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The Use of Artificial Neural Networks in Classification of Acid Mine Drainage Pollution Sources Found in Beosmanspruit Dam, Carolina, South Africa

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Abstract Acid mine drainage (AMD) has received considerable media coverage in South Africa as of late. The recent one being the deterioration of water quality in Beosmanspruit dam in Carolina, Mpumalanga province due to surrounding operational and / or abandoned mines. The dam supplies water to the Carolina town and surrounding farms. Chemical analyses revealed an AMD signature of water pH of 3.7 and above acceptable concentrations limits of iron, aluminium, manganese, sulphate in the dam. This has triggered researchers to find possible sources of AMD and to come up with mitigation measures. The paper outlines results of classification of possible acid mine drainage pollution sources.

A back-propagation artificial neural network (ANN) with four input nodes and one output node was used for classification based on available water chemistry, geology, hydrogeology and geophysical interpretation. Data for training and testing the ANN was collected at all the possible AMD producing site, the Beoasmanspruit dam, several operational opencast mines alone the Boesmanspruit river, old mine residual dumps in the upper Witrandspruit catchment area and abandoned underground mines located south of the Dam.

Areas with rapid increases in terrain conductivity forming “bulls eyes" conductivity anomalies as high as 50 mS/m with coincident low frequency magnetic dipole anomalies, low water pH were interpreted as regions of AMD producing site. The ANN classification method identified the old mine residual dumps and the operational opencast mine as two possible sources of AMD pollution found in the dam. Placement of proper holding and treating ponds at the two decanting pond at near operational opencast mine is recommended and also that the coal overburden in the wetland removed.

Keywords conductivity, magnetic gradiometry, artificial neural network, geophysics, mine residual dump, anomalies, acid mine drainage