

Executive Summary

In the present research, a model is developed to investigate the urbanization influence on river water quality. Formulation of three models has been carried out for assessing the impact of urbanization on the river water quality. The models formulated are: Water Quality Index model for the assessment of surface water quality, Urbanization Index model for the assessment of the urbanization level of the catchment of the location and Water Quality - Urbanization Regression model (WQURM) for establishing a relation between Water Quality and Urbanization and for predicting the surface water quality for a future estimated growth of urbanization.

For developing the Water Quality Index model, six physico - chemical and biological water quality indicator parameters, namely, pH, Dissolved Oxygen (DO), Biochemical Oxygen demand (BOD), Electrical Conductivity (EC), Nitrate Nitrogen and Total Coliform are selected. A Rating scale is prepared for the range of values for each of the parameter. For developing the rating scale, the concentrations ranges of these parameters are defined using the Central Pollution Control Board (CPCB) of India standards/criteria and Indian Standards (IS - 10500). For parameters and classes not included in the CPCB standards, reference was made to the standards defined by other agencies. For each parameter, weighing factor is evaluated on the basis of its weightage. Water Quality Index is then formulated using the rating value of each parameter and its corresponding weighing factor.

For formulating the Urbanization Index model, four multi - dimensional aspects have been considered for selecting the indicator parameters for urbanization: Demographic aspect, Economic development aspect, Spatial Aspect and Infrastructural development aspect. Under the four aspects identified, nine indicator parameters of Urbanization are selected namely, population size, population density, number of Industries, percentage of built- up area, roofing types, electricity facilities, educational facilities, availability of health services and assets (i.e. T V, computer/ laptop, telephone/mobile phone and scooter/car). The Urbanization Index formulation methodology is first developed for assessing the urbanization level of a district. Then, a methodology is developed for formulating the Urbanization Index of the catchment area of the station under study.

Water Quality - Urbanization Regression model (WQURM) is formulated for prediction of river water quality from the urbanization of the location from the Water Quality Index model and the Urbanization Index model developed in the present study. The application of the developed methodology is demonstrated on the Sabarmati River. The correlation is

established between the water quality parameters and Urbanization Index. It is observed that there exists a very high degree of correlation of UI with BOD & DO, good correlation with pH & EC and poor correlation with Nitrate Nitrogen & Total Coliform.

The Water Quality Index model is validated by obtaining the Water Quality Index results by Delphi technique. The Urbanization Index model is validated using the information about urbanization level of the district from the Census of India, 2011. The trend of WQURM model is validated by applying the model on Mahi river basin.

In the present research, the methodology of water quality assessment is developed to evaluate the surface water quality numerically. A methodology is also developed to evaluate the urbanization level of a district and catchment of a location numerically. Also the study is intended to provide a methodology for the assessment of the impact of urbanization on water quality and for the prediction of status of water quality from the urbanization level. The model can facilitate policy makers and/ or government regulatory bodies to promote the urbanization processes in a scientific manner so as to curb the water deterioration problems and carry out sustainable economical development without affecting the quality of surface waters.

Keywords: Water Quality Index, Rating Scale, Urbanization Index, Urbanization Index of the catchment, Water Quality – Urbanization Regression model.