National University of Science and Technology

Think in Other Terms

PROJECT TITLE:
POLLUTION MODELLING: A CASE STUDY OF SAKUBVA RIVER IN MUTARE

FINAL YEAR PROJECT

FOR

RONALD TAFADZWA MUGANO
(N 006 597 D)

Civil & Water Engineering Department

Faculty of Industrial Technology

Supervisor: Ms E. Mangore

JUNE 2011

ABSTRACT

Sakubva River, which passes through the city of Mutare and flows through the Dora communal lands, is a heavily polluted river. Its quality has deteriorated over the years leading to an ecological imbalance in the river. The purpose of this research was to evaluate the water quality of this river and find means of reducing pollution.

Water samples were collected along the length of Sakubva River and analysed for the water quality parameters pH, dissolved oxygen, temperature and BOD. Samples of effluent from Gimboki Treatment works were tested for DO, temperature and BOD. Measurements of river discharge, effluent discharge, depth of water in the river and the discharge channel were made. The data was used to model the river using Streeter-Phelps formulations. An application program in visual basic was used in modelling.

k_1 was found to be 2.605 while k_2 was found to be 3.863. Using the designed application program, the analytical solution of the Streeter-Phelps model gave a length of 3936.14m downstream of the effluent discharge point at Gimboki Sewerage works compared to an actual length of 3100m. The time to critical dissolved oxygen was found to be 0.1235days. The critical dissolved oxygen deficit was 10.108mg/l. Interview with the community's members showed that they are very aware and wary of the pollution in the river and that their livelihoods have been greatly negatively affected by the state of the river. They have shunned the water of the river for most domestic and agricultural use.

If recommended measures are taken to reduce pollution in Sakubva River by reducing the BOD of effluent to say 50mg/l in the effluent, according to the model the time to critical oxygen deficit will be 0.118days while the critical distance will be 3 753.38m. The critical dissolved oxygen deficit will be reduced to 4.19mg/l. The level of dissolved oxygen levels at this point will be 5.87mg/l. This shows that at reduced levels of pollution there is no hypoxia or anoxia in the river and this is good for the ecology of the river. Higher levels of oxygen improve the aesthetic quality of the river (better smell and look).