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Monitoring Stream Flow in the Sturgeon River Watershed, Dickinson County, Michigan

MiCorps Volunteer Stream Flow Monitoring – Pilot Project 2016

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Project Description

In 2016, the Dickinson Conservation District was one of two organizations to be awarded funding for MiCorps' Volunteer Stream Flow Monitoring Project, a pilot program that had been introduced that same year.

The Dickinson CD project proposed to identify locations where stream flows were impacted by water withdrawals from agriculture or other uses in the Sturgeon River system of Dickinson County. This system is primarily a sand bank/bed system whose bank stability and fishery can be compromised by widely fluctuating flow rates. Flow rate has not been studied locally in this system and we are particularly interested to see how the impact of water withdrawal in the vicinity of a number of potato farms influence it, as well as providing a data set for future climate change resilience studies.

A vast majority of the streams in the Sturgeon River system are designated Type 1 Trout Streams. Suitable habitat for trout species in these streams can be negatively impacted by water withdrawals when stream flow is decreased and water temperatures increase. These streams are also home to a number of freshwater mussel species including two Michigan Species of Concern (Round pigtoe and Elktoe) and one Michigan Threatened Species (Slippershell).

The goals of the study were:

1) To determine if current water withdrawals affect the base flow of the system in the study year;

2) To contribute information to partner organizations relevant to sensitive aquatic biota;

3) To allow us and partner agency, Natural Resources Conservation Service, to help farmers/water users understand and plan for climate resiliency;

4) To provide data from one previously unstudied parameter toward building a case for broader watershed assessment and management planning.

Site Description

As discussed above, the Sturgeon River watershed system was selected for monitoring under this project. The areas of the Sturgeon River watershed to be studied, being sub-watersheds of the Menominee River (HUC 04030108), comprises about 60% of the land area of Dickinson County, MI. The system flows south east into the Menominee River, which then flows south east along the Michigan/Wisconsin border to Lake Michigan. Subwatersheds include the East Branch Sturgeon (HUC 04030108-010), West Branch Sturgeon (HUC 04030108020), Pine Creek (HUC 04030108-030), and the Sturgeon River (HUC 04030108-040).

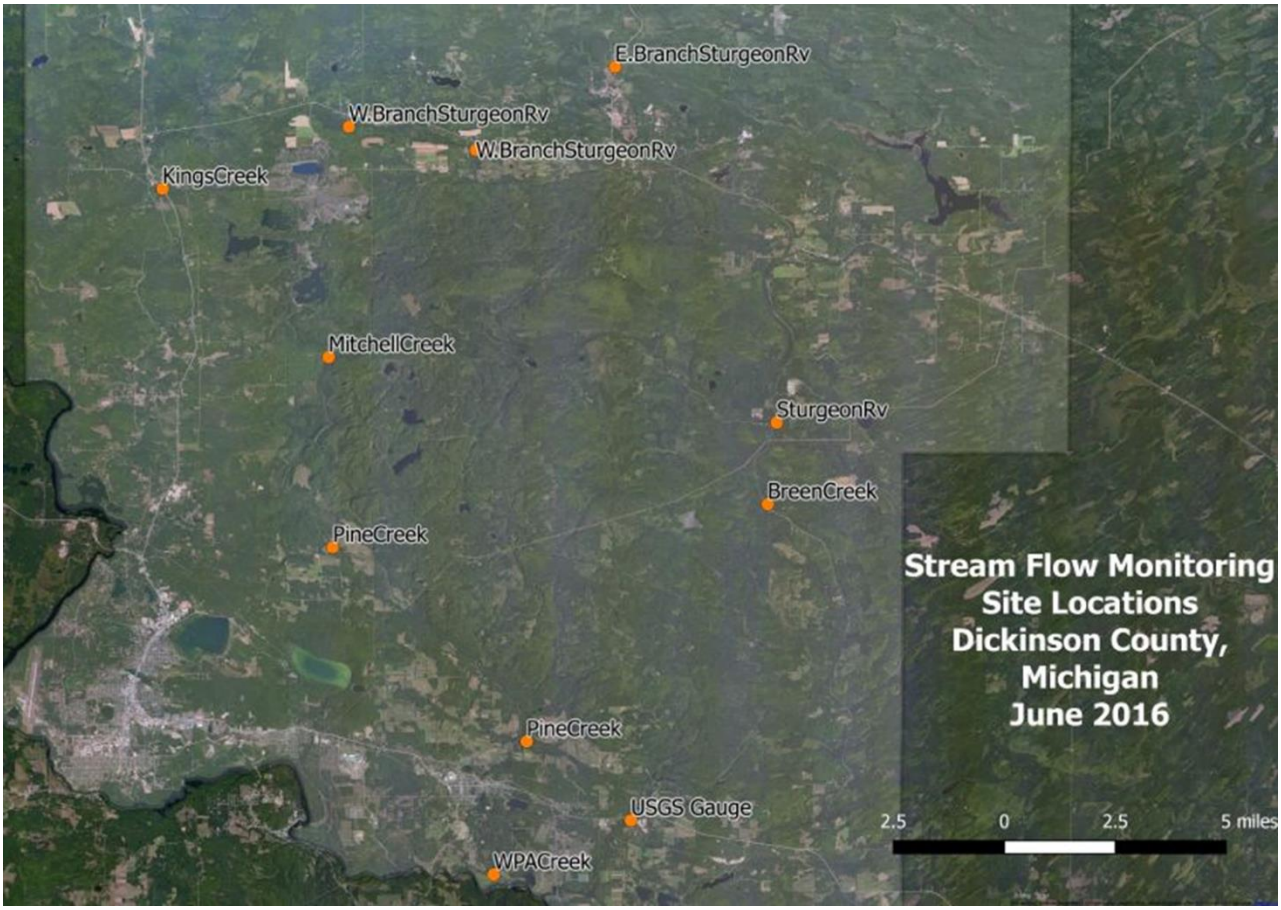

Figure 1. Map of stream flow monitoring sites located within Dickinson County.

Per grant requirement, 10 monitoring sites were selected across Dickinson County (Figure 1). Sites were selected for the study based on several criteria, including proximity (upstream and downstream) to known water withdrawal locations, the accessibility of sites, and their location within DEQ Water Management Areas (WMA). These areas are used in the Water Withdrawal Assessment Tool (WWAT), which is a model that predicts the index flow of streams and can determine the potential impact the installation of a new or large-quantity water withdrawal to the surrounding resource.

A USGS Gage site was also monitored during the project as a quality control measure. The actual discharge rate can be determined from the USGS website and compared to the reading obtained in the field. The accuracy of monitoring efforts can then be assessed by calculating a percent error.

There were approximately five known or potentially operating water withdrawal locations throughout the study area; three sites were located in the northern half of the system and two sites were located in the southern reaches. The travel between all sites was approximately 100-miles round trip and monitoring was typically divided between two days.

The following table provides specific location information for eleven sites selected for the study based on these criteria.

Site ID	Site Name	Description
1	Kings Creek	Downstream of road x-ing; within utility corridor; Evidence of stream flashiness (sand deposits in forest ~15' from stream bank, branch snags, etc.); **Width ~6', Depth ~8"**
2	W. Branch Sturgeon Rv	Road access across from ND School; small bridge at x-ing; wider stretch of stream, generally rocky (pebble to cobble, few boulders); Monitoring will occur upstream of road x-ing; Small rapids upstream, deeper pool downstream; Some erosion, banks pretty well vegetated; **Width ~20-25', Depth ~18"**
3	W. Branch Sturgeon Rv	East end of Groveland Mine Rd; Monitoring will occur downstream of road x-ing & large culverts, but before deep pool; Rocky substrate (cobble), high vegetated banks; Access flagged; **Width ~20'; Depth ~16"**
4	E. Branch Sturgeon Rv	Access on West side of road @ beginning of guard rail, Flagged; Monitoring will occur upstream of bridge before bend; Erosion on far bank; recent bridge work (resurfacing) downstream of monitoring location; **Width ~30', Depth ~8-28"**
5	Sturgeon Rv	Monitoring will occur upstream of bridge and rd x-ing; Access on DS side of Bridge & cross under the bridge; Rocky substrate, lots of mussels!; **Width ~40', Depth ~16"**
6	Breen Creek	Monitoring will occur downstream of road x-ing; Silty-sandy bottom, high banks; Deeper pool before bend, shallows after bend**; Width ~10'; Depth ~3"-3'**
7	Mitchell Creek	Monitoring will occur upstream of bridge; stream x-ing obvious from road; silty but navigable, some rock/gravel; **Width ~10', Depth ~16";** Stream access flagged
8	Browns Creek	Located at end of Bluffview Dr. off Upper Pine Creek Rd.; Small bridge @ stream x-ing; Monitoring will occur upstream of bridge, along clear straight stretch of water; relatively free of debris, small dam-like obstruction upstream approx 35'; Substrate is somewhat soft (~3in silt/muck); **Width ~8', Depth ~16"**
9	Pine Creek	Located at intersection of Pine Creek Lk Rd and Summit Rd; mixed substrate - sand/silt, cobble to boulder; ~40-50% embeddedness; wider; lots of vegetation on banks, over water
10	WPA Creek	Crossing on WPA Rd before farm; monitoring will occur downstream of road x-ing; Site after 2nd riffle, before wide riffle & narrowing of stream; Cobble and silt substrate; **Width ~8', Depth ~15"**
11	USGS Gauge	Located at USGS Gauge station site at US-2 in Loretto; **Wide stretch of stream ~80',** rocky substrate - cobble to boulder

Table 1. Descriptions of stream flow monitoring sites.

Procedures

Procedures and methodology for data collection followed the MiCorps protocol developed by the Huron River Watershed Council (HRWC) and the Great Lake Commission (GLC) for the Michigan Department of Environmental Quality (DEQ). The Project Procedures document for the MiCorps Volunteer Stream Flow Monitoring project is attached in Appendix A.

Results

The following figure illustrates the discharge (cubic feet/second) recorded for each site during each of the three monitoring events during 2016. As is evident, there was a dramatic increase in discharge rates during the third monitoring event which took place in late September. This was due to heavy rains and the data collected during this monitoring event was not recorded at base flow levels since the monitoring timeframe was reaching the deadline.

Detailed discharge rates are listed in Table 2. This table also shows averages for discharge rates for all sites and the calculated percent error based on the rates determined for the USGS Gage station. The DEQ index flows are also listed as comparison. These numbers are those determined for each water management area that included a monitoring site and are used in the DEQ's water withdrawal assessment tool.

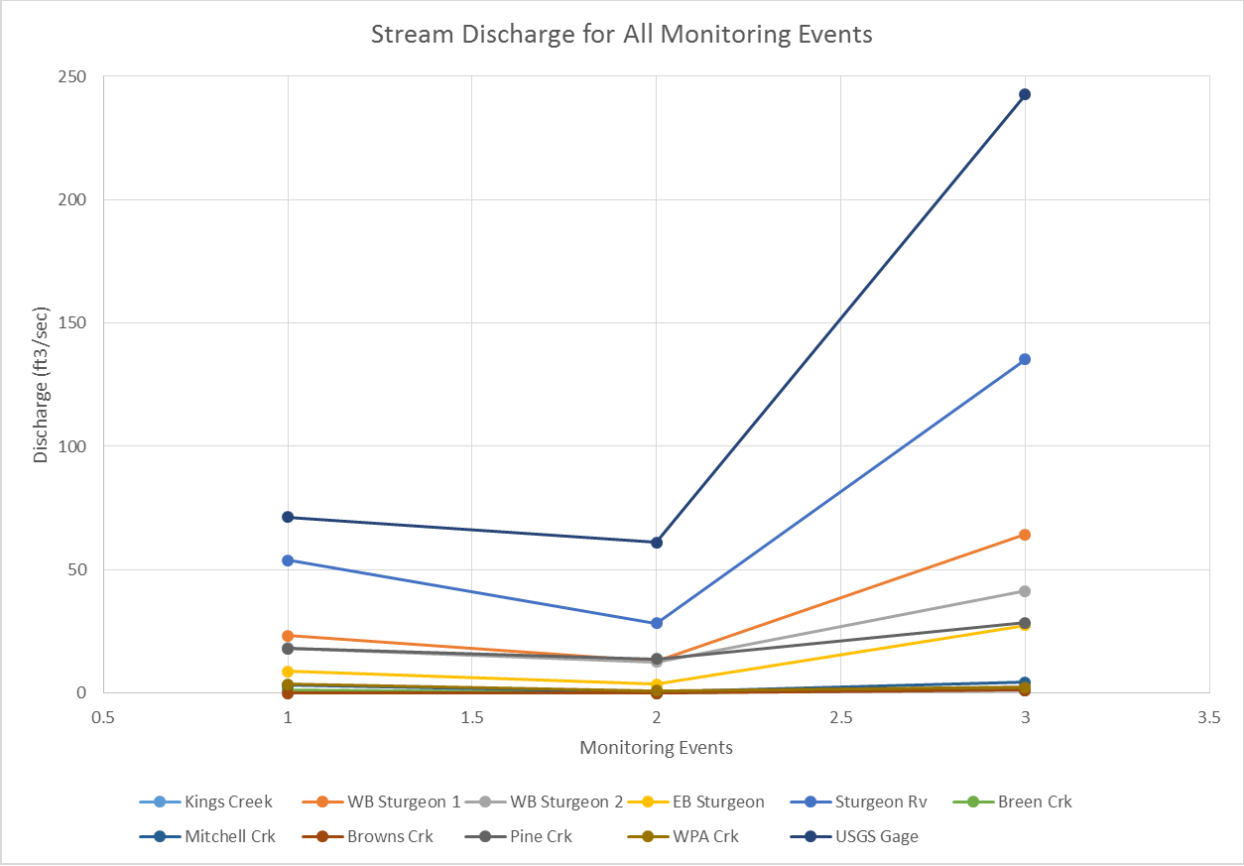

Figure 2. Discharge for all stream flow monitoring sites at each monitoring event in 2016.

	Kings Creek	WB Sturgeon 1	WB Sturgeon 2	EB Sturgeon	Sturgeon Rv	Breen Crk	Mitchell Crk	Browns Crk	Pine Crk	WPA Crk	USGS Gage	Actual	Error
Event 1	0.8565	23.20975	18.1926	8.881625	53.823	1.37725	3.20348575	0	18.125	3.466	71.316	113	36% error
Event 2	0.391	12.9315	12.6665	3.589625	28.3855	0	0.307	0	13.829	0.932	61.064	72	17.6% error
Event 3	1.145	64.2105	41.437	27.42775	135.22125	2.1585	4.402125	1.1425	28.5475	2.329	242.62875	228	6.14% error
Average	0.7975	33.45058	24.0987	13.29967	72.47658	1.1785	2.63753	0.38083	20.1671	2.243	125.0029	137.667	
DEQ Index Flows	2	17.4	17.4	14.8	95.5	3.3	3.4	9.9	15.4	4.4	128		

Table 2. Discharge rates for each stream site, including averages. DEQ Index Flows are also included for each stream site based on location within DEQ water management areas. Percent error calculations determined from data collected at the USGS Gage Station are also listed.

Discussion

Overall, results are inconclusive as to what level of effect water withdrawals have on the Sturgeon River system throughout Dickinson County. This is mainly due to the large amount of consistent rain over the course of the sampling period. As seen in Figure 3, the precipitation totals for Dickinson County between July and October was between 15" and 20" for much of the county. Monthly rain totals were recorded at the Iron Mountain – Kingsford station during the course of the project and are as follows:

Month (2016)	Total Rainfall (inches)
June	3.46
July	2.32
August	3.56
September	3.85
October	3.15

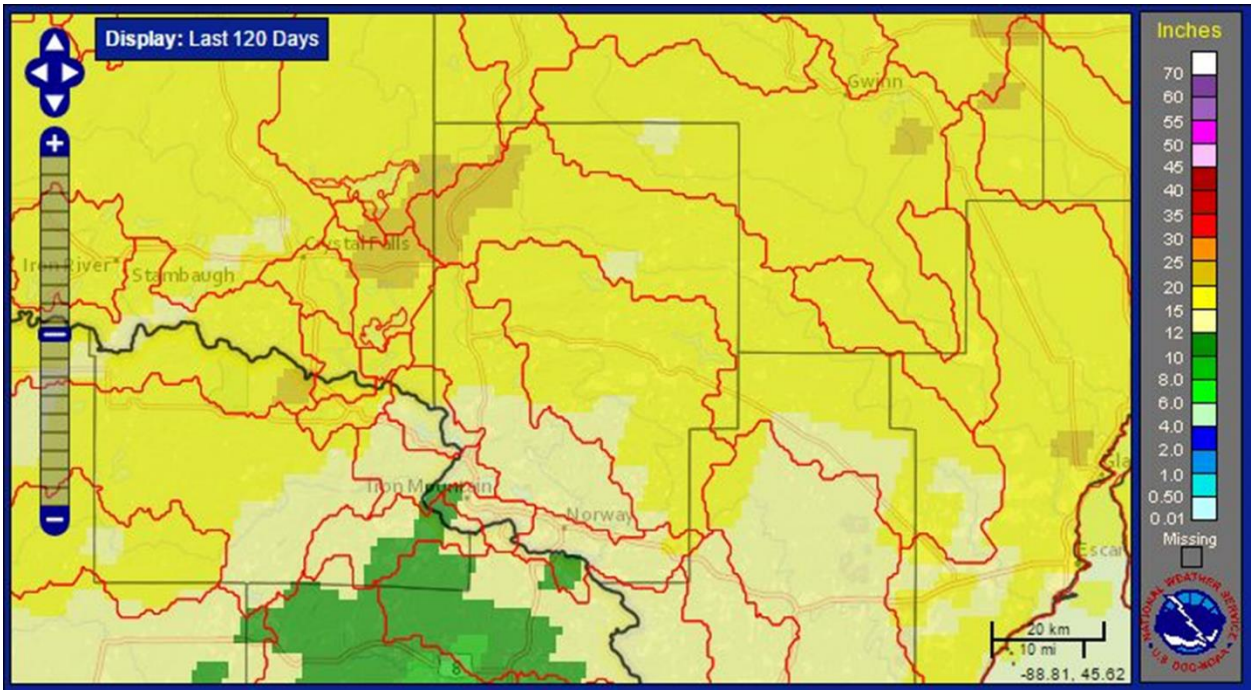

Figure 3. Precipitation totals for Dickinson County from July 3 to October 31, 2016.

Although the collected data did not answer the original question posed regarding the Sturgeon River system, much insight was obtained from this project. For instance, it was determined that after a large rain event (1.5"-2") the system would take approximately 10 days to return to base flow levels. Figure 4 shows indicates when the three monitoring events occurred in relation to the discharge recorded by the USGS Gage Station on the Sturgeon River. The impact of heavy rains on discharge is evident in this graphic.

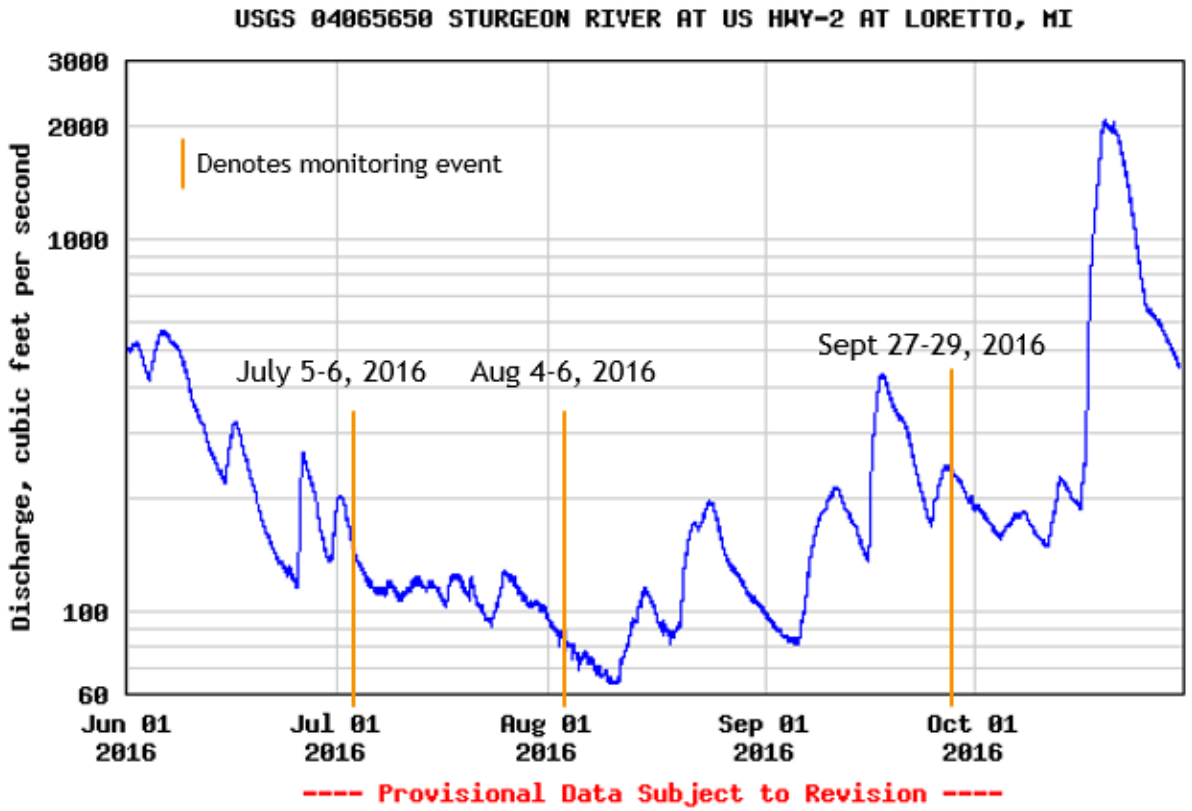

Figure 4. Discharge rates from the USGS Gage site on the Sturgeon River at US-2 in Loretto, MI from June 1st to October 31st, 2016.

These examples speak to the need for the project to run more than one field season in order to establish average baselines and to compensate for unusual or abnormal situations, such as frequent large rain events that can skew data.

To achieve accurate and/or more valuable results, several years of monitoring would need to occur in order to determine normal flow levels and to establish trends or distinguish abnormalities. More frequent monitoring (i.e. bi-weekly) would also assist in this regard. However, this presents its own challenges such as travel, time, staffing, budget, etc.

For this specific project, it would have been beneficial to work closer with area farmers to monitor directly above and below withdrawal locations to tack the amount of water being removed from the system. This was difficult to achieve due to timing and as the project was beginning, the farmers were preparing for the growing season and were too busy to be consistently involved with the program.

Overall, this project was a great experience and opportunity to learn more about a very important river system in our area. This program is a valuable addition to MiCorps' repertoire and serves as an effective introduction to stream flow monitoring activities.