Abstract

Pollution distribution can be effectively tracked by a well-designed water quality monitoring network. In a previous study, the simulated annealing (SA) algorithm was applied to design a water quality monitoring station network. However, the SA method generally could not obtain the global optimum. Therefore, in this study, two linear optimization models with objectives minimizing the deviation of the distribution of cost factors are developed. Six cost factors are considered, including the number of reaches, the bank length, the size, the phosphorus load, the nitrogen load and the sediment load in the area covered by each monitoring station. For the uniform cost (UC) model, the coverage of each station is individually determined, while the coverage elimination uniform cost (CEUC) model determines the coverage of a station by eliminating the area that has been covered by any upstream station. The study area is the Der-chi reservoir watershed located in central Taiwan. Water quality monitoring station locations determined by the UC and CEUC models are obviously better than those obtained by the SA method. The both models produce similar results, but the CEUC model requires significantly less computational time to solve. A web-based decision support system (DSS) has been also developed to integrate the optimization models and a Web-GIS. The DSS provides friendly interface for using the models and generate graphical charts for presenting various spatial results. The system is intended to facilitate the decision analysis for water quality monitoring station siting.

Keywords: water quality monitoring network, facility siting, simulated annealing, optimization, web-GIS; environmental systems analysis.