

# Evolution And Hydrology of Neptune Pass

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**Louisiana Universities Marine Consortium**

**Dallon Weathers**

**Delta Geo-Marine**

Neptune Pass From The Air: July 19 2021



# Location of Neptune Pass



Image source: Google Earth

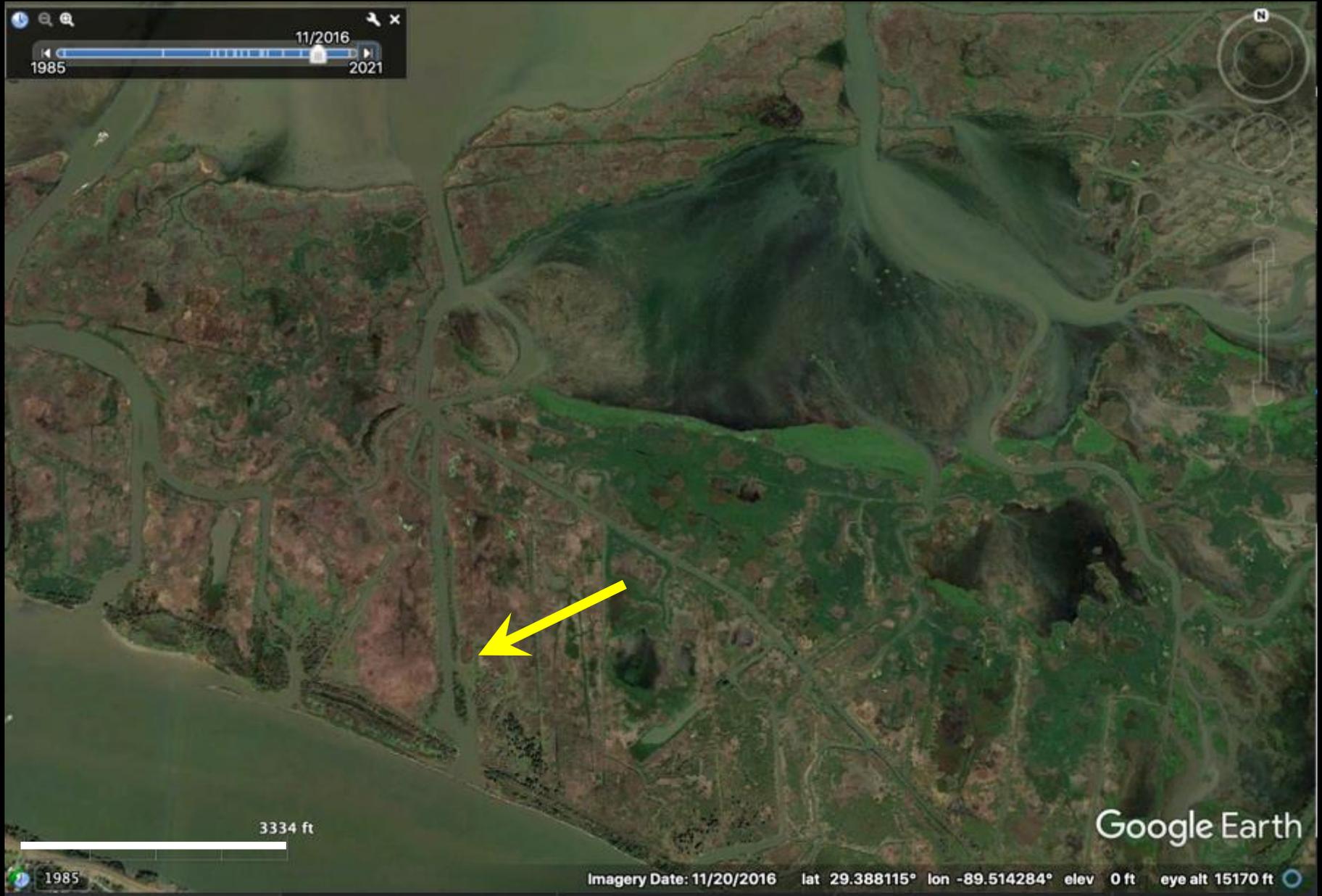
# Mardi Gras Pass From The Air: July 19, 2021



# Location of Neptune Pass



November 20, 2016



January 25, 2021



# Research Conducted To Date

## Goals:

Determine the discharge of Neptune Pass and its proportion of Mississippi River discharge.

Compare 2022 discharge values to earlier studies in the region to evaluate the potential for proportional changes in discharge in the Mississippi River and nearby crevasses

Map the bathymetry of Neptune Pass and nearby environments to help understand historic and potential future changes.

Examine satellite images to gauge the potential for regional changes, including land formation.

# Research Conducted To Date

- Discharge Survey May 24, 2022 via ADCP
- Multibeam bathymetric survey June 2, 2022
- Surveys conducted via small boat, including the New Delta and R/V Penland.
- Preliminary satellite imagery analysis of crevasse and receiving basin.

# Multibeam Derived Bathymetric Map of Neptune Pass

Neptune Pass  
Empire, LA  
Mississippi River

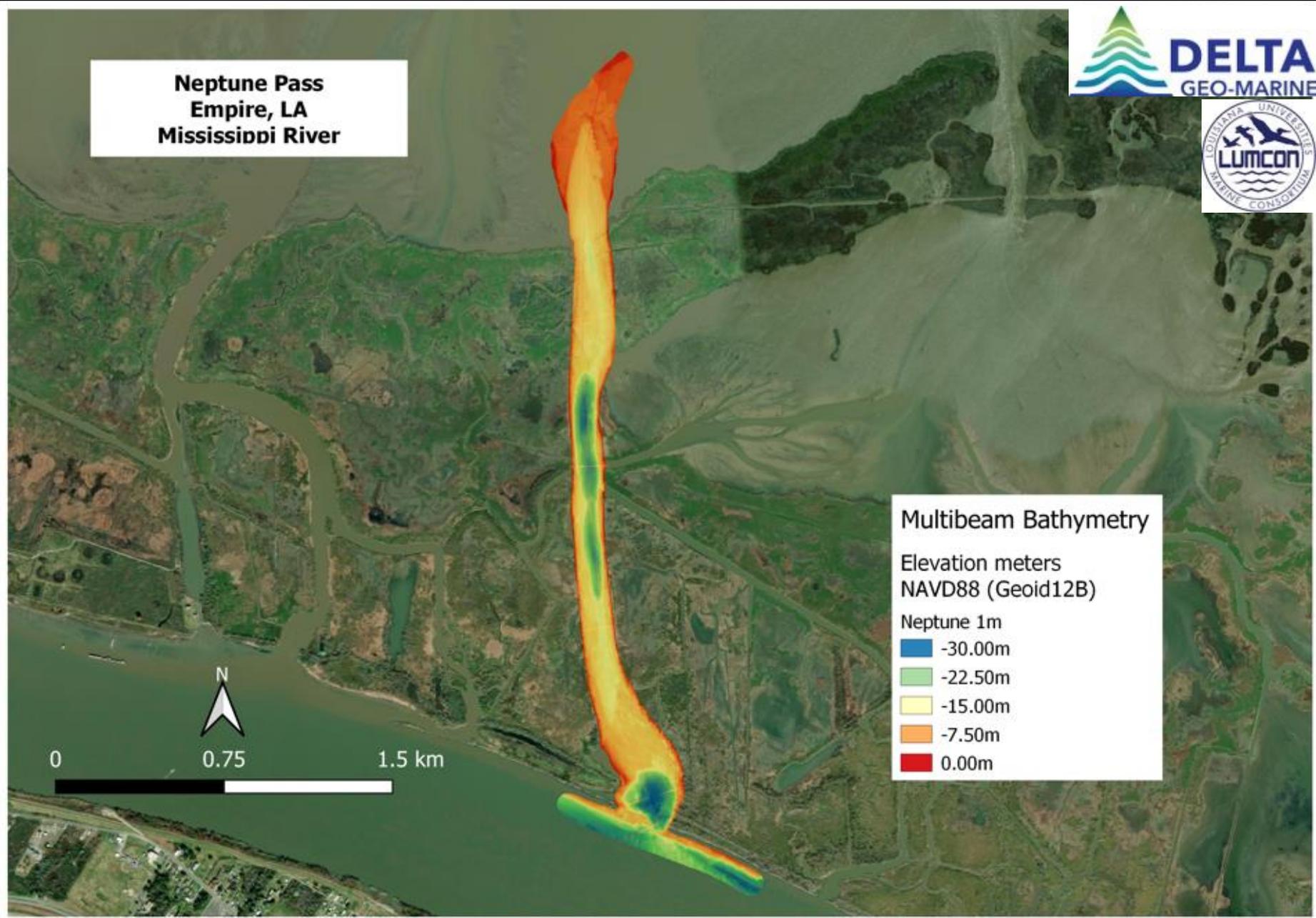


## Multibeam Bathymetry

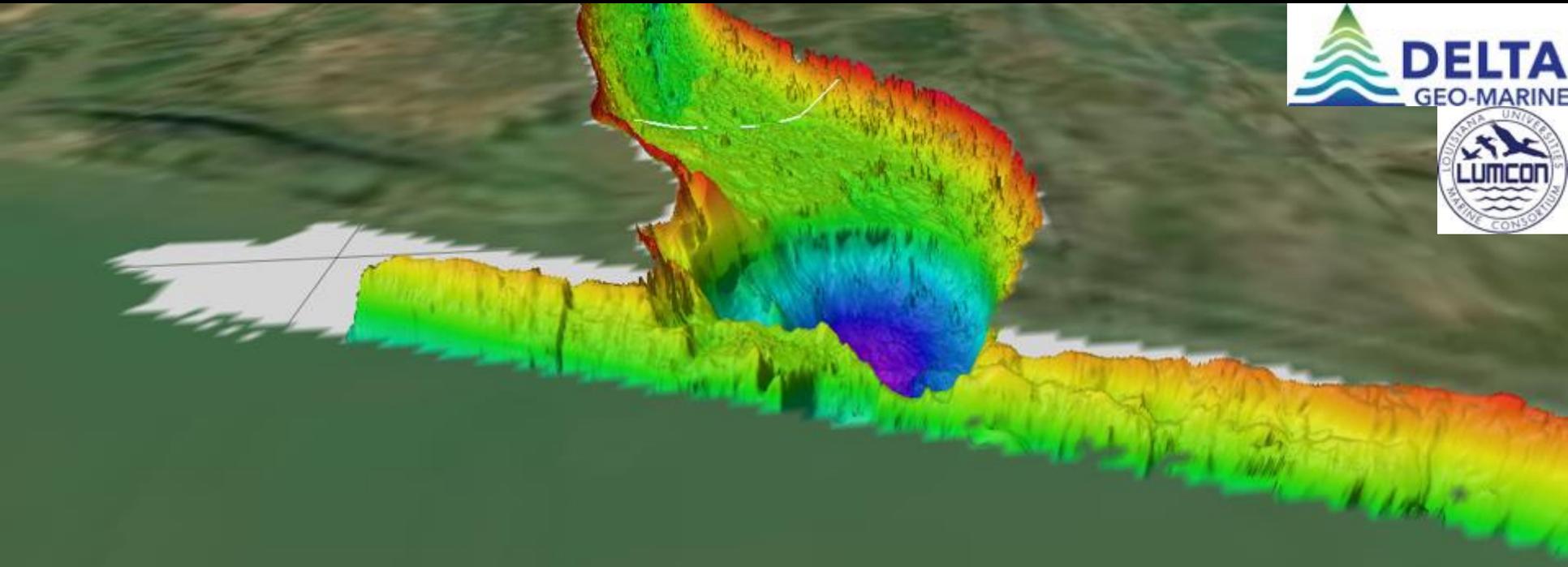
Elevation meters  
NAVD88 (Geoid12B)

Neptune 1m

- 30.00m
- 22.50m
- 15.00m
- 7.50m
- 0.00m



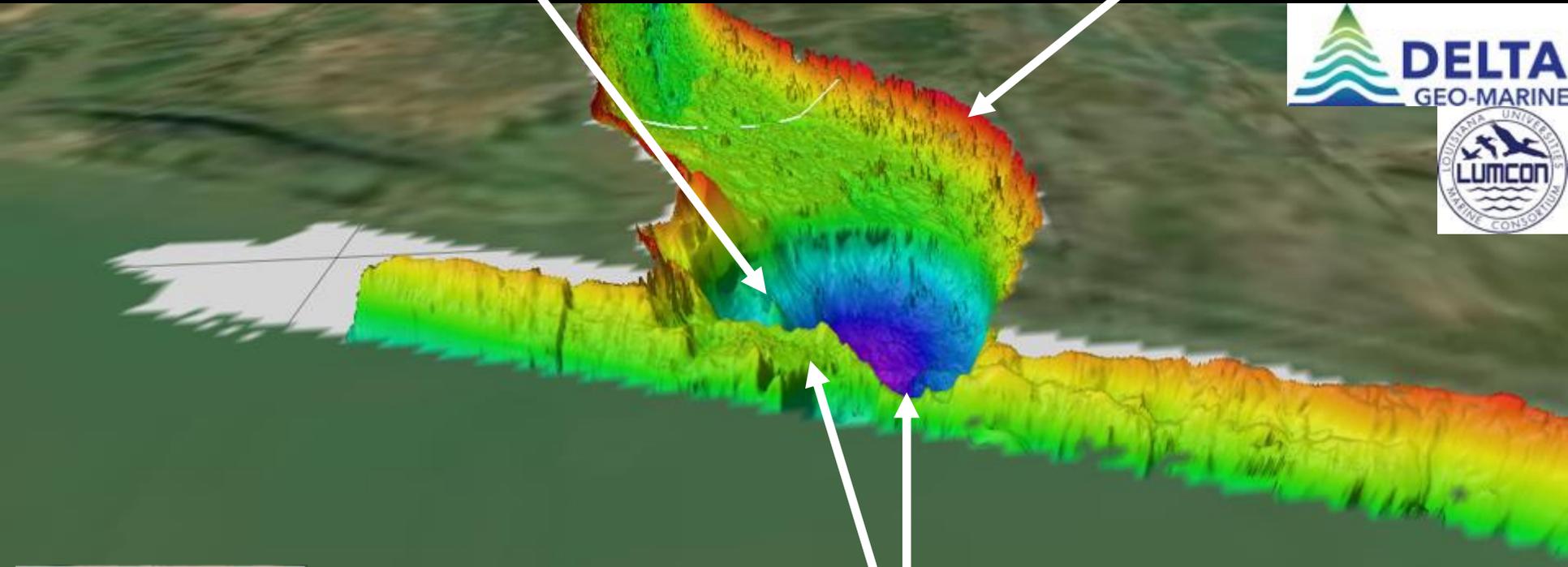
# Entrance To Neptune Pass



Source: Dallon Weathers, Delta Geo-Marine; Alex Kolker, Louisiana Universities Marine Consortium

Scour hole up over 30 m (100 ft) deep.

Steep channel walls



Uneven ledge, with enhanced erosion downstream.

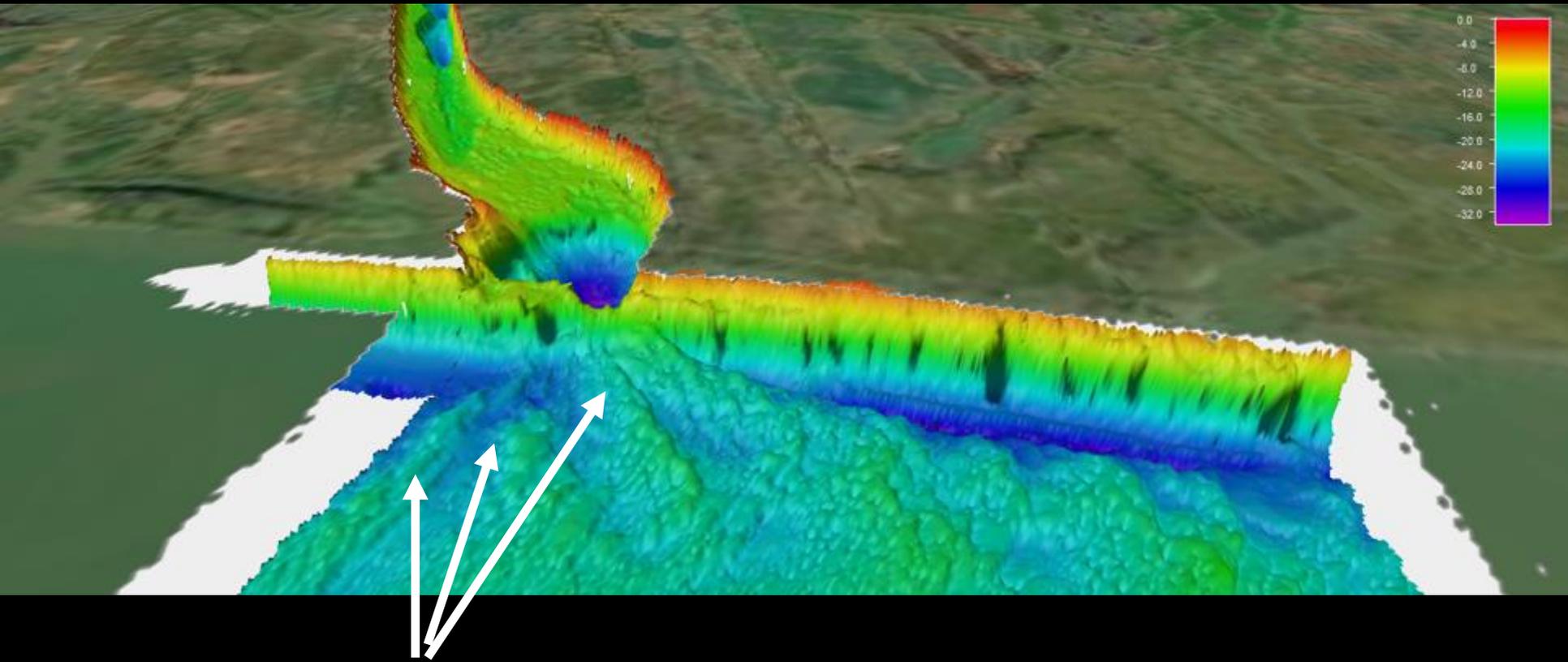
Multibeam Bathymetry

Elevation meters  
NAVD88 (Geoid12B)

Neptune 1m

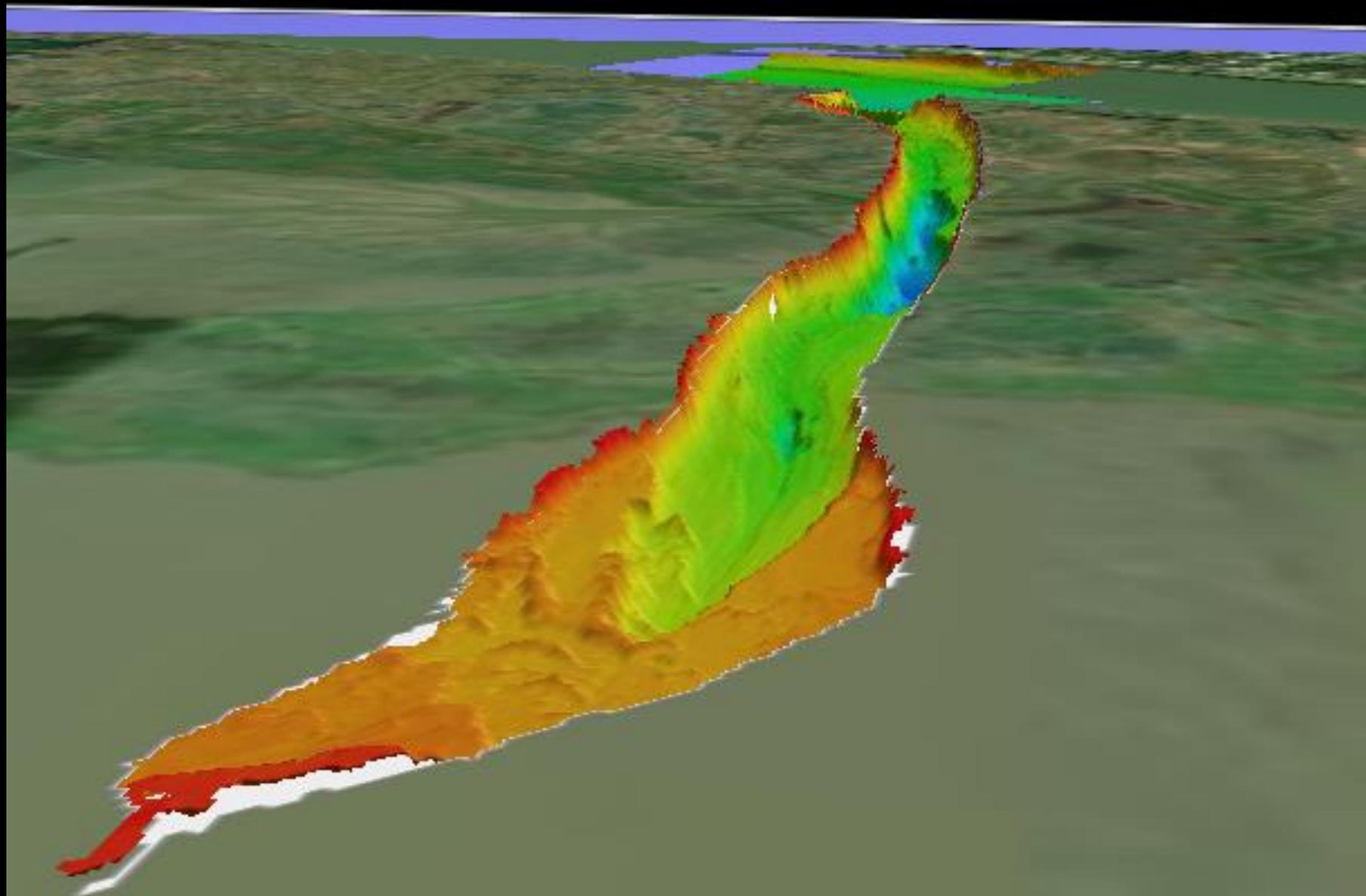
- 30.00m
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# Present Neptune Pass multibeam survey with US Army Corps river multibeam survey



Sand waves that are potentially cycling towards Neptune Pass

# Neptune Pass As Viewed From The Receiving Basin In Quarantine Bay



# Scour Hole Volume Removal Report

## 500,000 m<sup>3</sup>

### VOLUME CALCULATION REPORT

#### Settings

Project Neptune Pass  
 Computation method Square columns  
 Active layer Neptune 1m.grd Multibeam Mean value  
 Reference layer Neptune 1m.grd Reference Mean value  
 Tolerance Above 0.00  
 Tolerance Below 0.00  
 Boundary file name Volume Calcs.qgfaarea  
 Boundary layer name AREAS



#### Volume results

| Area name  | Netto volumetric difference m <sup>3</sup> | Used area m <sup>2</sup> | Selectio n area m <sup>2</sup> | Used area % | Above design Volume m <sup>3</sup> | Above design Area m <sup>2</sup> | Below design Volume m <sup>3</sup> | Below design Area m <sup>2</sup> | Over design Volume m <sup>3</sup> | Over design Area m <sup>2</sup> | Above design Volume m <sup>3</sup> |
|------------|--|--------------------------|--------------------------------|-------------|------------------------------------|----------------------------------|------------------------------------|----------------------------------|-----------------------------------|---------------------------------|------------------------------------|
| Scour Area | -502340.66                                 | 40738.586                | 40738.58                       | 100.0       | 0.00                               | 0.00                             | 502340.66                          | 40738.586                        | 0.00                              | 0.00                            | 0.00                               |
| Totals:    | -502340.66                                 | 40738.586                | 40738.58                       | 100.0       | 0.00                               | 0.00                             | 502340.66                          | 40738.586                        | 0.00                              | 0.00                            | 0.00                               |

# Discharge Survey Locations May 24, 2022



# Discharge Survey Results May 24, 2022

| Location   | Discharge (ft <sup>3</sup> s <sup>-1</sup> ) |
|--|--|
| <b>Mississippi River (Upriver)</b>                                       |  |
| Mississippi River at Belle Chasse (from USGS)                            | 776,000                                      |
| Estimated Flow leaving the River through Mardi Gras Pass                 | 25,000                                       |
| Estimate of flow loss to groundwater from Belle Chasse to <u>Ostrica</u> | 25,000                                       |
| Measured Flow Mississippi River Above <u>Ostrica</u> Locks               | 713,000                                      |
| <b>Ostrica</b>   |  |
| <u>Ostrica</u> Locks   | 13,400                                       |
| Bayou Tortillon  | 118,000                                      |
| <b>Ft. St. Phillip</b>   |  |
| Measured channels along Ft. St. Phillip                                  | 63,600                                       |
| Estimated flow of unmeasured channels along Ft. St. Phillip              | 40,500                                       |
| <b>Mississippi River (Downriver)</b>                                     |  |
| Mississippi River Below Fort St Philip Crevasse Complex                  | 433,000                                      |
| Estimated Missing Flow (either unmeasured or measurement error)          | 44,700                                       |
| <b>Total Eastward Flow, <u>Ostrica</u> Locks - Fort St. Phillip</b>      |  |
| Low, Does Not Include Missing Flow                                       | 235,500                                      |
| High, Includes Missing Flow  | 280,000                                      |
| Percent of River at Belle Chasse (Low)                                   | 30%  |
| Percent of River at Belle Chasse (High)                                  | 36%  |

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October 29, 2021

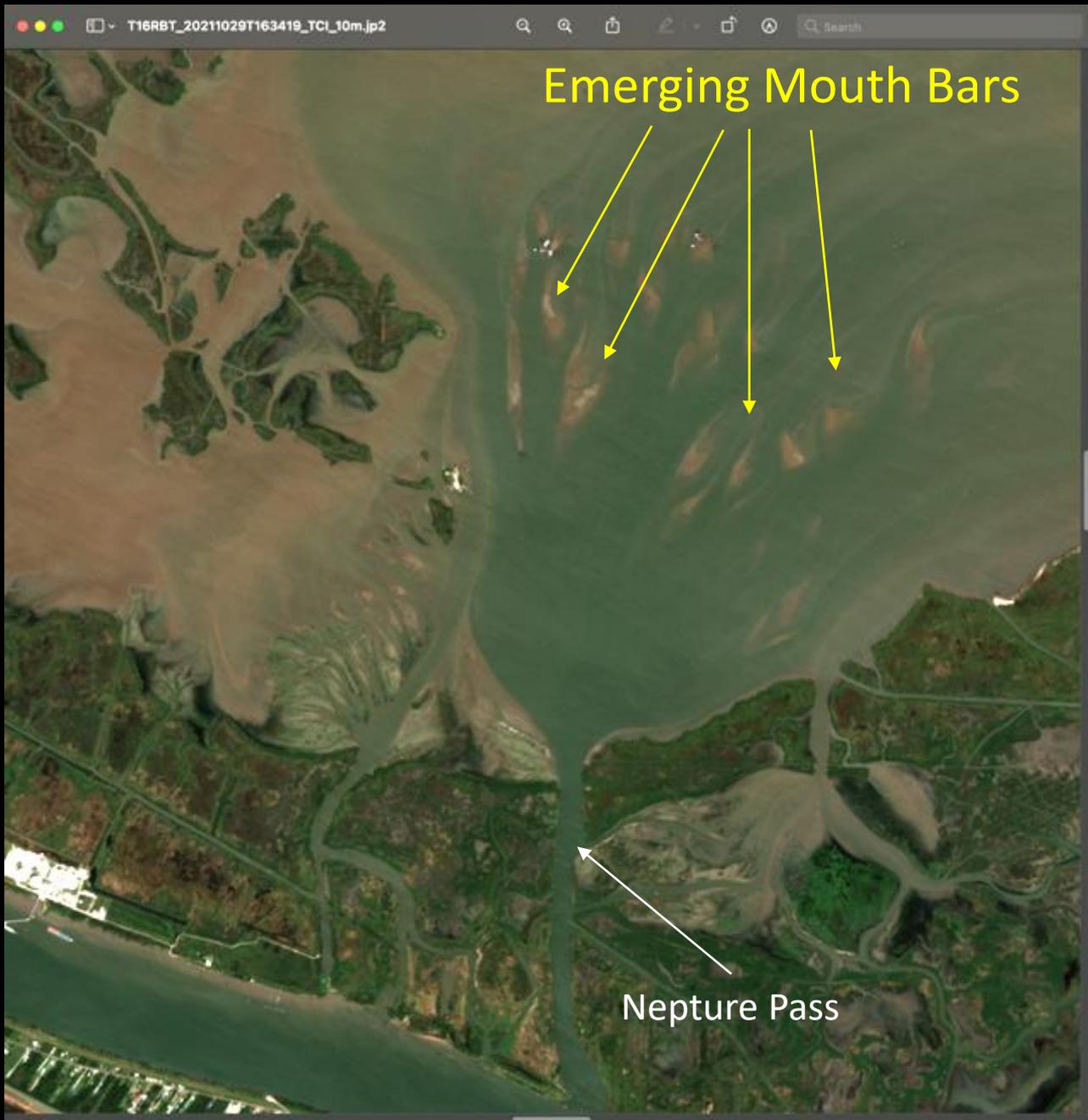


Image Source: Sentinel 2

December 2, 2021

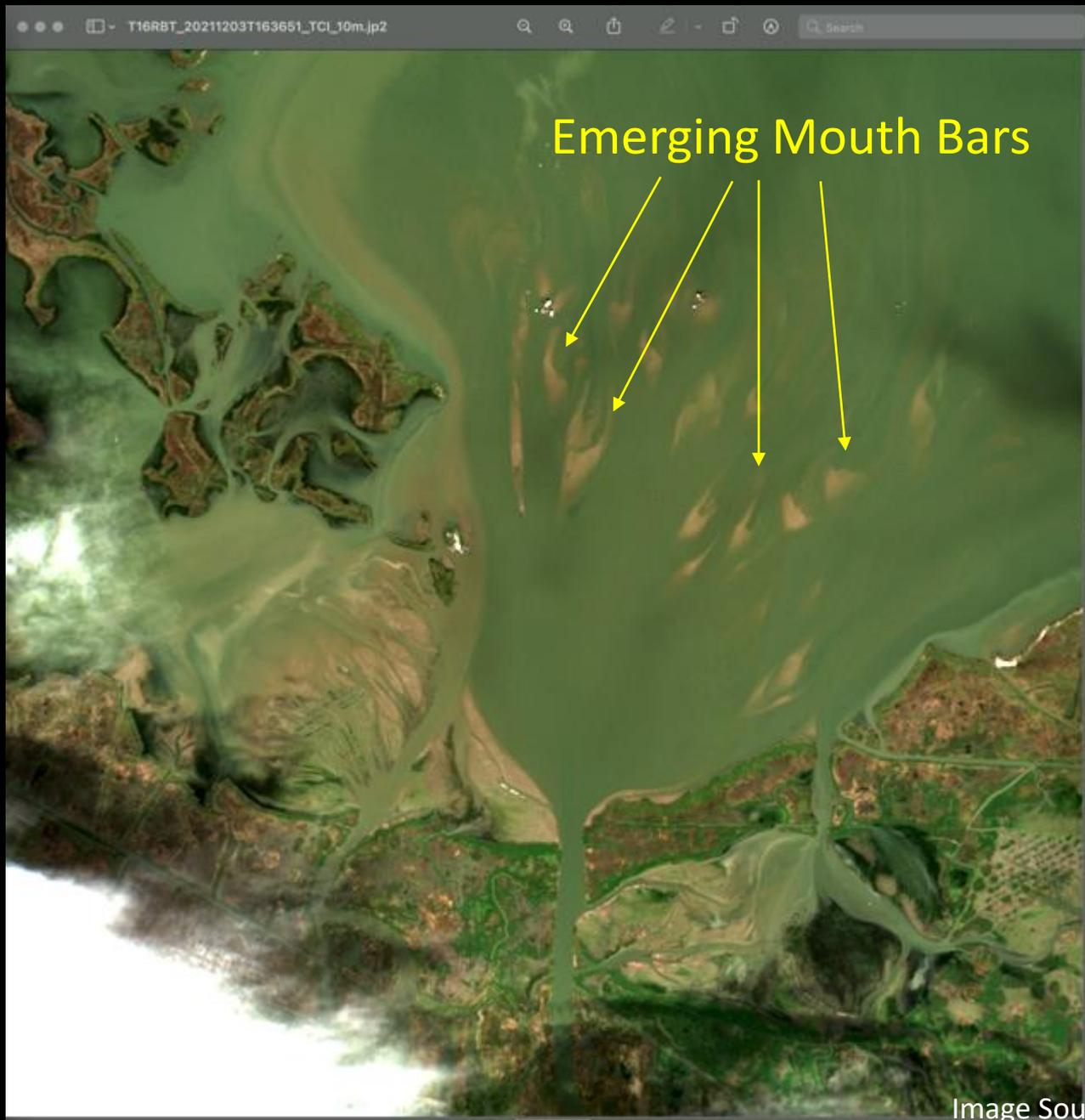


Image Source: Sentinel 2

# NASA Modis Imagery April 22, 2022



# June 2022 Composite Image



# Findings And Discussion Points

- Neptune Pass developed sometime between 2019 and 2021.
- Neptune Pass carries approximately 15% of the Mississippi River's discharge at Belle Chasse. This percentage increases when examining the discharge south of Mardi Gras Pass.
- Neptune Pass is in a region extending from the Ostrica Locks to upstream of Baptiste Collette that carries approximately 30 to 36% of the Mississippi River.

# Findings and Discussion Points

- The full cause of Neptune Pass's expansion is not yet known. Possible causes include degrading infrastructure, multiple high river events, hurricane impacts, and deltaic backstepping.
- There appear to be mouth bars developing in Quarantine Bay, suggesting the potential for land development.
- Whether these islands represent, "new," deltaic land building or simply a, "redistribution," of sediment from the eroding channel can be investigated through a mass-balance approach.

An aerial photograph of the Mississippi River Delta, showing a complex network of waterways and green wetlands. A large white rectangular box is overlaid on the bottom half of the image, containing text. The sky is blue with scattered white clouds, and the top edge of the image shows the underside of an aircraft wing.

# Thank You

- **The Mississippi River Delta Coalition provided funding for this research.**
- **Vessel support came from the University of New Orleans and Delta Discovery Tours.**
- **This research has benefited from conversations with numerous scientists in the region.**