Water Quality Model for Brewster Lake

Z. Aljobeh[1], G. Argueta[1]

[1]Valparaiso University, Valparaiso, IN, USA

Abstract

A 2-dimensional numerical model was developed to make spatial and temporal predictions of the water quality for Brewster Lake located in Barry County in southwestern Michigan. The numerical model takes into consideration the hydrodynamics of the lake, hydrologic conditions, physical, chemical and biochemical processes that take place in the lake, and nutrient loadings from the surrounding watershed. Physical, chemical, and biochemical data collected during summers 2012 and 2013 was used to establish appropriate initial and boundary conditions for the numerical water quality model and to calibrate the model. The data included measurements of the lake's dissolved oxygen, temperature, pH, specific conductivity, total nitrogen, nitrate nitrogen, ammonia nitrogen, total phosphorous, reactive phosphorous, total organic carbon (TOC), chemical oxygen demand (COD), biochemical oxygen demand (BOD), lake water levels, and outlet flow rates. In addition, hydrologic data for the region was obtained from three nearby weather stations.

COMSOL Multiphysics® software was used to solve the resulting integrated complex numerical model and to develop a 2-D graphical model of the lake. The equation-based modeling capability of COMSOL was used to input the lake's water quality mathematical modeling equations into its simulation platform. Only the lake's dissolved oxygen simulation is presented in this paper. The EPA WASP7 water quality simulation program was then used to compare predictions of the different water quality parameters.