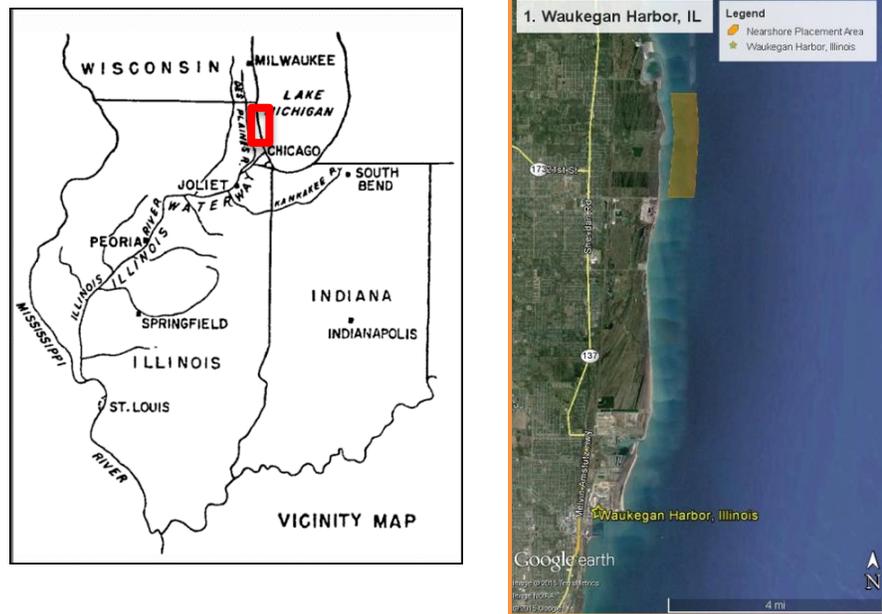




## Evaluation of the Application of Structure from Motion Topographic Survey for monitoring of Nearshore Placement in Southern Lake Michigan

### Description

LRC, in collaboration with the Illinois State Geological Survey (ISGS), Illinois Department of Natural Resources (IDNR), and Illinois Coastal Management Program (ICMP), will conduct repeated Structure from Motion (SfM) surveys of beach topography, nearshore bathymetry, and nearshore hydrodynamic conditions. These surveys will be conducted at study sites throughout Illinois Beach State Park (IBSP) to track the movement of sand that is dredged from Waukegan Harbor and placed in the nearshore at IBSP (Figure 1). SfM is a rapid and high-resolution method of collecting data to evaluate nearshore placement effectiveness. This method has been used in numerous coastal settings to monitor topographic and bathymetric changes, however, it has not been applied along the shorelines of the Great Lakes.



**Figure 1:** Location of study area in Southern Lake Michigan extends from Illinois Beach State Park in the north to Waukegan Harbor, Waukegan, IL to the south

### Issue/Challenge To Address

The interruption of the littoral drift along Western Lake Michigan due to coastal structures necessitates a regional framework for sand management. Areas with excess sand deposition can be sources of nourishment sand for areas with erosion problems. Approximately 75,000 cy from Waukegan Harbor has been dredged annually in recent years. The development of an affordable monitoring methodology will help improve our understanding of the impacts and effectiveness of placing this material to nourish a severely eroded shoreline (at IBSP) and to inform future dredging and placement activities.

While the need for littoral nourishment and shore protection has been established, placement frequency and methods are limited by both USACE and partner agency funding constraints. An improved understanding of various placement alternatives and their efficacy in littoral nourishment and combating shoreline erosion will support the



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justification of cost-effective nourishment activities. Establishing a regional sand management strategy for moving sand from accretionary sites to erosional sites will be more economical for communities that are currently spending millions of dollars to nourish beaches with sand from inland quarries.

#### Successes Lessons Learned

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

#### Expected Products

- Presentations at IPR and the Sand Management Working Group meeting
- Maps of beach and nearshore erosion and accretion and volume change measurements
- Time series of hydrodynamic conditions surrounding nearshore placement
- Technical report

#### Stakeholders/Users

ISGS, IDNR, ICMP, the Sand Management Working Group, and users of IBSP.

#### Projected Benefits Value Added

The goals of this study are: (1) Evaluate SfM technology for Great Lakes coastal monitoring; (2) Evaluate novel methods for measuring nearshore hydrodynamics and bathymetry that have been developed at the ERDC Field Research Facility; and (3) track alongshore and cross-shore transport of dredged sediment placed in the nearshore.

Improving the effectiveness of placement activities intended to nourish and protect eroding shoreline will support more sustainable shoreline management practices, protect valuable natural resources, and improve the efficiency of federal and stakeholder investments. Collaboration will encourage technical knowledge transfer across organizations.

#### Leveraging Opportunities

ICMP has recently partnered with the Prairie Research Institute (PRI) at the University of Illinois to conduct research and outreach projects along the Illinois coast to develop a regional sand management strategy. This project leverages funding from NOAA and EPA. NOAA funding is being used for projects along the Illinois shoreline, including long-term geologic change monitoring, nearshore sand mapping, coastal physical process monitoring, and development of a regional citizen science beach monitoring program. IDNR and ISGS, in collaboration with NOAA and USACE, received Great Lakes Restoration Initiative funding in FY18 to monitor coastal physical processes and develop a novel strategy for protecting habitat loss at IBSP. This RSM project will leverage these other funds to sustain monitoring of nearshore placement after the project period.

ERDC's Coastal & Hydraulics Laboratory is currently leading a work unit focused on providing UAS-based support to flood risk management. The work proposed in this proposal would directly leverage techniques developed within this program and also relationships with the Coastal Imaging Research Network (CIRN).

#### Points of Contact

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#### Participating Partners

Illinois State Geological Survey, Illinois Department of Natural Resources, Illinois Coastal Management Program, ERDC Field Research Facility