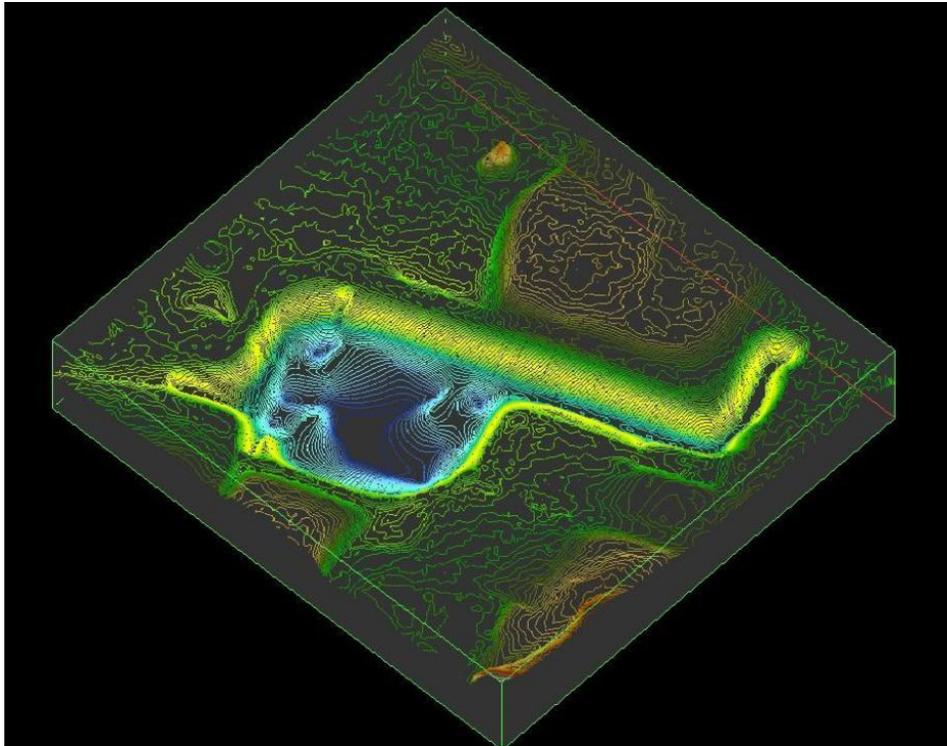


Innovative Approaches in Flood Damage Reduction

Solutions for the Stormwater Management



3D geospatial model of storm water management pond (GRCA, 2013)

High Level Results

- Enhanced understanding of storm water infrastructure, with options developed for future potential actions to be taken by the Town of Cobourg
- The use of high quality mapping and innovative survey technology allowed for the accurate determination of storm events that impact individual houses along rivers and streams
- Integrated and seamless 3D model of storm water infrastructure and its relation to adjacent terrain
- Reduced flood risk through innovative geodesign.

"The use of innovative mapping and survey techniques have greatly increased the ability of the Town of Cobourg to understand and work to address flooding issues in our municipality."

Stephen Peacock, P. Eng.
Chief Administrative Officer, Town of Cobourg

Project Context

The major impetus for this study was the winter rainstorm on January 25, 2010 that flooded a number of houses in the Town of Cobourg. The Town features four main creeks that run through it. The upper portions of the creeks' catchments are agricultural with the lower sections passing through residential neighbourhoods before discharging into Lake Ontario. While considering a growing residential population, the Town of Cobourg must balance new development with its storm water management infrastructure. The Town wishes to consider the possibility of building one or more ponds to store excess floodwaters and in turn protect downstream private property. As such, the Ganaraska Region Conservation Authority was tasked with conducting geospatial and engineering analyses in an effort to enable the Town of Cobourg to consider detailed options in addressing their current and future storm water management needs.



2010 major flood event in Town of Cobourg, ON (GRCA, 2010)

Challenge

Urban centres present unique challenges when dealing with surface water hydrology. Traditional approaches in assessing storm water management ponds have included the consideration of multiple plans and datasets in a fragmented fashion. Engineers and municipal planners have long desired a more accurate and precise way of doing this work. Key to understanding these issues are accurate, 3D models of the situation at hand. The Town of Cobourg is one urban centre which can benefit greatly from modern geodesign principles, particularly in the development/redevelopment of historic downtown areas.

Project Goals

This project was undertaken under the Ontario Ministry of the Environment's Showcasing Water Innovation program. The purpose of this study was to use the latest 3D geospatial technology to assess if the Town's storm water infrastructure was fulfilling its objectives, and to develop recommendations that address any identified concerns.

Project goals were to:

- Evaluate the functionality of a town's existing stormwater pond
- Determine the ability of flood control ponds to reduce flooding on Brook Creek
- Understand the flood susceptibility of the existing buildings in the floodplain of the lower Brook Creek by:
 - Evaluating the structures in the system that create constrictions and thereby create flood damage
 - Review past reports developed to address the subject flood damage area considering flows from all areas upstream of flood damage areas
 - Use innovative mapping and survey techniques to examine whether houses that were surveyed for low openings potentially are being inundated by flood waters
 - Determine what houses are being flooded by what return period storm and understand the dynamics of this flooding.

Solution

To ensure protection of people and property during potential flood events, the Town of Cobourg enlisted the Ganaraska Region Conservation Authority (GRCA) to implement a unique combination of proven strategies which incorporate innovative digital modeling techniques to understand the potential effects of flood damage in the Town of Cobourg, such as:

- LIDAR
- Survey-grade Real-Time Kinematic (RTK) GPS surveying
- Traditional total station surveying
- Cutting-edge 3D geospatial modeling
- Innovative use of hydrologic and hydraulic engineering models

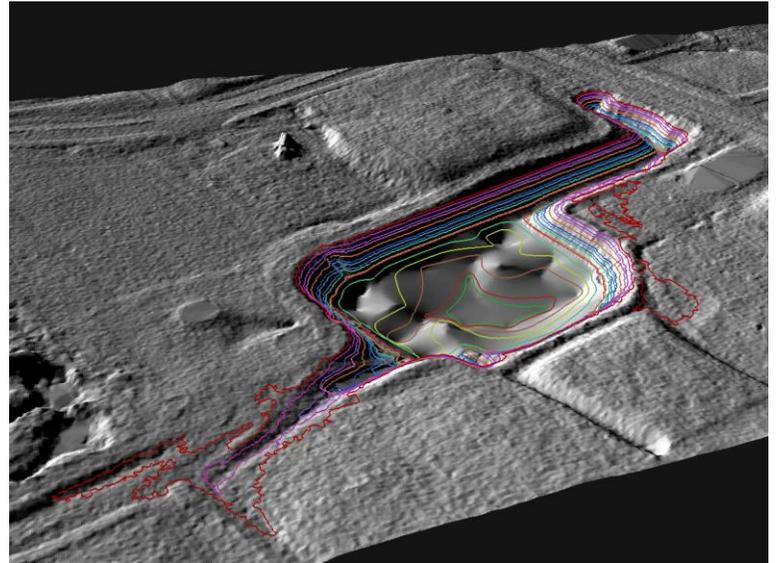
For further information on the 3D modelling approach, please refer to the technical report and how-to manuals at:

http://www.grca.on.ca/downloads/showcasingwaterinnovation/Supporting_Sustainable_Water_Management.pdf

Results

The geospatial and engineering services provided by the GRCA have given the Town of Cobourg a detailed understanding of the flood damage areas, as well as options and recommendations in addressing specific flood mitigation concerns.

This study has determined that the infrastructure in the flood affected area can convey flows up to $10 \text{ m}^3/\text{sec}$. Since a number of houses affected by flooding are downstream of this infrastructure, it is imperative that flows in the creek are limited to at least this value. Analysis shows that flow targets required to address flooding concerns on Brook Creek can be achieved by using both the originally recommended Brook Road Pond and additional controls (a pond) on the West Industrial Park tributary. In addition, all future upstream development should put stormwater control works in place to maintain peak flows as a number of structures have been identified as flood susceptible in this study.



Final fused hydraulic DEM of storm water management pond with adjacent terrain (GRCA, 2013)

The accuracy of the study allowed the identification of urban flooding (flooding due to the failure of urban infrastructure) that was initially thought to be originating from the stream. Urban flooding is an emerging area of concern due to a number of flash flood events that have inundated built areas (ex. Toronto April 2013 flood). It is recommended that more detailed analysis is carried out to Determine how to address the emerging issue of urban flooding.

By way of innovation and cutting-edge geospatial analysis, the Town of Cobourg can continue to grow in a sustainable and prosperous manner.

Next Steps

The following next steps are recommended:

- Assess other locations for siting of flood control infrastructure or storm water management facilities
- Complete conceptual design analysis of candidate sites
- Completion of EA process for final site
- Completion of Design and Drawings for final site
- Continue to work with the Town of Cobourg to address urban drainage issues.

Application for Ontario communities

Flooding of existing development areas within historic communities of Ontario is a challenge for many municipal governments. With climate change, flooding issues are projected to be more frequent and possibly more severe. Additionally, the insurance industry has identified flooding as one of the most significant insurance issues given recent flood events in the cities of Toronto and Calgary. One of the solutions to address this flooding is the creation of flood damage reduction ponds. This study provides examples of innovative techniques in the conceptual design of storm water management facilities. Communities across Ontario can use this example in their addressing of this issue. Additionally, this study shows that accurate geospatial models can be used to understand urban flooding issues.

Contact Information

Ian Jeffrey
GIS/Remote Sensing Specialist
Ganaraska Region Conservation Authority
905-885-8173
ijeffrey@grca.on.ca
2216 County Road 28
Port Hope, ON
L1A 3V8

Mark Peacock, P. Eng.
Director, Watershed Services
Ganaraska Region Conservation Authority
905-885-8173
mpeacock@grca.on.ca
2216 County Road 28
Port Hope, ON
L1A 3V8

This project has received funding support from the Government of Ontario. Such support does not indicate endorsement by the Government of Ontario of the contents of this material.