REPORT

On contract research for

SAVANNAH ENVIRONMENTAL

SOIL IMPACT ASSESSMENT FOR THE PROPOSED GEELSTERT GRID CONNECTION NEAR AGGENEYS, NORTHERN CAPE

By

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DECLARATION

I have over 30 years' experience in soil surveying, classification and interpretation. I have compiled over 150 soil survey reports, including numerous EIA and related studies. I have a PhD in soil science and am a member of the Soil Classification Working Group of South Africa.

I hereby declare that I am qualified to compile this report as a registered Natural Scientist (SACNASP Registration No. 400463/04) and that I am independent of any of the parties involved and that I have compiled an impartial report, based solely on all the information available.

D G Paterson
June 2020

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1. INTRODUCTION

ARC-Institute for Soil, Climate and Water was contracted to undertake a soil and agricultural potential assessment as part of the Basic Assessment (BA) process being undertaken for the proposed Geelstert Grid Connection in the Northern Cape Province.

ABO Wind renewable energies (Pty) Ltd is proposing the development of a grid connection for the proposed Geelstert 1 and Geelstert 2 solar PV facilities on a site 11 km south-east of Aggeneys in the Northern Cape Province. The Geelstert Grid Connection will include the development of a collector substation and a double-circuit power line, of up to 220 kV, to connect the proposed Geelstert 1 and Geelstert 2 solar PV facilities to the national grid. A 1 km wide (extending to 2 km at the Aggeneys Main Transmission Substation (MTS)) and 17.5 km long corridor (known as the project development corridor) is being assessed to allow for the optimisation of the grid connection infrastructure to accommodate the environmental sensitivities identified within the corridor. The assessed grid connection corridor falls within the Northern Strategic Transmission Corridor and the Springbok Renewable Energy Development Zone (REDZ 8). The grid connection solution comprises of the following project-specific infrastructure, namely:

- A new Collector Substation/Switching Station of up to 1.25 ha in extent, including:
  - Construction of a new platform with earth mat and civil works.
  - New feeder bay/s and busbar/s (up to 220 kV) complete with protection equipment.
- A double-circuit power line of up to 220 kV between the existing Aggeneis MTS and the Geelstert Collector Substation, complete with structures, foundations, conductor, fibre layout, insulation and assemblies.
- A 6 m wide access road to access the Geelstert Collector Substation and 4 m wide jeep tracks to provide access to and along the power line servitude.
- A single-circuit power line (of up to 220 kV) to connect the authorised Aggeneys 1 and Aggeneys 2 Collector Substation to the proposed Geelstert Collector Substation, including a 6 m wide access road along this power line.
- Works within the Aggeneys MTS HV yard:
  - Establish new feeder bay/s (up to 220 kV), inclusive of line bays, busbars, bus section and protection equipment.
  - If grid connection on 132 kV level is required by Eskom, a new transformer (up to 500 MVA 400/132 kV) would need to be installed.

The corridor traverses six (6) properties, namely:

- » Remaining Extent of the Farm Bloemhoek 61
- » Remaining Extent of the Farm Aggeneys 56
- » Remaining Extent of Portion 1 of the Farm Aggeneys 56
- » Portion 2 of the Farm Aggeneys 56
- » Portion 12 of the Farm Aggeneys 56
- » Portion 13 of the Farm Aggeneys 56

2. TERMS OF REFERENCE

The purpose of the investigation is to contribute to the Impact Assessment process for the proposed Geelstert Grid Connection. The objectives of the study are;

- To obtain all existing soil and related information,
- To produce a soil map of the specified area, and
- To assess broad agricultural potential and impacts.

2.1 Legislative and Policy Framework

In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), any application for change of land use must be approved by the Minister of Agriculture, while under the Conservation of Agricultural Resources Act (Act 43 of 1983) no degradation of natural land is permitted.

The following section summarises South African Environmental Legislation with regard to soil and agricultural issues:

- The law on ***Conservation of Agricultural Resources*** (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. The Act also requires the protection of land against soil erosion and the prevention of water logging and salinization 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.

- The ***Bill of Rights*** states that environmental rights exist primarily to ensure good health and well-being, and secondarily to protect the environment through reasonable legislation, ensuring the prevention of the degradation of resources.

- Environmental rights are furthered in the ***National Environmental Management Act*** (No. 107 of 1998), which prescribes three principals, namely the precautionary principle, the "polluter pays" principle and the preventive principle. It is stated in the above-mentioned act that the individual/group responsible for the degradation/pollution of natural resources is required to rehabilitate the polluted source.

- Soils and land capability are protected under the ***National Environmental Management Act*** (Act 107 of 1998), the ***Environmental Conservation Act*** (Act 73 of 1989) and the ***Conservation of Agricultural Resources Act*** (Act 43 of 1983).

- The ***National Veld and Forest Fire Bill*** of 10 July 1998 and the ***Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act*** (Act 36 of 1947) can also be applicable in some cases.

- The ***National Environmental Management Act*** (Act 107 of 1998) requires that pollution and degradation of the environment be avoided, or, where they cannot be avoided, are minimised and remedied.

3. SITE CHARACTERISTICS

3.1 Location

Areas for the proposed Geelstert 1 and 2 project sites which were identified are located to the south-east of the town of Aggeneys. Both of these projects will utilise the proposed grid connection corridor to connect the infrastructure to the Aggeneis Main Transmission Substation (MTS). The position of the proposed Geelstert Grid Connection is shown by the **black polygon** on Figure 1.

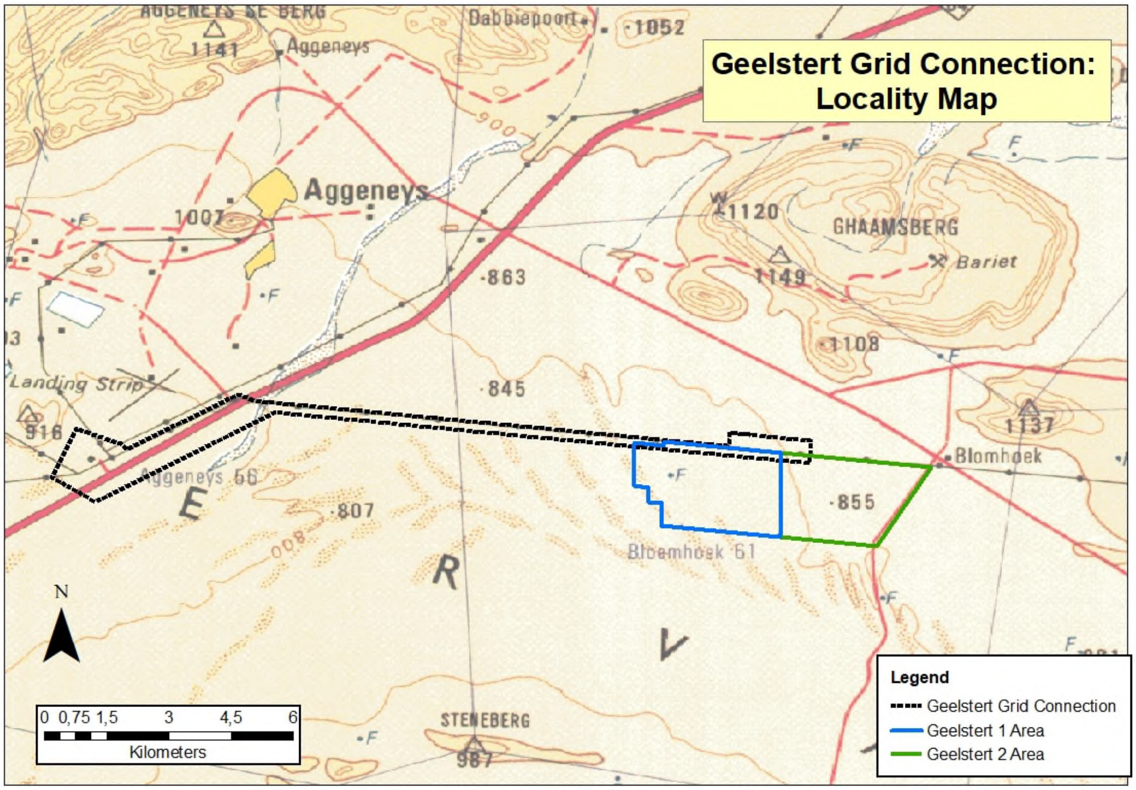

Figure 1 *Geelstert Grid Connection Locality Map*

3.2 Terrain

The study area that comprises the proposed grid connection route consists of gently undulating topography, with slopes of less than 5% over most of the area, and with an altitude above sea level of between 800 and 850 m.

The current natural vegetation of the project site comprises very sparse natural shrub vegetation (see Figure 2). The southern boundary of the grid connection route borders onto a dune system see Figure 3).

Figure 2 *Natural vegetation in study area*

Figure 3 *Dune landscape towards the southern boundary of the grid connection route*

3.3 Climate

The climate of the area has a mostly all year rainfall distribution, but the annual average is very low, at around 75 mm per year, although this might be slightly higher in the higher parts of the landscape (Koch *et al.*, 1987).

Temperatures will be warm to very hot in summer, with daily maximums regularly exceeding 40°C, but cool to cold in winter, with almost no occurrence of frost.

3.4 Parent Material

The area is underlain by Quaternary sediments, mostly sandy (Geological Survey, 1984). As previously stated, dunes occur in places in the landscape.

4. METHODOLOGY (Land Type Survey)

Existing desk-top information was obtained from the map sheet 2918 Pofadder (Schloms & Ellis, 1987) from the national Land Type Survey, published at a 1:250 000 scale. A ***land type*** is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

The broad study area under investigation is covered by two land types, as shown on the map in Figure 4, namely:

- **Af21, Af26** (High base status, red soils, with dunes)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur.

A summary of the dominant soil characteristics of each land type is given in Table 1 below.

Column 6 shows the distribution of agricultural potential per soil class within each land type (see Section 5), with the dominant class shown in **bold**. These figures will always add up to 100%, so that the relative proportions of each potential class within every land type can be determined and easily compared with other land types.

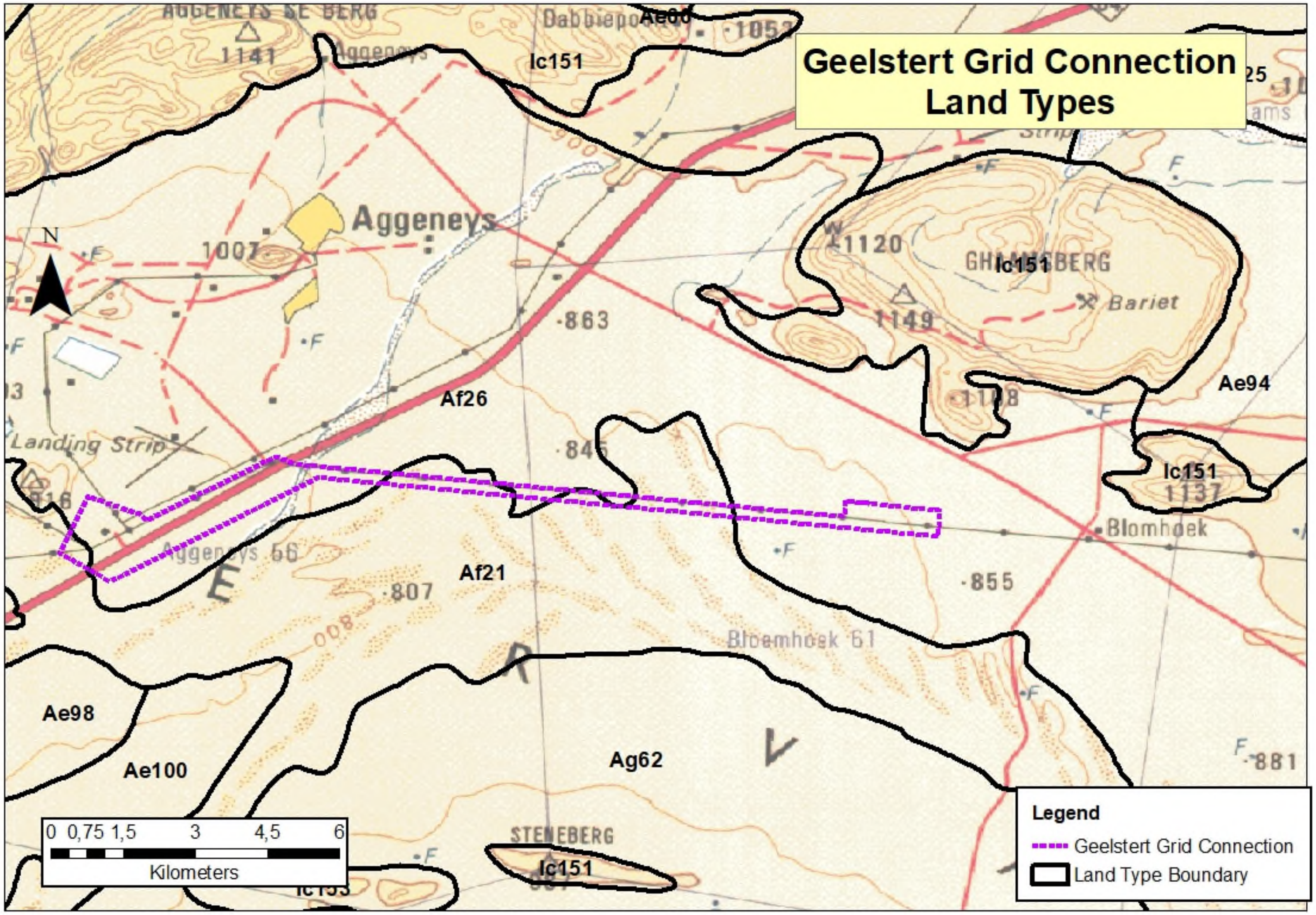

Figure 4 *Land types occurring, Geelstert Grid Connection corridor*

Table 1 Land types present within the study area (with soils in order of dominance)

Land Type	Dominant soils	Depth (mm)	Percent within land type	Characteristics	Agric. Soil Potential* (%)
Af21	Hutton 31 Hutton 32/35	>1200 300-700	75% 16%	Red, sandy, structureless dune soils Red, sandy, structureless soils, on calcrete/dorbank	High: 0.0 Mod: 0.0 **Low: 100.0**
Af26	Hutton 30/31 Fernwood 21	>1200 >1200	63% 17%	Red, sandy, structureless soils, occasional dunes Grey, sandy, structureless soils	High: 0.0 Mod: 0.0 **Low: 100.0**

***Note** – this describes the **soil characteristics only**, and does not take into account any other limiting factors, such as climate.

5 SOILS

5.1 Field observations

The vicinity of the project site was visited for a previous development (proposed Aggeneys 1 and 2 solar PV facilities and the associated grid connection infrastructure) on 6th and 7th November 2018. The purpose of the field visit was to confirm, by reconnaissance ground-truthing, the soils occurring in the area, as well as to carry out a visual evaluation of the landscape. The soils were investigated using a hand-held soil auger on a free style basis throughout the study area. No samples were collected, due mainly to the low prevailing agricultural potential.

As evident from Figure 4, the Geelstert Grid Connection corridor lies mostly within land type **Af26**, which consists largely of deep, sandy soils, although it crosses land type **Af21** (dunes) in places along the route. However, possibly due to the location at the foot of the rocky hills to the north, the field investigation confirmed the presence of shallower soils along the route in question, with soils classified as belonging to the **Garies** (orthic topsoil on red apedal subsoil on cemented dorbank) and **Knersvlakte** (orthic topsoil on cemented dorbank) forms, with depths of less than 900 mm. Some outcrops of gravel and dorbank were also observed at the surface, as shown in Figure 5. These shallower soils occurred mainly at the eastern end of the corridor (closer to the connection/s with Geelstert 1 and 2), as well as the portion where the corridor follows the main road close to Aggeneys itself.

Figure 5 *Cemented dorbank layer exposed in soil profile*

5.2 Erodibility

The soils present along the Geelstert grid connection route are not considered susceptible to erosion by water. However, if the vegetation cover is disturbed (for example by overgrazing or construction activities) and considering the sandy nature of the topsoils, as well as the dry climate, there is a significant possibility of removal of some or all of the topsoil by wind action.

This can be mitigated by ensuring that the minimum area is disturbed, and that rehabilitation of surface vegetation is carried out as soon as possible.

6. AGRICULTURAL POTENTIAL

As can be seen from the information contained in Table 1, there are no high potential soils present within the project site. The soils present are generally of low potential at best. This is mainly due to a combination of the shallow depth in places (observed during the field visit) and the sandy texture which will lead to rapid water infiltration and the soils drying out.

In addition, the low rainfall in the area (Section 3.3) means that there is little potential for rain-fed arable agriculture in the area in any case. Arable production would therefore be possible only by irrigation, and no indications of any irrigated areas, within and surrounding the project site, can be identified through Google Earth (and none was identified during the previous field visit in 2018).

In general, the soils that do occur within the project site are suited for extensive grazing at best, and the grazing capacity of the area is very low, at around 26-40 ha/large stock unit (ARC-ISCW, 2004).

6.1 Recommendations

The prevailing potential of the soils for rain-fed cultivation throughout most of the area, as well as the use of irrigation activities for cultivation, is low. Considering the land types and soils located along the Geelstert Grid Connection corridor and the current land-use activities, it is recommended that no further detailed soil investigation is required for the Geelstert Grid Connection project.

7. IMPACTS

Assessment of Impacts

Direct, indirect and cumulative impacts of the issues identified through the scoping study, as well as all other issues identified in the EIA phase are assessed in terms of the following criteria:

» The **nature**, which includes a description of what causes the effect, what will be affected and how it will be affected.

- The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it is indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which is determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which is described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S = (E+D+M) x P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- » 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- » > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Two impacts have been identified to be associated with the development of the Geelstert Grid Corridor from a soil perspective; these impacts include:

***Impact 1* (Table 2)**: In most environmental investigations, the major impact on the natural resources of the site would be the loss of potential agricultural land due to the installation of the required infrastructure. However, in this instance, there is no evidence of any cultivation in the vicinity, so this impact would be of extremely limited significance and would be local in extent, if at all. This is due mainly to the isolated and limited nature of the grid infrastructure.

***Impact 2* (Table 3)**: In this area, the sandy soils, coupled with the dry climate, means that a possible impact would be the increased risk of wind erosion of the topsoil when vegetation cover is removed or disturbed. This would be especially relevant for the construction of access roads associated with the development.

The significance of the impacts can be summarised as follows:

Table 2 Loss of agricultural land, Geelstert Grid Connection

Nature: Loss of potentially productive agricultural land *(both construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance (E+D+M) x P	**Low (18)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible.		
Cumulative impacts: likely to be low, as all soil-related aspects will be confined to the site, and the prevailing agricultural potential in the area is low.		
Residual Risks: likely to be low, since the implementation of the appropriate mitigation measures will enable more or less complete rehabilitation during and after the life of the project.		

Table 3: Soil erosion

Nature: Increased soil erosion hazard by wind *(construction and operation phase)*		
	Without mitigation	**With mitigation**
Extent	Local to regional (3)	Local (1)
Duration	Permanent (5)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance (E+D+M) x P	**High (64)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Very possible	No
Can impacts be mitigated?	Yes	
Mitigation: The main mitigation measures would be: • To minimise the footprint of construction as much as possible. • Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-vegetated as soon as possible. • Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure).		
Cumulative impacts: likely to be high, as wind erosion can carry soil particles for a considerable distance, depending on wind strength and direction, as well as soil texture.		
Residual Risks: if mitigation is not carried out, long-term wind erosion, with results such as loss of valuable topsoil, may occur.		

The main impact would be due to the construction-related activities for the grid connection infrastructure (pylons, cables, roads, etc.).

7.1 Cumulative Impacts

The likelihood of cumulative impacts for wind erosion may be significant, if not mitigated. This is because concurrent developments are proposed close to the Geelstert Grid Connection investigated in this report, as shown in Figure 6. The impacts are summarised in Table 4 below.

When considering the other renewable energy developments and the associated grid connections within the surrounding area (within a 30 km radius from the development area), it is assumed that the impact of erosion and appropriate mitigation measures at a site-specific level for each of the facilities has been considered and the mitigation measures recommended are sufficient for the management and mitigation of erosion. Therefore, considering that the impact of erosion at each facility proposed within the 30km radius will be low in extent, subject to the implementation of the recommended mitigation measures, and managed for each facility separately, the cumulative impact for erosion is considered to be low. Under these circumstances, the loss associated with erosion is therefore considered to be acceptable loss, without detrimental consequences.

If there is large-scale development of renewable energy facilities and associated grid connections in the area, any failure to prevent wind erosion of topsoil on one project could lead to that material being deposited on any or all neighbouring properties.

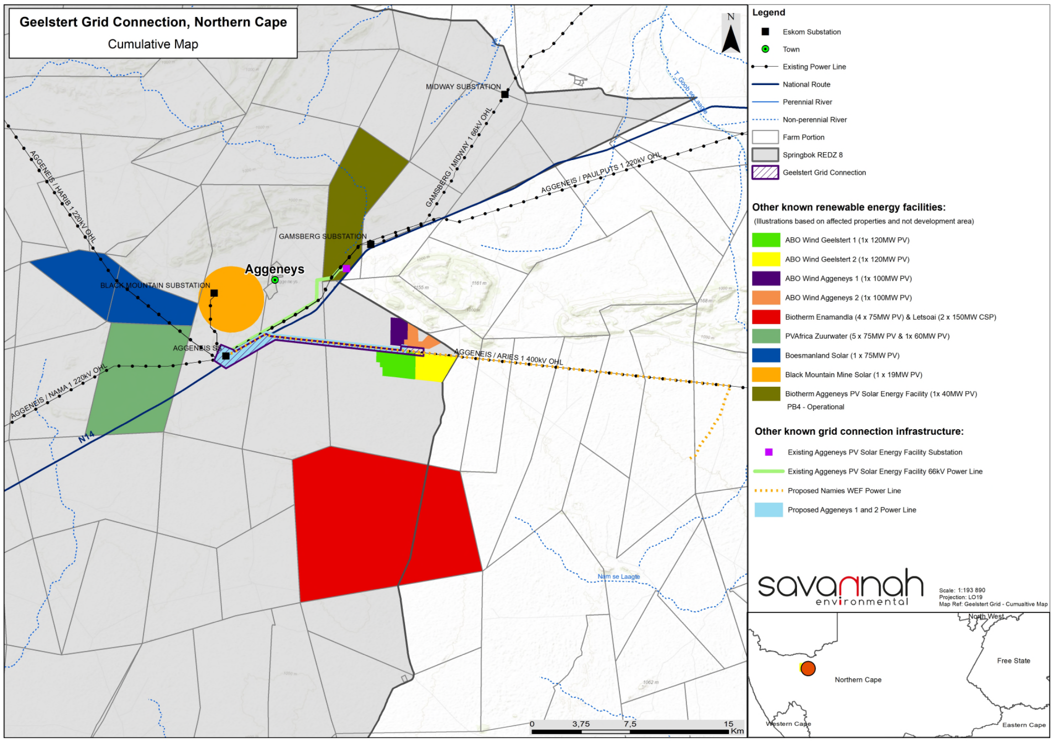

Figure 6 Map showing Renewable Energy projects in the vicinity of Geelstert Grid Connection corridor.

7.2 Assumptions and Limitations

The main limitation regarding soil information has been addressed with the field visit, which has confirmed soil conditions prevalent in the area, as well as carrying out a visual inspection.

It is assumed that, for accurate determination of any cumulative impacts, there will be an optimal level of co-operation between representatives of all projects planned in the vicinity in the future. This will ensure that important environmental information is not withheld, that could lead to increased impact levels, such as wind erosion.

The cumulative impacts are summarised in Table 4 below.

Table 4 Cumulative Impacts

<table>
<tr><td colspan="3">Nature: Cumulative impact of the Proposed Development in terms of wind erosion</td></tr>
<tr><td></td><td>Overall impact of the proposed project considered in isolation[1]</td><td>Cumulative impact of the project and other projects in the area[2]</td></tr>
<tr><td>Extent</td><td>Local (1)</td><td>Local (2)</td></tr>
<tr><td>Duration</td><td>Short-term (2)</td><td>Short-term (2)</td></tr>
<tr><td>Magnitude</td><td>Minor (2)</td><td>Minor (2)</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>Improbable (2)</td></tr>
<tr><td>Significance (E+D+M)x P</td><td>Low (10)</td><td>Low (12)</td></tr>
<tr><td>Status (positive/negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>High</td><td>High</td></tr>
<tr><td>Loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Confidence in findings:
High.</td></tr>
<tr><td colspan="3">Mitigation: The main mitigation measures would be:
• To minimise the footprint of construction for each facility as much as possible.
• Where soil is removed/disturbed, ensure it is stored for rehabilitation and re-vegetated as soon as possible.
• Implement all appropriate soil conservation measures, including contouring, culverts etc. (for road construction), geotextiles and slope stabilisation (for all infrastructure).
• Ensure that equal responsibility and co-operation is accepted if more than one facility will be using the same access road, or if the possibility exists of sediment transfer (by wind or water) from one site to another</td></tr>
<tr><td colspan="3">Residual Risks:
Significant risk of accelerated soil erosion by wind if mitigation measures of each facility are not applied correctly.</td></tr>
</table>

[1] It is assumed that the appropriate mitigation measures have been implemented.

[2] It is assumed that the appropriate mitigation measures have been implemented.

8 CONCLUSION AND RECOMMENDATIONS

The main recommendation is that care should be taken within all aspects of the construction phase to ensure that erosion is managed and mitigated appropriately. The grid connection route traverse a dry area, with fragile vegetation and sandy topsoils, and will be susceptible to uncontrolled topsoil removal by wind. The long-term effects of ignoring this aspect could be severe, both for the project and for the surrounding environment.

8.1 Measures for inclusion in the draft Environmental Management Programme

OBJECTIVE: Conservation, as far as possible, of the existing soil resource, both on site and in adjoining areas.

Project component/s	Construction of all infrastructure where topsoil will be disturbed
Potential Impact	Loss of topsoil leading to wind erosion
Activity/risk source	Construction activities
Mitigation: Target/Objective	To retain all topsoil with a stable soil surface

Mitigation: Action/control	**Responsibility**	**Timeframe**
• Storage of all topsoil that is disturbed (maximum height 2 m; maximum length of time before re-use 18 months).	Construction Engineer	Construction
• Immediate replacement of topsoil after the undertaking of construction activities within an area	Construction Engineer	Construction
• Soil conservation measures must be put in place to ensure soil stabilisation	Construction Engineer	Post-Construction

Performance Indicator	No indications of visible topsoil loss
Monitoring	Visual inspection every 6 months (minimum) of all areas where disturbance has taken place (for both the construction phase and the duration of the project). Responsibility: Project site manager. If soil loss is suspected, acceleration of soil conservation and rehabilitation measures must be implemented (as specified above).

Considering the findings of the report and the current soils environment within which the Geelstert Grid Connection is proposed, it is the opinion of the specialist that the proposed activities should be authorised, subject to the implementation of the recommended mitigation measures. The activities proposed are considered to be acceptable from a soil perspective considering the characteristics and potential of the soils present within the project site.

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