U.S.ARMY

GUIDANCE ON LIFECYCLE MANAGEMENT OF WETLAND NOURISHMENT WITH DREDGED MATERIAL FOR COASTAL NAVIGATION

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COASTAL INLETS RESEARCH PROGRAM

FY22 IN PROGRESS REVIEW

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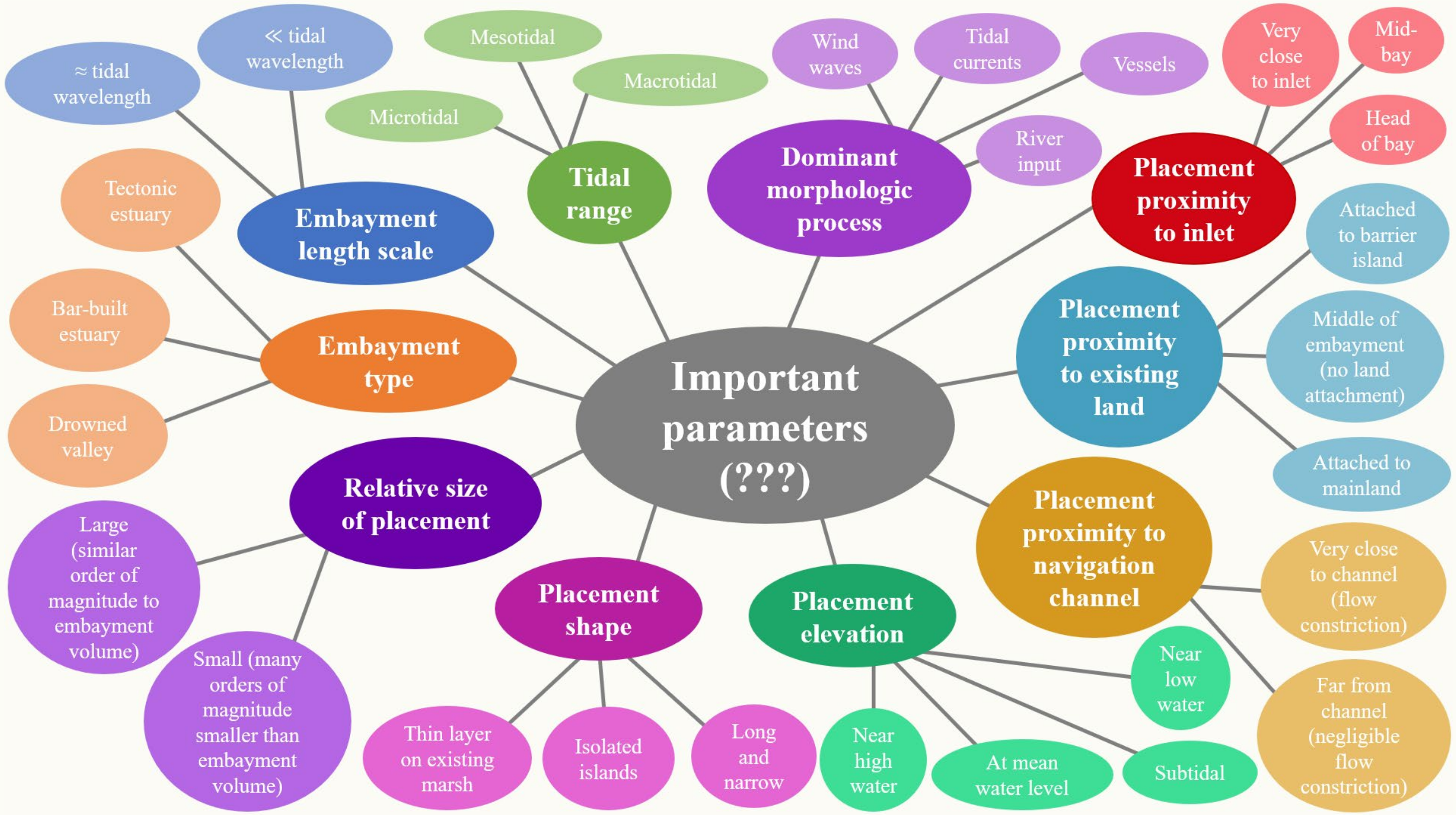
Guidance on Lifecycle Management of Wetland Nourishment With Dredged Material For Coastal Navigation

Objective: Incrementally advance towards generalized guidance for understanding sediment management impacts on navigation channel sediment transport, morphology change, and hydrodynamics.

FY22 & FY23 FOCUS: Channel adjacent islands



STATEMENTS OF NEED:

- FY20 1411 (Sustainable Dredged Sediment Management Practices to Support Wetlands)
- FY20 1322 (Near-shore Placement for Wetland Nourishment)
- FY24 1970 (Multi-scale Analyses of BUDM impacts on long-term navigation channel maintenance)

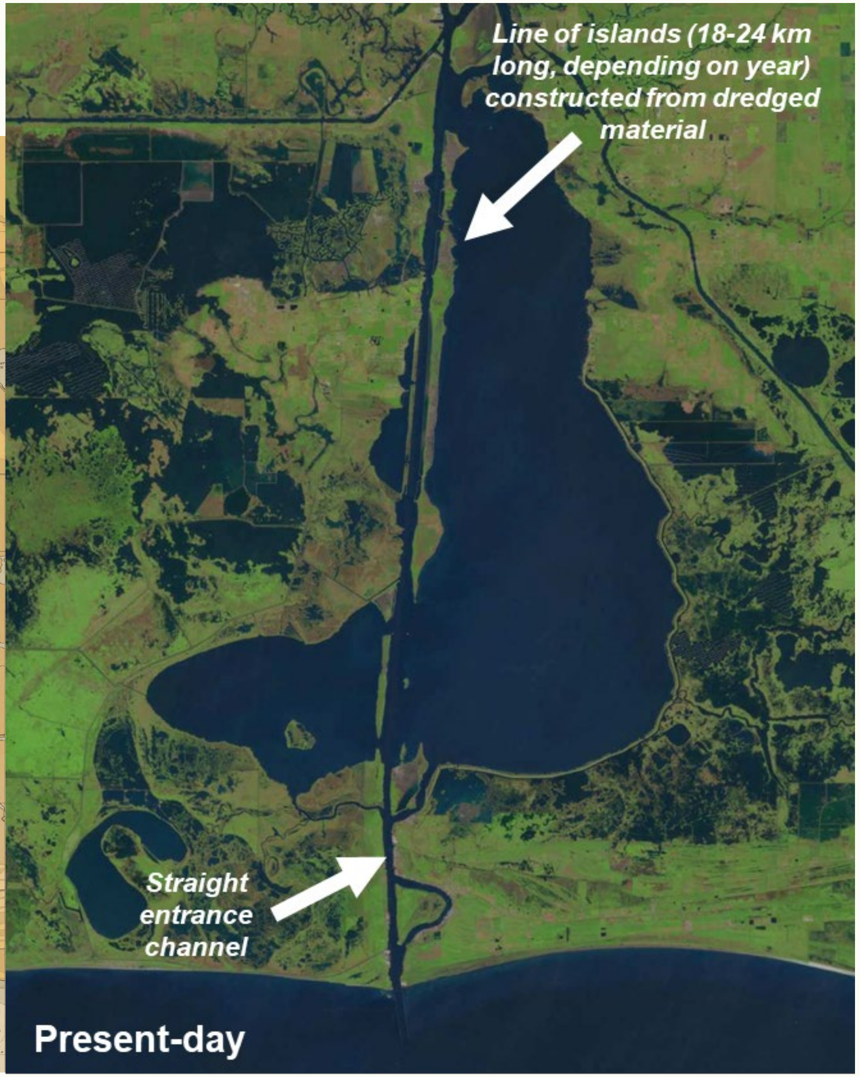
Case Study: Calcasieu Ship Channel, LA

APPROACH: Select one case study with:

- Decades of modification
- A long record of data

TASKS:

1. Accumulate historical records of dredging and morphology
2. Numerical modeling to evaluate historical dredged sediment placement strategies
   - Compare to dredging data
3. Data analysis at local to basin scale
   - Investigate factors excluded from the modeling

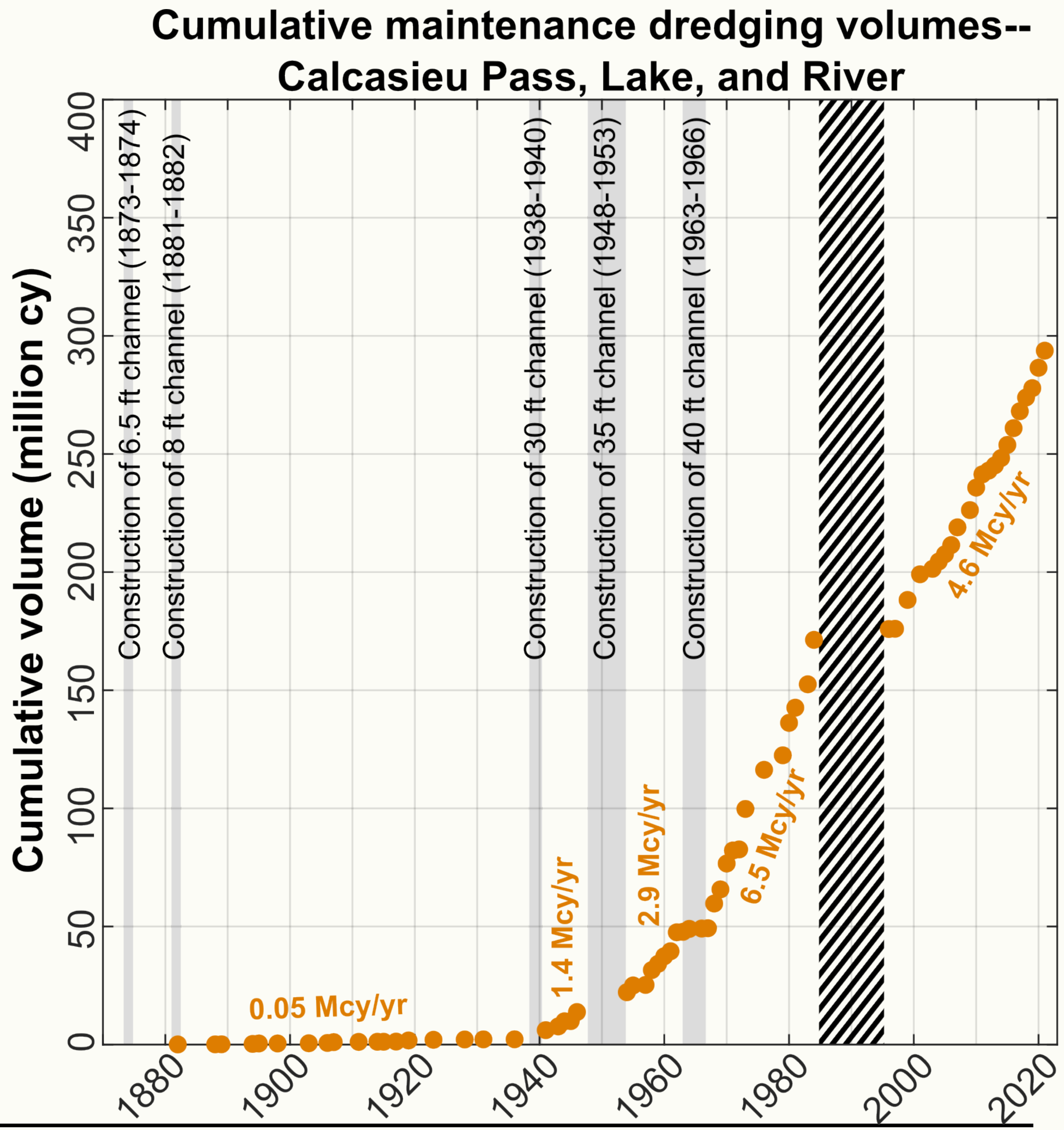


Historical Dredging Rates

- Channel and dredging information was determined from the Annual Reports to the Chief of Engineers, U.S. Army, on Civil Works Activities between 1874 – 1980

- Dredging information before 1980 was combined with more recent data from 1996 to 2021 and grouped by channel configuration to understand decadal scale shoaling changes

- Are there comparisons that we can make with available data and numerical model results to explain changes in dredging rates?

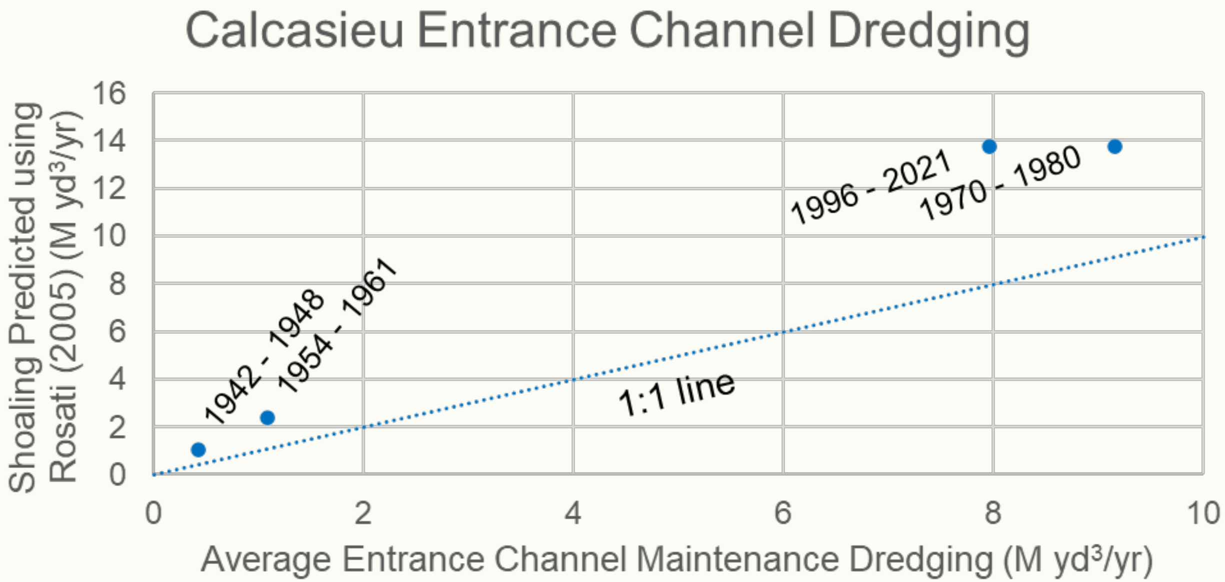


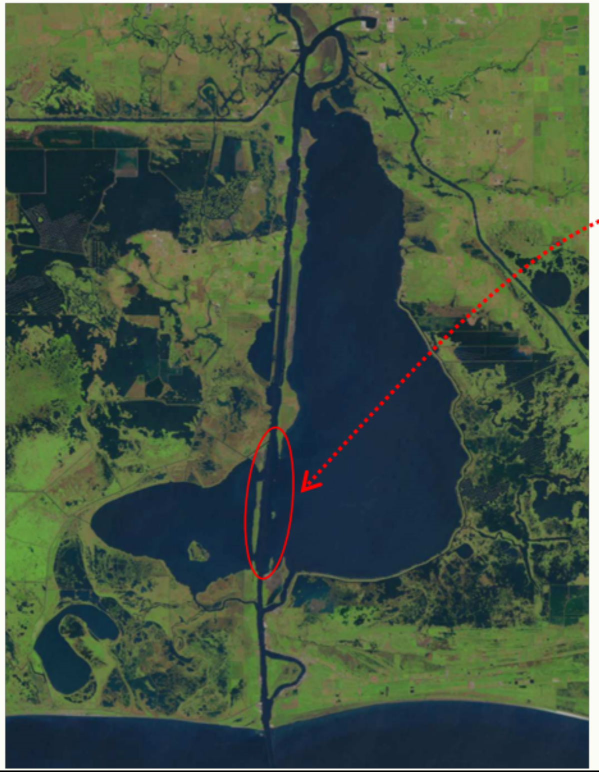
Dredging Rates vs. Channel Dimensions

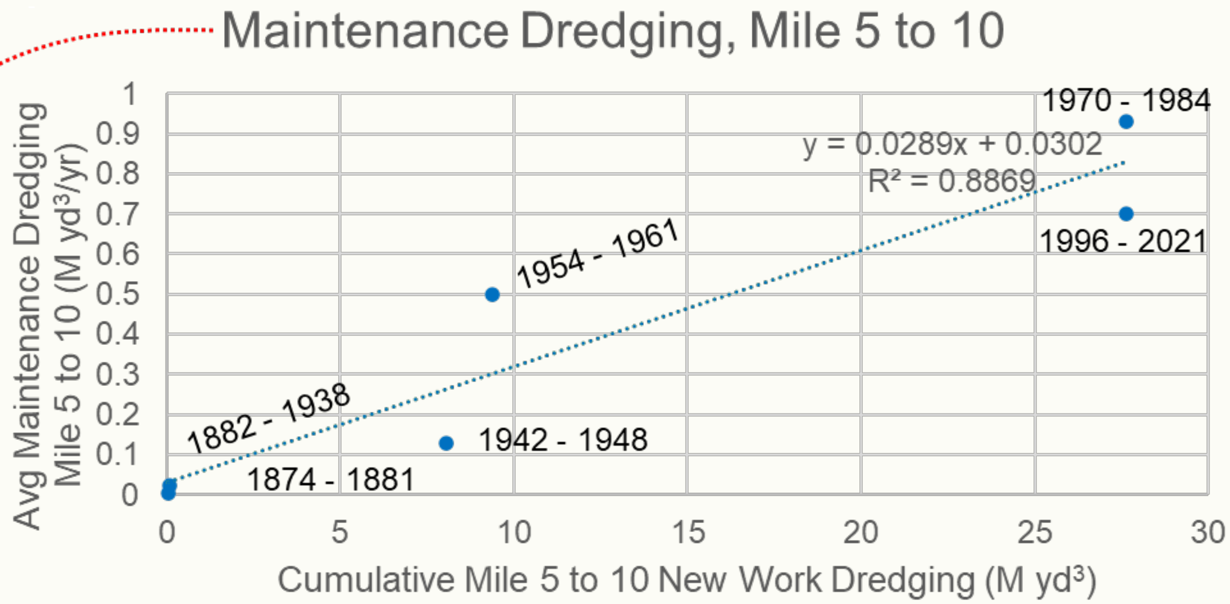
- Rosati (2005) approximated entrance channel shoaling changes with channel volume as,

$$R = (0.0613\ yr^{-1}) \cdot (L_d W_d D_d - L_n W_n D_n)$$

- This predicts Calcasieu entrance channel dredging reasonably well (Upper scatter plot)
- Does a similar concept apply inside of embayments? (Lower scatter plot)
- Will more granular shoaling data follow a similar trend?



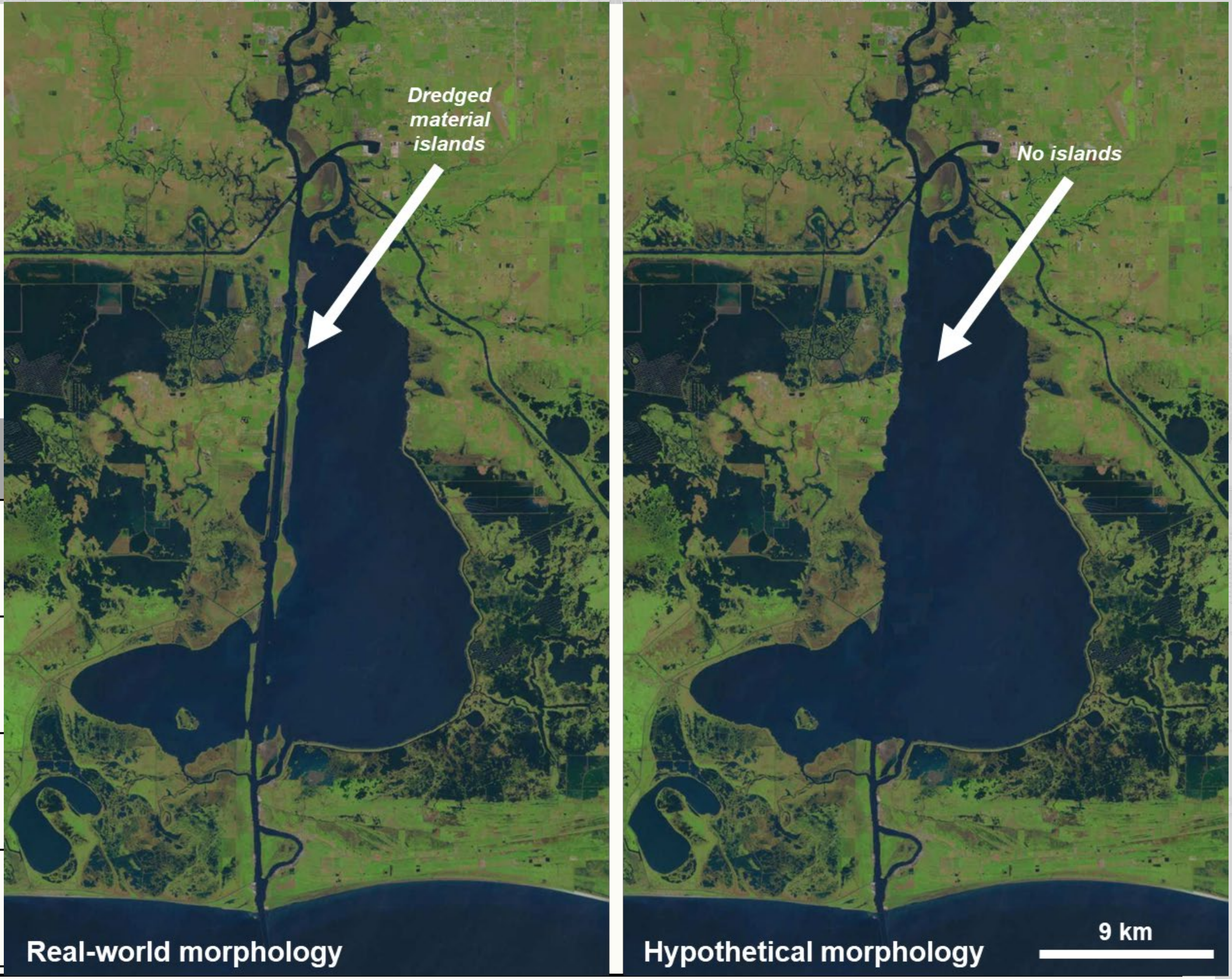




Numerical Modeling

- CMS is being used to investigate changes in channel & island configuration through time

Channel depth	Actual bathymetry	Without islands
Post-1873 (6.5 ft depth)	**Case 1:** 1916 bathymetry	
Post-1937 (30 ft depth)	**Case 2A:** 1941 bathymetry	**Case 2B:** 1941 bathymetry without island construction
Post-1946 (35 ft depth)	**Case 3A:** 1956 bathymetry	**Case 3B:** 1956 bathymetry without island construction
Post-1960 (40 ft depth)	**Case 4A:** 1973 bathymetry	**Case 4B:** 1973 bathymetry without island construction



Shoaling vs. Wetland Loss

- Extensive wetland loss between 1932 and 2006
- Similar to other locations, years with more oil and gas activity lost more wetland (top subplot)
- Rates of wetland loss may have some connection to changes in dredged volumes (bottom subplot)

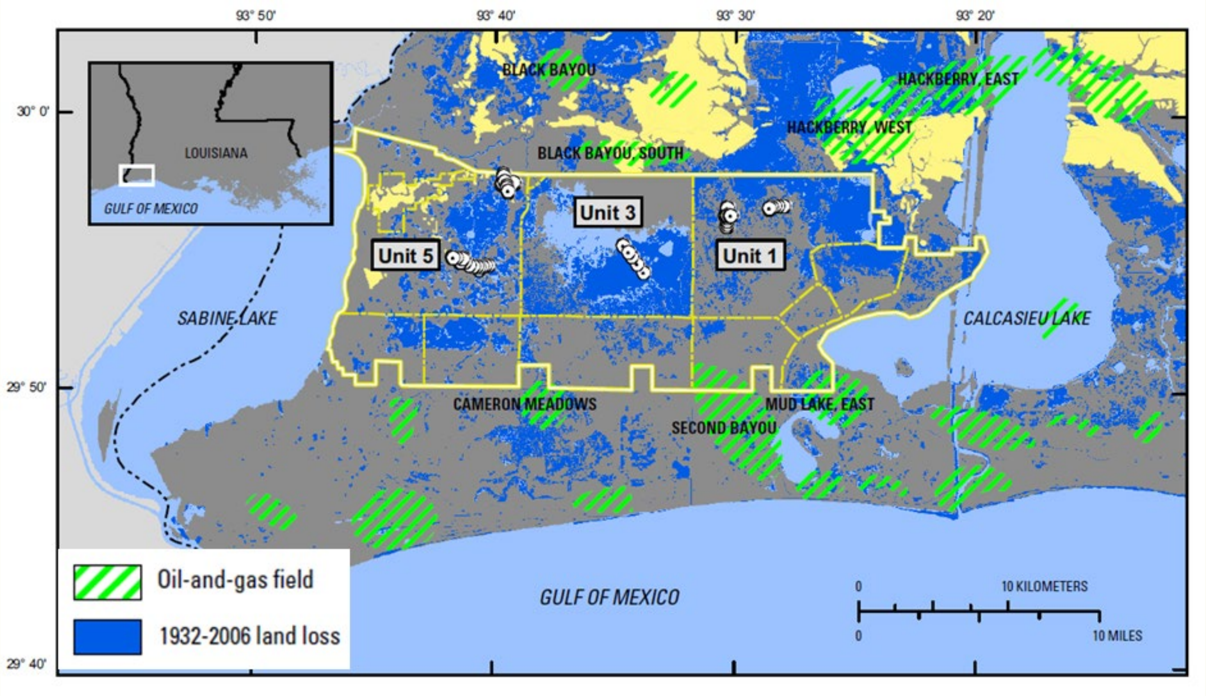
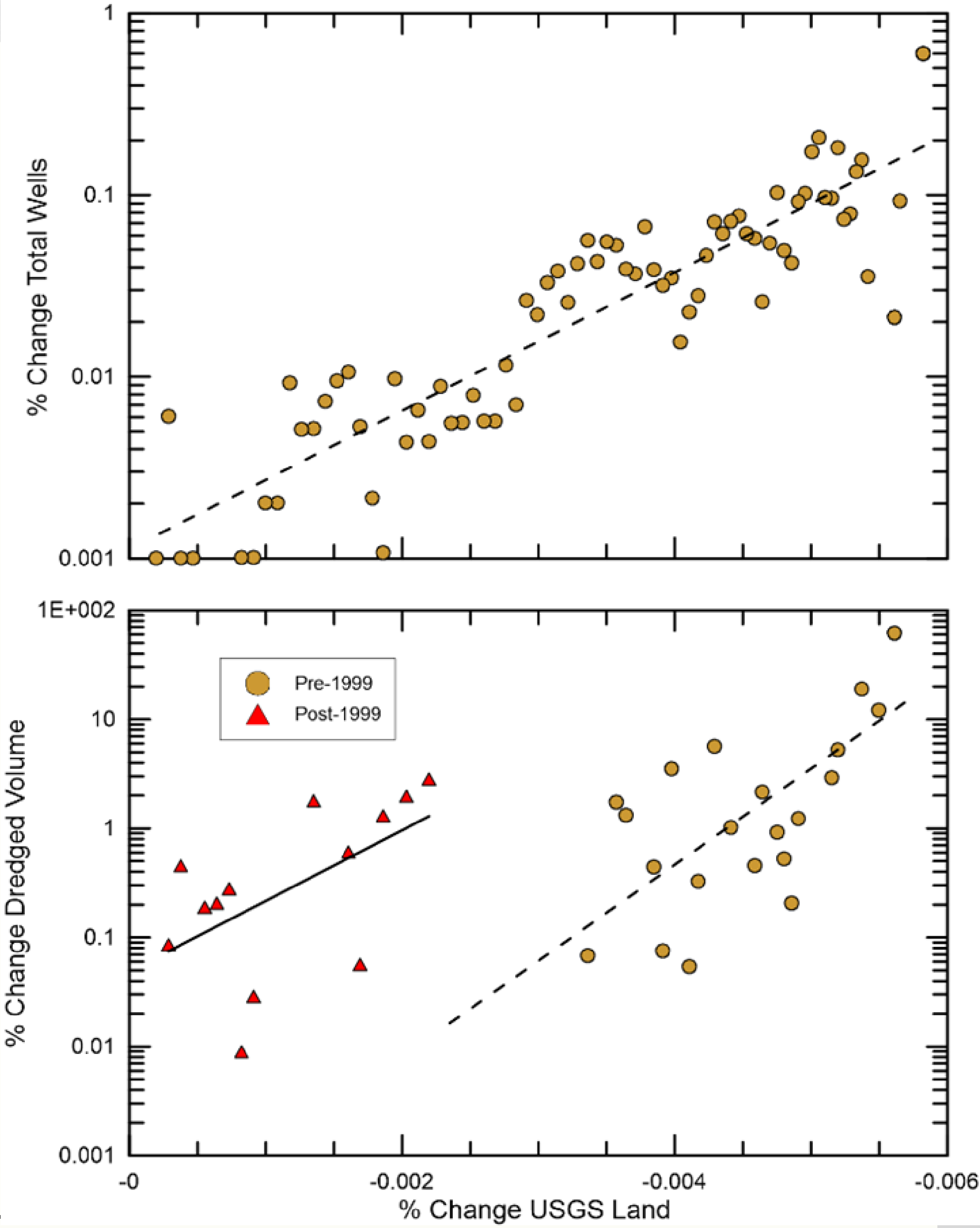


Figure 2 from Bernier et al. 2011 USGS Open File Report 2011-1169



Milestones

Publications

- A Review of Tidal Embayment Shoaling Mechanisms in the Context of Future Wetland Placement – SR – November 2022
- Numerical modeling to evaluate the impact of historical placement strategies in the Calcasieu basin – JP/TR – September 2023
- Data analysis at local to basin scale – JP/TR – September 2023

Technical Discussions

- Q3/FY23 – Calcasieu Shoaling Data Analysis
- Q4/FY23 – Calcasieu Numerical Modeling Results for Historical Channel Configurations