Tool of the Scafell grid connection area (generated by SLR, 30 July 2021)

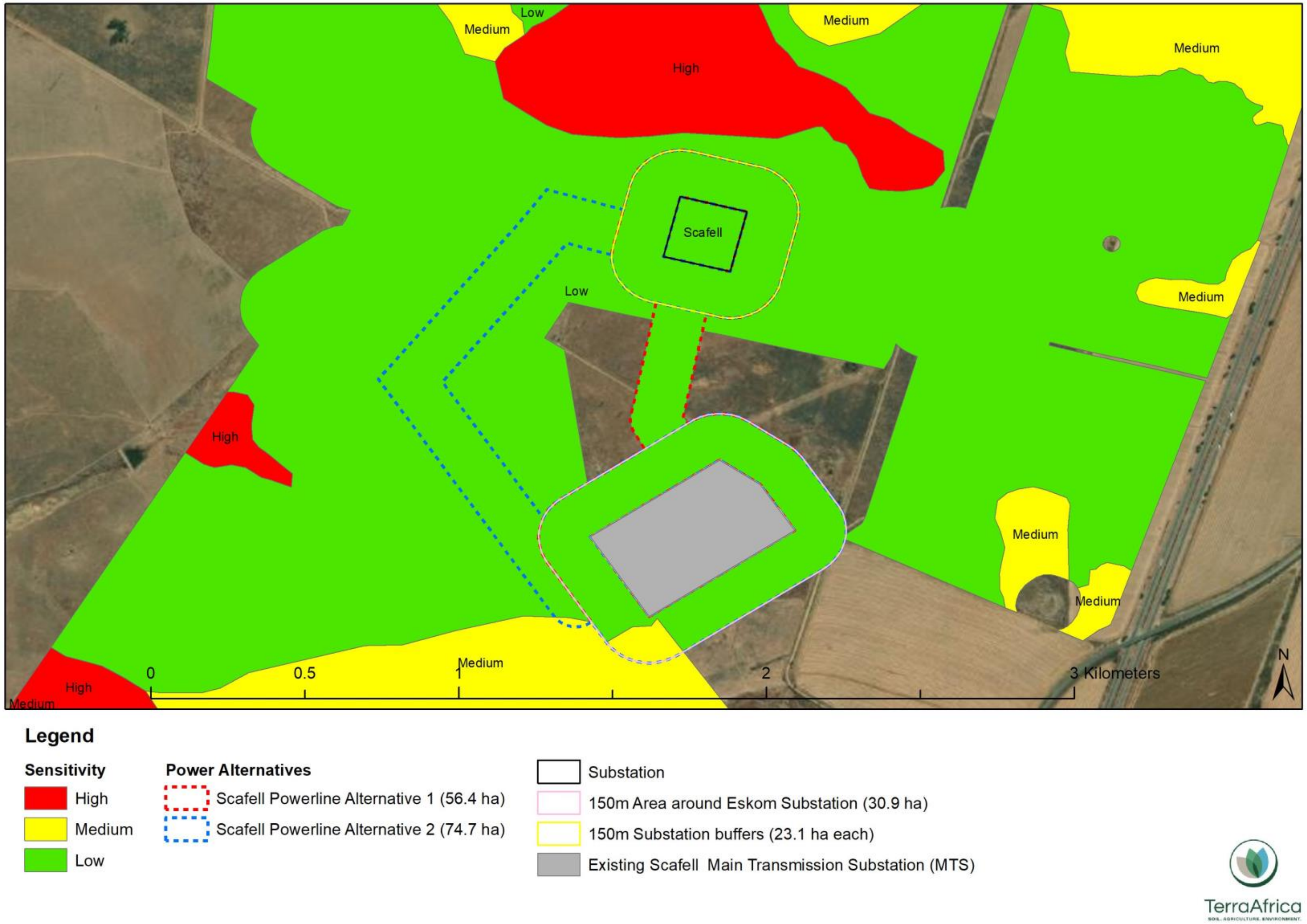

Figure 15 Sensitivity rating of the Scafell grid connection alternatives

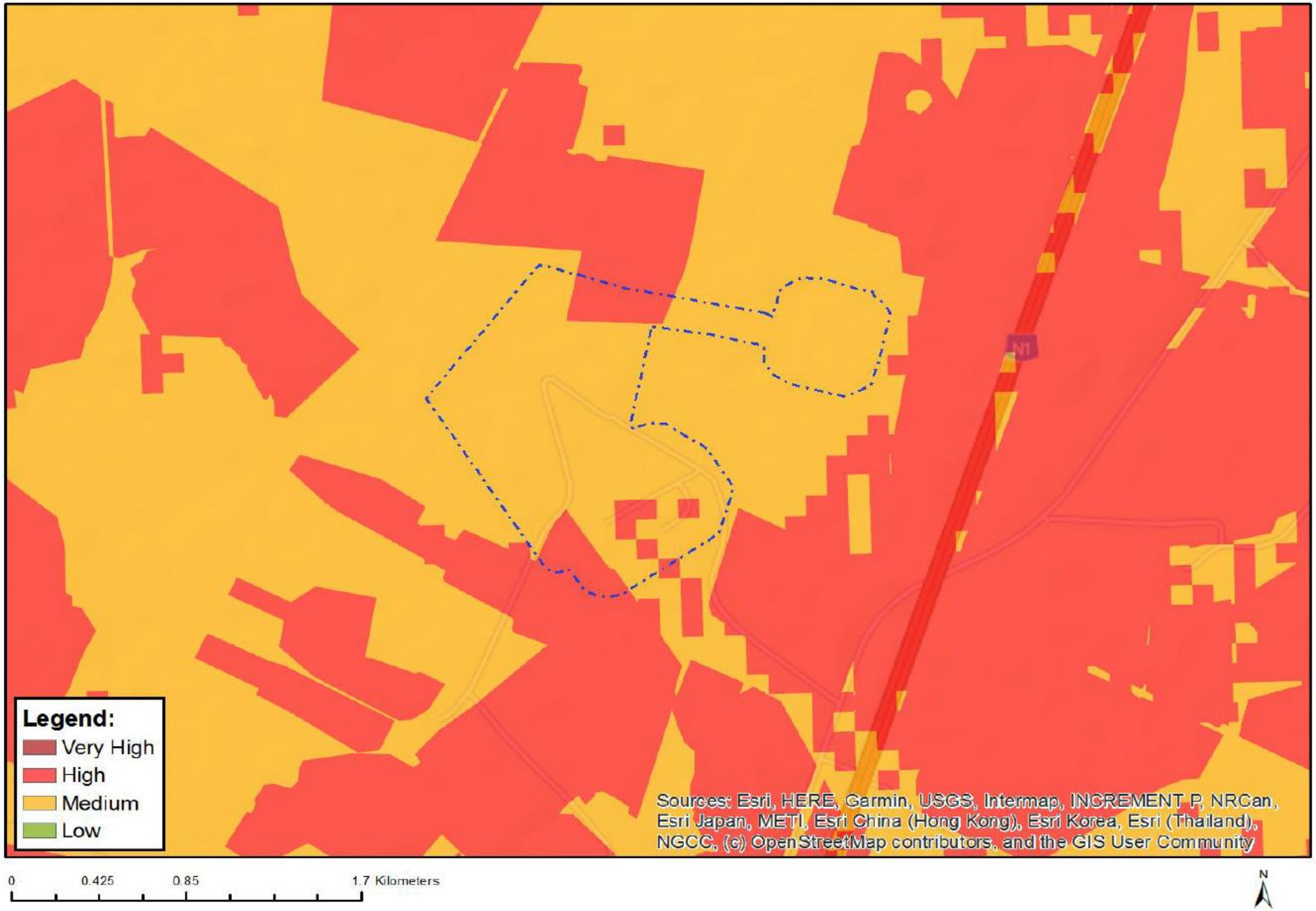

Figure 16 Relative Agricultural Sensitivity from DFFE's Screening Tool of the Vlakfontein grid connection area (generated by SLR, 30 July 2021)

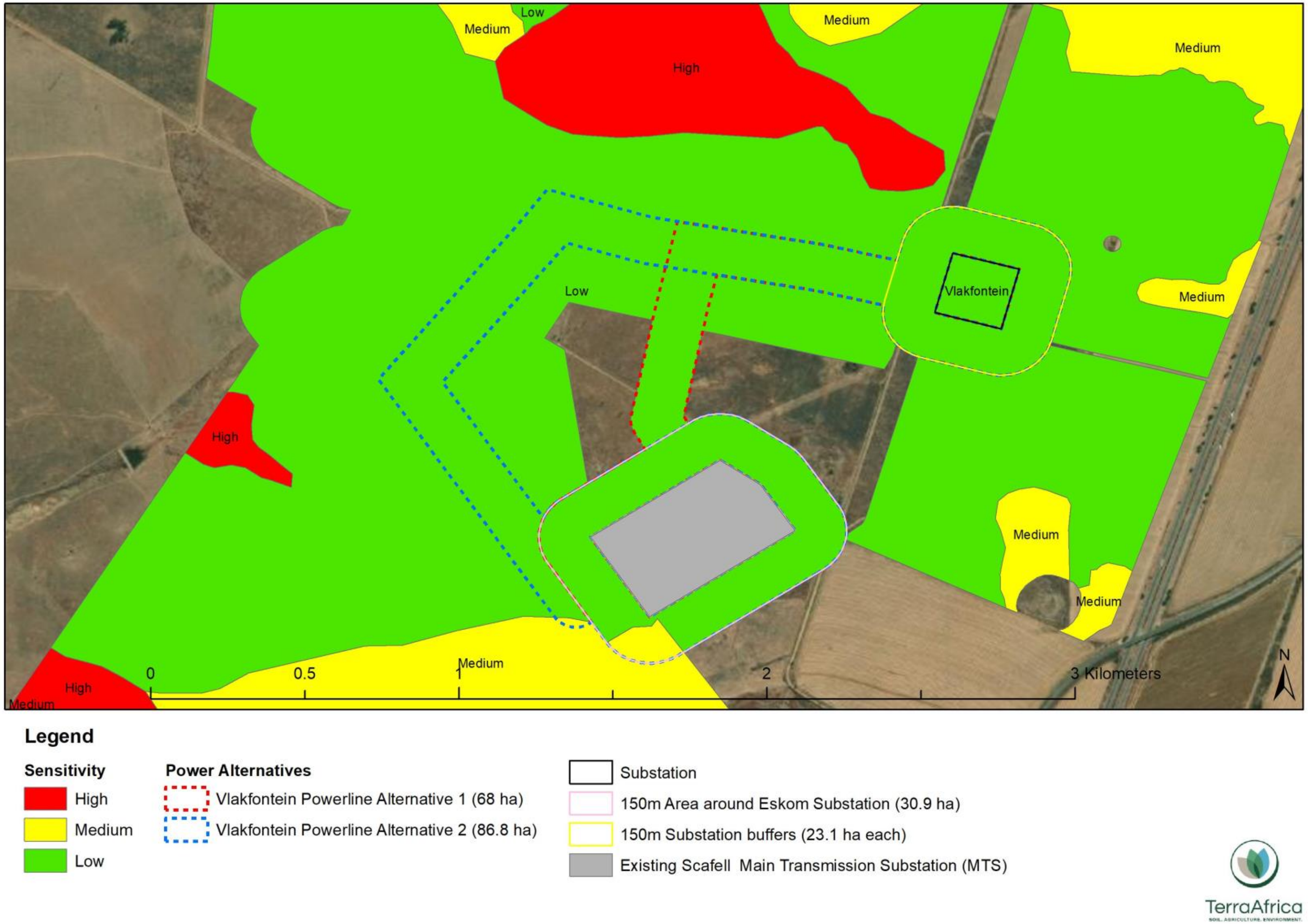

Figure 17 Sensitivity rating of the Vlakfontein grid connection alternatives

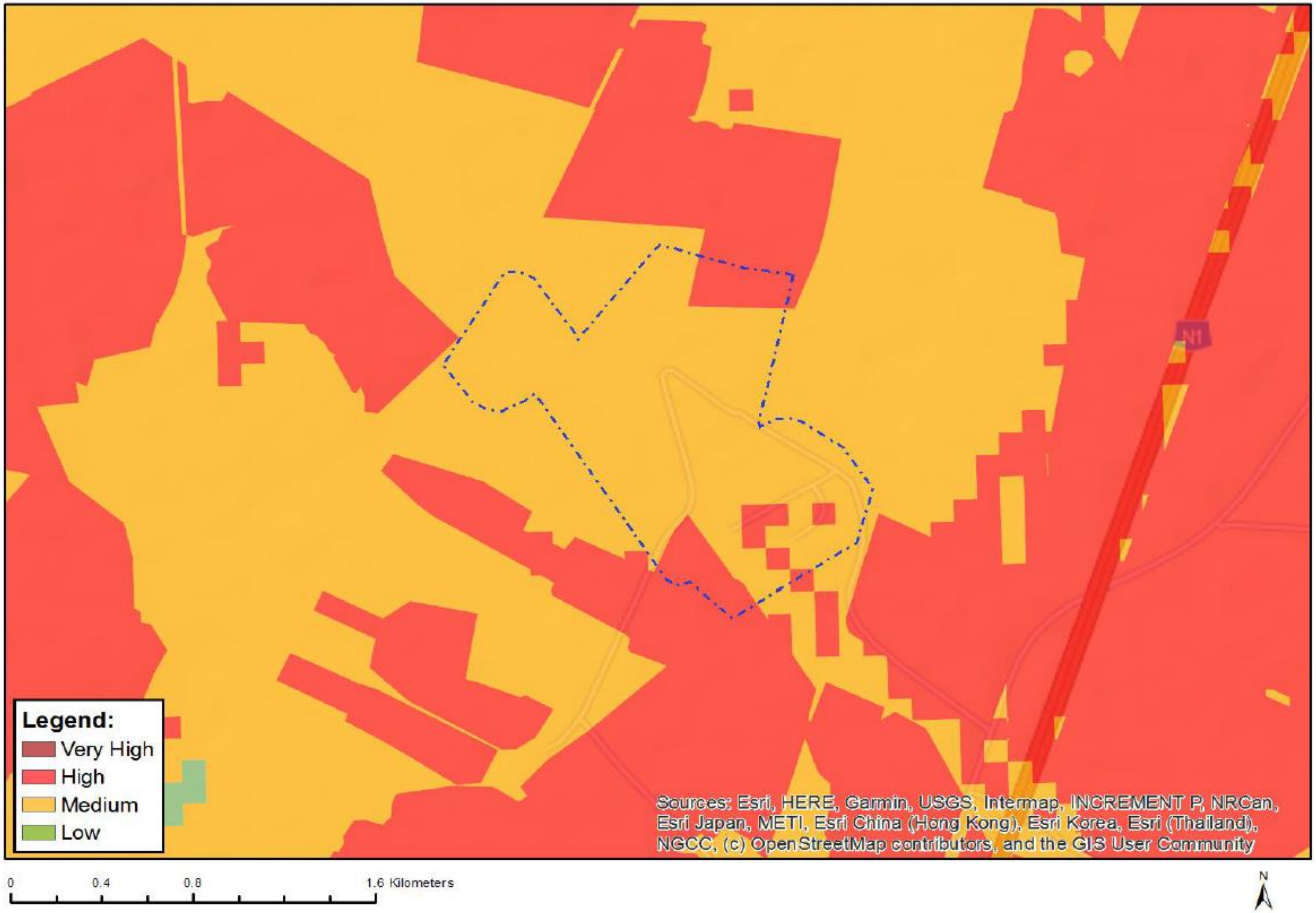

Figure 18 Relative Agricultural Sensitivity from DFFE's Screening Tool of the Ilikwa grid connection area (generated by SLR, 30 July 2021)

Figure 19 Sensitivity rating of the Ilikwa grid connection alternatives

Considering the different layouts provided for the grid connection alternatives, Alternative 1 of each of the grid connection corridors, is the preferred alternative as it will disturb a smaller area of land.

8. Impact assessment

The following sub-sections will describe and rate the significance of impacts on soil and agriculture as a result of the proposed grid corridor projects. The proposed projects are anticipated to have construction and operational phases but no decommissioning phases.

8.1 Construction Phase

The construction phase of the proposed project will include the site preparation and construction of all grid connection infrastructure. The following impacts are anticipated for this phase.

8.1.1 Disturbance of natural soil profiles that reduce biophysical soil functionality

Clearance of vegetation and delivery of construction materials will impact on the current soil functionality of the development footprint and affect nutrient cycling, rainwater infiltration and physical stability of the soil. The reduction in the biophysical functionality of the soil will be prominent (High intensity) and last for the proposed project life of 20 years or more if left unmitigated. In the unmitigated scenario, the disturbance of soil and its functionality will affect the entire project site of 162 ha (Low extent). It is probable that his impact will occur (High probability). The significance of this impact is rated as High for the unmitigated scenario.

When mitigation measures are implemented, the intensity of the impact can be reduced to a Moderate change that although real, may not have substantial consequences. In areas where no permanent infrastructure will be present, mitigation measures can reduce the duration of the impact to medium-term (Medium duration). The extent of the impact can also be reduced from the entire project site (Low) to only a part of the project site (Very Low) where the development footprint will be. The impact of soil profile disturbance that reduce biophysical soil functionality in the mitigated scenario, has Medium significance. Table 3 presents the ranking of the impact significance of the mitigated and unmitigated scenarios.

Table 3 Significance rating of soil disturbance during the construction phase of the grid connection projects before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	H	H	L	H	H
Mitigated	M	M	VL	M	M

The following mitigation measures must be implemented to reduce the significance of this impact:

- Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;
- Unnecessary land clearance must be avoided;
- Levelling of soil must be restricted to areas where it is necessary for construction;
- Any topsoil that remain on the surface after levelling, must be incorporated into areas of disturbance and not allowed to remain as stockpiles on the surface where it will be prone to soil erosion.
- Restrict earthworks to only that which is essential for the construction phase of the project.

8.1.2 Soil erosion

In all areas where vegetation are cleared, the soil will be exposed to both wind and water. Soil erosion results in the removal of soil particles from the area that becomes eroded. Soil erosion during the site preparation phase will result in a Moderate disturbance with real but not substantial consequences (Moderate intensity). Soil erosion, without the implementation of mitigation measures, will be permanent (Very High duration) and can affect areas outside of the development footprint (Low extent). In the unmitigated scenario, the impact will probably occur (High probability). Soil erosion is considered an impact with High significance in the unmitigated scenario.

With the implementation of mitigation measures, the intensity of soil erosion can be reduced to a minor disturbance (Low intensity) that will still be an irreversible loss of soil particles (Very high duration) but that can be limited to small areas within the development footprint (Very low extent). In this scenario, it is conceivable that erosion may occur (Low duration). With the implementation of mitigation measures, the soil erosion impact of the site preparation phase, can be reduced to Low significance. Table 4 presents the ranking of the impact significance of the mitigated and unmitigated scenarios.

Table 4 Significance rating of soil erosion during the construction phase of the Scafell Cluster grid connection projects before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	M	VH	L	H	H
Mitigated	L	VH	VL	M	VL

The following mitigation measures must be implemented to reduce the significance of this impact:

- Vegetation clearance during the construction phase must only be undertaken immediately prior to the building of infrastructure;
- Vegetation clearance must be kept within the development footprint;
- Unnecessary land clearance must be avoided;
- Level any remaining soil that remained on the surface after site preparation instead of allowing small stockpiles of soil to remain on the surface;
- Design and implement a Stormwater Management System / Plan where run-off from the access road is expected;

- Where possible, conduct the site preparation activities outside of the rainy season;
- Regularly monitor areas where vegetation removal and earthworks took place, for early signs of soil erosion; and
- Vegetation establishment during the construction phase must be monitored to see whether it was successful and provide sufficient coverage for bare soil surface.

8.1.3 Soil compaction

Construction of the substations, will result in soil compaction. In these areas, soil material will be deliberately compacted to ensure a stable road surface. Soil compaction will result in a moderate disturbance of the soil quality and without any mitigation measures, will remain permanent (Very High Duration). Without mitigation measures, the extent of the impact may affect the entire site (Low Extent). With the implementation of mitigation measures, the extent can be limited to only the development footprint. This impact will definitely occur, both in the mitigated and unmitigated scenarios. The rating criteria of this impact is presented in Table 5.

The significance of soil compaction can be reduced from High significance to Medium significance through the implementation of the following mitigation measures:

- Minimise the areas of activity to that indicated in the infrastructure layout (refer to
- The activities of construction contractors or employees will be restricted to the planned areas.
- Roads that will carry heavy-duty traffic should be designed in areas previously disturbed rather than clearing new areas, where relevant.

Table 5 Significance rating of soil compaction during the construction phase before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	M	VH	L	H	H
Mitigated	M	H	VL	M	M

8.1.4 Soil chemical pollution

During the construction phase, construction workers will mix cement and assemble substation components. This can result in spills of diesel and oil by machinery and equipment as well as the generation of domestic waste and containment breaches related to the battery units and any inadvertent chemical exposure therefrom.

The intensity of soil pollution is considered a moderate deterioration during the construction phase (Medium intensity) that will remain for a long term and may affect an area outside of the development footprint (Low extent). It is probable that this impact will occur and in the unmitigated scenario, this impact will have Medium significance.

When mitigation measures are implemented, the impact can be reduced to a negligible nuisance with minor consequences (Very low intensity) that can be reversed over a period of less than 5 years. Soil pollution can also be managed to only affect a part of the site (Very low extent). It is possible that the impact will occur and the mitigated scenario has Very low significance. The ranking criteria of both the unmitigated and mitigated scenarios are presented in Table 6.

During the construction phase, soil chemical pollution must be minimised through implementation of the following mitigation measures:

- Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material;
- Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area;
- Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste at licensed waste disposal / recycling facilities;
- Containing potentially contaminating fluids and other wastes; and
- Cleaning up areas of spillage of potentially contaminating liquids and solids.

Table 6 Significance rating of soil chemical pollution before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	L	H	L	M	M
Mitigated	VL	L	VL	L	VL

8.2 Operation Phase

The operational phase will include in staff visiting the area to do maintenance work. This will result in a risk of soil chemical pollution.

8.2.1 Soil chemical pollution

The intensity of soil pollution is considered a moderate deterioration during the construction phase (Medium intensity) that will remain for a long term and may affect an area outside of the development footprint (Low extent). It is probable that this impact will occur and in the unmitigated scenario, this impact will have Medium significance.

When mitigation measures are implemented, the impact can be reduced to a negligible nuisance with minor consequences (Very low intensity) that can be reversed over a period of less than 5 years. Soil pollution can also be managed to only affect a part of the site (Very low extent). It is possible that the impact will occur, and the mitigated scenario has Very low significance. The ranking criteria of both the unmitigated and mitigated scenarios are presented in Table 7.

During the construction phase, soil chemical pollution must be minimised through implementation of the following mitigation measures:

- Losses of fuel and lubricants from the oil sumps and steering racks of vehicles and equipment should be contained using a drip tray with plastic sheeting filled with absorbent material;
- Using biodegradable hydraulic fluids, using lined sumps for collection of hydraulic fluids, recovering contaminated soils, and treating them off-site, and securely storing dried waste mud by burying it in a purpose-built containment area;
- Avoiding waste disposal at the site wherever possible, by segregating, trucking out, and recycling waste at licensed waste disposal / recycling facilities;
- Containing potentially contaminating fluids and other wastes; and
- Cleaning up areas of spillage of potentially contaminating liquids and solids.

Table 7 Significance rating of soil chemical pollution before and after the implementation of mitigation measures

Scenario	Intensity	Duration	Extent	Consequence	Significance
Unmitigated	L	H	L	M	M
Mitigated	VL	L	VL	L	VL

9. Conclusion and recommendations

The soil and agricultural properties and sensitivities of the proposed Scafell grid connection corridors was the subject of the Agricultural Agro-Ecosystem Assessment conducted. The soils in the grid connection areas are dominated by soils of the Glenrosa form while other soil forms are that of the Clovelly, Avalon, Mispah and Westleigh forms as well as Technosol

The largest area of the Scafell project site consists of land Moderate (Class 08) and Low-Moderate (Class 07) land capability. Almost the entire area considered for the grid connections have low agricultural potential and only a very small section in the south has moderate potential.

The sensitivity rating of the site was based on the soil classification of the project site. The largest area has Low sensitivity and only a small area has Medium sensitivity. For all the grid connection alternatives, the Alternative 1 layout is the preferred alternative as it affects the smaller area of each project, respectively.

It is my professional opinion that this application be considered favourably, permitting that the mitigation measures stipulated in this report are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected.

10. Reference list

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South Africa (Republic), 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

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APPENDIX 1 – CURRICULUM VITAE OF SPECIALIST

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EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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