Water Quality Evaluation – Update and Potential Next Steps

Healthy Lake Huron Meeting

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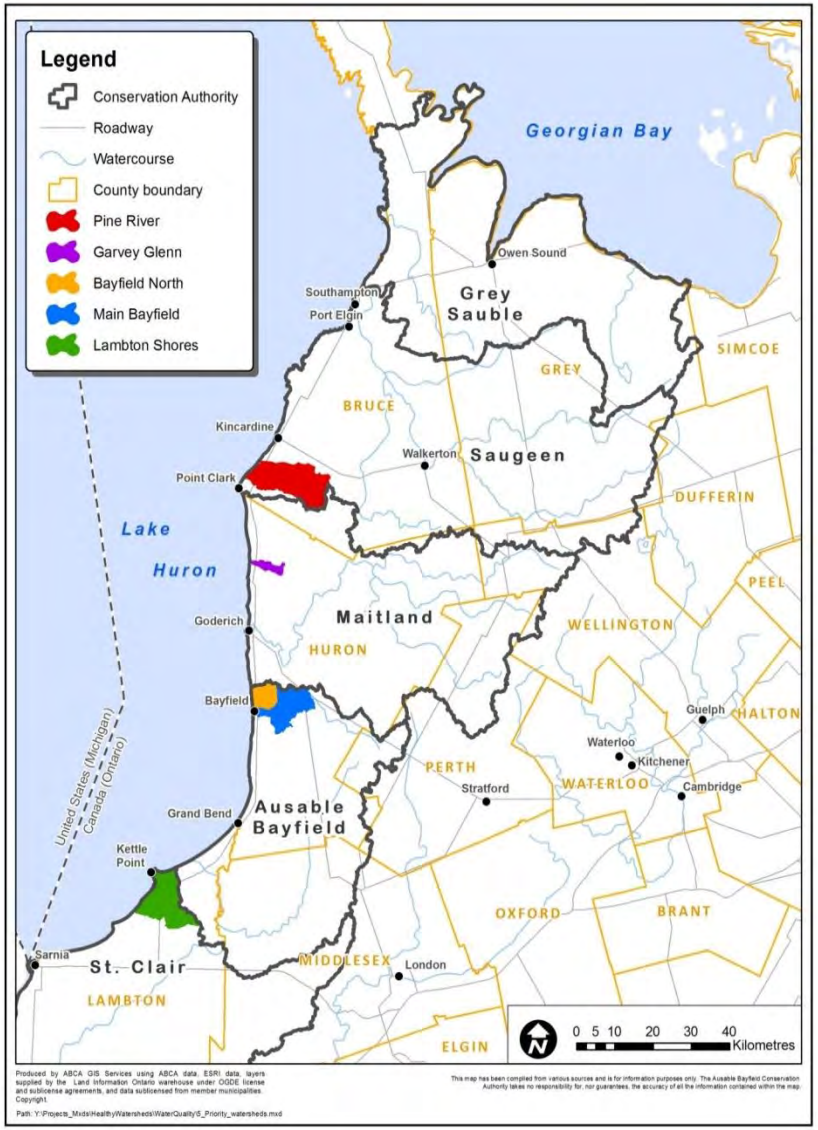
Healthy Lake Huron



Objective of the Healthy Lake Huron Project is to improve water quality along southeast shore of Lake Huron

At each monitoring station we collected:

- Continuous flow,
- Water samples analysed for nutrients and sediment

How are we doing?

How Are We Doing?

Objectives:

1. Results from field scale BMP monitoring in Gully Creek
2. Results from watershed scale monitoring for the priority watersheds
   - Monitoring data (n=3,000 water samples between October 2010 to September 2017)
3. Results from the SWAT model for Garvey-Glenn and Gully Creek

Pollutant Loads

$$Pollutant\ Load\ = Stream\ Discharge \times Pollutant\ Concentration$$

mass of pollutant per time	volume of water per time	mass of pollutant per volume of water

Calculating pollutant loads (in addition to monitoring concentrations) enhances our ability to:

- Compare different watercourses, or the same watercourse over time
- Evaluate land management activities (e.g., best management practices)
- Determine the effect of a watercourse on a downstream receiving waterbody (e.g., Lake Huron)

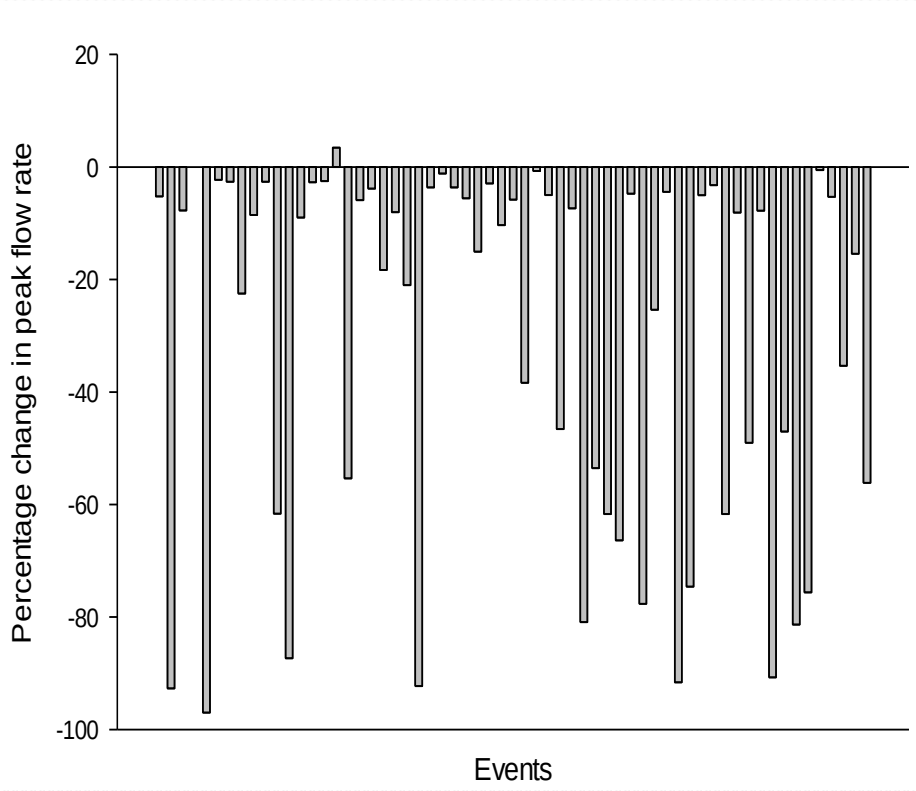
Effectiveness of BMPs

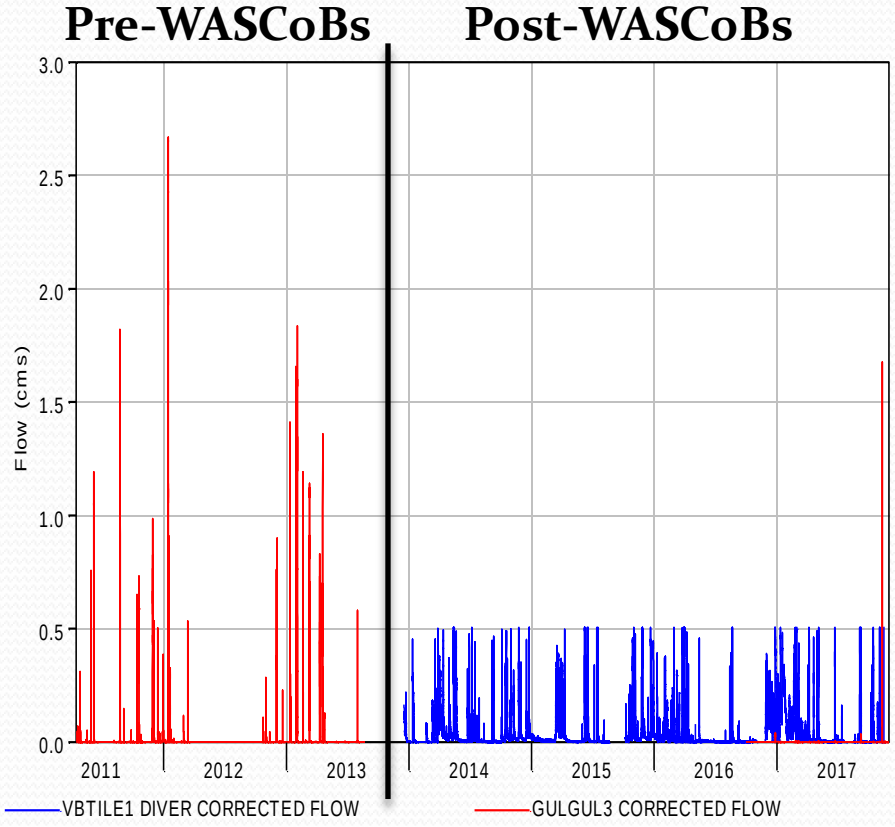
Evaluate the effectiveness of Best Management Practices (i.e., cover crops, nutrient management, conservation tillage, Water and Sediment Control Basins) at the watershed and field edge scale:

- At the **field edge**, we have monitored improvements to water quantity and quality from structural BMPs however, management practices are hard to measure; with long term data – anything is possible
- At the **watershed scale**
  - Monitored negligible reductions due to scale of BMP implementation and/or overwhelmed by weather and contra-management
  - Hydrologic models help to mathematically isolate management practices

Field Scale - WASCoBs

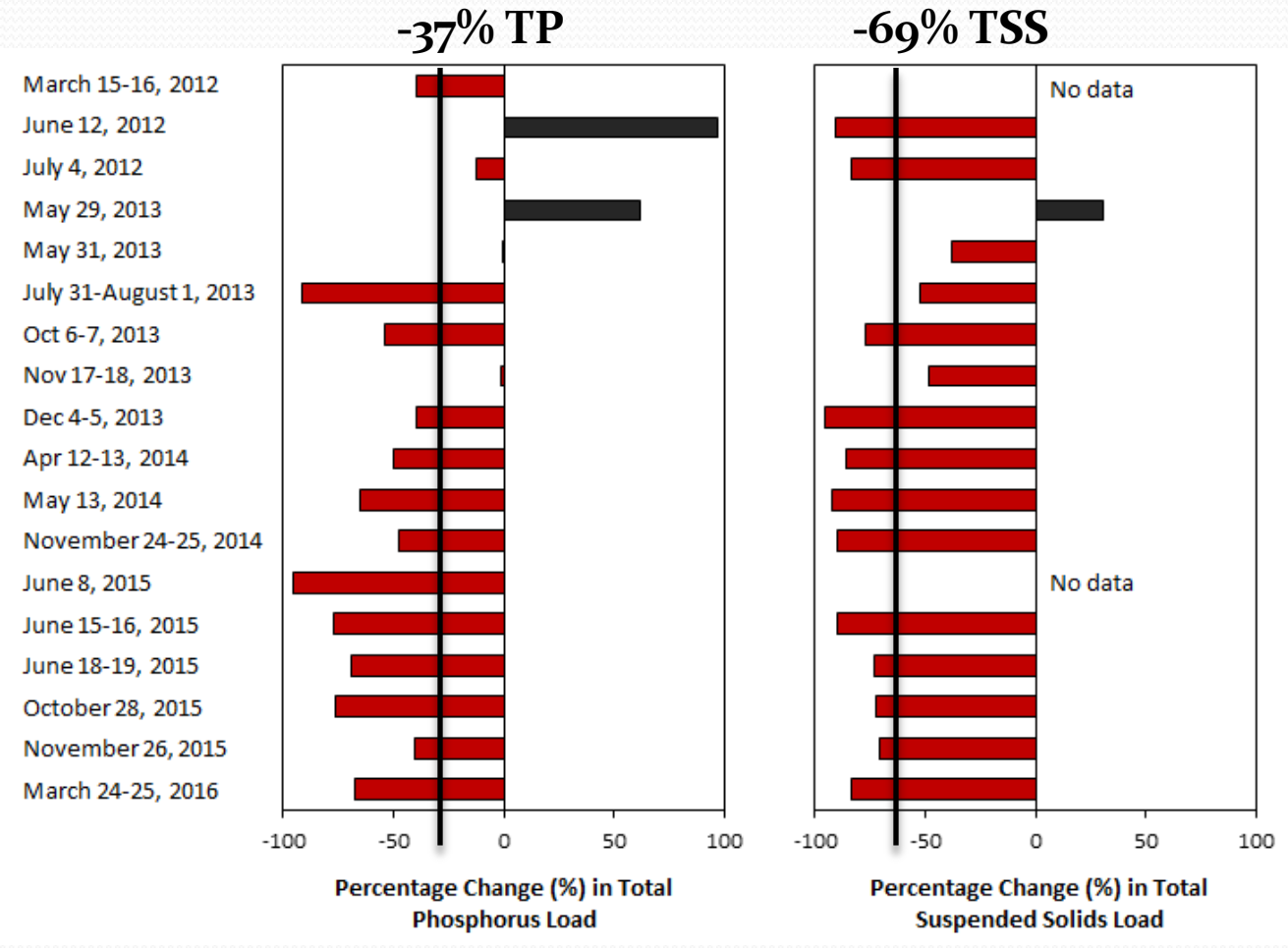
Reductions in peak flows into and out of WASCoBs





Field Scale - WASCoBs

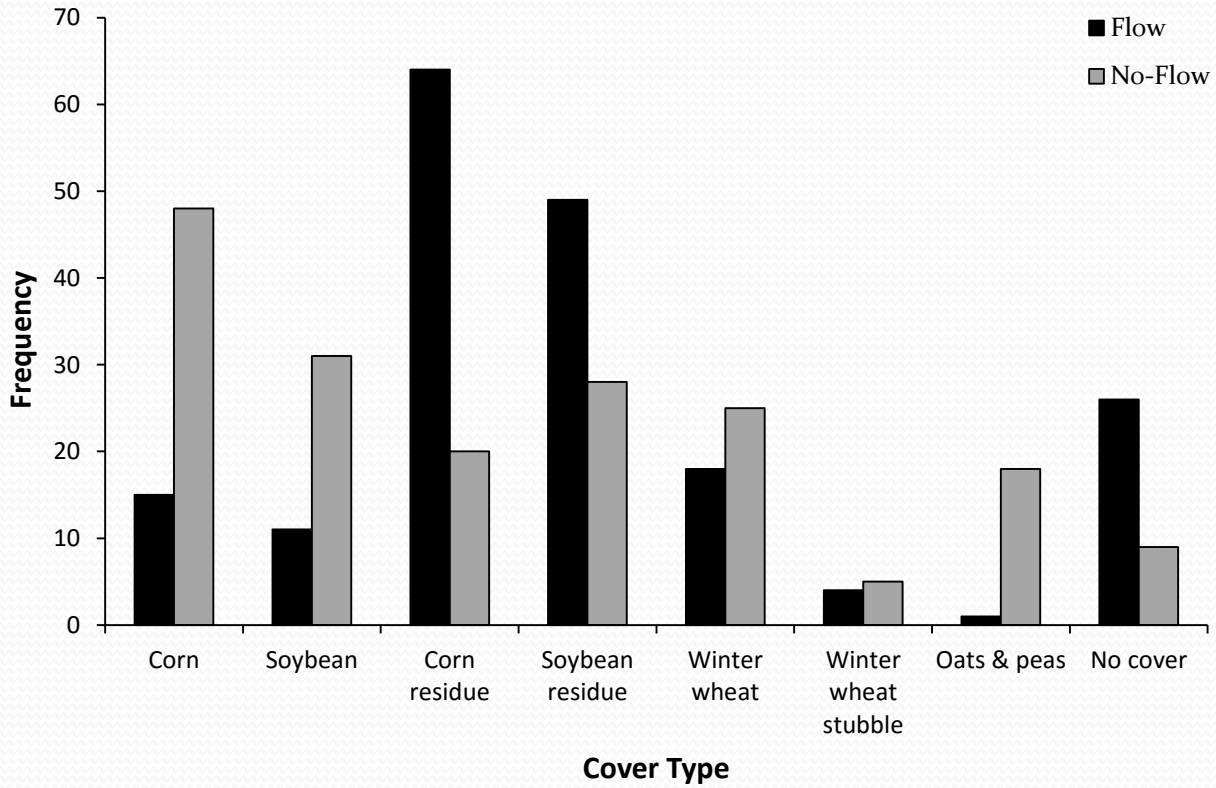
Reductions in loads into and out of WASCoBs



Field Scale - Land Cover

Flow/no-flow events at two WASCoB monitoring stations

- KVBAY – March 2012 to September 2017 (n=205)
- DFTEL – June 2013 to September 2017 (n=167)



Watershed Scale - Trends

Water quality trends in monthly flow-weighted mean concentrations for the priority watersheds. Arrows represent direction of trend.

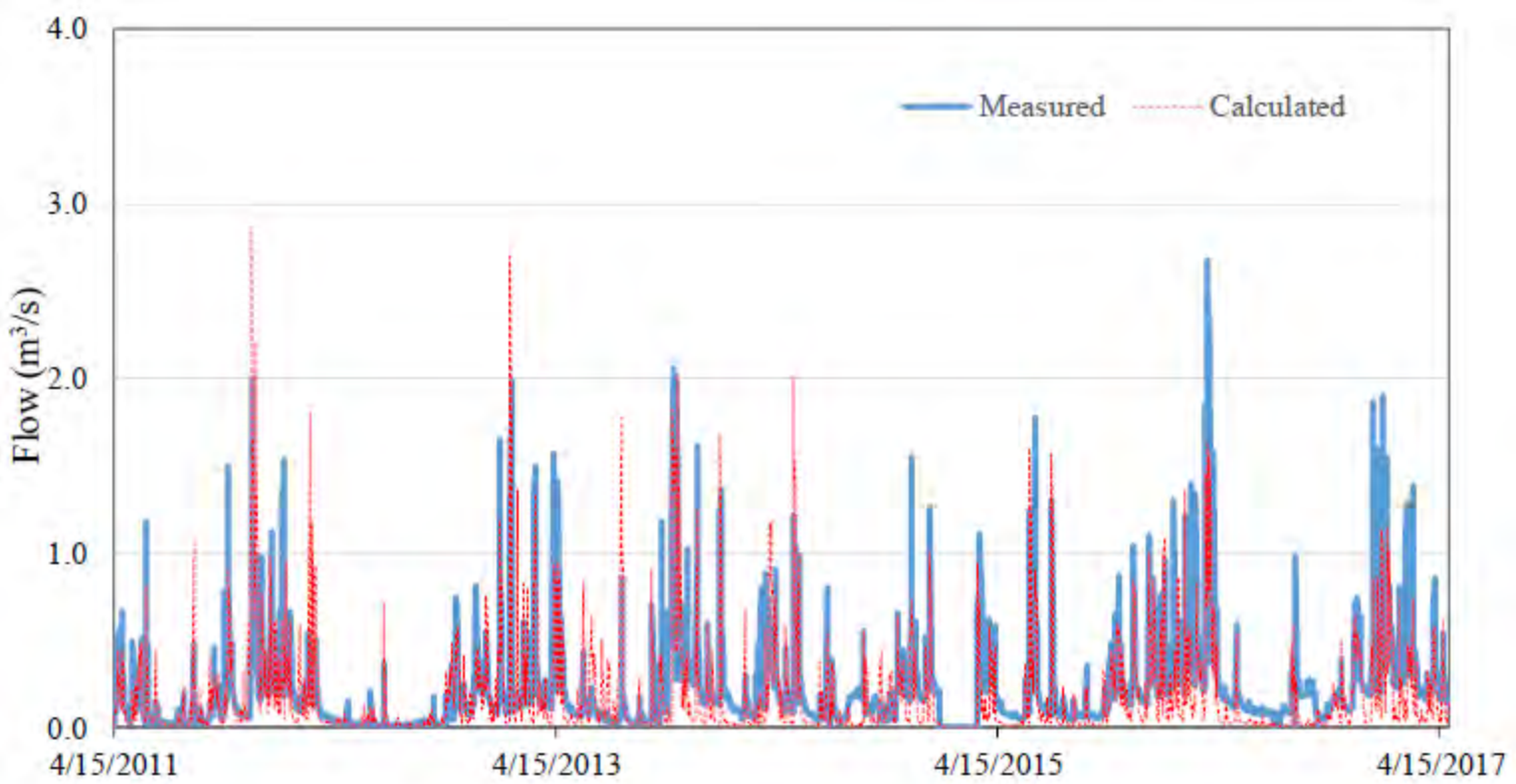
Station	2010 to 2016		2010 to 2017	
	TP	TSS	TP	TSS
Garvey-Glenn Drain	–	▼	–	–
Gully Creek	▼	▼	–	–
Shashawandah Creek	–	–	–	–
South Pine River	–	▼	–	–
Trick's Creek	▲	▲	–	▲

– Non-significant trend ($p > 0.05$)

▲ Significant positive (increasing) trend ($p < 0.05$)

▼ Significant negative (decreasing) trend ($p < 0.05$)

Watershed Scale - SWAT Model



Weather, soil and water, land management, crop growth and rotation data to evaluate BMPs

Watershed Scale - SWAT Model

SWAT developed for Gully Creek and Garvey-Glenn Drain to evaluate BMPs

- Load reductions of **22%/yr** TP and **26%/yr** TSS in Gully Creek
- Load reductions of **6%/yr** TP and **1%/yr** TSS in Garvey-Glenn

Monitored data tells the whole watershed story, while models help to account for BMP effectiveness

What Have We Learned?

- At field-scale, BMPs effectively reduce peak flows, nutrient and sediment loads
- Effectiveness of BMPs at watershed-scale not as apparent due to cumulative effects (e.g., weather, a systems approach to land management required – Avoid, Control, Trap and Treat)
- Without a systematic approach to BMP implementation, models are necessary to evaluate BMPs

Next Steps

- Continue to monitor to understand the differences in trends in the priority watersheds
  - Need for long-term monitoring to evaluate management decisions through dry and wet years
  - Provide concrete results and feedback to community

- Process-based ecosystem models (e.g., SWAT and RSWMM) required to evaluate environmental and economic costs and benefits of land management practices in the priority watersheds

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