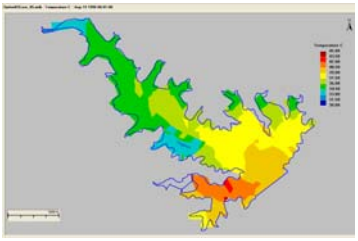
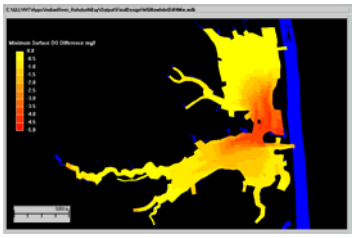
Lake Mohave Water Quality Modeling Study

Southern Nevada Water Authority, Lake Mohave, Nevada





Situation

In order to improve the water quality in the Las Vegas Wash embayment, the City of Las Vegas proposed to relocate its main wastewater treatment outfall to the deeper waters of Lake Mead. The outfall will be closer to Hoover Dam and consequently Lake Mohave, immediately downstream. Although the proposal also involves a significant upgrade of the level of wastewater treatment, the relocation near Hoover Dam allows for less natural assimilation of the introduced nutrients. The Southern Nevada Water Authority needed estimates of the net effects of the upgrade and relocation on Lake Mohave's water quality and on the nutrient load discharged downstream of Lake Mohave.

Approach

ERM's Surfacewater Modeling Group approached the problem by using a combination of historical nutrient balances and deterministic modeling. The model chosen for the study was CE-QUAL-W2, a time varying, longitudinal-vertical hydrodynamic and water quality model. The application of this model to Lake Mohave includes a representation of the lake bathymetry and time varying boundary condition data sets for the periods 1977-1978 and 1981-1982. Simulations of these periods were compared to observations to insure that the model reproduced the observed behavior. The model was then used to assess the response of Lake Mohave to the change in nutrient loads.

Long-term concentration data were also analyzed by developing nutrient balances to supplement the modeling. Similar analyses have been carried out in the past for 1977-78 and 1981-82. These nutrient balances assumed no sources or sinks of phosphorus to the lake other than inflow from Lake Mead and outflow at the Lake Mohave dam.

Results

Results of the model simulations suggested that the nutrients added in excess of the existing load will be partially retained in Lake Mohave. The retention rate for excess load appears to be higher than the retention rate for the existing load. The long-term nutrient balances demonstrate that a retention estimate anywhere from 21% to 3% could be derived depending on the assumptions made in correcting the record for outliers and below-detection measurements.

The model calibration effort suggested that there might be phosphorus input to the lake other than Lake Mead outflow. If such additional sources are indeed significant, the overall nutrient retention was underestimated in previous reports covering 1977-78 and 1981-82.