

CrowdHydrology

About the CrowdHydrology Effort

CrowdHydrology, an effort to collect crowdsourced hydrologic data, has been successfully deployed in New York (Lowry and Fielen 2013) and expanded into several other states including Michigan, Wisconsin, and Iowa. The CrowdHydrology project places stream gaging-staffs at popular recreation destinations (e.g., nature centers, hiking trails, fishing areas) with signage asking passersby to submit the stream height stage via text message to the CrowdHydrology database. Using the open-source Social.Water code (Fielen and Lowry 2012), the water level measurements are appropriately parsed and read, and participating citizens can see their submission in nearly real-time on the CrowdHydrology website (www.crowdhydrology.org). An interactive map displays CrowdHydrology locations across the country and the public can download or view data for each station.



CrowdHydrology station in Kalamazoo (top).
Example CrowdHydrology gage sign (bottom).

CrowdHydrology in Michigan

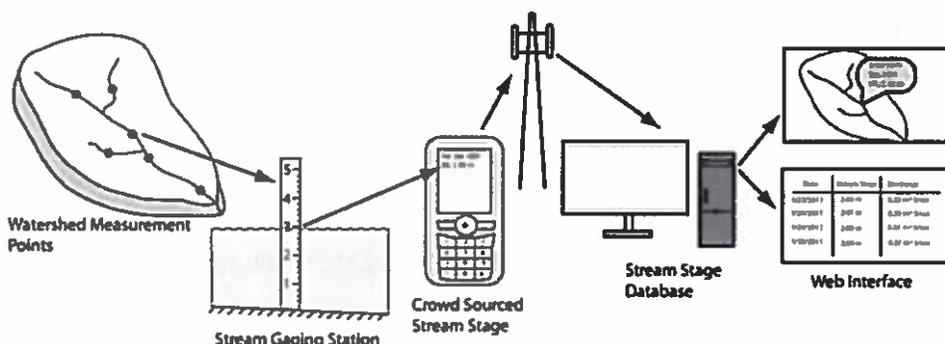
A small network of sites have been established throughout Michigan. This approach to monitoring may provide a more accessible pathway for citizens to understand and participate in water science as well as collect measurements of stream stage during base flow events. The State University of New York at Buffalo, United States Geological Service and the Michigan State University Institute of Water Research partnered to expand the Michigan network.



CrowdHydrology sites in the Midwest.

Research with CrowdHydrology

This project expands upon on-going work conducted by Dr. Chris Lowry at the State University of New York at Buffalo and Dr. Mike Fielen at the USGS Wisconsin Water Science Center. Fielen and Lowry (2012) describe the open source Social.Water software that the CrowdHydrology project uses to collect, organize and store data from user submitted text messages. Social.Water was designed with future customization and modification in mind to increase the ease with which data are submitted and accessed by researchers and the general public. Lowry and Fielen (2013) also explored the value of engaging citizen scientists to collect crowdsourced data and best practices for increasing user submissions. They investigated the level of uncertainty of the crowdsourced hydrologic data and found that the error between user submitted stream stage measurements and those collected by a pressure transducer was less than a quarter of an inch resolution of USGS Style A staff gages used for CrowdHydrology stations. Similar efforts at the North Temperate Lakes Long Term Ecological Research Program in Wisconsin, are using crowdsourced data to evaluate lake levels.



CrowdHydrology (Continued)

Water Monitoring Community in Michigan

There are 86 major watersheds in Michigan (http://msue.anr.msu.edu/news/michigan_water_facts) – what if each watershed had 20 gages to supplement USGS monitoring stations? That would be 1,720 gages across the state, giving thousands of residents the opportunity to become more involved in managing Michigan's water resources. While the DEQ has agreed to allow multiple gages by watershed, there is a cost of \$50 per permit. For volunteers and non-profits operating on very tight budgets, this permitting fee presents a major barrier to installing these gages. CrowdHydrology already has a dedicated database at the State University of New York at Buffalo to house all data collected through the program. Furthermore, staff gages will be installed and maintained utilizing a network of volunteers and local organizations. Through outreach activities, CrowdHydrology will be promoted and data collected by "citizen scientists," typically on a voluntary basis.

CrowdHydrology Works for the State

The CrowdHydrology system supports the 2015 MDEQ Water Strategy recommendation of creating an integrated water-based monitoring system. Ultimately, the state benefits from using CrowdHydrology by eliminating many costs associated with this simple form of water resource monitoring. Firstly, the state will be able to leverage stream gage water monitoring equipment for free that is already installed by CrowdHydrology users. Secondly, there will be no need to pay for an instrument to gather this type of data. Lastly, the state would not need to invest in the development or maintenance of a water database to house information retrieved from monitoring locations. CrowdHydrology has major potential to provide data that helps with inland lake level monitoring, as well as dam and bridge inspection. With regard to inland lake level monitoring, the Water Use Advisory Council discussed the extreme lack of data for the majority of the 65,000 inland lakes in Michigan, including those showing historical fluctuations in lake levels. CrowdHydrology users could easily contribute this information, providing a more comprehensive set of records.

Michigan in the Forefront

Michigan has the opportunity to be a leader in exploring the benefits of crowdsourcing hydrologic data. This new methodology needs to be further explored in Michigan. With a robust crowdsourcing CrowdHydrology gaging network, Michigan researchers will be able to examine questions such as: what motivates someone to participate, what other agencies and organizations could utilize the data, how to improve the crowdsourcing process by refining its participatory approach, and many others. Crowdsourcing hydrologic data poses a great opportunity to not only build a more informed and engaged citizenry, but also provides periphery-level data that local and state agencies could use for water resource management.

CrowdHydrology Database

These CrowdHydrology gages are one tool that we can use to monitor stream flow in un-gaged and rural watersheds in order to better manage water resources. One of the biggest issues in the Great Lakes is nutrient pollution. To quantify nutrient fluxes we must first quantify stream flows. CrowdHydrology gages are a first step in monitoring the volume of water flowing within these streams. These data in combination with nutrient sampling can help estimate the discharge of nutrients into the Great Lakes. Building and maintaining the current network of CrowdHydrology gages provides an inexpensive way to monitor both seasonal and long-term changes in stream and lake levels. Data collected through CrowdHydrology could also be examined for use within the Water Withdrawal Assessment Process to supplement existing USGS gage data and build a better database for inland lakes.

References

- CrowdHydrology, Inc. 2015. CrowdHydrology [Website]. Retrieval from <http://crowdhydrology.geology.buffalo.edu/>
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- Lowry, C.S. and M.N. Fienen. 2013. CrowdHydrology: Crowdsourcing Hydrologic Data and Engaging Citizen Scientists. *Groundwater* 51(1): 151-156.