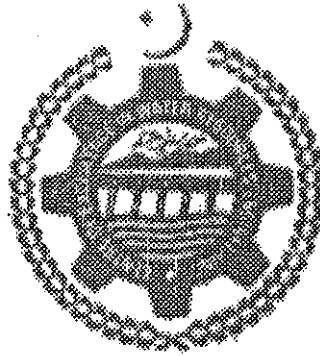


THESIS

APPLICATION OF QUAL2E MODEL TO THE
CONTAMINANT TRANSPORT IN RIVER RAVI



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ABSTRACT

At present the River Ravi has turned into a main sewage carrying drain of Lahore city. About $18 \text{ m}^3/\text{sec}$ of wastewater from Lahore city is being disposed off into the river without any treatment. This flow of wastewater is expected to be doubled by the year 2017. The main sources of wastewater are; domestic sewage discharging into the river from 6 major pumping stations along with wastewaters discharging into the river through Hudiara and Deg Nullahs.

The discharge in the Ravi river is highly variable and it ranges from $10 \text{ m}^3/\text{sec}$ to $1000 \text{ m}^3/\text{sec}$ during the year. The variations in river discharge also affect the dilution of pollutants as the wastewater load remains almost constant throughout the year.

The sources of fresh water to the River Ravi are Marala-Ravi and Qadirabad-Balloki link canals. These canals have capacities of $620 \text{ m}^3/\text{sec}$ and $410 \text{ m}^3/\text{sec}$ respectively. The M.R. Link Canal joins the river at 40 km upstream of Lahore and can be used as a source of fresh water for dilution.

The present study is conceived taking into consideration the dilution option by using discharge from M. R. Link Canal. Now the question remains that how much water is required to dilute the pollutants to meet river water quality standards. The present study is an attempt to answer this.

To monitor the behavior of contaminants along the river, QUAL2E model is used to simulate various conditions. In the present study only two important environmental parameters, Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) are considered. A 84 km long river reach from Ravi Syphon to Balloki Headworks are

selected. This reach is further divided into six sub-reaches and then into elements of 1 km length. The model has used one-dimensional-advective-dispersive mass transport and reaction equation to calculate the environmental parameters for each element.

The model is calibrated both for low flow and high flow conditions using the discharge data of river during 1997-98. The study reveals that under the existing condition of flow and wastewater loads, the DO is very low and BOD value is very high near the disposal points of domestic sewage. When a discharge of 92 m³/sec is hypothetically released from M. R. Link Canal, the DO attains a minimum value of 4.0 mg/l in the whole reach while the BOD reduces from 19.21 to 11.44 mg/l.

The wastewater loads are projected for the year 2017 and the model is run with these loads. It is estimated that in the year 2017, about 153 m³/sec is required to dilute the contaminants to meet DO level of 4.0 mg./L.