REPORT

On contract research for

Environmental Impact Management Services

PHOTOVOLTAIC FACILITY, GROOTVLEI POWER STATION, MPUMALANGA

Soil and Agricultural Potential Assessment

By

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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by Environmental Impact Management Services to conduct a soil and agricultural study of a small portion of land (referred to as Alternative Site 1) within the Eskom power station property at Grootvlei, Mpumalanga Province. Alterative Site 1, in the south-east corner of the property was chosen to be surveyed (as indicated by the yellow arrow).

Figure 1 Soil assessment study area – Alternative site 1

The objectives of the study are;

- To carry out a field survey to classify the soils occurring and to produce a detailed soil map of the specified area, as well as
- To supply information on the most important soil characteristics, as well as an assessment of broad agricultural potential.

2. SITE CHARACTERISTICS

2.1 Location

Grootvlei power station lies close to the town of Grootvlei, south of Balfour in Mpumalanga Province. Site alternative 1 is located, between the junction of 2 railroads and the power station at 26° 46' 31" S and 26° 46' 53" S and between 28° 30' 19" E and 28° 30' 48" E, and the area that was investigated comprises 17 ha. This Site area was obtained by digitizing the study area outline as provided by the Lead consultant.

2.2 Terrain and vegetation

The Site area is flat, and is largely occupied by a +/- 4 m high heap of (old rehabilitated) ash waste from the power plant. The Site area lies at an altitude of around 1 540 meters above sea level, and is covered mainly by grass and weeds. There are cultivated lands immediately to the south and east of the site.

2.3 Parent Material

Parent material comprises shale and sandstone of the Vryheid Formation, Ecca Group with occasional dolerite intrusions in the south (Geological Survey, 1986).

2.4 Climate

The climate of the area can be regarded as typical of the Highveld, with cool to cold, dry winters and warm, moist summers (Kotze, 1985). The main climatic indicators are given in Table 1.

Table 1 Climate data for Grootvlei area

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Average frost dates
Jan	118.8	13.8	27.0	Start date: 13/5 End date: 13/9 Days with frost: ± 32
Feb	93.3	13.1	26.3	
Mar	79.3	11.6	24.9	
Apr	39.6	7.6	23.0	
May	19.7	3.0	20.3	
Jun	6.8	-0.7	17.7	
Jul	8.8	-0.8	17.5	**Heat units (hrs > 10°C)**
Aug	8.4	1.8	20.6	Summer (Oct-Mar): 1671 Winter (Apr-Sept): 392
Sep	22.1	6.1	23.6	
Oct	64.1	10.4	26.0	
Nov	109.1	11.9	25.9	
Dec	110.2	13.2	26.8	
Year	**680.2 mm**	**18.2 °C (Average)**		

The long-term average annual rainfall is 680.2 mm, of which 574.8 mm, or 84.5%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 27.0ºC and 13.8ºC for January to 17.5ºC and -0.8°C for July respectively. The extreme high temperature that has been recorded is 38.9°C and the extreme low –13.3ºC. Frost occurs every year on approximately 32 of the 100 days on average between May and August.

3. METHODOLOGY

The study area was visited on the 4th of October 2012 and the soils were investigated on a grid of 150 x 150 m, using a hand-held soil auger to a maximum depth of 1.2 m (or shallower, if a limiting layer was encountered). The positions of the soil observations were determined using ArcGIS to create a grid, from where the points could be transferred to a hand-held GPS device for use in the field.

At each grid point, the main soil characteristics (colour, texture, structure, mottling, coarse fragments, wetness status, calcareousness) of the topsoil and subsoil horizons were noted by using a soil auger, and the soil was classified (Soil Classification Working Group, 1999) into the relevant soil form. Similar soils were then grouped together into mapping units, whose distribution is shown on the soil map (Figure 2). The DEA requirements for BA application were limited to identifying soil forms on site, delineating these areas with GPS and maps, the depth of the soil at the survey point, soil colour, clay content, and limiting factors. The slope of the site was determined to be flat (3-5%).

A decision was made by the specialist on site that no laboratory samples were required. This was mainly due to the small size of the study area under investigation, as well as the location within an existing power generation facility. The analytical data would not have added significant value to the assessment and the information contained in this report. The report thus complies with the DEA requirements outlined above.

4. SOILS

The soils can be divided into either yellow-brown, apedal soils of the Clovelly form (**Cv** map unit, in the middle and eastern part) or similar soils, but with a mottled, plinthic subsoil, of the Avalon soil form (**Av** map unit) in the western part (Figure 2). In general the soils have a clay content of over 30%, often as high as 45%. A significant part of the area is occupied by an old rehabilitated ash disposal area of the power station (**Wb** map unit).

The top soil of many parts of the power station property and on alternative site 1 is disturbed, probably caused by movement of vehicles and/or removal of soil material. Small components of ash were observed in places in the topsoil layer, or lying on the surface across the study area, in addition to the ash heap. The main soil characteristics are described in Table 2.

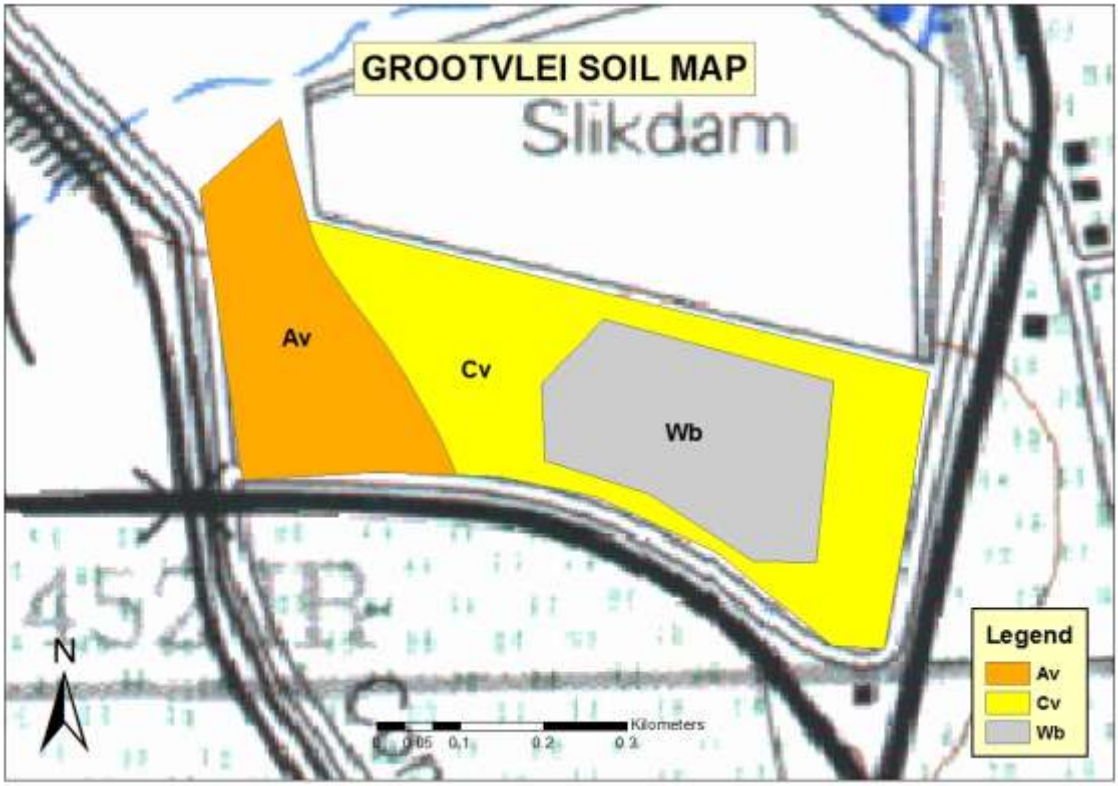

Figure 2 Soil map of Alternative site 1, Grootvlei study area

Table 2 Soil legend, Alternative site 1

MAP UNIT	DOMINANT SOIL FORM/FAMILY	SUBDOMINANT SOIL FORM/FAMILY	EFFECTIVE DEPTH (mm)	DISCRIPTION OF MAPPING UNIT	LAND CAPABILITY	AREA (ha)
Av	Avalon 3100	Pinedene 3100	900-1200+	Dark brown to grey brown topsoil over well drained, yellow-brown, apedal to weakly structured subsoil over imperfectly drained, grey material with red, yellow and black iron and manganese oxide mottling. In places, gleyed (signs of wetness) subsoil may be found.	Arable (moderate to high)	6.08
Cv	Clovelly 3100	Avalon 3100, Witbank 1000	1200+	Dark brown to grey brown topsoil over freely drained, apedal yellow-brown soil material, occasionally with a imperfectly drained grey material with red, yellow and black iron and manganese oxide mottling. In places, the soil has been disturbed and mixed with ash.	Arable (high)	9.8
Wb	Witbank 1000	-	1200+	Man-made soil, consisting of yellow brown apedal soil material mixed with ash.	Very low	6.06
					TOTAL	**21.94**

5. AGRICULTURAL POTENTIAL

The soils occurring vary in terms of their agricultural potential across the Grootvlei site with types Av, Cv and Wb being present across the entire site. The Grootvlei region could thus be considered to have good arable soils.

The yellow-brown, apedal soils (**Cv** map unit) found on alternative site 1 can be regarded as good arable soils because of the well-drained apedal profile and an effective depth of more than 1 200 mm. Plinthite horizons occasionally occur at 900 mm or deeper, so that the imperfect drainage of this layer will cause a slight impediment to root and/or water penetration. The land capability class can be regarded as **arable, high potential**.

The yellow-brown, apedal soils with soft plinthite (**Av** map unit) can also be regarded as arable soils, but the plinthite subsoil horizon, causing imperfect drainage, occurs much more frequently and at shallower depth in this map unit. This layer will cause an impediment to root and/or water penetration, but the land capability class can still be regarded as **arable, moderate potential**.

A flat topped heap of ash material is an artificially produced soil profile (**Wb** map unit) and has virtually no agricultural potential or land capability.

In general, the soils on the Grootvlei site in general and Alternative site 1 are suitable for arable agricultural production. However, the adjacent ash disposal facility on alternative site 1, as well as infrastructure such as road and rail road, makes the area less than ideal for crop production. Site Alternative 1 and the Grootvlei site in general would thus not be feasible as agricultural use.

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