REPORT

On contract research for

SLR Consulting Africa (Pty) Ltd

SOIL INFORMATION FOR PROPOSED MINING OPERATION FOR LEHATING MINE, NEAR HOTAZEL

by:

D.G. Paterson (*Pr. Nat. Sci.* 400463/04)

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ARC-Institute for Soil, Climate and Water,
Private Bag X79, Pretoria 0001, South Africa

Tel (012) 310 2500 Fax (012) 323 1157

Declaration:

I declare that the authors of this study are qualified, registered natural scientists (soil science), are independent of any of the parties involved and have no other conflicting interests.

D.G. Paterson

March 2012

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1. TERMS OF REFERENCE

The ARC-Institute for Soil, Climate and Water (ARC-ISCW) was contracted by SLR Consulting (Africa) (Pty) Ltd to collect soil information for the proposed Lehating mine, near Hotazel in the north east of the Northern Cape Province.

The purpose of the investigation is to contribute to the environmental impact assessment report for the proposed mine.

The objectives of the study are;

- To classify the soils occurring in the specified area as well as
- To assess the soil potential and soil characteristics in the study area.

2. SITE CHARACTERISTICS

2.1 Location

The area that was investigated occurs on Portion 1 of the farm Lehating 741 and the access corridor runs through Portion 2 of Wessels 227, lying approximately 20 km north-west of Hotazel in the Northern Cape. The area lies to the north of the R380 tar road, close to the Kuruman River.

The location of the study area is shown in blue in Figure 1.

2.2 Terrain

The terrain morphological class of the area can described as plains with low relief, lying at an altitude of around 1 000 meters above sea level (Kruger, 1983). The area is flat with no surface drainage in the area, except for the Kuruman River on the southern boundary.

2.3 Parent Material

Parent material comprises red to flesh-coloured wind blown sand of Quaternary age and a small piece of surface limestone of Tertiary age in and around the Witleegte stream in the north (Geological Survey, 1979).

Figure 1: Locality map (with the study area in blue)

2.4 Climate

The climate of the area can be regarded as typical of the northern interior, with cool to cold, dry winters and hot, dry summers (Koch & Kotze, 1986). The main climatic indicators are given in Table 1.

Table 1 Climate Data

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Heat units (hrs > 10°C)
Jan	58.6	17.8	32.0	Summer (Oct-Mar): 2 350
Feb	59.7	17.1	30.8	
Mar	65.7	15.1	28.4	
Apr	34.7	10.9	25.1	Winter (Apr-Sept): 719
May	15.6	6.4	21.1	
Jun	5.6	2.5	18.2	
Jul	2.9	2.5	18.3	
Aug	5.4	4.6	20.9	
Sep	6.2	8.3	24.5	
Oct	17.1	12.1	27.8	
Nov	26.8	14.9	29.7	
Dec	38.1	16.9	31.6	
Year	**336.4 mm**	**18.3 °C (Average)**		

The long-term average annual rainfall is 336.4 mm, of which 266 mm, or 79%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 36.7ºC and 11.4ºC for January to 23.2ºC and –2.9°C for July respectively. The extreme high temperature that has been recorded is 41.6°C and the extreme low –7.5ºC.

2.5 Vegetation

The prevailing vegetation type is "Kathu Bushveld and Southern Kalahari Mekgacha" (Mucina & Rutherford, 2006).

The Kathu Bushveld is described as an open savannah with *Acacia erioloba* and *Boscia albitrunca* as the prominent trees. The shrub layer is dominated by *A. mellifera, Diospyros lycioides* and *Lycium hirsutum* and the grass layer is described as being vary variable. The Southern Kalahari Mekgacha is typically found on the bottom of dry river beds. It is characterized by low shrublands in places with patches of taller shrublands on the banks of the river. Tall *Acacia erioloba* trees can form a dominant belt along some of the rivers.

3. METHODOLOGY

For a variety of reasons (outlined below), it was decided not to carry out a field survey.

Firstly, the land type survey of the region (Eloff *et al*, 1986) indicated that the study area falls within land type Ah5. The land type inventory for this land type shows that more than 94% of the landscape comprises deep (>1 200 mm), sandy, red and yellow soils of the Hutton and Clovelly forms with a high degree of homogeneity of soil properties.

Secondly, a previous survey (Dreyer & Paterson, 2006) was carried out to the south of Hotazel in very similar soil conditions. That survey involved around 95 auger observations on a 250 x 250 m grid and confirmed that virtually the whole area was covered by deep, sandy Hutton and Clovelly soils. In addition, 16 soil samples were collected and analysed, confirming that the soils are sandy in texture, neutral in pH and have a low CEC value, leading to infertility.

Finally, the low annual rainfall and hot temperatures (Table 1) mean that this area, despite the deep, friable soils, will have a low potential for arable agriculture and that the area is best suited for extensive grazing.

4. AGRICULTURAL POTENTIAL

The entire study area is considered to be of low agricultural potential due to the low clay content of the soils and the low rainfall and is only suited for grazing.

This part of the Northern Cape is suited for grazing at best, and the grazing capacity of the region is very low, around 18-20 ha/LSU (ARC-ISCW, 2004).

According to the criteria by Schoeman (2004), land in the Northern Cape is only considered to be of high potential if it is under permanent irrigation.

The Google Earth image of the area (Figure 2) shows no evidence of any arable cultivation and none of irrigation.

Figure 2 Google image of study area

4.1 Dryland

The soils of the area are sandy and deep (>1 500 mm). They will therefore drain rapidly. Due to this tendency, along with the lack of fertility as shown by the low CEC values, they have a low agricultural potential.

Coupled with the hot, dry nature of the climatic regime, it can be seen that this area is not suited to dryland arable agriculture, and most of the farming enterprises in the vicinity are either game farms or cattle ranches. This is the optimum land use option given the environment.

4.2 Irrigation

The soils would have a moderate potential for irrigation, due to the very low clay content. The sandy nature of the soils would necessitate very careful scheduling because of the very low water holding capacity of the soils. The soils would require a substantial and reliable supply of water to ensure optimum soil moisture at all times, even if such a water supply was available.

4.3 Wind Erosion

The sandy soils (generally with a fine grade of sand) in the vicinity mean that, if the surface vegetation is removed, there may be a significant hazard for wind erosion, especially in the winter months.

If the soils are disturbed by excavation, preventative measures would need to be employed. These would include:

- Reducing the height of any topsoil stockpile as far as possible
- Maintaining surface moisture by regular water spraying
- Construction of windbreaks perpendicular to prevailing wind direction

4.4 Wetland

Despite the prevailing dry climate, the adjacent Kuruman River is a natural drainage channel, which will flow periodically. Care needs to be taken to prevent excessive sedimentation or other contamination due to mining–related actions.

There should be a buffer distance between any activities and the river itself and any access or other roads which cross the river should be constructed by qualified engineers to minimize soil erosion and not to affect water flow.

5. LAND CAPABILITY

The prevailing land capability class in the area is Class VI, which is suitable for moderate grazing at best, with no arable potential (Schoeman et al., 2000). This is due to the combination of unfavourable climate and sandy soils.

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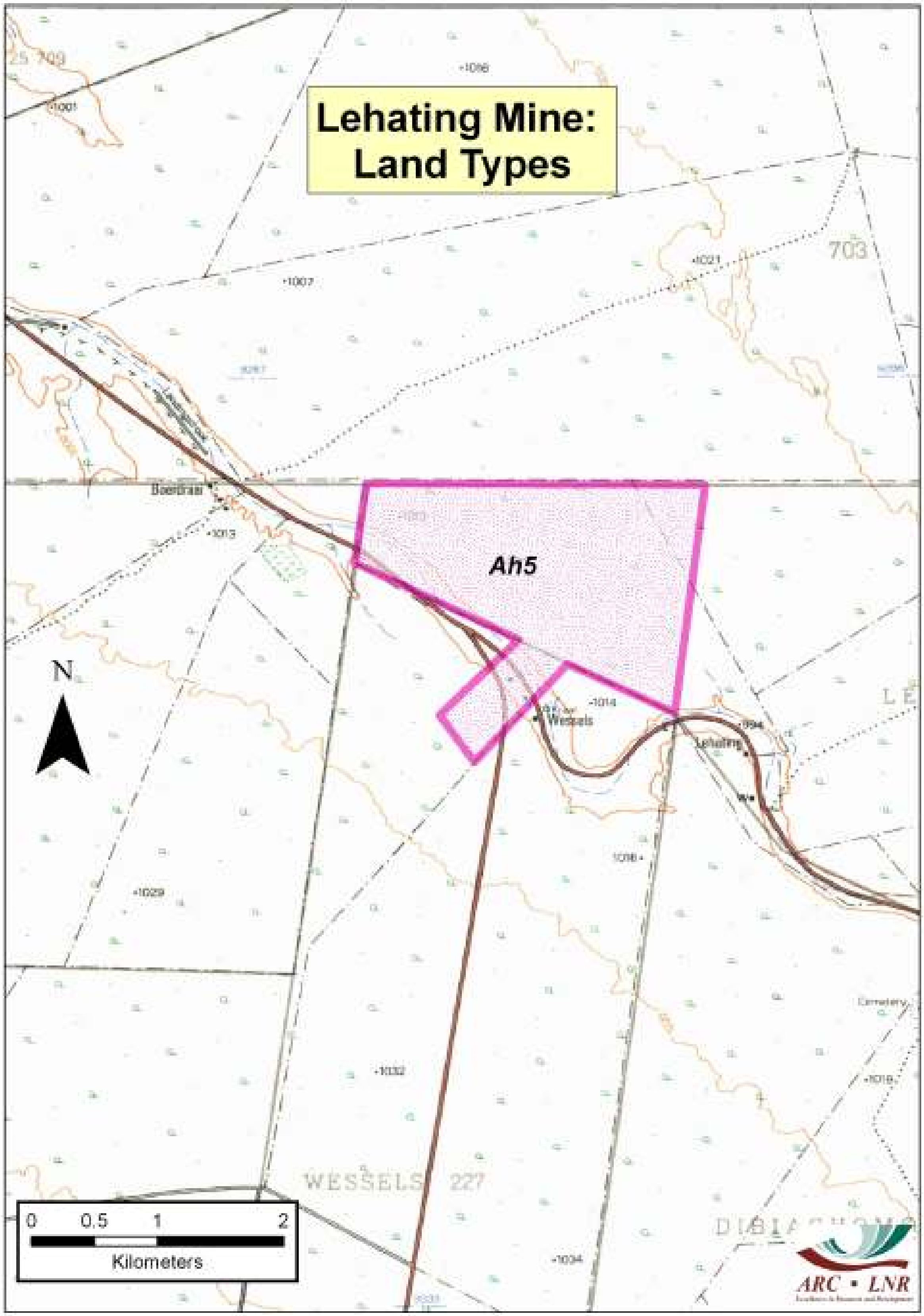
APPENDIX

LAND TYPE MAP



Lehating Mine:
Land Types
Ah5
N
0 0.5 1 2
Kilometers
Boerdraai
Wessels
Lehating
WESSELS 227
703
Cemetery
ARC • LNR