Chicago Waterway System Three Dimensional Modeling

Chicago Waterway System (CWS) Three-Dimensional Hydraulic Computational Modeling Using the EPA Environmental Fluid Dynamics Code (EFDC)

This work will build upon earlier modeling work on the Chicago River, including short segments of the adjoining North and South Branches. The prior work focused on the density current phenomena and has been completed. The U.S. Geological Survey Illinois Water Science Center (USGS) performed bathymetry and field measurements while the University of Illinois at Urbana-Champaign, Department of Civil and Environmental Engineering Hydrosystems Laboratory (UIUC) performed both computational and physical modeling.

The new work will add to the prior work the remainder of the South Branch, the Chicago Sanitary and Ship Canal (CSSC) to Cicero Avenue, South Fork (Bubbly Creek), Collateral Channel and connecting off-channel slips. This reach is of particular interest because of its complex nature; including wet-weather inflow from the Racine Avenue Pumping Station (RAPS); high sediment oxygen demand in the Collateral Channel, South Fork and off-channel slips; and thermal inputs from the Crawford and Fisk Generating Stations. The inflow from RAPS can cause a hydraulic summit at the South Branch Turning Basin and flow reversal in the South Branch.

The AECOM/CTE reports on flow augmentation and supplemental aeration have shown the high cost of improvements to meet water quality standards in this reach of the CWS. The analytical tools used for that analysis may not be sophisticated enough for this complex reach to verify that the suggested technologies may actually achieve compliance with the standards. Further, Region V has suggested temperature standards for the CWS and Lower Des Plaines River and again, the current tools may not be sufficient to determine if these suggested standards can be met with or without additional technology. For these reasons and others, it is desirable to proceed with a new and more detailed comprehensive model.

For the new work, the USGS will again perform bathymetry and field measurements, including reactivation of the Columbus Drive and Grand Avenue gages and the installation of a new gage at Cicero Avenue. These gages will form the boundary controls for the model. The UIUC will develop the three-dimensional computational model using the EFDC, which is in the public domain and has been used successfully for TMDL studies in coastal estuaries. The computational model will be resource demanding and will be developed with the input of the scientists at the UIUC National Center for Supercomputer Applications (NCSA). This model will be too resource-demanding to eventually be operational on the District's computer hardware platforms.

The UIUC cost for this work is $460,000 over three years, with $148,000, $154,000 and $158,000 for years one, two and three, respectively. The USGS work will cost $464,000, with $335,000 for the first year and $64,500 annually for the following two years.

The water quality model developed by Marquette University currently in use by the District's R&D Department will continue to be the primary tool for analysis of waterway operations, water quality conditions and the evaluation of alternative technologies to achieve water quality objectives.

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