Nannapasorn Inyim 2012: Development of Water Quality Management
Model for a Tidal River with Application to Tha Chin River. Doctor of
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Water quality management model for a tidal river was developed in this study. The main objective of the model was to determine the proper allocation of treatment levels at all wastewater treatment plants along the studied tidal river so that river water quality, measured in terms of BOD and DO, was still maintained within the specified standard. The formulated management model was in the form of linear programming. The objective function was to maximize total BOD discharge loading whereas the constraints included ranges of treatment plant efficiencies, and allowable BOD and DO concentrations in the river water. The BOD and DO constraints were formulated from unsteady-state BOD and DO dispersion models obtained from the two-dimensional vertically-averaged mass balance equations. The finite element method was used to develop the BOD and DO dispersion models. The BOD and DO dispersion models were developed such that the BOD and DO concentrations at any time were expressed in terms of the values at the initial time. By setting the BOD values less than or equal to the specified limits and the DO concentrations greater than or equal to the allowable values, the BOD and DO constraint inequalities were obtained. The degrees of treatment at various treatment plants in the study area were considered as model decision variables. The developed model was applied to the middle and lower sections of the Tha Chin River as a case study, so as to demonstrate applicability of the model and to test the model reliability. It was found that the model could be used for supporting water quality management of a tidal river. The results indicated the optimal degrees of BOD load removal of all treatment plants and showed the critical locations in the river with a risk of violating the BOD and DO standards.

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