A GEOGRAPHICAL INFORMATION SYSTEMS TOOL FOR *E.COLI* MONITORING IN PLASTER CREEK WATERSHED

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Project Summary

Understanding human impacts on water quality continues to be a focus for government agencies and other stakeholders. Improvements are needed when selecting sites for watershed monitoring and pollution reduction. Previous analyses of water quality data have typically been limited to basic metrics such as minimum and maximum, average, and pass/fail. Furthermore, analysis is difficult because data is collected by many stakeholders and not shared. Data collection and intervention sites are often selected based on ease of access instead of using best-practices for site selection. This project creates a new tool for water quality data analysis using ArcGIS Explorer Online™ by Esri®, a geographical information systems (GIS) software. This interactive mapping tool compiles data from different stakeholders, locations within a watershed, and locations for potential pollution inputs. Thus, allowing users to determine the efficacy of current monitoring sites or select additional sites. Plaster Creek, a tributary of the Grand River, was chosen as the focus for this tool because it is currently designated as unsafe for human contact due to high levels of Escherichia coli (*E. coli*). Human contact with *E. coli* may cause diarrhea, anemia, kidney failure, and death. Sustained use of this tool will aid stakeholders in further water quality assessments in Plaster Creek and other watersheds.

Current & Proposed Monitoring Sites for Plaster Creek

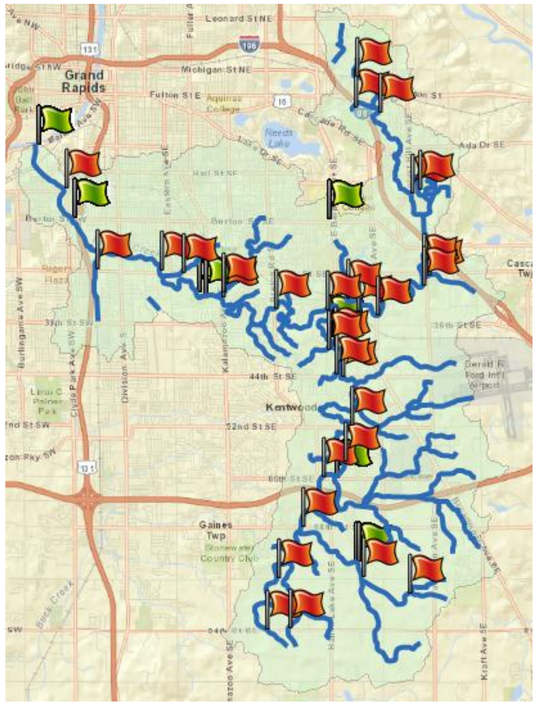

Figure 1: Plaster Creek Watershed with current and proposed monitoring sites

Objectives

- Create a free, user-friendly tool to understand water quality data
  - Tool must record and visualize water quality data
  - Tool must be interactive and help determine potential pollution sources
- Use the tool to select monitoring sites based on best-practices criteria
- Use the tool to determine the location of pollution inputs

Best-practices for *E.coli* Monitoring Site Selection

Sampling sites should represent the overall quality conditions of the water body.

- Near potential pollution sites
  - Storm drains
  - High septic tank density
  - Agricultural/livestock areas
  - Impervious surfaces
- Previous monitoring sites
- Rain events
- Safely accessible
- Year round water flow
- Branch junctions

Using Best-practices for Site Selection

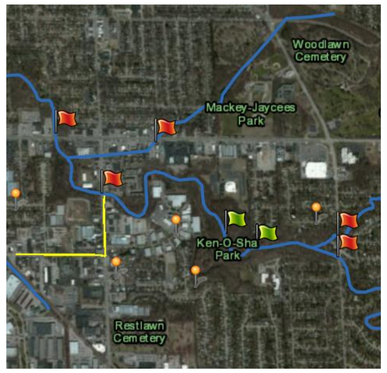

Figure 2: Ken-O-Sha Park, Grand Rapids, MI

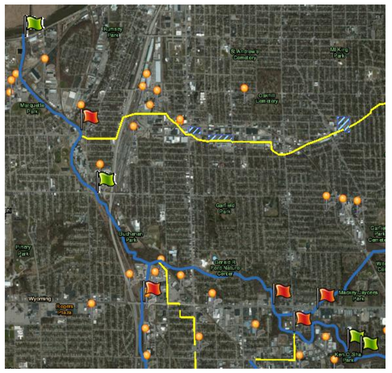

Figure 3: Downtown Grand Rapids, MI

Map Key

- Plaster Creek Watershed
- Plaster Creek
- *E. coli Monitoring Site*
- *Recommended monitoring site*
- *Storm Drain*
- *Storm Main*

For use with Figures 1 – 3

Acknowledgements

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Methods

- Obtain *E. coli* data from multiple stakeholders - Calvin College, Kent County, Michigan Department of Environmental Quality (DEQ), and City of Grand Rapids
- Compile and clean data from multiple sources and different formats into one standardized master data set
- Determine GPS coordinates for sampling locations from electronic and handwritten documents and add to master data set
- Obtain locations of storm drains from Michigan DEQ database
- Obtain locations of septic tanks from Kent County
- Gather weather data from multiple sources to obtain a complete record for the master data set
- Use AcrGIS Explorer Online™, a free online software, to create an interactive map that shows the information contained in the master data set
- Obtain useful, publically served GIS layers such as Plaster Creek Boundaries from Calvin College and drain and hydrology maps from Kent County
- Determine best-practices for monitoring site selection
- Use the mapping tool, best-practices for monitoring site selection, the master data set, and GIS layers to analyze the efficacy of current monitoring sites and potentially recommend additional sites

Future Work & Challenges

Future Work

- Begin recording *E. coli* data from selected monitoring sites based on best-practices using the mapping tool
- Create publically available, central repository for *E. coli* data
- Determine additional stream quality metrics to be recorded in central repository
- Use central repository to determine pollution sites
- Implement improvement projects at pollution sites
- Record water quality upstream and downstream to verify the efficacy of improvement projects

Challenges

- There is no central repository for water quality data
- Stakeholders cannot easily share water quality data
- Stakeholders do not use the same reporting methods
- Additional monitoring stations requires staff time & funding
- Some sites may require permission from private land owners
- Implementing a new central data repository requires staff time to maintain
- Funding is needed to implement water quality improvement projects