

# **Predictions of Future Urban Water Use and Strategies for Water Conservation**

Samuel Li

*Department of Building, Civil and Environmental Engineering  
Concordia University  
Montreal, QC*

There have been shortages of freshwater supply in many urban centres around the world. This is partly due to rapid urbanisation and climate change. Sustainable development of modern urban centres should include strategies for minimising water use by people living and working in cities and urban areas. This requires reliable predictions of urban water demands by residential, commercial, and industrial users. However, it has proven difficult to obtain such predictions. This presentation covers discussions of the recent progress in the development of prediction methods as well as a case study. The discussions include methods based on the statistical approach and stochastic approach. Long-term records of water use are typically decomposed into a number of components, associated with primary influence factors. The challenges are how to realistically quantify the influences of geophysical features, social and demographic characteristics, land use, and economic activities. In particular, it is challenging to reliably quantify climate change as an influence factor. The case study, conducted by researchers in the Water Resources Engineering Group at Concordia University, involved the collection of appropriate data of daily water use, meteorological parameters, and socioeconomic factors for a city in the metropolitan area of Montreal, Quebec. Analyses of the data were performed using multiple regression techniques. The techniques represent a new approach to predictions of daily water use. The originality of the research lies in predicting the base use component as a function of socioeconomic factors, as opposed to a function of time in existing approaches. The quality of the new approach is quantitatively demonstrated. Predictions of daily water use closely match observed characteristics. The new approach is shown to improve the results of the weighted coefficient of determination, the relative index of agreement, and the root mean square error from the existing approaches. The case study has led to the development of a useful tool for decision makers to manage water use. Examples include adjusting annual charge for water use, and regulating weekday/weekend water consumptions. The analysis procedures reported can be applied to analyse water use in other cities. Future studies should investigate what proper measure should be taken in order to achieve sustainable water-resources planning and management for urban centres. It is of practical interest to quantify savings associated with each measure. It is important to consider multiple climate change scenarios.