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Hydrogeophysical Investigations And Mapping of Ingress Channels Along The Blesbokspruit Stream In The East Rand Basin Of The Witwatersrand, South Africa

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Abstract : Mining has been the cornerstone of the South African economy for the last century. Most of the gold mining in South Africa was conducted within the Witwatersrand basin, which contributed to the rapid growth of the city of Johannesburg and capitulated the city to becoming the business and wealth capital of the country. But with gradual depletion of resources, a stoppage in the extraction of underground water from mines and other factors relating to survival of the mining operations over a lengthy period, most of the mines were abandoned and left to pollute the local waterways and groundwater with toxins, heavy metal residue and increased acid mine drainage ensued. The Department of Mineral Resources and Energy commissioned a project whose aim is to monitor, maintain, and mitigate the adverse environmental impacts of polluted water mine water flowing into local streams affecting local ecosystems and livelihoods downstream. As part of mitigation efforts, the diagnosis and monitoring of groundwater or surface water polluted sites has become important. Geophysical surveys, in particular, Resistivity and Magnetics surveys, were selected as some of most suitable techniques for investigation of local ingress points along of one the major streams cutting through the Witwatersrand basin, namely the Blesbokspruit, which is found in the eastern part of the basin. The aim of the surveys was to provide information that could be used to assist in determining possible water loss/ ingress from the Blesbokspriut stream. Modelling of geophysical surveys results offered an in-depth insight into the interaction and pathways of polluted water through mapping of possible ingress channels near the Blesbokspruit. The resistivity - depth profile of the surveyed site exhibit a three(3) layered model with low resistivity values (10 to 200 Ω.m) overburden, which is underlain by a moderate resistivity weathered layer (>300 Ω.m), which sits on a more resistive crystalline bedrock (>500 Ω.m). Two locations of potential ingress channels were mapped across the two traverses at the site. The magnetic survey conducted at the site mapped a major NE-SW trending regional linearment with a strong magnetic signature, which was modeled to depth beyond 100m, with the potential to act as a conduit for dispersion of stream water away from the stream, as it shared a similar orientation with the potential ingress channels as mapped using the resistivity method.

Keywords : eletrictrical resistivity, magnetics survey, blesbokspruit, ingress
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