

Water Demands, Infrastructure Development, and Ingenuity in Responding to the Changing Water Quality of the Vaal River

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The inauguration of the Vaal River Barrage in July 1923 by the Rand Water Board (now Rand Water) provided the first significant water supply for the growing gold mining, manufacturing, and industrial development of South Africa's former Witwatersrand region. However, the Barrage Reservoir soon became an unintended sink for pollution, leading to significant water quality challenges. Located downstream of urban settlements, mining, and industrial operations, the reservoir received mine effluent, treated sewage, and polluted urban stormwater runoff. Worse still, the poor-quality water stored in the reservoir was beneficially reused for various purposes within the catchment. The Barrage quickly reached its supply limit, prompting the construction of the Vaal Dam upstream in 1938 and the Bloemhof Dam, about 350km downstream, in 1970. Releases from the Vaal Dam introduced a dilution option (using Vaal Dam water to dilute pollution in the Barrage) and a blending option (mixing poor-quality Barrage water with high-quality Vaal Dam water) to manage water quality. Conversely, the Bloemhof Dam reduced the need for releases from the Vaal Dam to support lower Vaal irrigation, decreasing the dilution of the polluted Barrage reservoir. New abstraction locations were situated upstream from the main polluting tributaries to circumvent pollution. Ultimately, Rand Water moved all abstraction points from the Barrage to the Vaal Dam, supplying significantly better quality water. Today, the Barrage no longer supplies water to the Witwatersrand, but remains an important reservoir for recreational use and as a water source for downstream users. In one of South Africa's longest-running water quality monitoring programs, Rand Water continues to diligently sample and record water quality at various sites in the Vaal River Barrage catchment. Appraising historical water quality trends in relation to infrastructure development and management interventions, provides important contextual pointers for developing future water quality strategies and plans. This is especially important given the continued pollution loads draining into the Vaal River Barrage reservoir with unwanted consequences.