Longitudinal Assessment of Water Quality During Low and High Flow Conditions Along Innisfil Creek

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Significance: It is expected that the results of this study will help inform land management practices and initiatives along the creek that could reduce the mobilization of sediment excess nutrients to the stream.

Innisfil Creek, located in the southeastern region of the **Nottawasaga River watershed**, has long suffered from poor water quality, including high turbidity and phosphorus levels. Stream water quality changes from unimpaired where discharges from the Simcoe upland headwaters to impaired as the creek flows down into the Simcoe lowlands and joins the Nottawasaga River. The impacts of poor water quality along Innisfil Creek extend downstream into the Nottawasaga River and persist all the way to Wasaga Beach.

Building on previous research, a 7-month temporally and spatially intensive water quality monitoring project was carried out to more fully understand the hydrologic- and land use-related controls on water quality in this system.

Using the results of 9 longitudinal synoptic water quality surveys that spanned a range of flow levels (i.e. baseflow to stormflow), a positive linear concentration-discharge relationships for total suspended solids (TSS), total phosphorus (TP) and soluble reactive phosphorus (SRP), suggesting that the export of problematic sediment and excess nutrients from this watershed are exacerbated during high flow conditions that connect critical sources areas (e.g. agricultural fields) to the stream and promote erosion of stream banks.

The relative contributions of inorganic and organic matter to TSS were also assessed along the creek and its tributaries and found that the fraction of TSS that is particulate organic carbon is highly variable at low flows but decreases rapidly with increasing flow. Interestingly, this was not the case for the major agricultural drainage ditch draining the southern mid-section of the watershed where the organic fraction of TSS increased rapidly with increasing flow.

In terms of land use, the effects of potatoes, pasture, and wetlands on water quality were examined through multiple regression and residual spatial analysis. The results of this modeling work showed that proportion of pastureland in the local contributing area was negatively (albeit weakly) related to turbidity and TP under high flow conditions. Despite low sample size, we observed some spatial structure (clustering) in the residuals.

Future research in this watershed will focus on understanding the physical and hydrological processes that are responsible for mobilizing sediment and nutrients under varying flow conditions.