Specialists in:
- Groundwater Exploration
- Site Assessment
- Water Supply
- Resource Definition
- Numerical Modeling
- Geochemical Characterisation

Specialist support in:
- Groundwater Planning
- Management
- Mining
- EIA's
- EMP's

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25 November 2024

The Director,
Department Water and Sanitation,
Limpopo-North West Proto CMA,
Private Bag X995,
Pretoria, 0001

ATTENTION: Environmental Officer: Water Resources Management
Mr. Tiyani Makhubele (email: makhubelet@dws.gov.za)

Dear Sir,

THE MATTER OF AN APPLICATION FOR A WATER USE LICENSE BY BUNDU MINING (WU34872): GROUNDWATER IMPACT ASSESMENT

Veltwater Groundwater Specialists previously sited and drilled successful water supply boreholes in the Krauseville area and was approached by the Magalies Bewarea Conservancy (MBC) for a professional opinion on the relevance and gaps in the groundwater impact assessment presented by Bundu Mining as part of the Water Use License Application (WULA) process. The MBC is especially concerned about the impact that blasting (seismic activity) will have on water yielding boreholes in the area, as well as the overall dewatering of the aquifer because of the proposed deep excavations that is now part of the official mine plan.

This review was not intended to be an in-depth examination identifying critical flaws. Instead, it aimed only to highlight deficiencies in the impact assessment to safeguard existing lawful use.

Version – Final Draft 1, 25 September 2024, of Umhlaba Environmental Consulting CC, GCS Project Number: 23-0738 was reviewed and comments were sent to the project team, for consideration for future updates on the report. The specialist replied with less than acceptable comments, indicating a reluctance to re-assess the shortcomings.

The following shortcomings were identified in the conceptual and numerical models presented, leading to a lack of assessed impacts. The data screened was found in the report, with no additional data sourced. Hence, the specialist was privy to the same, if not more, data while performing the work. Deficiencies in the current impact assessment presented by Umhlaba Environmental Consulting CC include:

- At least 27 water levels were available within a 5km radius in the submitted report. The Bayesian correlation presented in the report, however, includes only 15 water levels,

seemingly limited to the data available before the 2024 hydrocensus was performed (i.e., NGA2023 plus two water levels from the Bundu boreholes).

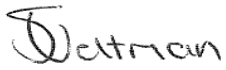
- The western and eastern boundaries of the GHRU presented were chosen due to changes in surface topography. No physical barriers to flow exist in the subsurface at the model boundaries and it cannot be a no-flow boundary. Subsurface drainage occurs from the east to the west, with local groundwater from the east draining to the site area. Minor surface drainage lines do not deter groundwater flow from the upstream catchment within the aquifer.
- The Bundu BH tested did not achieve sufficient drawdown during the aquifer test to assess the aquifer flow characteristics.
- The numerical model objective states that dewatering impacts are considered but adds that: *"The mining activity will take place to a maximum estimated depth of 10m for the shallow sand mining area and 50m for the deeper blasting workings. This is above the water table, and dewatering impacts are highly unlikely to occur."* This is a flawed assumption, since the saturated levels measured at boreholes in the same lithology and east-west strike of the formation show water levels 22 – 25 meters below ground level (mbgl), indicating a likely lowering of the water level in the mining area by up to 25 meters. Deeper blasting excavations will indeed have a dewatering effect on the hard rock saturated zone.
- The numerical model lacks differentiation between flow in the upper weathered aquifer and the semi-confined fractured rock aquifer of the Pretoria Group. These two groundwater units are modelled as one layer.
- The numerical model lacks the input of preferential flow direction in the fractured rock aquifer due to anisotropy. The geological sequences show foliation in an east-west direction, perpendicular to the stress direction at the time of folding. In the modelling environment this is dealt with through anisotropy, not as zones of different hydraulic conductivity, where flow within a specific geological unit is more pronounced in one direction.
- No formal mine plan could be assessed and therefore, the worst-case scenario must be assumed, with quarry cutting into the surface topography to 50 meters below ground level (mbgl) for the entire mining block. Drawdown achieved in the modelled blast area does not reach these depths (especially towards the south / the highest elevation of the proposed pit), calling into question the model's dewatering impact results.
- No monitoring boreholes for dewatering were placed around the proposed pit / blasting area.

The following conclusions are significant for making an informed decision on the application, subsequent phases of the specialist studies, as well as the granting of the proposed water use license (WUL):

- Groundwater in the area is sourced from two types of aquifers:
    - 1) The unconfined sandy aquifer (referred to as "mud" or "sand" boreholes due to silt being dumped into the boreholes from the weathered/hard rock contact after high rainfall) and
    - 2) The deeper semi-confined fractured rock aquifer of the Pretoria Group, which provides clear, pristine water from fractures deeper than 40 m.
- Groundwater in the area is a sole source of water to residents and has been in use for generations for domestic purposes.

- Mitigation measures and a monitoring programme are required to ensure that this development does not deprive people of access to water for Basic Human Needs.
- Groundwater levels, utilising all data from the reviewed report, show a very strong Bayesian correlation across the wider catchment. Therefore, unless physical boundaries exist that will hinder groundwater flow, groundwater will flow from higher to lower topography in both the south-to-north and east-to-west directions.
- The 2024 hydrocensus data was omitted during development of the conceptual model, since this task was completed before the 2024 hydrocensus took place.
- A distinction between the upper weathered aquifer (10 m deep at the proposed mine site) and the semi-confined Pretoria Group fractured rock aquifer (10 – 50 m deep at the proposed mine site) needs to be made in both the conceptual model and how it is dealt with in the numerical model.
- Transient state calibration was possible with the pump test data for Bundu BH, even if only to validate the hydraulic conductivity and the storage parameters used.
- Drawdown contours extend outward in the southern parts of the proposed mining area, indicating that drawdown reaches model boundaries. Hence, the model boundaries are either too close or inappropriate.
- Dewatering effects will be more pronounced in the “upstream” section of the aquifer due to Darcy’s Law: the greater the hydraulic gradient difference, the greater the volume of water that drains when hydraulic conductivity is constant.
- If hydraulic conductivity increases, which often happens when blasting in hard rock occurs, the dewatering effect is likely to be even more pronounced in the east-west direction of foliation, with an increase in the impact radius.
- Remote sensing techniques is cost-effective and quick. The lack of confirmation of preferential flow paths in the hard rock in the wider aquifer is a major oversight and will also inform the risk to borehole integrity due to blasting activities.
- Monitoring boreholes need to penetrate the aquifers to the final depth of proposed mining and be constructed with multiple piezometers to distinguish between dewatering effects within the unconfined and semi-confined aquifers.

Kind regards,



Mrs S Veltman

Principal Hydrogeologist (M.Sc. Pr.Sci.Nat.)