

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CIVIL AND WATER
ENGINEERING

NUST LIBRARY

FINAL YEAR PROJECT (APRIL 2000)

PROJECT TITLE: DESIGN OF NKAYI SAND
ABSTRACTION UP TO WATER RETICULATION NETWORK

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ABSTRACT

The project focuses on the design of a Sand Abstraction Scheme up to the reticulation network for the drought prone Nkayi area. The peak water demand for the area was determined from the layout plan of stands and some soil samples were collected at the station and laboratory tests were carried out to establish soil parameters of relevance to the design. A sieve analysis was carried out to establish the particle size distribution, a constant head test to determine the permeability and a drainage test to establish the specific yield of the soil.

The critical period of demand was also established from previous rainfall and discharge data for the Shangani river and the feasible water with-draw rate during the critical period was calculated using the Israelsen and Hansen equation. The discharge into the infiltration based on the yield from the river bed was then established and the geometry of the infiltration arm, based on the average width of the river bed in the study area was also calculated.

Based on the demand an optimum submersible pump was selected to pump water from the abstraction well into a storage reservoir through a pumping main, that was again sized from the peak water demand using the continuity equation.

From the elevated storage reservoir whose size was determined using the minimum flow approach from the Shangani river discharge, the water gravitated into the water reticulation network. The reticulation network was sized from the UNDP loop program, which is based on the Hardy Cross method.

Finally an economic analysis was carried out in which a bill of quantity for the abstraction as well as the reticulation network was prepared. From the total cost of a cost-benefit analysis was carried out for the whole project to determine the feasibility of the whole project.