IMPACT ASSESSMENT REPORT

On contract research for

SAVANNAH ENVIRONMENTAL

Proposed Construction of a 75 MW Photovoltaic Power Plant, Majuba Power Station, Mpumalanga Province

Soils and Agricultural Potential

EIA Study

By

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DECLARATION

I hereby declare that I am qualified to compile this report as a registered Natural Scientist and that I am independent of any of the parties involved and that I have supervised the compilation of an impartial report, based solely on all the information available.

D G Paterson

September 2015

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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Savannah Environmental to undertake a soil investigation near Amersfoort, in Mpumalanga Province. The purpose of the investigation is to contribute to the Environmental Impact Assessment (EIA) process for a proposed Photovoltaic (PV) power generation facility at Eskom's Majuba Power Station.

EIA Report

The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase of the proposed projects. This is achieved by site visits and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase.

The EIA report must include:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (including direct, indirect, cumulative impacts and residual risks) that have been identified
- Direct, indirect, cumulative impacts and residual risks of the identified issues must be evaluated within the EIA Report in terms of the following criteria:
  - the nature, which shall include a description of what causes the effect, what will be affected and how it will be affected;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- a comparative evaluation of the identified feasible alternatives, and **nomination of a preferred alternative** (where relevant)
- Any aspects which are conditional to the findings of the assessment which are to be included as conditions of the Environmental Authorisation
- This must also include any gaps in knowledge at this point of the study. Consideration of areas that would constitute "acceptable and defendable loss" should be included in this discussion.
- A reasoned opinion as to whether the proposed project should be authorised.
- A summary of the positive and negative impacts and risks of the proposed project and identified alternatives.

» Mitigation measures and management recommendations to be included in the Environmental Management Programme to be submitted with the FEIR

The objectives of the study are;

- To obtain all existing soil information and to produce a soil map of the specified area as well as

- To assess broad agricultural potential and the potential impacts that might result from the proposed PV development.

2. SITE CHARACTERISTICS

2.1 Location

The study area (Figure 1, orange area) is located 20 km south west of Amersfoort. The area is 93 ha in extent and lies immediately to the south of Majuba Power Station, between 26° 43' and 26° 45' S and between 27° 56' and 27° 59' E.

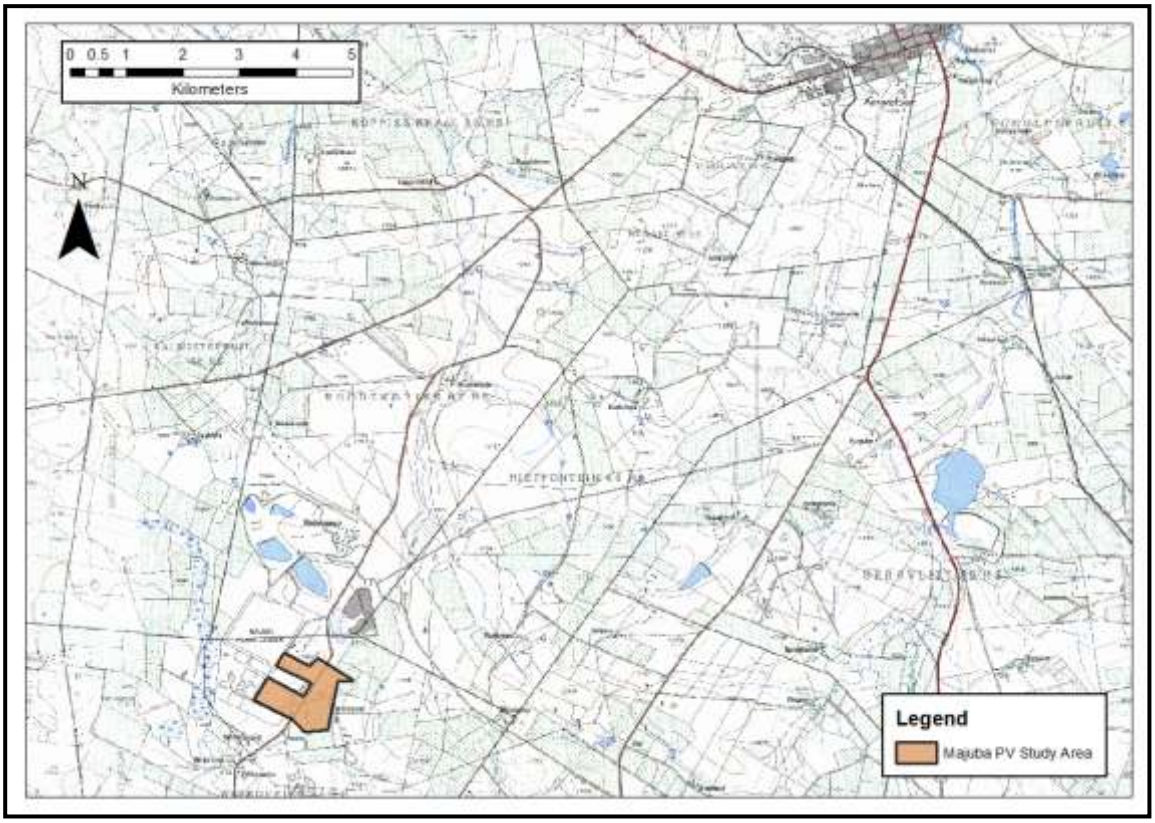

Figure 1 Locality map

At the time of the field visit (September 2015), the site was not being utilized. The site consisted of thick grass cover in the northern and eastern parts.

2.2 Terrain

The study area lies at a height of approximately 1 730-1 740 metres above sea level. The slope of the area is flat to gently undulating, with slopes of less than 2%. No perennial or non-perennial streams could be observed, but a potentially wet area was identified in the northern part of the study site (**Se** and **Es** map units).

2.3 Climate

Climate data was obtained from the national Land Type Survey (Kotzé, 1986).

The climate of the area can be described as typical of the south-eastern Highveld, with warm, moist to wet summers and dry, cool to cold winters. The main climatic parameters are given in Table 1.

On average, 85% of the annual average rainfall of 812.0 mm falls in the growing season (October to March).

Frost, often severe, occurs in winter. The extreme maximum temperature is 34.3°C and the extreme minimum –13.3°C

Table 1 Climate data for Amersfoort area

Month	Rain-fall (mm)	Min. Temp (°C)	Max. Temp (°C)	Average frost dates
Jan	119.8	12.2	24.4	Start date: 23/04 End date: 28/09 Days with frost: ±74
Feb	93.5	11.5	23.9	
Mar	75.5	10.0	23.0	
Apr	37.6	5.9	21.3	
May	17.9	1.8	18.8	
Jun	6.8	-1.6	16.4	
Jul	9.8	-1.7	16.1	**Heat units (hrs > 10°C)**
Aug	12.4	1.2	19.0	Summer (Oct-Mar): 1296 Winter (Apr-Sept): 222
Sep	30.2	5.3	21.6	
Oct	83.6	8.7	23.0	
Nov	115.9	10.2	23.0	
Dec	121.6	11.6	24.2	
Year	**812.0 mm**	**13.8°C (Average)**		

2.4 Parent Material

The geology of the study area consists of Shale and sandstone of the Volksrust Formation, Ecca Group, and dolerite (Geological Survey, 1981)

3. METHODOLOGY

The area was investigated using a hand-held soil auger to a maximum depth of 1.2 m. The grid of observation was approximately 150 x 150 m, with the positions controlled by GPS. At each soil observation point, the most important soil characteristics, including texture, colour, structure, mottling, coarse fragments and internal drainage were identified and noted. The soils were then classified (Soil Classification Working Group, 1991) and similar soils grouped into mapping units, whose distribution is shown in the soil map in the Appendix.

In addition, samples of topsoil and subsoil were collected at three localities and taken for analysis at the laboratories at ARC-ISCW. Parameters analyzed include particle size (sand, silt and clay), exchangeable cations (Ca, Mg, Na, Mg) and cation exchange capacity (CEC), organic carbon, pH (H_2O) and P (Bray 1).

4. SOILS

The soils occurring in the study area are brown to grey-brown, with high clay subsoils, usually with a grey, mottled subsoil horizon indicating signs of wetness.

A summary of the dominant soil characteristics is given in **Table 1** below.

Table 1 Soil legend

Map Unit	Dominant soils	Sub-dominant soils	Depth (mm)	Characteristics	Area (ha)
Gs	Glenrosa	Mispah	0-300+	Brown, apedal sandy clay loam A horizon overlying weathered rock	**18.09**
Ms	Mispah	Glenrosa	0-200+	Brown, apedal sandy clay loam A horizon over hard rock	**10.73**
Ss	Sterkspruit		300-900+	Brown apedal sandy clay loam A-horizon overlaying B-horizon with dark brown clay cutans	**18.48**
Es	Escourt		300-1200+	Grey brown, weakly structured clay loam A horizon over grey, structureless E horizon abruptly overlying prismatic structured mottled sandy clay to clay (Duplex soil)	**20.01**
Se	Sepane	Tukulu	300-1200+	Grey brown, weakly structured clay loam A horizon with gradual transition to brown, moderately blocky structured clay B horizon on gleyed clay underlying horizon.	**14.32**
We	Westleigh		300-650+	Grey brown, weakly structured clay loam A horizon over mottled sandy clay loam to clay subsoil with signs of hydromorphy (wetness)	**10.10**
Bu	Buildings			Built up area with structures	**0.93**
				Total	**92.66**

4.1 Soil Analyses

The results of the soil analyses are given in Table 2.

Table 2 Soil analyses (Majuba)

Sample No.	S1 (Se)		S2 (We)		S3 (Ss)	
	0-300 mm	**300-900 mm**	**0-300 mm**	**300-650 mm**	**0-300 mm**	**300-600 mm**
Co-ordinates	27° 06′ 28.5″S 29° 46′ 34.6″E		27° 06′ 44.1″S 29° 46′ 43.6″E		27° 06′ 46.0″S 29° 46′ 21.7″E	
Sand (%)	56	44	28	48	66	64
Silt (%)	20	14	48	22	14	10
Clay (%)	24	42	24	30	20	26
Na (cmol (+) kg^{-1})	0.236	0.735	0.069	0.243	0.026	0.048
K (cmol (+) kg^{-1})	0.290	0.303	0.186	0.309	0.447	0.420
Ca (cmol (+) kg^{-1})	7.242	6.344	2.706	4.889	3.145	1.718
Mg (cmol (+) kg^{-1})	2.106	4.684	1.623	4.158	1.704	1.580
CEC* (cmol (+) kg^{-1})	16.129	16.804	8.896	12.204	7.699	6.158
$P^{\#}$ (ppm)	35.63	1.08	1.74	1.17	4.04	0.89
Organic C (%)	3.83	0.88	1.09	0.76	1.65	0.66
pH (H_2O)	6.23	7.49	5.69	6.04	6.12	6.02

= Bray No. 1 Method
* = Cation Exchange Capacity

The analysis results show that there is a clear texture increase from the topsoils to the subsoils, which have a sandy clay loam to clay texture. The soils are slightly acidic to neutral, with moderate to low P and organic carbon levels (although the A horizon of site S1 is higher). The soils are moderately leached, which would be expected from the clay content and the climatic regime.

No abnormal or unexpected results were obtained.

5. AGRICULTURAL POTENTIAL

The area consists of a mixture of soils ranging from clay soils with cutanic subsoils to shallow soils on rock. The depths vary somewhat, with zones of shallow, duplex soils or plinthite soils also occurring (as can be seen from the information contained in Table 1).

The broad agricultural potential is summarized in Table 3 below.

Table 3 Agricultural potential

Agric. Potential Class	Map Unit(s)	Limitations	Area (ha)
Low	Se, St, Es, We	B horizons with clay cutans and mottles which have a potential for waterlogging during rainy seasons.	**62.91**
Very Low	Gs, Ms	General shallow depth to underlying hard rock or weathering rock.	**29.75**
		Totals	**92.66**

From Table 3, it can be seen that the whole study area has low agricultural potential or worse.

6. IMPACTS

The major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. With the lack of high potential soils in the vicinity, this impact would in all probability have a limited significance. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact.

These impacts can be summarized as follows:

Table 4 Impact significance

Nature: Loss of agricultural potential		
	Without mitigation	**With mitigation**
Extent (E)	Low (2)	Low (2)
Duration (D)	Long-term (4)	Long-term (4)
Magnitude (M)	Slight (4)	Minor (2)
Probability (P)	Probable (3)	Improbable (2)
Significance (E+D+M)*P	**Low (24)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: The main mitigation measure will be to develop the facility on low potential soils, wherever possible		
Cumulative impacts: Little or none foreseen at this time		
Residual Risks: Little or none, as long as proper rehabilitation measures are carried out.		

6.1 Evaluation of study area

The north and east parts of the study area consist of soils with high clay content in the subsoil which may be waterlogged during rainy seasons, while the southern and western parts consist of shallow soils as indicated in the map (Appendix A).

Such soil conditions will need to be borne in mind for planning purposes (eg foundations).

However, within the broader region around Majuba Power Station, the loss of the land where the PV facility is proposed would not have a significant effect on agricultural production. In addition, due to the fact that the various infrastructure of the Power Station has already impacted on the environment, there would not be a meaningful cumulative impact.

REFERENCES

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APPENDIX A

SOIL MAP

(Majuba P/S PV facility)


Majuba Power Station
Solar Power PV
Project Soil Map
N
Se
14.32 ha
S1
Es
20.01 ha
Gs
18.09 ha
We
10.10 ha
S2
Ss
18.48 ha
S3
Ms
10.73 ha
0 0.075 0.15 0.3 0.45
Kilometers
ARC • LNR