

**U. S. Geological Survey
Minnesota Water Science Center
Statewide Sediment Network
Work Order #10 – Final Report
Period ending December 30, 2016**

Project Name: Statewide Sediment Network

MPCA Work Order Number: Swift ID: 105428, PO # 3000016051

Begin Date: April 2016

End Date: Dec. 2016

Project Chief: Joel Gröten

Cooperators: Minnesota Pollution Control Agency

Objective:

The objective of this study is to improve understanding of relations among streamflow, SSC, bedload, turbidity and acoustic backscatter at existing sediment network sites.

Tasks Completed in Work Order

Task A: Develop relations between streamflow, suspended-sediment concentrations, bedload, turbidity, and acoustic backscatter at selected sites.

More than 25 water samples were collected and analyzed for suspended-sediment concentration (SSC), total suspended solids (TSS), and percent fines at three monitoring sites (Knife River, Blue Earth River, and Zumbro River). Field measurements of water temperature, specific conductance, transparency, and turbidity were made during each sample event.

Task B: Provide online web-based real-time continuous turbidity measurements at three sites (Knife River, Blue Earth River, and Zumbro River).

Real-time turbidity monitoring was completed using fixed-location turbidimeters at the Knife River, Blue Earth River, and Zumbro River gage sites. Data was transmitted via GOES satellite to the USGS Water Science Center in Mounds View and then posted to USGS NWIS website.

Task C: Publish a daily suspended sediment load at the USGS stream gage on the Minnesota River at Mankato, Minnesota (station ID 05325000).

107 SSC samples were collected during scheduled visits to the Minnesota River at Mankato gage site and from daily observer samples. Daily and annual suspended-sediment loads were computed and published via NWIS for the Minnesota River at Mankato (USGS ID 05325000).

Task D: Describe differences between SSC and TSS and assign proportions attributable to differences in field data collection procedures and/or laboratory analytical methods.

More than 35 water samples were collected and analyzed for SSC and TSS at five sites in addition to the Task A sites. The five sites included the Minnesota River at St. Peter, Clearwater River at Plummer, Sauk River near St. Cloud, Redwood River near Marshall, and Root River near Mound Prairie. EWI sampling for SSC and bedload sampling was completed at these sites under agreements with the Minnesota Department of Natural Resources and the Legislative Commission for Minnesota Resources.

Preliminary analysis of the data indicated that TSS concentrations were significantly less than corresponding SSC with a relative percent difference near 40%. The median concentrations for TSS and SSC were 64 and 116 mg/L, respectively. Evaluation of the different combinations of sample method and laboratory method indicated that the difference in concentrations were due to a combination of both. Additional summary metrics are shown in the following table:

	TSS (mg/L)	SSC (mg/L)	% Fines
Sample count	65	64	63
Median	64	116	74
Mean	177	275	74
Minimum	2	1	30
Maximum	1,800	2,530	100

The work order for \$108,5470 (Swift ID: 105428, PO # 30000016051) was completed and ended 12/30/2016. All funds have been expended and an invoice has been submitted for the remaining MPCA funds.

Plans for Next Work Order

Future work will focus on the development and incorporation of surrogate technology to improve understanding of sediment transport and processes and to improve the accuracy of sediment load calculations. A work order will be developed to continue the Statewide Sediment Network work through 2018. A focus of the work will be to establish real-time reporting of SSC using surrogate sensors on the Knife River near Two Harbors, Zumbro River near Kellogg, and Blue Earth River near Mankato. The work order will include on-going suspended sediment and particle-size sampling and analysis at the three sites ~~above and the Minnesota River at Mankato~~ along with grab sampling for TSS analysis by the MDH Laboratory. The work order will include the drafting of a USGS Scientific Investigations Report documenting results through 2016.

Significant Results for Work Order #8

Preliminary data analysis of 2016 sample results affirm the differences between TSS and SSC in Minnesota reported in a USGS Scientific Investigations Report published in January 2014.

The table below lists the number of SSC and bedload samples collected during the open water season in year 2016. This includes all sampling methodologies (equal-width increment, single equal-width increment, non-isokinetic, grab samples, and point samples) for each site that are included in the USGS database (NWIS) through September 30, 2016.

Site	Number of SSC samples collected from Mar. – Oct. 2016
USGS 04015330 KNIFE RIVER NEAR TWO HARBORS, MN	8
USGS 05325000 MINNESOTA RIVER AT MANKATO, MN	107

USGS 05374900 ZUMBRO RIVER AT KELLOGG, MN	10
USGS 05321995 Blue Earth River at Hwy 169, Mankato, MN	11

Continuous turbidity and acoustic data has been stored for use in developing continuous SSC estimations through the development of regression relationships.