Unmanned Underwater and Aerial Survey of a Beneficial Use Dredged Material Site at St. Joseph, Michigan

This effort directly supports the U.S. Army Corps of Engineers' navigation mission and its goal to beneficially use at least 70% of dredged sediment by 2030. By combining advanced sensing technologies such as AUVs and UASs, the study provides high-resolution data to evaluate the environmental conditions and performance of nearshore sediment placement. These insights will inform more effective and sustainable dredging practices, demonstrating how routine navigation maintenance can also deliver shoreline protection and sediment retention benefits. This approach advances the strategic use of dredged material as a resource, rather than a waste product, contributing to a more resilient Great Lakes system.

A cutterhead dredge was contracted by the USACE Detroit District to dredge the Saint Joseph harbor entrance channel. The water-sediment slurry, consisting primarily of fine to coarse sands, was pumped through a pipeline and placed at a nearshore berm along Silver Beach, where it was beneficially used to nourish the shoreline. The goal of this passive berm included beach nourishment for Silver Beach, wave attenuation, and preservation of sediment within the littoral zone. The berm relies on natural processes such as wave action and currents to shape and distribute the sediment.

To learn more about this beneficial practice a research project, 'Monitoring and Direct Comparison of Subaerial Beach Placement Methods in the Great Lakes (ISM 25-06)' led by Jennifer Miller and Doug Krafft and funded by the Dredging Operations and Environmental Research – Innovative Sediment Management is collecting data at the disposal site. As part of this research effort, an autonomous underwater vehicle (AUV) and a small unmanned aerial system (UAS) were successfully deployed by Justin Wilkens and Shea Hammond to collect water quality data and aerial imagery. The AUV recorded water quality parameters including turbidity (i.e., water clarity), dissolved oxygen, temperature, conductivity, depth, and side scan sonar imagery near the beneficial use site, capturing both ambient (non-dredging) and active dredging conditions. (Figure 11)

The UAS was used to capture aerial images of the turbidity plume and to document changes to the berm over time. (Figure 12) Over 15,000 water quality records were collected, ranging from 5 meters to 1,000 meters from the disposal site during a three-day survey period. These data will be used to describe conditions around the disposal site and support expanded opportunities for the beneficial use of dredged sediment in the Great Lakes.

Figure 11: UAV collecting water quality data

Figure 12: Dredging placement near St. Joseph harbor, photo taken by UAS.

This work is part of a larger effort 'Monitoring and Direct Comparison of Subaerial Placement Methods in the Great Lakes' funded by Civil Works R&D and supports Civil Works R&D Task 18, NAV. The larger project supports USACE Statement of Need 2075 "Update and Expand Dredged Material Research Program Technical Reports to Support Beneficial Uses of Dredged Material."

PoCs: Monitoring Effort PIs: Dr. Jennifer Miller (Jennifer.Miller@usace.army.mil) and Mr. Douglas Krafft (Douglas.R.Krafft@usace.army.mil). Ecomapper PIs: Mr. Justin Wilkens (Justin.L.Wilkens@erdc.dren.mil) and Mr. Shea Hammond (Shea.L.Hammond@ERDC.DREN.MIL).