AURECON SOUTH AFRICA

Proposed Wind Energy Facility Near Copperton, Northern Cape

Desktop Agricultural Assessment

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Declaration

I, Kurt Barichievy, declare that I –

- act as an independent specialist consultant in the fields of Soil Science and Agricultural Potential for the **Desktop Agricultural Assessment for the Proposed Wind Energy Facility near Copperton, Northern Cape**;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

Mr. K.R. Barichievy (Pr. Sci. Nat.)
Scientist
SiVEST

AURECON SOUTH AFRICA

PROPOSED WIND ENERGY FACILITY: COPPERTON

DESKTOP AGRICULTURAL ASSESSMENT

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1 INTRODUCTION

Aurecon South Africa (Pty) Ltd (Aurecon) on behalf of Plan 8 (Pty) Ltd (Plan 8) requested a desktop agricultural assessment for the area affected by the proposed wind energy facility near the town of Copperton in the Northern Cape Province. The primary objective of this assessment is to provide specialist agricultural, soil and land use input for the overarching Environmental Impact Assessment Report. In order to achieve this objective a study of the climate, soils, terrain, aspect, land capability, geology and current agricultural practices was carried out. This report serves to summarise such a study and present the relevant results.

The proposed project includes the construction of a wind generated energy facility in the Northern Cape Province of South Africa. It is proposed that the site be developed using a 3 phase approach, depending on Eskom's timelines for purchase of the energy (**Aurecon, 2011**). The proposed wind energy facility includes the phased construction of eighty (80) wind turbines, a connecting transmission line and the construction of service roads to link the various turbines. Once fully completed this facility will generate approximately 200 Megawatts and will be connected into the existing Eskom power grid using adjacent distribution infrastructure.

The proposed project would take place on Struisbult Farm (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5). Struisbult Farm is located approximately 5 km east of Copperton, and the two portions (portions 4 and 7) cover approximately 3 100 ha. It is hoped that this assessment, along with the other specialist studies, will inform the turbine positioning and transmission line routing process and thus minimise the predicted impacts on the receiving environment.

1.1 Study Objectives

1.1.1 Compile a detailed desktop agricultural potential assessment

In terms of this study, agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use, and in most cases this potential is benchmarked against crop production. Thus the objective of this desktop study is to broadly assess the agricultural potential of the affected land by interrogating relevant climate, topographic, landuse and soil datasets. By combining these relevant data sets one is able to broadly assess the agricultural potential of the affected land.

1.1.2 Undertake an agricultural constraint analysis and initial impact assessment

The constraint analysis utilises the desktop to indicate, from an agricultural perspective, any potential fatal flaws which could result from the proposed activities. This section will outline predicted impacts on agricultural resources, highlight problematic areas and specify 'no-go zones'.

1.2 Assumptions and Limitations

This desktop assessment is used to identify any major agricultural impacts relating to the proposed development. It should be clearly noted that, since the spatial information used in portions of this report is of a reconnaissance nature, only broad/large scale climate, land use and soil details are provided.

2 DESCRIPTION OF PROPOSED ACTIVITIES AND TECHNICAL DETAILS

The technical details provided in this section are primarily extracted from the Final Scoping Report produced by Aurecon (**2011**).

The proposed wind energy facility includes the phased construction of eighty (80) wind turbines, a connecting transmission line and the construction of service roads, with a width of 6 m, to link the various turbines.

A wind turbine is a rotary device that extracts energy from the wind. Turbines used in wind farms for commercial production of electricity are usually horizontal axis, three-bladed and pointed into the wind by computer-controlled motors. These have high tip speeds of over 320 km/hour, high efficiency, and low torque ripple, which contribute to good reliability. The blades are usually coloured light grey and range in length from 20 - 50 m or more. The tubular steel towers range from 60 - 100 m tall. The blades rotate at 10 - 22 revolutions per minute. A gear box is commonly used for stepping up the speed of the generator. Some models operate at constant speed, but more energy can be collected by variable-speed turbines. All turbines are equipped with protective features to avoid damage at high wind speeds, by feathering (turning) the blades into the wind which ceases their rotation, supplemented by brakes. Horizontal axis wind turbines have the main rotor shaft and electrical generator at the top of a tower in a nacelle. Conventional horizontal axis turbines can be divided into three components.

- The rotor component, which includes the blades for converting wind energy to low speed rotational energy.
- The generator component, which includes the electrical generator, the control electronics, and most likely a gearbox component for converting the low speed incoming rotation to high speed rotation suitable for generating electricity.
- The structural support component, which includes the tower and rotor yaw mechanism (which turns the rotor into the wind) (**Internet 1, 2011**).

Once completed, the proposed facility will produce a total of 200 MW. Each mast will be approximately 80-100m in height, and each of the three rotors will be approximately 50m in length (100m diameter).

The final foundation design of turbines is dependent on geotechnical investigation; however it is likely that for the proposed project foundations would be made of reinforced concrete. The foundations would be approximately 20 m x 20 m and an average of 3 m deep. The foundation would be cast *in situ* and could be covered with top soil to allow vegetation growth around the 6 m diameter steel tower.

A hardstand for a crane, made of an impermeable material such as concrete or tar and approximately 20 m x 6 m, would be constructed adjacent to each turbine. Gravel surface access roads of 6 m wide would also be required between each turbine.

There is electricity distribution infrastructure adjacent to the farm which is designed for 132 kilovolt (kV) distribution. This line could be used by the proposed project to evacuate the power generated and hence a new line, other than the existing 2 km long connection, would not be required. However, Eskom may require that the electricity is evacuated via the Cuprum substation, which is located on the site of the disused copper mine rock crushing facility approximately 6.5 km to the south west. The final connection will be dependent on the technical requirements and cost set out by Eskom (**Aurecon, 2011**).

3 DESKTOP AGRICULTURAL ASSESSMENT

The objective of the desktop agricultural assessment is to provide broad soil and agriculturally related characteristics of the study area. In order to ascertain these characteristics relevant climate, topographic, landuse and soil datasets were sourced and interrogated.

Existing high level GIS data was sourced from National GIS Datasets as well as the Environmental Potential Atlas for South Africa (ENPAT) Database for the Northern Cape Province of South Africa, compiled by the Department of Environmental Affairs and Tourism (**DEAT, 2001**). The main purpose of ENPAT is to proactively indicate potential conflicts between development plans and critical, endangered or sensitive environments. By combining the aforementioned data sources one is able to broadly assess the site alternatives, receiving environment, and its ability to accept change, in the form of development. More agriculturally relevant spatial information was obtained from the AGIS Database.

3.1 Climate

The study area has an arid continental climate with a summer rainfall regime i.e. most of the rainfall is confined to summer and early autumn. The rainfall data for the study area was sourced from the Daily Rainfall Extraction Utility (**Lynch, 2003**). This utility is essentially a database which contains long term rainfall records from 11 269 South African rainfall stations. According to this database the Mean Annual Precipitation (MAP) for the project area is approximately 176 mm per year with 62% of this falling between January and April (**Figure 1**).

Mean Annual Precipitation of 176 mm is deemed extremely low remembering that 500mm is considered the minimum amount of rain required for sustainable dry land farming (**Smith, 2006**) (**Figure 2**). Thus without some form of supplementary irrigation natural rainfall for the study area is insufficient to produce sustainable harvests. The low rainfall is reflected in the lack of dry land crop production within the study area. The region typically experiences hot days and cold nights with the average summer temperature of approximately 33 °C and the average winter night time temperatures of approximately 1 °C.

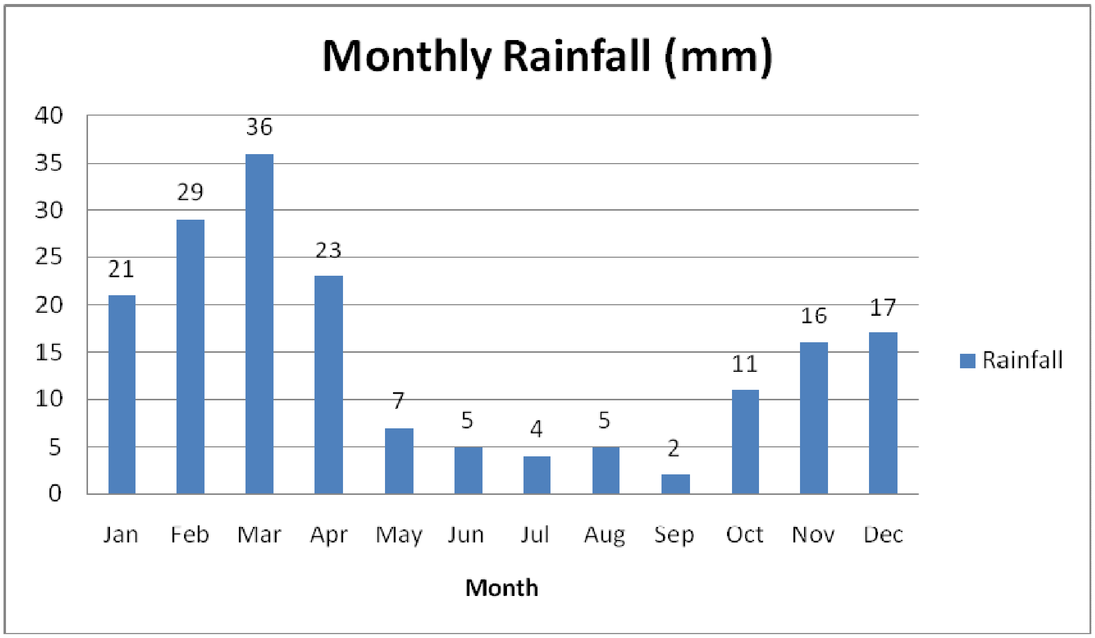

Figure 1: Mean Monthly Rainfall Graph for the Copperton Area (Source: Daily Rainfall Extraction Utility, Lynch 2003)

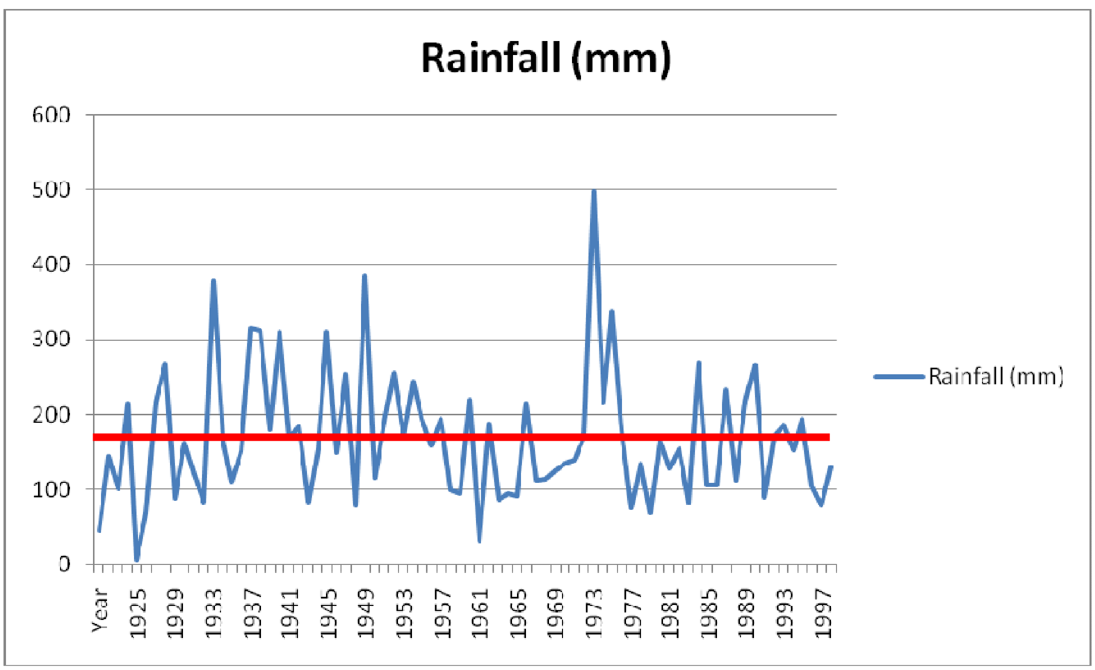

Figure 2: Long term annual rainfall (1922 – 1999) for the study area and long term average (indicated by the red line) (Source: The Daily Rainfall Extraction Utility, Lynch 2003)

3.2 Geology

The study area is underlain by a variety of parent materials including quartzite, sedimentary and tillite (**Figure 3**). Tillite is however, the most dominate geologic material and underlies the central portions of the site. Tillite consists of consolidated masses of unweathered blocks and unsorted glacial till. Quartzite, a medium grained metamorphic rock, underlies the north eastern and eastern portions of the site and is formed from recrystallised sandstone with the fusion of sedimentary quartz grains. Non-descript sedimentary geologic materials are found in the northern areas and along the south western boundary of the site.

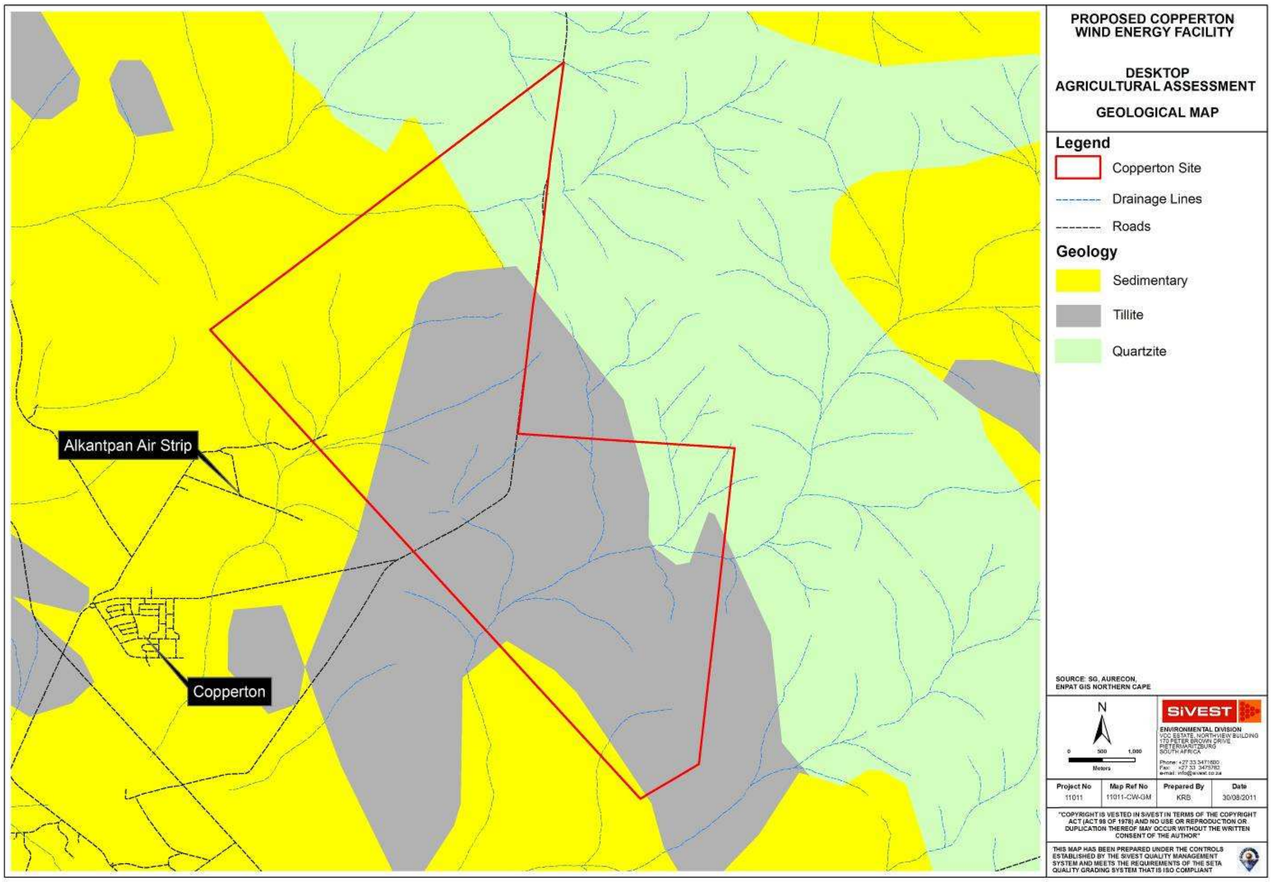

Figure 3: Geological Map

3.3 Slope

The study area is characterised by flat and gently sloping topography with an average gradient of less than 10% (**Figures 4** and **5**) making this area ideal for intensive agriculture, with high potential for large scale mechanisation. The topography is thus not a limiting factor for either agriculture or the proposed development.

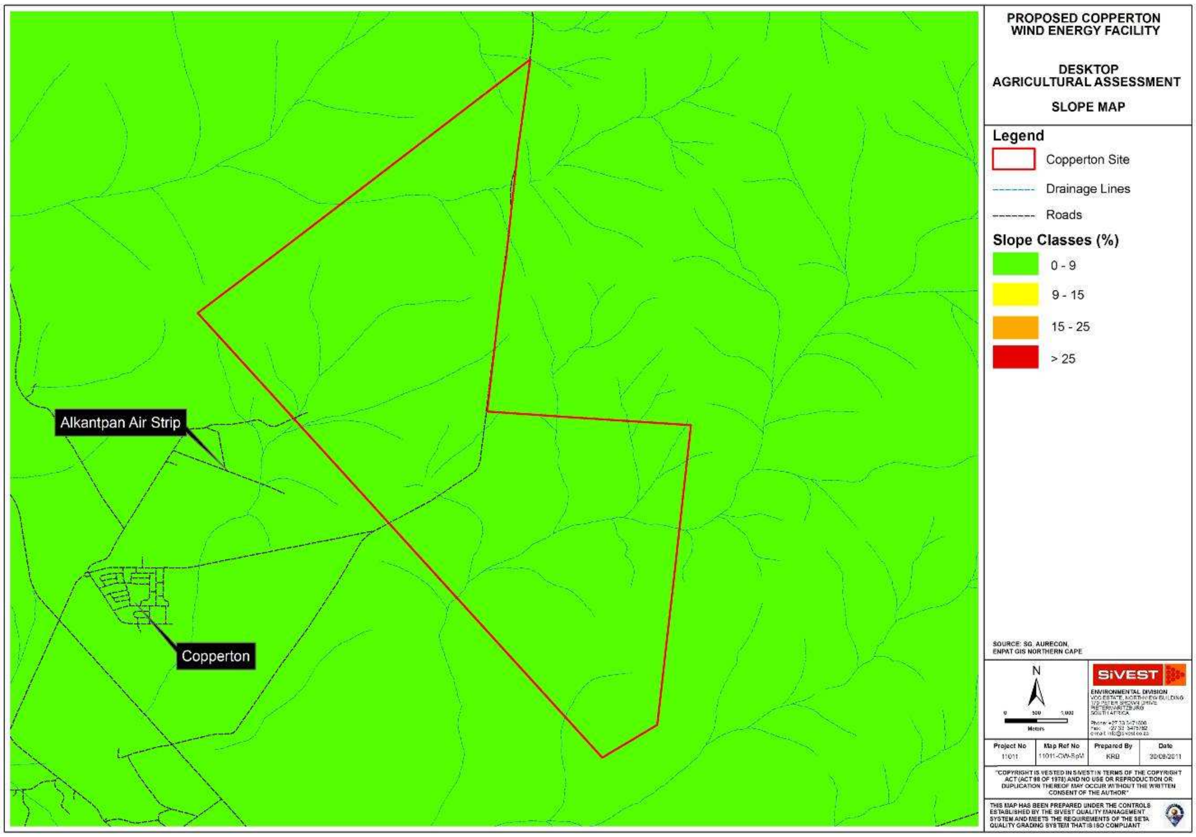

Figure 4: Slope Map

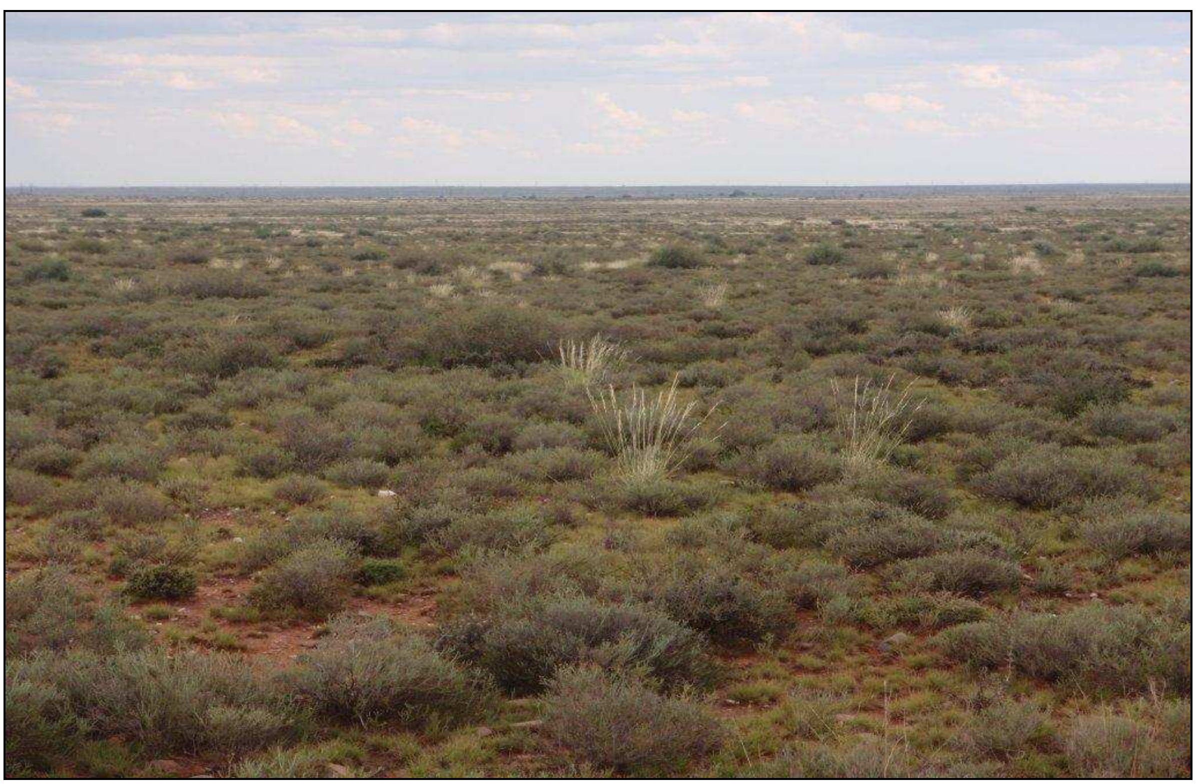

Figure 5: Typical topography encountered on the Copperton Site (Source: Aurecon, 2011)

3.4 Land Use

The dominant veld type for the area is classified as Arid Karroo and Desert False Grassland (**Acocks, 1975**). The proposed development area consists of a mix of natural veld and vacant land which is used as general grazing land for sheep (**Figures 6, 7** and **8**). Vast un-improved grazing land is interspersed by non-perennial stream beds and pans. Stocking rates for the region are estimated at 1 small animal unit per 6 hectares. According to the land use data there are no signs of formal agricultural fields or cultivation.

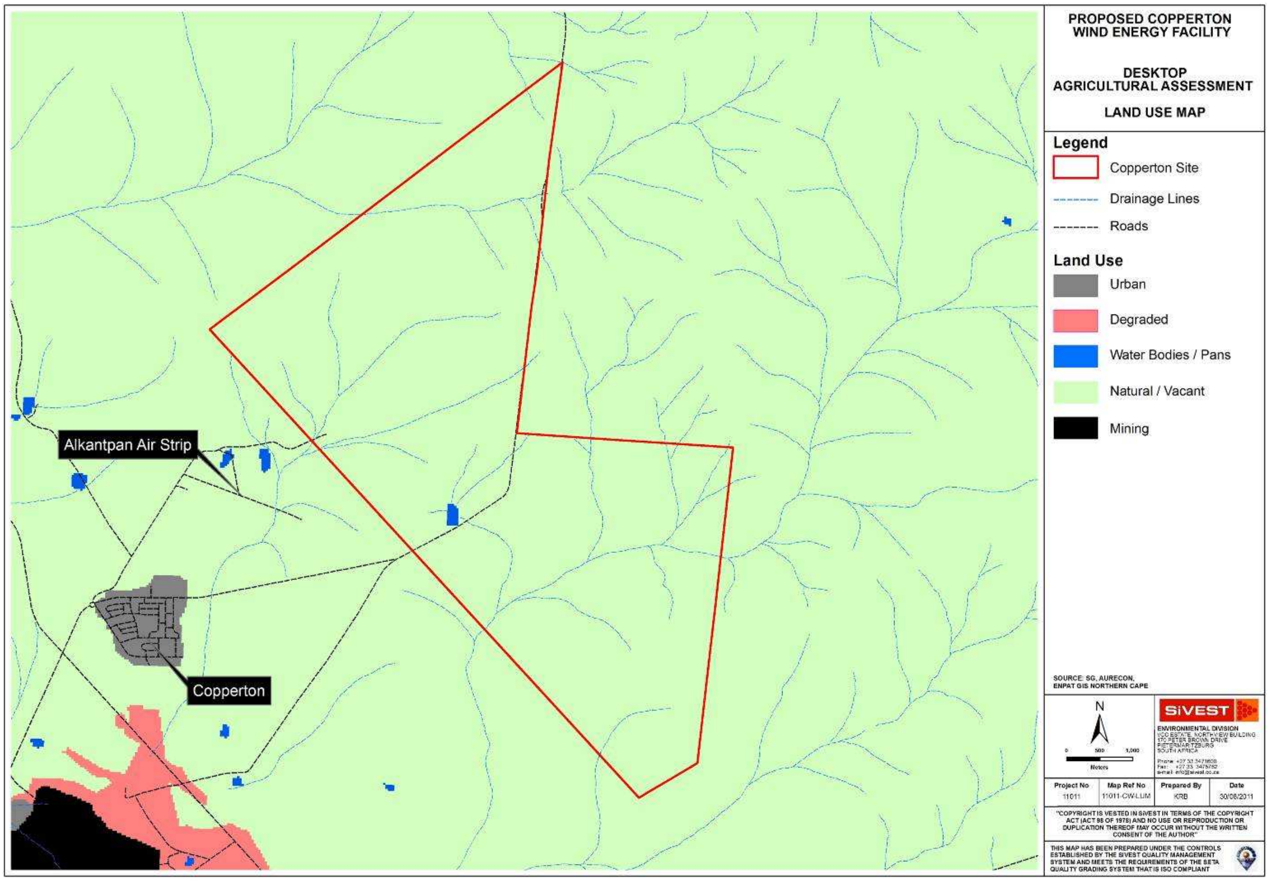

Figure 6: Land Use Map

Figure 7: A herd of sheep grazing in the Copperton area

Figure 8: Typical land cover within the Copper Site (Google Earth, 2011, imagery date 2008)

3.5 Soil Characteristics and Soil Potential

According to the ENPAT database the Copperton site is dominated by red apedal soil types (**Figure 9**). Apedal soils lack well formed peds other than porous micro-aggregates and are weakly structured. Apedal soils tend to be freely drained, and due to overriding climate conditions these soils will tend to be Eutrophic (high base status). The study area is classified as having an effective soil depth, depth to which roots can penetrate the soil, of less than 0.45 m deep which is a limiting factor in terms of sustainable crop production (**Figures 10, 11 and 12**).

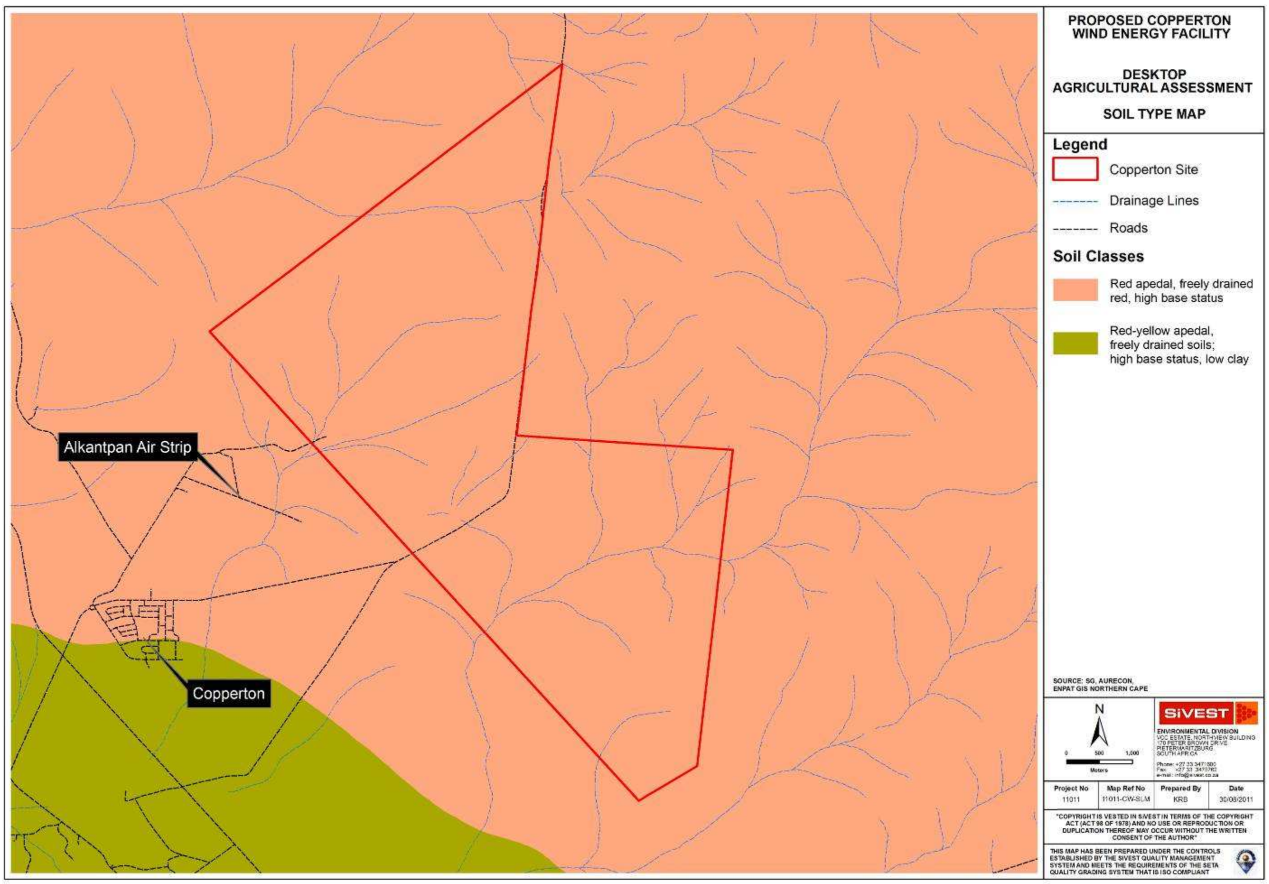

Figure 9: Soil Map

Figure 10: A shallow apedal soil identified near the Site. Soils, similar to the above photo, are expected to dominate the majority of the Copperton Site

Figure 11: An example of rocky and shallow soils found within the study area (Source: Aurecon, 2011)

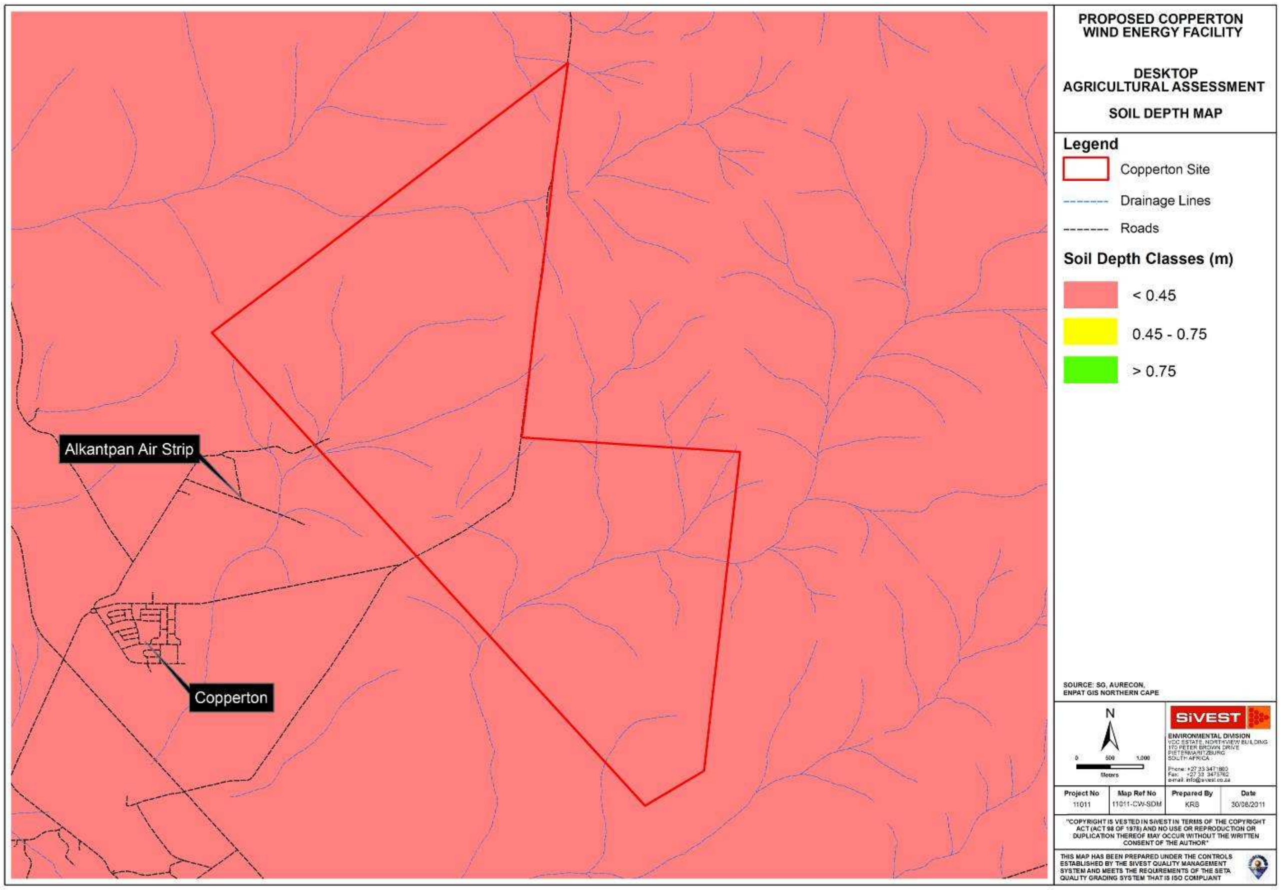

Figure 12: Soil Depth Map

The ENPAT Database also provides an overview of the study area's agricultural potential based on its soil characteristics, although it should be noted this spatial dataset does not take *prevailing climate into account*. According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still be used as grazing land (**Figure 13**). Restrictive climate characteristics, due to the strong summer rainfall regime, moisture stress and low winter temperatures, further reduce the agricultural potential of the site.

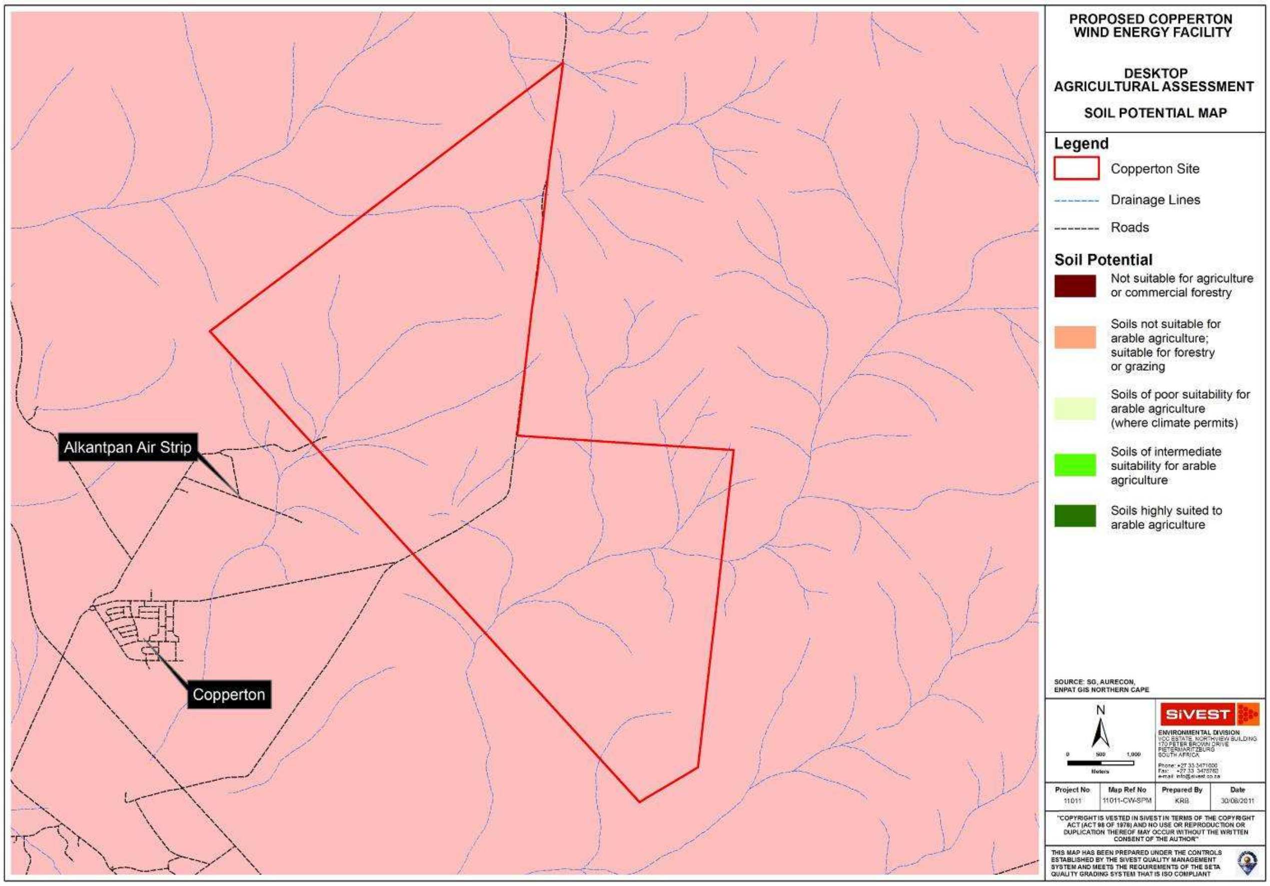

Figure 13: Soil Potential Map

3.6 Desktop Agricultural Assessment: Result Summary

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being extremely low for crop production while moderate to moderately low for grazing. This poor agricultural potential rating is primarily due to restrictive climatic characteristics and soil depth limitations. The site is not classified as high potential nor is it a unique dry land agricultural resource.

4 CONSTRAINT ANALYSIS AND INITIAL IMPACT ASSESSMENT

The primary aim of the constraint analysis is to highlight problematic areas and 'no-go zones' in terms of agricultural production and potential. In terms of this study, agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use and in most cases this potential is benchmarked against crop production. The desktop assessment (**Section 3**) has already shown that the study area is unsuitable for crop production and is dominated by unimproved grazing land.

The proposed development's primary impact on agricultural activities will involve the construction of the wind turbines and associated infrastructure. This will entail the clearing of vegetation around the footprint of the turbine and the crane hardstand, as well as creating service roads. Normal grazing (the dominant agricultural activity) will be permitted around the turbines. The Copperton site is dominated by grazing land and this activity is considered non-sensitive when assessed within the context of the proposed development. Consequently the impact of the proposed development on the study area's agricultural potential will be extremely low, with the loss of agricultural land being attributed to the creation of the service roads and around the turbine foundations. The total loss of grazing land will be in the region of 36.2 ha (road creation, turbine foundation and crane hardstand) which is 1.2 % of the total farm area. Again this loss is considered inconsequential within the context of this assessment.

There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development and as such there are no problematic or fatal flaw areas for the Copperton Site (**Figure 14**).

ISSUE	**Loss of agricultural land and production caused by the construction of the Copperton Wind energy**
DISCUSSION	Loss of agricultural land due to the construction of the wind turbines, service roads and associated infrastructure.
EXISTING IMPACT	N/A
PREDICTED IMPACT	The proposed development will have a very limited impact on agricultural potential or production on the Copperton Site as normal agricultural activities (grazing) can still take place around the turbines. The only loss of grazing land will be directly below the turbine, the crane hardstand footprint and within the road servitude. This area has been estimated at 1.2% of the total available grazing land which is negligible when considered within the context of this assessment.
EIA INVESTIGATION REQUIRED	A full EIA investigation should not be necessary unless the reconnaissance nature of this desktop report is found to have not described all the potential impacts sufficiently.
CUMULATIVE EFFECT	None anticipated.

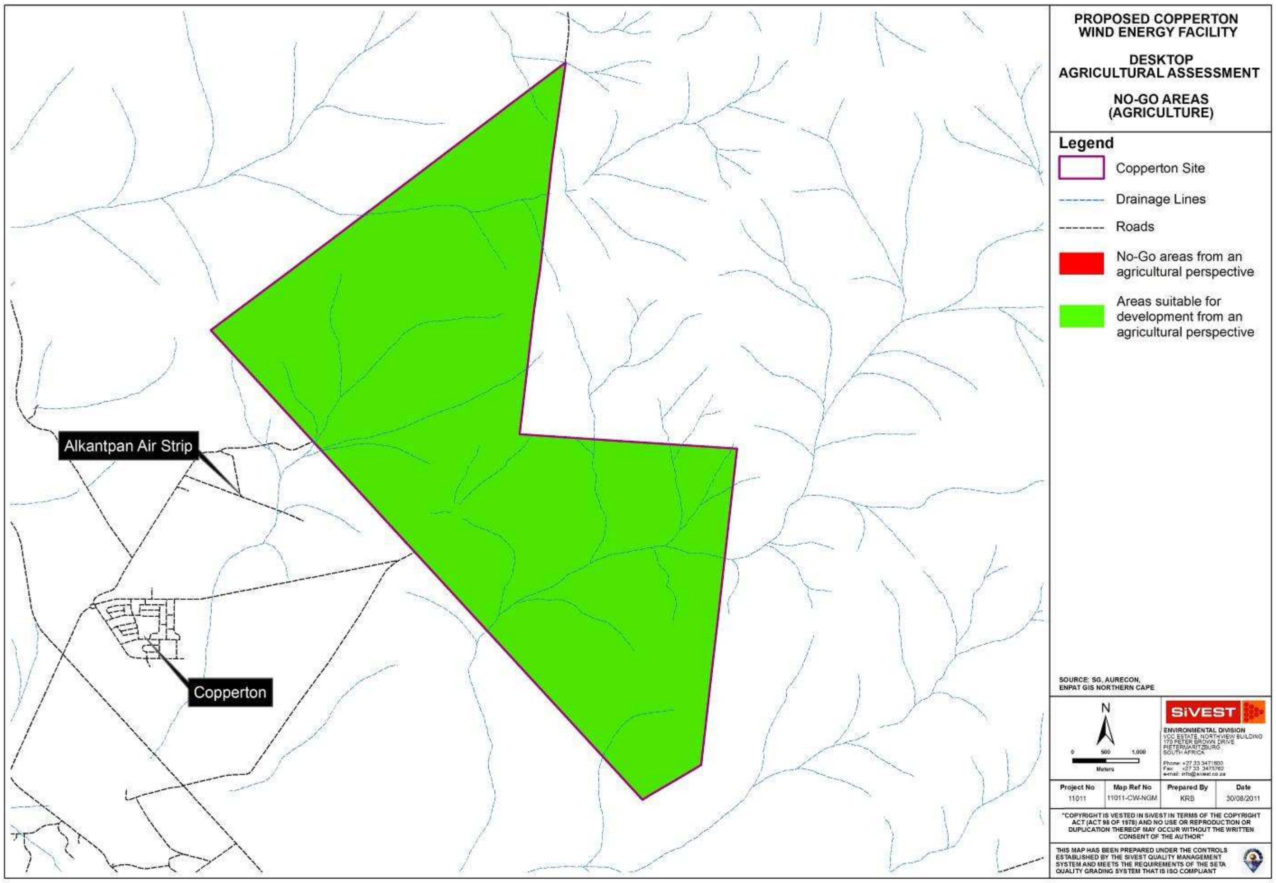

Figure 14: Developable and no-go areas from an agricultural perspective for the Prieska Site

5 CONCLUSIONS AND RECOMMENDATIONS

SiVEST were appointed by Aurecon to undertake a desktop agricultural assessment for the area affected by a proposed wind energy facility near the town of Copperton in the Northern Cape of South Africa.

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the study area is classified as being extremely low in terms of crop production, while moderate to moderately low for grazing. This poor agricultural potential rating is due to severe climatic limitations and marginal soil characteristics.

The Copperton site is dominated by grazing land and this land use can be seen as non-sensitive when assessed within the context of the proposed development. There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development and as such there are no problematic or fatal flaw areas for the Copperton Site. A full agricultural assessment in the EIA phase of the environment process should not be necessary unless the reconnaissance nature of this desktop report is found to have not described the pertinent site characteristics or potential impacts sufficiently.

6 REFERENCES

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