DHI CASE STORY

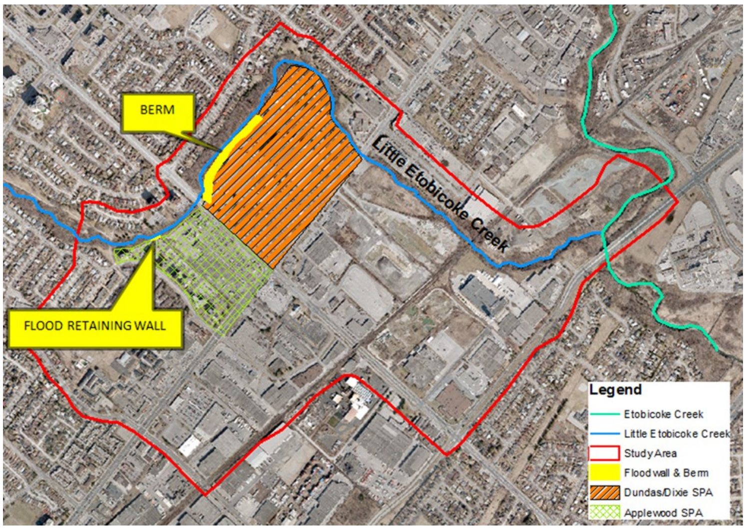
DETAILED FLOODPLAIN MODELLING FACILITATES URBAN DEVELOPMENT IN MISSISSAUGA, CANADA

Using 2D modelling to refine floodplain maps and support flood mitigation planning

The city of Mississauga has recently identified strategic growth areas where investments will be targeted for redevelopment and intensification projects. One of the growth areas has a history of flooding during major storm events. In order to redevelop this area, businesses and land owners need to prepare development proposals ensuring that appropriate flood proofing requirements have been achieved and emergency management plans have been prepared. Although the area had previously been included in an update to the regulatory floodplain mapping, the one-dimensional (1D) model that was used to map the floodplain was not capable of representing the complex overland flow within the study area. Therefore, it was determined that a more detailed two-dimensional (2D) hydraulic model was required to refine the floodplain mapping for this area. The team of DHI and MMM Group—a community planning and infrastructure design consultancy— were selected to take on this challenge.

UNDERSTANDING WHERE OVERBANK FLOODING OCCURS AND HOW FAR IT GOES

The area of interest for this project includes two Special Policy Areas (SPAs) located within the regulatory floodplain of Little Etobicoke Creek. Both of these SPAs fall within the jurisdiction of Toronto Region Conservation Authority (TRCA).



Study area and model domain. © DHI

SUMMARY

CLIENT

Toronto and Region Conservation Authority (TRCA)

CHALLENGE

Accurately represent flooding extents, depths and velocities in an urbanised area

SOLUTION

Develop a MIKE FLOOD model to accurately represent 1D river channel flow and 2D overland flow throughout the study area

VALUE

- Provide a detailed refinement of floodplain mapping including flooding extent, depth and velocity of flow
- Model provides a reliable tool to assess development plans including flood proofing and flood mitigation measures

LOCATION / COUNTRY

City of Mississauga, Canada

Little Etobicoke Creek flows southeast and briefly heads northeast under Dixie Road. It then returns to a southeast path, passing under Dundas Street, and finally turns east to its confluence with Etobicoke Creek. The total drainage area contributing to the creek is approximately 2291 ha, with predominantly residential, commercial and industrial land uses.

MIKE FLOOD was selected for the modelling because it couples a 1D channel flow model (MIKE 11) with a 2D overland flow model (MIKE 21). This approach was advantageous because it could leverage the existing 1D HEC-RAS model to prepare a MIKE 11 model for the 1D channel flow in Little Etobicoke Creek and then model the overland flooding using the 2D MIKE 21 model.

The existing 1D HEC-RAS model of Little Etobicoke Creek was converted to a MIKE 11 model and the results from the MIKE 11 model were validated against the results from the HEC-RAS model for several flood events in order to ensure consistency between the 1D models.

The 2D MIKE 21 model was prepared using a 2 m grid cell size throughout the study area. The topography for each grid cell was obtained from the light detection and ranging (LiDAR) data that TRCA collected for the study area, and the surface roughness was obtained using a map of land use types and a standard set of roughness values, as defined by TRCA, for each land use.

The MIKE 11 model was then trimmed such that it represented only the channelised portion of flow in Little Etobicoke Creek and it was coupled to the 2D MIKE 21 model using lateral links along the right and left banks of the MIKE 11 model. By coupling the models, the 1D channelised flow can be calculated using MIKE 11 while the overbank flows throughout the urbanised study area are calculated using the 2D model.

ANALYSING FLOODING FOR FLOOD MITIGATION OPTIONS

The resultant model was used to run different storm events such as 5-year, 50-year, 350-year and regional flow for the existing condition where the flood wall and flood protection berm were included in the model. Similar models were also run for 350-year and regional flow events for the condition without flood wall and the berm in order to determine the current level of flood protection being provided, and to meet regulatory floodplain mapping requirements.

The model will also be used to evaluate the effectiveness of the proposed flood proofing and flood mitigation plans. The updated flood constraint mapping will also provide guidance to local, regional and provincial government agencies as well as private sectors in managing and planning existing and future developments throughout the region.

Maximum flood depth for 100-year flood event with flood wall and berm implemented. © DHI

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