Using two-dimensional hydraulic modeling to quantitatively assess fish habitat improvements

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Whilst two-dimensional (2D) hydraulic modeling is well established elsewhere as a tool for river management, its application is less common in Canada, where one-dimensional HEC-RAS modeling remains the industry standard. However, recent increase in demand for, and application of, 2D hydraulic approaches in Canada, offers exciting opportunities for quantitative assessment and prediction of changes in fish habitat, based on Habitat Suitability Indices (HSI) for flow velocity and depth. This opportunity is supported by technical advances, including the development of HEC5.0 (building 2D capability into HEC-RAS), possibilities to couple 1D and 2D models, and improved computer processing power, which now make 2D modeling more readily applicable.

2D hydraulic models have the potential to improve the effectiveness of river rehabilitation projects, by providing spatially explicit data for existing channel conditions, and offering a means of assessing proposed changes in a quantitative manner. In particular, such approaches could support planning for, and demonstration of, overall benefit for aquatic species at-risk, such as Redside Dace.

This presentation will demonstrate the application of 2D modeling to assessment of fish habitat change, based on a worked case study on the Humber River. During a high flow event in July 2013, material from a temporary coffer dam was entrained and deposited downstream. AECOM used 2D modeling to predict if and when the deposited material would be transported downstream, but also took the opportunity to investigate potential implications of the deposition for fish habitat. Assessment was based on the Adult Rainbow Darter, since this species is actively managed according to Humber River Fisheries management plan.

The project demonstrated that quantitative assessment of fish habitat suitability involves close interaction between ecological and hydraulic specialists. This can be usefully facilitated by fluvial geomorphologists, who, in tandem, use model outputs to assess the implications of hydraulic change for sediment transport processes.