HENDRINA ASH DAM EXTENSION

GROUNDWATER SCOPING REPORT

Prepared For

Lidwala Consulting Engineers

METAGO PROJECT NUMBER: WGC130

REPORT NO. 01

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HENDRINA ASH DAM EXTENSION GROUNDWATER SCOPING REPORT

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ACRONYMS AND ABBREVIATIONS

Below is a list of acronyms and abbreviations used in this report.

Acronyms / Abbreviations	**Definition**
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
MBGL	Metres below ground level
Mg/L	Milligrams per litre
SWL	Static water level
TDS	Total dissolved solids

EXECUTIVE SUMMARY

This Groundwater report was undertaken and compiled by Metago Water Geosciences in their capacity as groundwater specialists. Following a pre-screening phase assessment of the area around Eskom's Hendrina Power Station, an interim groundwater vulnerability map was produced. As a result of the pre-screening phase study, five sites close to the existing Hendrina ash dam have been suggested as suitable sites for the proposed ash dam extension. This Scoping Phase report considers the five sites from a groundwater perspective, and ranks them in terms of their estimated impact on groundwater resources in the area. The work relies on two field visits to Hendrina power station, a review of existing data, and the development of a conceptual groundwater model for the vicinity of the existing ash dam. All five sites for the ash dam extension fall into the same DWA hydrogeological classification (i.e. D2: Intergranular and fractured aquifers with borehole yields between 0.1 - 0.5 L/s), and on the same geological formation (Vryheid Formation). Proximity to surface water resources and mine workings (potential receivers of leachate from the ash dam), proximity to the existing ash disposal dam and topographic setting were therefore regarded as the most important factors in distinguishing one site from another.

According to the available data, site 1 is the preferred site. The site is not within any surface water buffer zone and additionally in close proximity to the existing active ash storage facility. While the hydrogeological setting of site 2 is very similar, it is less preferred due to its potential impacts on two water courses in close proximity.

While sites 3 and 4 fall partially within the 250 m buffer zone around surface water features, sites 4 and 5 are in close proximity to mine voids and sites 3 to 5 therefore not preferred.

1 INTRODUCTION

1.1 BACKGROUND

This groundwater specialist input is made for the Scoping Phase of the Environmental Impact Assessment for the proposed expansion of ash disposal facilities at Eskom's Hendrina power station, situated about 40 km south of Middelburg in Mpumalanga Province. As part of Eskom's plans to ensure continous electrical power supplies in years to come, Hendrina power station requires additional ash disposal facilities. The power station is expected to produce approximately 64.2 million m^3 of ash between now and the end of its estimated life span in 2035. Current ash disposal facilities (ash dams 3 and 5) will only last another five or so years. Hendrina power station uses a wet ashing facility (ash is pumped to the ash disposal facility as a slurry), incorporating ash water dams, pipelines, stormwater trenches, seepage water collection systems, pump stations and seepage dams.

1.2 HYDROGEOLOGY

Hendrina power station and surrounds is located on coal-bearing rocks of the Vryheid Formation, part of the lower Karoo Supergroup. These rocks are principally deltaic and fluvial siltstones and mudstones, with subordinate sandstones (Johnson et al, 2006). The coal seams originated as peat swamps, or similar environments. Where the Dwyka Group is absent (suspected in the study area), the Vryheid Formation has been deposited directly onto rugged pre-Karoo topography, and the thickness of the Formation can be quite variable as a result. The Vryheid Formation rocks are well lithified (hard) and have little primary porosity. Groundwater storage and transport in the unweathered Vryheid Formation is likely to be mainly via fractures, bedding planes, joints and other secondary discontinuities. The success of a water supply borehole in these rocks depends on whether one or more of these structures are intersected. In general the Vryheid Formation is considered to be a **minor aquifer**, with some abstractions of local importance. Relatively minor outcrops of the Rooiberg and Quaggasnek Formations that underlie the Vryheid Formation are also found in the study area.

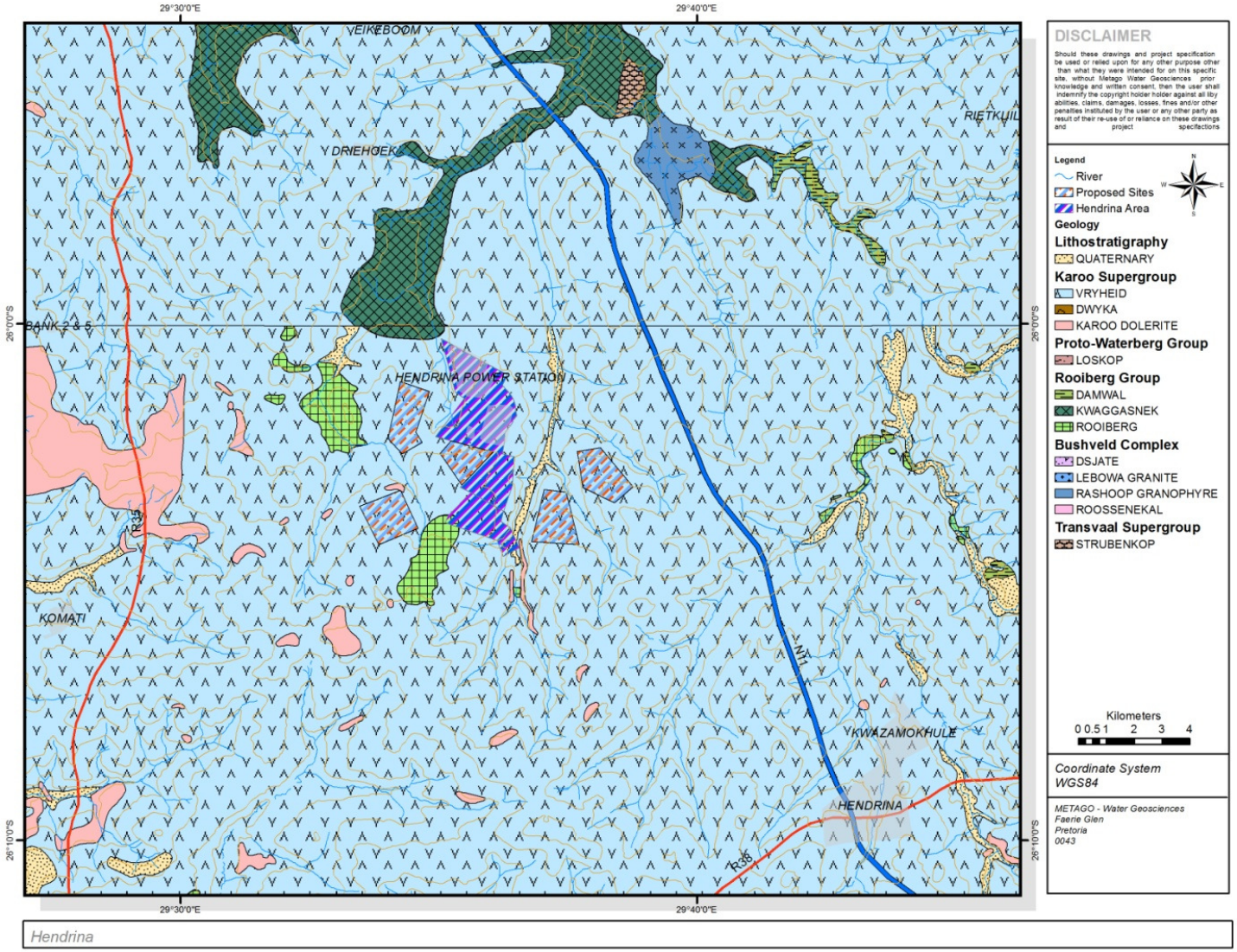

FIGURE 1.1: GEOLOGY MAP OF THE HENDRINA AREA

1.3 PRE-SCREENING PHASE GROUNDWATER STUDY

Pre-screening phase groundwater study

A sensitivity analysis was completed for the pre-screening stage of the EIA process, and an interim groundwater vulnerability map was produced allowing a basic distinction to be made between more and less favourable areas for the siting of the proposed ash dump at Hendrina power station. This map was based on the hydrogeological map classification of the area within 8 km of the power station, combined with a 250 m buffer zone placed around surface water features as the receiving environment of potential groundwater pollution. This allowed three zones (lower, medium and higher sensitivity) to be defined within the 8 km buffer zone, as shown in Table 1.1 below:

TABLE 1.1 SENSITIVITY CLASSIFICATIONS USED IN THE PRE-SCREENING PHASE STUDY

	Description
Lower Sensitivity	Areas falling outside of the 250 m buffer around surface water features, and outside of the area classified as "D3" (higher borehole yields) on the general hydrogeology map series (GRA1 data)
Medium Sensitivity	Areas falling within the area classified as D3, but still outside of the 250 m surface water buffer zone.
Higher Sensitivity	Those areas within the 250 m surface water buffer zone.

2 SCOPE AND LIMITATIONS

This study is limited to a consideration of groundwater and hydrogeology in the vicinity of Hendrina power station. Two field visits (the second to measure water levels and electrical conductivity in boreholes) have been made, but this study also relies on available published information about the geology and hydrogeology of the area. It is assumed that the available data is correct in its representation of the groundwater conditions in the area. This document does not evaluate the existing groundwater monitoring and management programme at Hendrina; it is assumed that this is in line with best practice (see DWA, 2008 for more information).

3 METHODOLOGY

3.1 DESCRIPTION OF THE METHODOLOGY/IES USED.

Information gained from a site visit was combined with a review of available literature and available data sources to form a conceptual model of groundwater occurrence in the vicinity of Hendrina power station. The five sites were then evaluated against the conceptual model, to arrive at an estimate of their relative impacts on local groundwater resources.

The DWA Best Practice Guideline – Water Management for Mine Residue Deposits (DWA, 2008) suggests that the groundwater impacts of a mine residue deposit (MRD, also applicable to an ash disposal facility) should be identified before a final site is chosen. Suggested criteria (DWA, 2008) include:

- The impact on downstream water users
- Impacts on sensitive or protected areas
- Impacts on any open-cast or underground workings, shafts or occupied premises; the stability of the underground/excavated workings can be affected by possible seepage and the mass of the MRD,
- Effects of seepage on dam stability, and/or
- Groundwater quality impacts.

These factors and others have been considered in this study.

3.2 SUMMARY OF EXISTING DATA

The Department of Water Affairs (DWA) have produced a series of 1:500 000 scale hydrogeology maps (General Hydrogeology Map Series), together covering the whole of South Africa. Analysis of median borehole yields and aquifer types has allowed DWA to classify the hydrogeology of the country according to an alphanumeric code incorporating aquifer type and borehole yield, as follows:

TABLE 3.1 GENERAL HYDROGEOLOGY MAP CLASSIFICATION OF SOUTH AFRICA

Aquifer Type	**Borehole Yield Class (L/s)**				
	Class "1" 0 - 0.1	Class "2" 0.1 - 0.5	Class "3" 0.5 - 2.0	Class "4" 2.0 - 5.0	Class "5" >5.0
Type "a": Intergranular	A1	A2	A3	A4	A5
Type "b": Fractured	B1	B2	B3	B4	B5
Type "c": Karst	C1	C2	C3	C4	C5
Type "d": Intergranular and fractured	D1	D2	D3	D4	D5

The area within an 8 km radius of the Hendrina site is almost all classified as "D2". The small outcrop of the Quaggasnek Formation in the NW of the study area appears to be the reason for the small area classified as "D3" on the general hydrogeology map series.