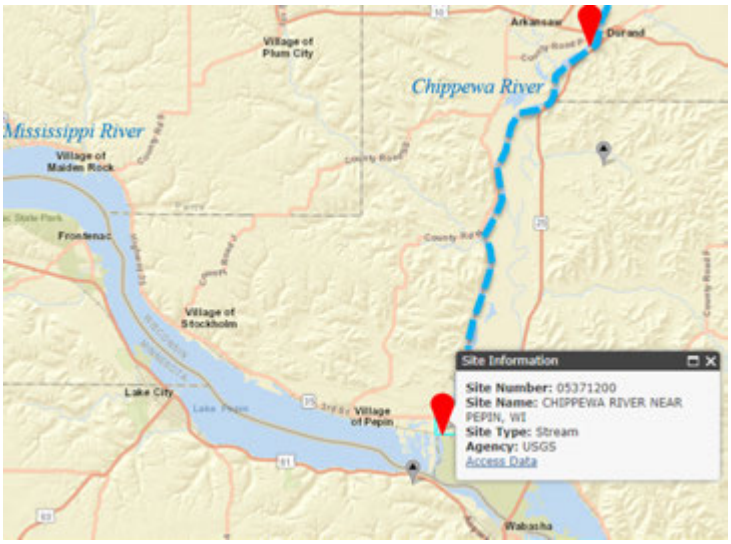
US Army Corps of Engineers
Engineer Research and Development Center

National Regional Sediment Management Program St. Paul District (MVP):

Real-Time 1D Bedload Transport Model of the Chippewa River, WI

Description

A reliable tool for predicting future bedload sediment quantities being transported from the Chippewa River to the Mississippi River navigation channel would be beneficial in facilitating channel maintenance decisions on an annual basis. Two current studies are underway, by the USGS and USACE-ERDC, to monitor and sample sediment movement along the Chippewa River in Wisconsin - one of the major contributors of sand-sized sediment to the Upper Mississippi River below Lake Pepin. These recent efforts present an opportunity to utilize these datasets in developing and calibrating a 1D sediment transport model along a 17 mile reach of the Chippewa River, from Durand, WI to the mouth of the river, to estimate the cumulative bedload volume and storage of sediment on an ongoing basis. This tool will help USACE in estimating bedload lag-time, sediment quantities & sinks, and in developing dredging strategies & channel maintenance decisions along the Upper Mississippi River.



Chippewa River proposed modeling reach between two monitoring locations

Issue/Challenge To Address

In 2014, sediment deposition in the Upper Mississippi River (UMR) navigation channel below the Chippewa River caused channel closures between Winona and Wabasha, Minnesota, delaying commercial navigation for a period of 3 weeks. This event was costly (millions of dollars per day) to both private industry and the federal government and the methods of dredging used in this emergency situation were met with great scrutiny and concern by federal and state natural resource agencies. With the implementation of the FY18 RSM effort to monitor bedload transport along the Chippewa River using the ISSDOTv2 approach as well as the USGS effort to collect and quantify suspended and bedload sediment in real-time at the Durand, Wisconsin gage, there is an opportunity to build off of these previous efforts to provide bedload projections at the mouth of the Chippewa River using a one-dimensional hydraulic-sediment model. A sediment transport model using HEC-RAS can be calibrated against the wealth of recently available data and detailed dredging records along the Mississippi River for use in capturing the bedload lag of sediment traveling from Durand, WI to the navigation channel. This model could be used on an annual, monthly, weekly, or even daily basis to estimate future projections of the transport lag-time, sediment sinks, and bedload quantities which can help inform channel maintenance decisions.

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Successes Lessons Learned

Lessons learned will be compiled during the duration of this study.

Projected Benefits Cost Savings Value Added

- Planning information for future dredging activities
- Cost savings in developing more efficient dredging plans
- May inform environmental impacts

Expected Products

- Hydraulic/sediment model to be used into the future
- Technical report summarizing modeling effort and initial findings

Stakeholders/Users

St. Paul District Operations Division, USGS, ERDC-CHL

Leveraging Opportunities

This proposed project directly leverages both a contracted effort by the USGS to provide real-time monitoring of suspended and bedload transport along the Chippewa River and an effort by USACE-ERDC to fully characterize the bedload transport along same reach of river using the ISSDOTv2 method. The one-dimensional model will bridge the gap between funded and executed data collection & analysis with future decision making made by operations personnel.

Points of Contact

Alex Nelson, USACE-MVP-EC-H, Senior Hydraulic Engineer (Technical Lead)
Zach Kimmel, CEMVP-OP-CH, Channel Maintenance Coordinator (OPS Review)

Participating Partners

This work will be coordinated with the USGS and USACE-ERDC-CHL in obtaining collected data. This analysis will provide feedback for the previous data collection efforts in how cost-saving decisions can be made from having a better understanding of sediment processes in the Upper Mississippi River basin.