POLLUTANT LOADS GENERATED FROM LAKE ST. CLAIR METROPARK DURING DYNAMIC STORMWATER RUNOFF EVENTS

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Urban Stormwater

Urban stormwater is the primary source of water quality impairments for 13% of all rivers, 18% of all lakes and 32% of all estuaries in the United States based on the 2000 National Water Quality Inventory, despite comprising only 3% of the land mass in the US (NRC 2008).

“all highly urban watersheds produce severely degraded receiving waters”
Data collected from [www.bmpdatabase.org](http://www.bmpdatabase.org/)
Paired data (Location, Storm, EMC)
216 BMP sites

\[
\log \beta = \log \left( \frac{M_{out}}{M_{in}} \right)
\]
Annual unit area loads of dissolved reactive phosphorus (DRP) at four Lake Erie watersheds

Maumee, Sandusky, Honey Creek, Rock Creek

NCWQR, Heidelberg University, unpublished data.
Passive Treatment Systems

“this technology is still immature and additional research is needed to provide quantitative design and performance information” (Davis et al. 2009)

“there is a need for modeling tools to accurately predict the hydrologic and waterquality performance of bioretention system designs and verify the suitability of current guidelines” (Roy-Poirier et al. 2010)
Passive Treatment Systems

Very few studies have investigated metal retention

- Multiple-event study of bioretention for treatment of urban storm water runoff (Hsieh and Davis, 2005)
- Sorption and Release of Dissolved Pollutants Via Bioretention Media (Morgan 2011)
- Chemical fractionation of Cu and Zn in stormwater, roadway dust and stormwater pond sediments (Camponelli et al. 2010)
- Design and hydraulic characteristics of a field-scale bi-phasic bioretention rain garden system for storm water management (Yang et al. 2009)
- Contaminant removal and hydraulic conductivity of laboratory rain garden systems for stormwater treatment (Good et al. 2012)

To date, no studies have investigated how changes in organic-metal complexation influences (1) transport of metals during stormwater runoff events and (2) retention and release of metals from passive treatment systems
“Even though the process of soil Fe-oxyhydroxide reduction is important in controlling metal mobility in wetland soils...the dominant mechanism for this process is OM release” (Grybos et al. 2007)
Gaps in Understanding

1. Organic complexation
2. retention/release is controlled by episodic events, not equilibrium processes (i.e. kinetics)
3. analytical techniques limit understanding of dynamic changes in metal speciation
4. there are very few studies that investigate specific mechanisms of retention as well as, and possibly more importantly, the release of metals in these systems
Catchments with extensive **vegetation** produce DOC lower in hydrophobicity than **urban** land uses.
Hydrophobic fractions of DOC are removed during transport.
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Project Description:
The Huron-Chinant Metropark Authority recently received a US EPA Great Lakes Restoration Initiative Grant (EPA-826-GL-2011-1) to implement green infrastructure to reduce, capture, and treat stormwater runoff generated at the parking lot at Lake St. Clair Metropark (formerly Marysville Metropark). By reducing the contaminants discharged from the parking area to Black Creek, it is anticipated that the project will help reduce the number of beach closures at the park, increase flow to the Point Rolette Marsh and enhance generally increase water quality within the Black Creek.

As part of this effort, the Environmental Chemistry Research Laboratory at Wayne State University is monitoring the stormwater flow before, during, and after parking lot renovations. For more information, contact Shannon Millmurry (amillmurry@wayne.edu) or Mike Allen (mikeallen@metroparks.com).

Limitation & Data Disclaimer:
Uncertainty and potential for error can be associated with environmental monitoring data. Data users are cautioned to consider carefully the provisional nature of the information before using it for decisions that concern personal or public safety or the conduct of business that involves substantial monetary or operational consequences.

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Anaerobic (Grybos et al. 2007)
Aerobic (Grybos et al. 2007)
Oxidation of (previously anoxic) sediment is estimated to be the most efficient way to mobilize metals into the environment (Förstner et al., 1989) since it is correlated with increased exchangeable and/or reducible metal fractions, induced by a decreasing pH and an increasing ORP (Saeki et al., 1993).