Long-term erosion monitoring on Niagara Escarpment watercourses

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Stormwater management techniques are used to mitigate the effects of urban hydromodification on receiving watercourses and regulatory agencies increasingly require an evaluation of the success of these techniques. However, natural rates of erosion and channel adjustment are influenced by surficial and bedrock geology; drainage area and hydrological inputs; climate and vegetation; and land use and historical impacts in the watershed. Stream type classifications provide a useful framework to constrain different degrees of expected natural variability in channel monitoring parameters, and the classifications can be refined to reflect detailed watercourse observations on a project-by-project basis. Pre-development monitoring data and statistics for identified stream types provide a basis to assess if post-development changes within a watercourse are natural or are attributable to the changes to the hydrologic regime. Our methods and results demonstrate that erosion exceedance targets for stream morphology monitoring projects should not be developed as "one size fits all."

This study focused on channels located within the physiography of the Niagara Escarpment. Monitoring sites were identified above and below the Escarpment and grouped into four categories based on channel characteristics. Data were collected by topographic survey using monumented cross sections and high-tension chalk lines between iron bars to increase survey accuracy and repeatability. Parameters including cross-section capacity and mean bed elevation were used to gauge channel enlargement and aggradation/degradation, processes typically associated with urban hydromodification. Pre-development monitoring was undertaken to determine the variability of typical parameter values at four different stream types and to establish erosion target thresholds to detect exceedances that could potentially be attributable to upstream development.

Results have shown that channels within the Queenston shale formation exhibit a high degree of natural variability, particularly compared to the other stream types in the study area. This evidence supports the hypothesis that the degree of natural variation can differ between stream types, and stream type classification are effective to accurately assess signals of development-related impacts within the background natural variability.