

CORPS SHOALING ANALYSIS TOOL (CSAT) ADVANCEMENTS COASTAL NAVIGATION PORTFOLIO MANAGEMENT

PIs: Rachel Bain and Michael Hartman

Team: Charlene Sylvester, Kaitlyn McPherran,
Anna Dominique Godfrey

District PDT: Jeff Swallow (NAO), Shahidul
Islam (SWG)

18 APR 2024

COASTAL INLETS RESEARCH PROGRAM
FY23 IN PROGRESS REVIEW



U.S. ARMY



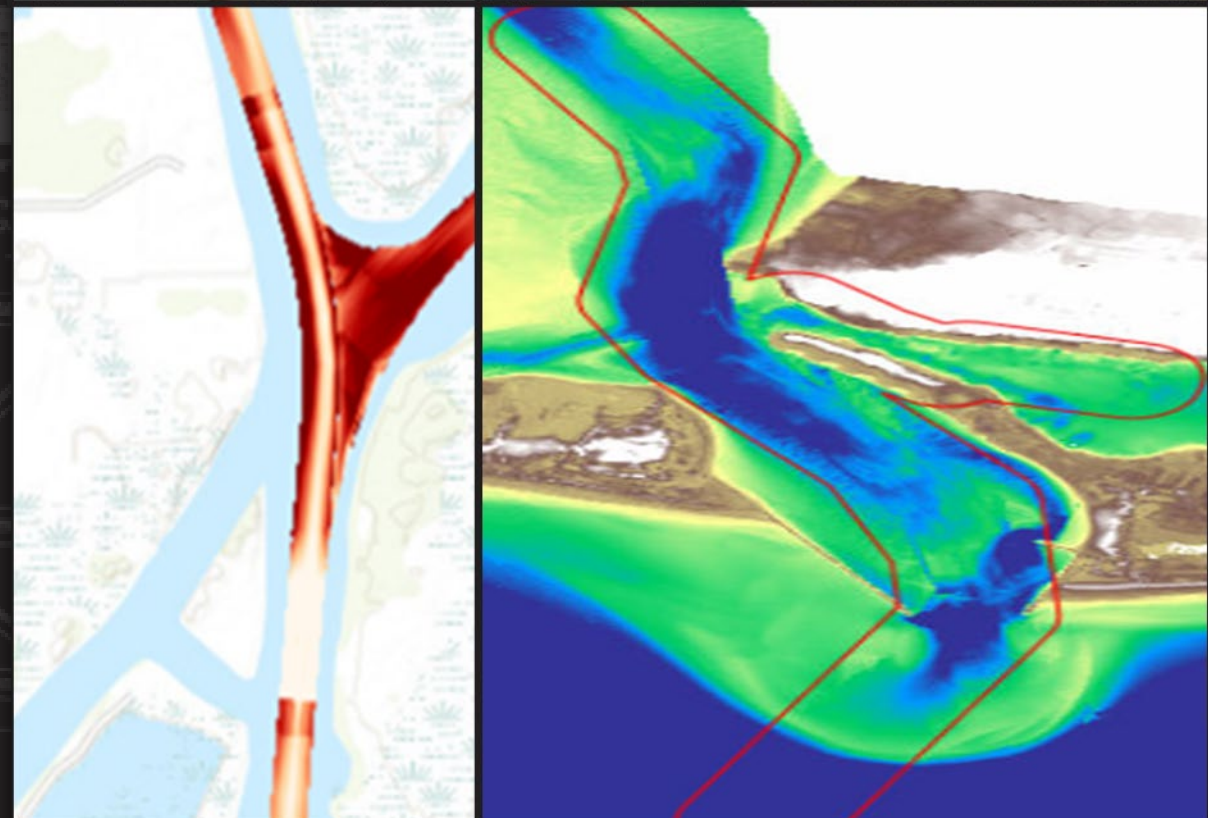
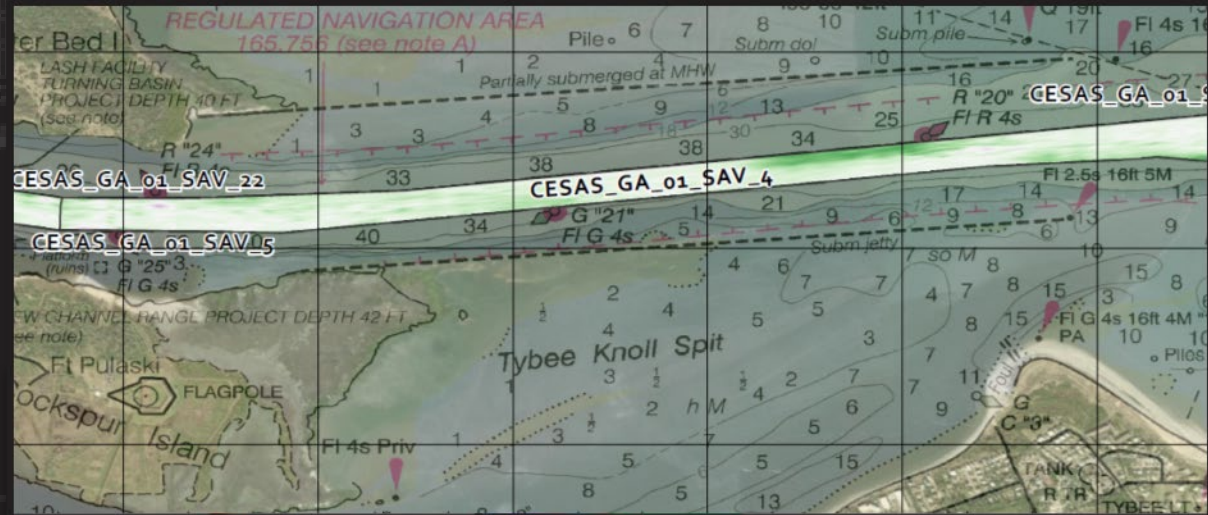
US Army Corps
of Engineers®



ERDC



CIRP





PROBLEM STATEMENT

Nearly \$1 billion in O&M funding is distributed among the coastal districts in support of the USACE Navigation Mission.

Objective, consistent data analytics for the Corps' coastal navigation infrastructure portfolio ensures that limited financial resources are rationally allocated across portions of the system with the greatest need for channel maintenance.

CSAT is an ongoing project in the Coastal Navigation Portfolio Management Work Unit.

Statements of Need:

- NAV-21-1671 "Corps Shoaling Analysis Tool (CSAT) Enhancement"
- 2015-N-15 "Integration of national and local monitoring datasets to support navigation and operations projects"
- 2015-N-40 "Reducing the need for dredging"



CAPABILITY AND STRATEGIC IMPACT



Shoaling rates can be used to identify hot spots or areas of increased sedimentation, **allowing engineers and scientists to evaluate environmental and human-induced changes on the Navigation portfolio.** Additionally, CSAT shoaling rates and channel navigability supports decision makers efforts to **maximize the use of Operations and Maintenance (O&M) funding** in the Navigation Business Line.

Ongoing development and maintenance of CSAT ensures continued District access to a data-driven tool for assessing future dredging budget requirements.

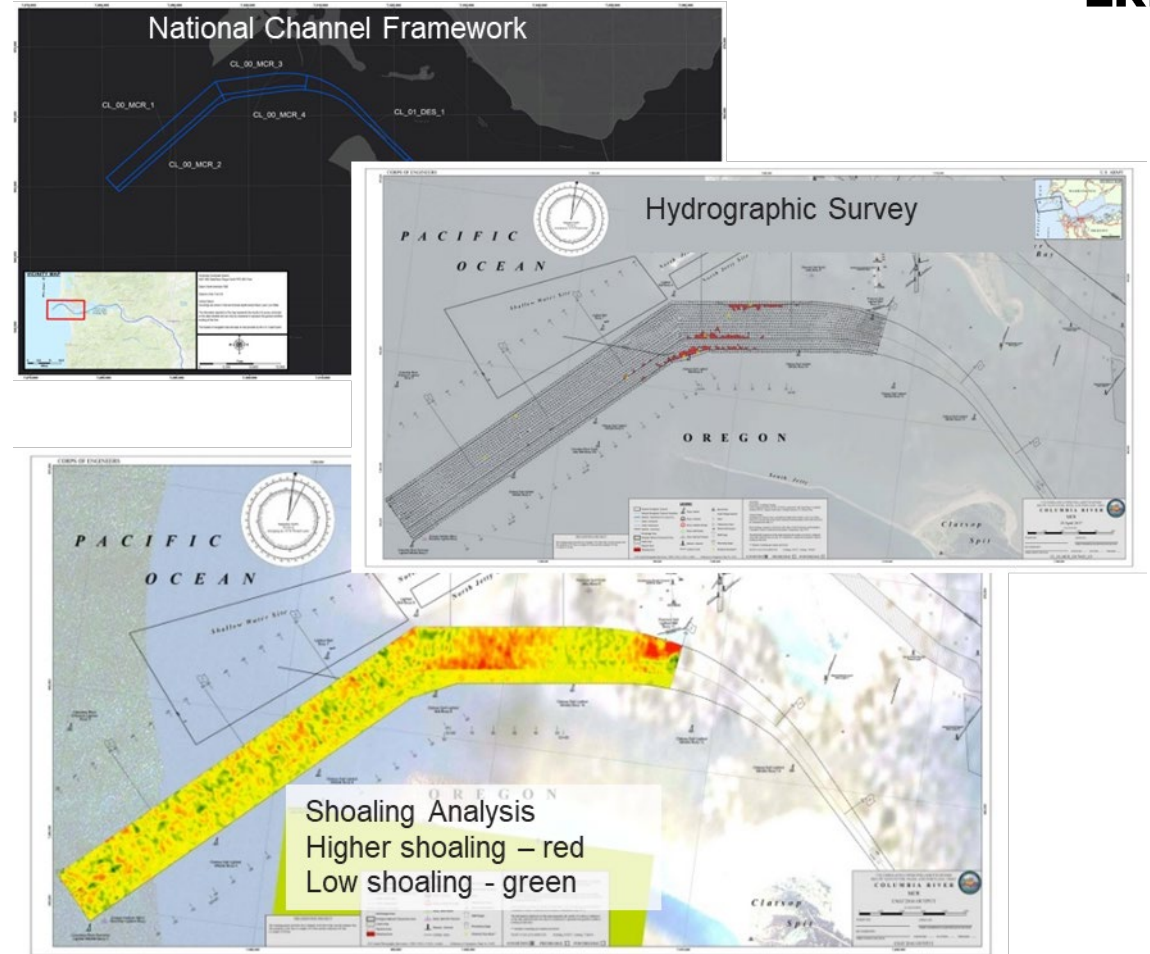


CORPS SHOALING ANALYSIS TOOL (CSAT)



Description

- CSAT estimates shoaling rates using hydrographic surveys within the boundary of the National Channel Framework.
- CSAT uses the historical shoaling rates to predict future dredging volumes at various channel depth intervals.
- Where are shoaling 'hot spots' within the navigation channel?
- How has shoaling changed as a result of meteorological events (extratropical storm, rainfall or drought periods), dredge schedule change or dredge type change?



National Channel Framework, hydrographic survey map sheet from eHydro, and the shoaling rate prediction for Columbia River, OR.



WHAT IS THE CORPS SHOALING ANALYSIS TOOL (CSAT)?



1) USACE Districts upload hydrographic survey data to the eHydro database in a standardized format.

USACE Hydrographic Surveys powered by eHydro

USACE District:
All

USACE Channel:
All

Channel ID:
All

Survey Type (New Feature)
No category selected

Survey Date Range:
Predefined Custom Date Range

All Surveys

Last 60 days

2022

2021

2020

Reset

Use the dropdown menus or simply pan and zoom on the map to filter the Hydrographic Survey data.

Use any combination to drill down to the data you are interested in. To remove the filter, set the filter to "All".

Select Survey:
List is limited to 100 records. To see older surveys, configure a custom date range or zoom in on the map to limit results.

District: CEMVP
Name: POOL_03_UPPER_MISSISSIPPI
Survey Date: 4/8/2024
Download: UM_SP_P03_20240408_CS_8010_8020

District: CEMVP
Name: POOL_03_UPPER_MISSISSIPPI
Survey Date: 4/8/2024
Download: UM_SP_P03_20240408_CS_8020_8030

District: CEMVP
Name: POOL_10_UPPER_MISSISSIPPI
Survey Date: 4/8/2024
Download: UM_SP_P10_20240408_CS_6190_6200

District: CEMVP
Name: POOL_10_UPPER_MISSISSIPPI
Survey Date: 4/8/2024
Download: UM_SP_P10_20240408_CS_6200_6210

District: CENWP
Name: KALAMA BAR
Survey Date: 4/8/2024
Download: CL_20_KLM_20240408_CS

District: CENWP
Name: VANCOUVER TURNING BASIN
Survey Date: 4/8/2024
Download: CL_29_VTBX_20240408_CS

District: CENWP
Name: MORGAN BAR IWD Disposal
Survey Date: 4/8/2024
Download: CP_27_MGN_20240408_OT_ANCHORAGE

District: CENWP

Survey List Recently Updated

Number of Surveys
97,022
1,167 last 60 days

1,000 km
500 mi

Earthstar Geographics | Spatial Data Branch (OP/J), U.S. Army Corps of Engineers (USACE)
Powered by Esri

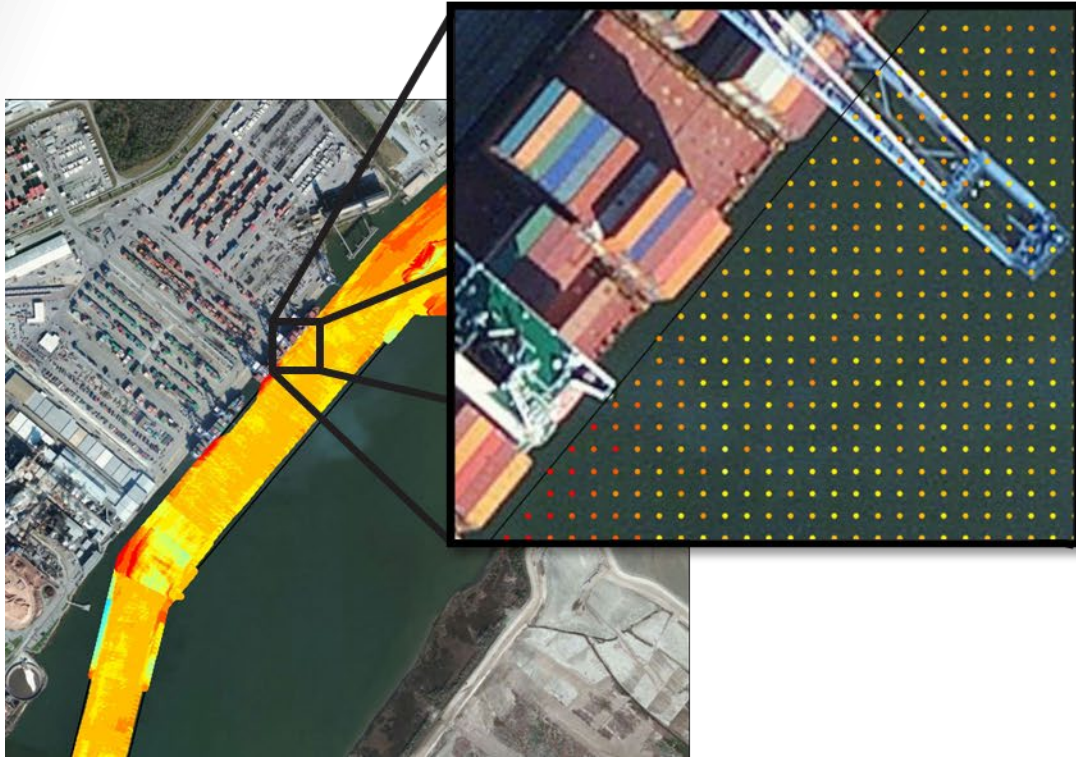


WHAT IS THE CORPS SHOALING ANALYSIS TOOL (CSAT)



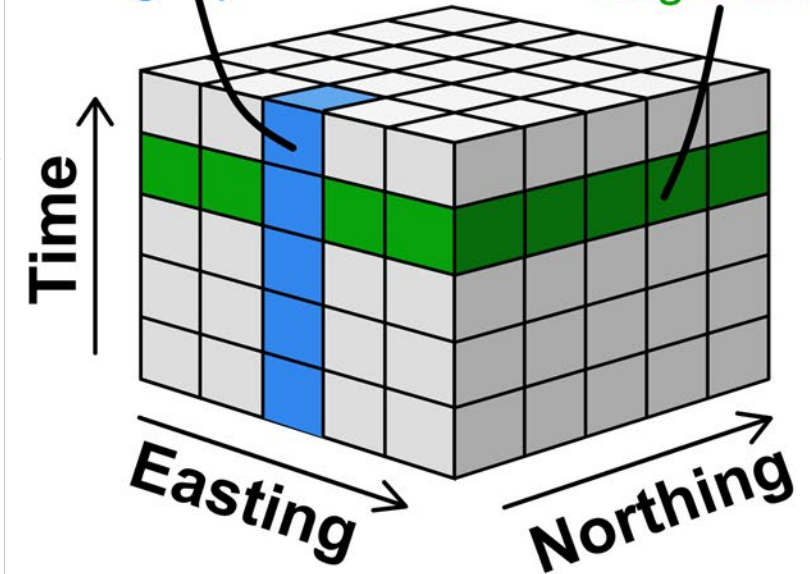
cont.

2) The bed elevations are gridded to create a space-time cube.



Time series of elevations at a single point

Bathymetric surface at a single time

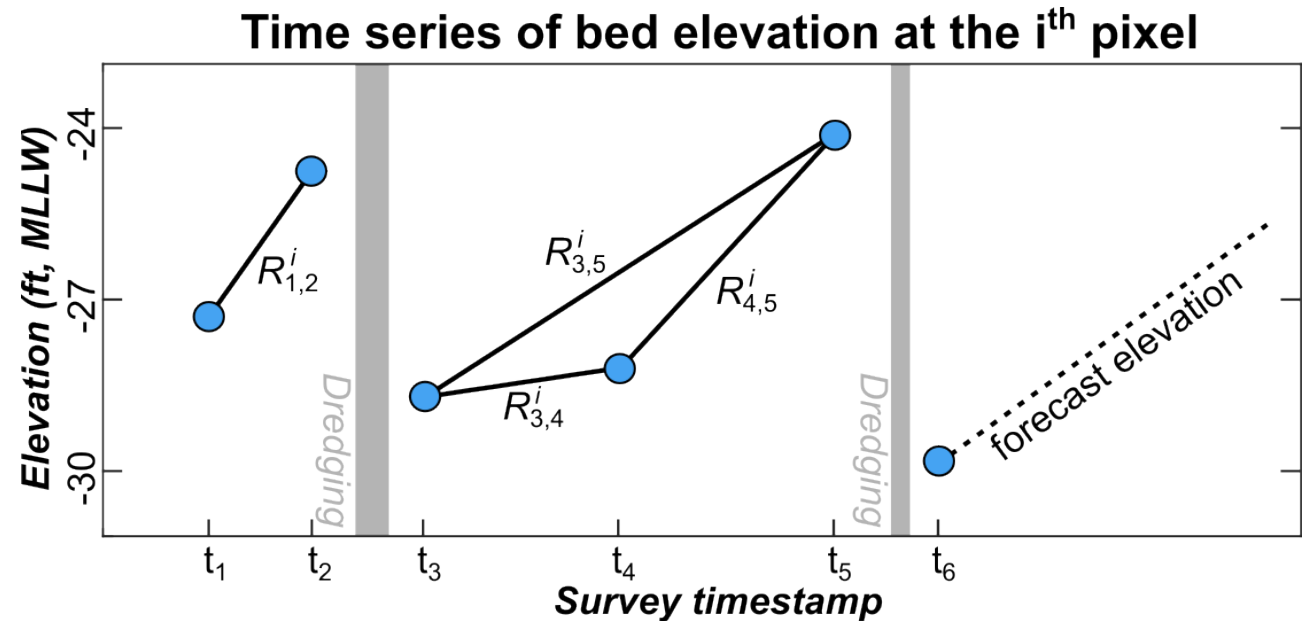
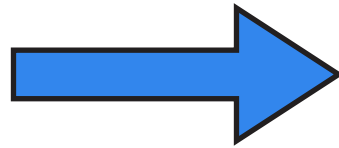
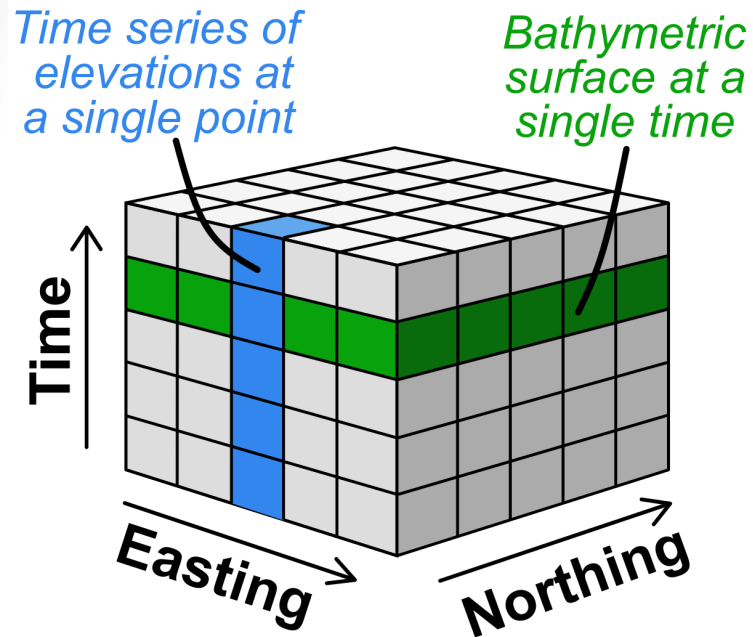




THE CORPS SHOALING ANALYSIS TOOL (CSAT) cont.

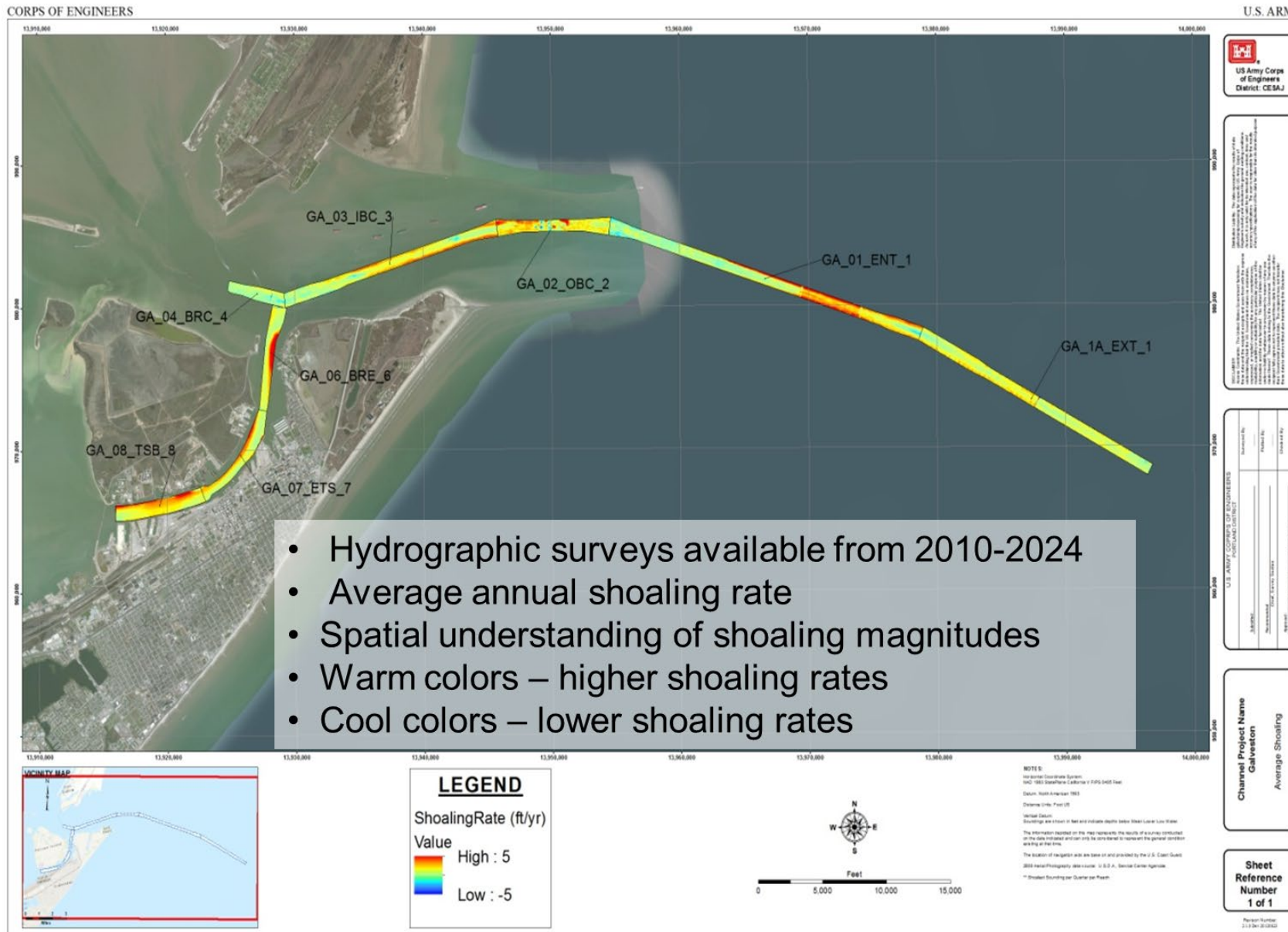


- 3) At **each pixel**, the time series of observed bed elevations is used to forecast future bed elevations.
- 4) Summing the pixelwise predictions generates a shoaling volume forecast for the entire reach.





CSAT Output: Shoaling Rate Map





CSAT Output: Project-Level Volume Tables

- Report volumes at different depth/time intervals and shoaling rates

Oakland Harbor (12990)

RelativeDepth	0_Months	6_Months	12_Months	18_Months	24_Months	30_Months	36_Months
VA_s5	170	268	17011	110995	256638	439863	651617
VA_s4	380	629	37849	160493	333984	543181	777208
VA_s3	822	1848	73338	230601	435783	671386	928089
VA_s2	1760	10408	131878	330139	568150	830209	1107008
VA_s1	8097	46367	228386	470456	739993	1024519	1318239
VA_p0	22591	131827	382466	663121	956930	1258243	1564307
VA_p1	69944	325969	618266	919374	1226110	1536123	1848464
VA_p2	352952	646087	948645	1257045	1568686	1882661	2198080
VA_p3	699612	1002390	1312029	1625199	1940585	2257072	2574207
VA_p4	1076911	1386917	1701263	2017559	2334818	2652699	2970999
VA_p5	1476264	1791251	2108145	2425936	2744281	3062973	3381847

0_months column is equivalent to Summary Planning Quantities (SPQs)



SUMMARY



FY23 Major Advancements in Capability

- Streamlined Conda environment creation
 - Improved setup time (hours reduced to minutes)
- eHydro & JALBTCX Data Integration
 - Reproducible scientific workflow
 - Standalone Jupyter Notebook
- Improved input generation process
 - Supporting MultiPolygon Channel Reaches
 - Adapted to changes in eHydro schema
- Forecasting method validation
 - Ongoing effort

FY24 Products & Advancements

- Integrating with DQM data
 - Supplementing existing workflows
 - Improved spatial understanding of dredge activity
- Making eHydro & JALBTCX Data Integration Operational
- Continued validation of different forecasting methods
- Adding additional CSAT Desktop capabilities to NavPortal (DIG)
 - Volume Tables
 - “Now-casting” bathymetry conditions

FY23 Major Products & Collaborations

- Version 2.6.3 Release
- eHydro & JALBTCX Data Integration
 - Coastal Sediments '23 (April 2023)
 - Technical Note
- CSAT User Guide (In EPAS)
- CSAT Training Events
 - Savannah District (In Person)
 - Chicago District (Remote)
- CW Weekly
- CIRP TD
- Storyboard
- CWG Poster and Presentation
- Coastal Engineering PROSPECT Course Presentation
- RD24 Presentation
- Supported CSAT District Users
 - LRB, LRC, LRE, LRL, LRH, MVK, MVN, NAO, NWK, NWP, POA, POH, SAJ, SAM, SAS, SWG