

# **ERDC Dredging Operations Technical Support Program (DOTS)**

#### **U.S. ARMY CORPS OF ENGINEERS**

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#### **Response Summary:**

USACE Detroit District (LRE) requested the assistance of ERDC-CHL in identifying occurrence rate and environmental factors of rip current formation at a breakwater site via web camera imagery. The project site is located on the eastern shore of Lake Michigan at Holland State Park, approximately 95 miles northeast of Chicago, IL. The current site consists of two converging breakwaters (Figure 1), having lengths of 752 and 801 feet for the north and south breakwaters. The site is prone to bathymetric change and rip currents along the northernmost breakwater (Figure 1, bottom).

A Pan-Tilt-Zoom (PTZ) camera hosted by Southeast Coastal Ocean Observing Regional Association (SECOORA) was used. ERDC downloaded archived videos and developed a Support Vector Machine (SVM) model to only capture

certain beach views (Figure 1) to alleviate the problem of a rotating camera. From beach views, georectified image products such as time-exposure (timex), were created. These image products were looked at in depth to understand and identify rip currents via visual signatures (Figure 2).

Projected timex images were analyzed from May 2020 to March 2023 to determine days when currents were present. Results from the image products were compared to wind data from NOAA Buoy 9087031 stationed off the

coast of Holland to determine a correlation between wind

speed and direction and resultant rip currents (Figure 3). The comparison shows when the wind was blowing onshore/cross-shore  $(180^\circ - 360^\circ)$  and above 12 knots, there was a rip current.

### Period of Performance:

1/11/2023 - 4/1/2023

# Benefits of the Response to the USACE Dredging/Navigation Program:

This imagery allows for a historical record of shoreline change, and a better understanding of forcing factors that cause rip currents in relation to dredging/navigation projects. In addition, it laid the framework for near-real time dissemination of imagery and geospatial products via ERDC CorpsCam.

### **Deliverable:**

These results will be discussed and shared with local shareholders to better understand and forecast hazardous swimming conditions at Holland State Park. In addition, work done will contribute to integration of this web camera for near real time processing and disseminations of timex etc via the CorpsCam network.

Providing environmental and engineering technical support to the U.S. Army Corps of Engineers Operations and Maintenance navigation and dredging missions



Figure 1. (Top) View of breakwater (No Beach). (Bottom) View of Beach System.



Figure 2. (Left) Georectified timex image showing a rip current. (Right) Georectified timex showing no waves or current.



Figure 3. Comparison between wind direction (CW from true north) and wind speed with color representing the presence of a Rip Current.

#### Brittany Bruder, Tanner Jernigan Coastal and Hydraulics Laboratory Brittany.L.Bruder@erdc.dren.mil, Tanner.A.Jernigan@usace.army.mil

DOTS ID: DOTS-21-No.

From:	Bruder, Brittany L ERDC-RDE-CHL-NC CIV
То:	Wilkens, Justin L ERDC-RDE-EL-MS CIV; Bruder, Brittany L CIV USARMY CEERD-CHL (USA)
Cc:	Suedel, Burton C CIV USARMY CEERD-EL (USA); Malburg, Rachel M CIV USARMY CELRE (USA)
Subject:	Re: DOTS Request
Date:	Wednesday, February 7, 2024 11:13:54 AM
Attachments:	DOTS Response Holland Michigan Rip.docx

Please see attached DOTS response.

From: Wilkens, Justin L ERDC-RDE-EL-MS CIV
Sent: Tuesday, January 30, 2024 6:11:55 PM
To: Bruder, Brittany L CIV USARMY CEERD-CHL (USA)
Cc: Suedel, Burton C CIV USARMY CEERD-EL (USA)
Subject: FW: DOTS Request

Brittany,

Please see the DOTS request below from Rachel in Detroit. Will you be available to help?

Please note that due to limited funding this fiscal year, DOTS will be able to support only up to 40 hours of labor and one site visit, if needed.

Also, I did not recall receiving a DOTS response for the previous DOTS request from Rachel (see immediately below). I sent a follow-up email about this on 10/23/2023 to you and Sean McGill.

If you are able to assist Rachel with the current request and after a DOTS response is completed for the previous year, please send your Org Code, labor rate and hours (not to exceed 40), and travel plans if needed (w/burdens broken out).

Deliverable: Analyze video Name of DOTS response or activity: CHL Bruder/McGill Holland Harbor Currents Data Analysis for LRE Description: No information Assigned to: Brittany Bruder Cost: \$8,610.00 Start Date: 1/18/2023 Due Date: No information WIC: 9830J2 DOTS Request: Name: Rachel Malburg District: Detroit Email: rachel.m.malburg@usace.army.mil Request Explanation: Analyze video collected by NOAA at Holland Harbor to identify rip currents and the potential for structure induced currents caused by the federal navigation structure at Holland. This work will support efforts to predict structure induced currents caused by the federal navigation structure and determine if a redesign of the harbor is necessary to improve safety. Desired products: Other Explain other products: Data processing and interpretation and technology transfer Requested Scientist or Engineer: Brittany Bruder and Sean McGill

Thank you for your help,

Justin

-----Original Message-----

From: Wilkens, Justin L ERDC-RDE-EL-MS CIV Sent: Tuesday, January 30, 2024 5:03 PM To: Malburg, Rachel M CIV USARMY CELRE (USA) <Rachel.M.Malburg@usace.army.mil> Cc: Suedel, Burton C CIV USARMY CEERD-EL (USA) <Burton.Suedel@usace.army.mil> Subject: RE: DOTS Request

Rachel,

Thank you for your DOTS request. I will check on Brittany's availability.

Please note that due to limited funding this fiscal year, DOTS will be able to support only up to 40 hours of labor and one site visit, if needed.

Thank you,

Justin

-----Original Message-----From: Malburg, Rachel M CIV USARMY CELRE (USA) <Rachel.M.Malburg@usace.army.mil> Sent: Tuesday, January 30, 2024 11:02 AM To: Suedel, Burton C CIV USARMY CEERD-EL (USA) <Burton.Suedel@usace.army.mil>; Wilkens, Justin L CIV USARMY CEERD-EL (USA) <Justin.L.Wilkens@usace.army.mil>; Malburg, Rachel M CIV USARMY CELRE (USA) <Rachel.M.Malburg@usace.army.mil> Subject: DOTS Request

Name: Rachel Malburg District: Detroit Email: rachel.m.malburg@usace.army.mil

Request Explanation: Smaller stone than typical design size was placed along the breakwater at Manistee Harbor, Michigan. This request is to utilize imagery remote sensing techniques to monitor movement of stone placed adjacent to navigation structures. If these techniques are successful, the data will help determine if smaller stone size can be placed at navigation projects and monitor if smaller stone sizes have potential to migrate into navigation channels.

Desired products: Training/Workshop, Other

Explain other products: Programming of cameras for imagery collection; guidance for installation of cameras

Requested Scientist or Engineer: Brittany Bruder

Completion Date: 11/30/2024