

# Drivers of Drainage Hydrology of the Coastal Watershed West of Atchafalaya River

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Olsson

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State of the Coast Conference

New Orleans, Louisiana

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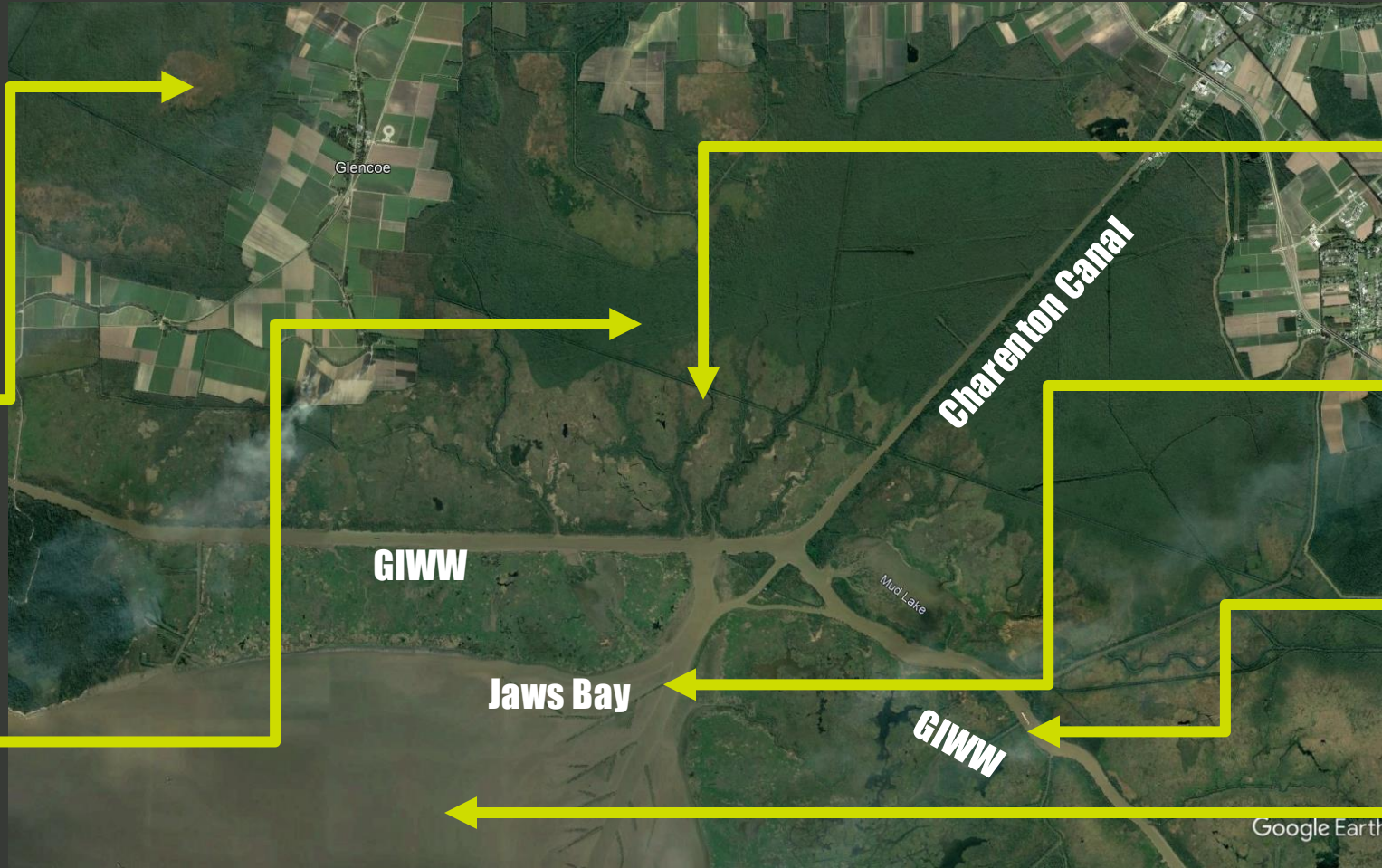
# Drainage Concerns & Potential Causes



## Concerns

Sustained higher water levels in recent years

Water does not drain as quickly as it used to in the past



## Potential Causes

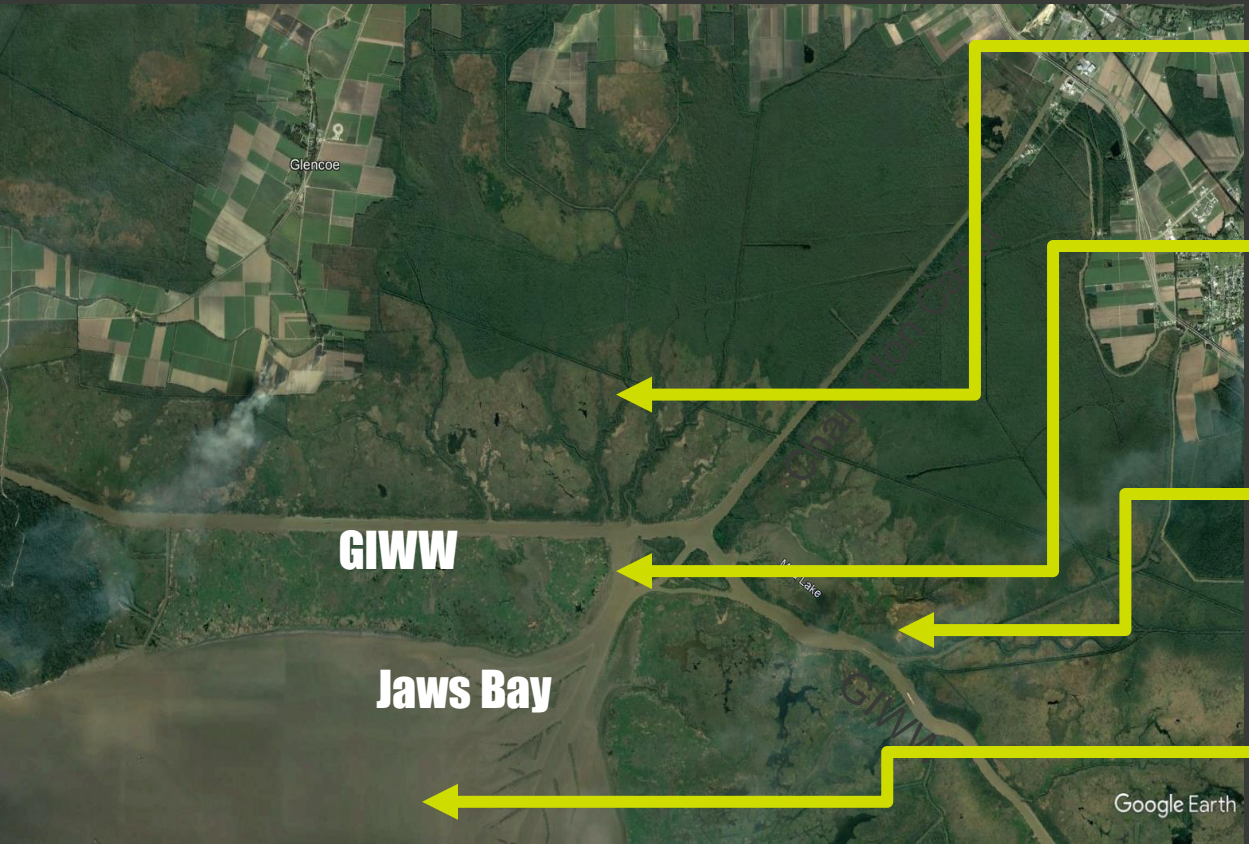
Sediment deposition in local bayous

Sediment deposition in Jaws Bays

Increased inflows from Atchafalaya River

Sea Level Rise

# Study Investigations

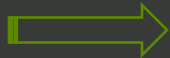


## Potential Causes



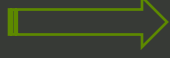
## Investigations

Sediment deposition in local bayous



Field surveys

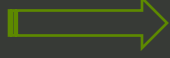
Sediment deposition in Jaws Bays



Computer Model

Dredging

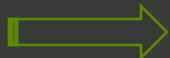
Increased flows from Atchafalaya River



Flow control structure

Dredge WLO to divert GIWW water

Sea Level Rise



Historical water level records analysis

# Field Topographic Surveys & Aerial Recon



Vermilion  
Bay

Morgan  
City

GIWW

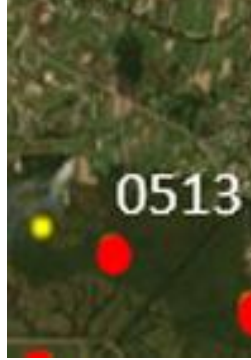
No significant  
blockages  
observed

Surveys by Miller Engineering (2022)

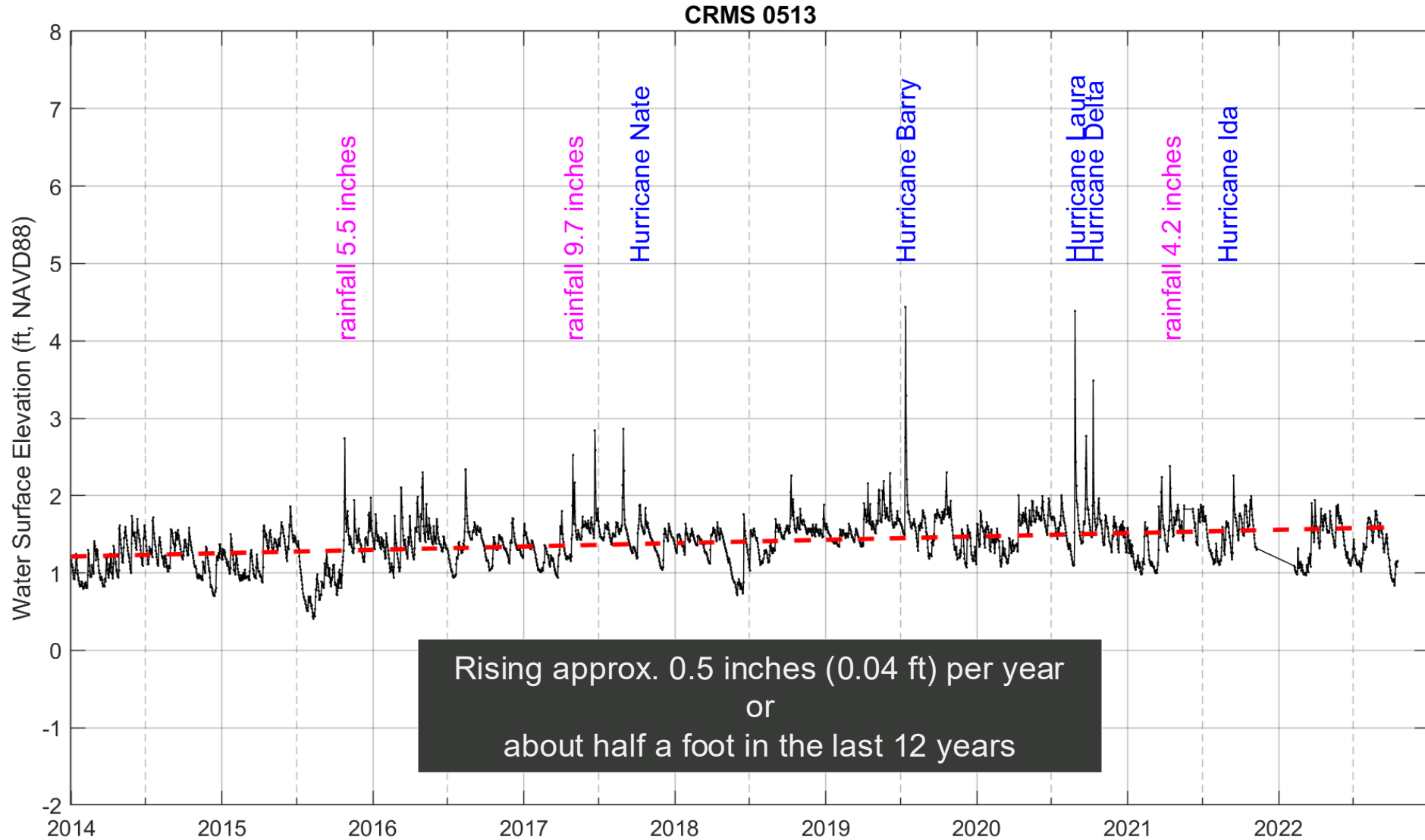
# Extensive Review of Historical Records

- CPRA Coastwide Reference Monitoring System (CRMS) Gages
- USGS Gages
- NOAA Gages





# What do historical water level records show?



Much of the increased water level experienced is due to Sea Level Rise.

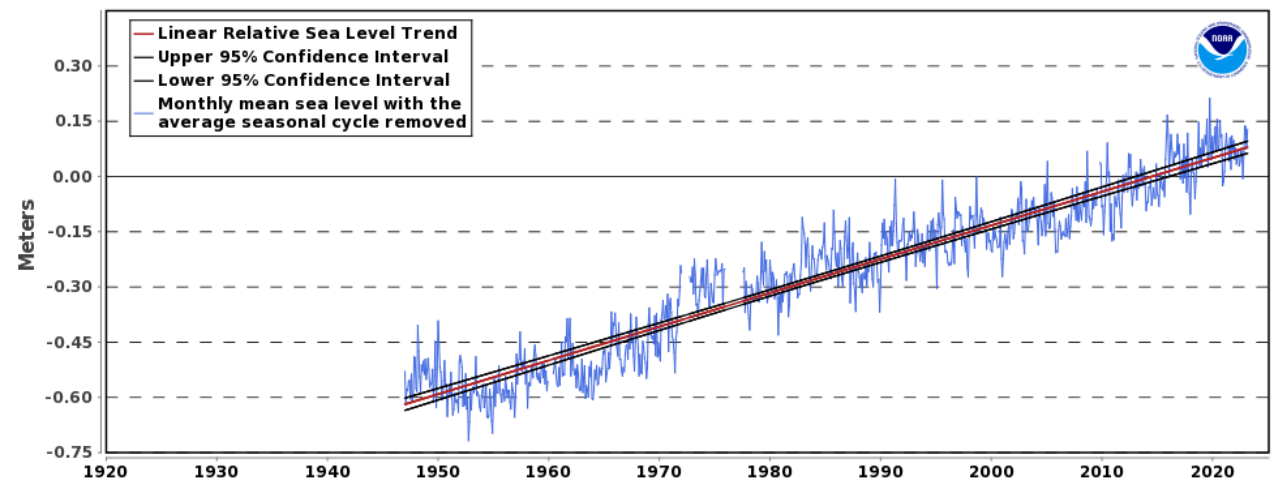
# Water Level Rise Consistent with CPRA, NOAA Findings

## NOAA Grand Isle, LA

0.03 ft/year

8761724 Grand Isle, Louisiana

9.16 +/- 0.37 mm/yr

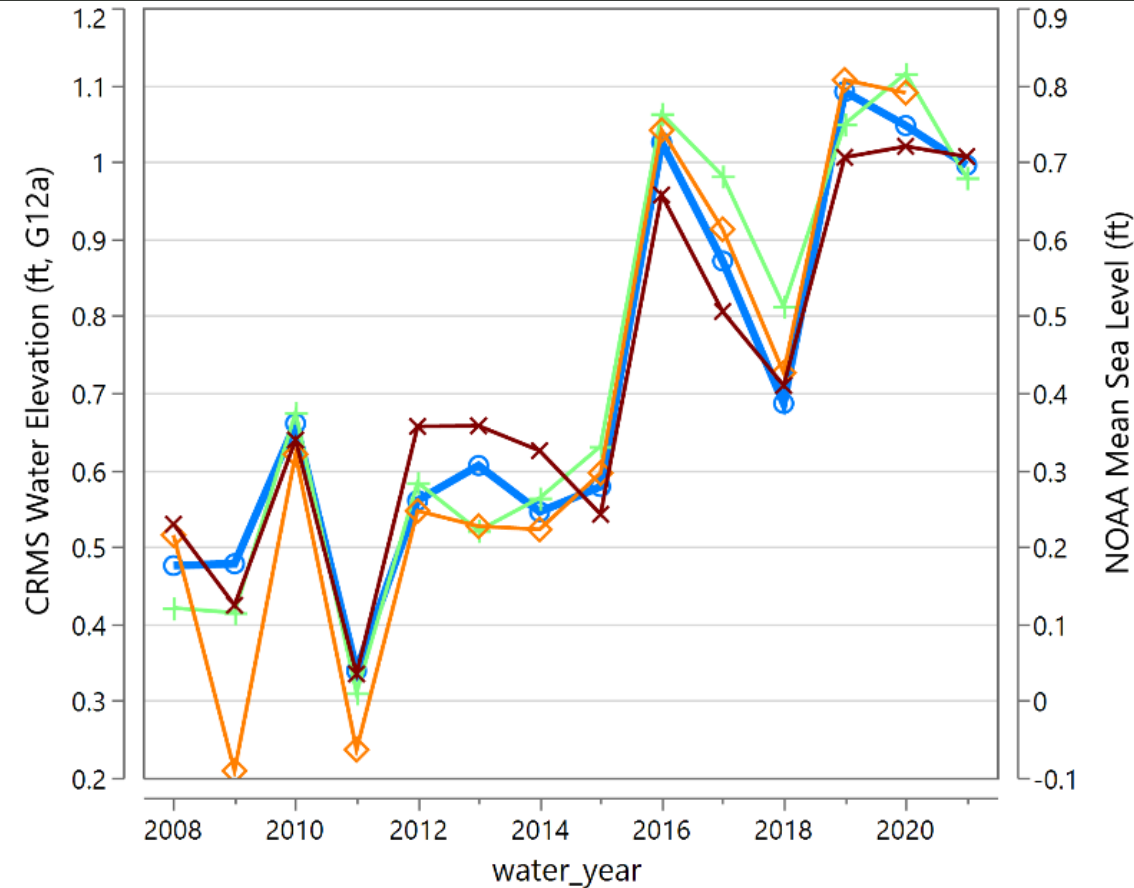


More than 70 years of record



## CPRA Coastwide Gages

0.05 ft/year



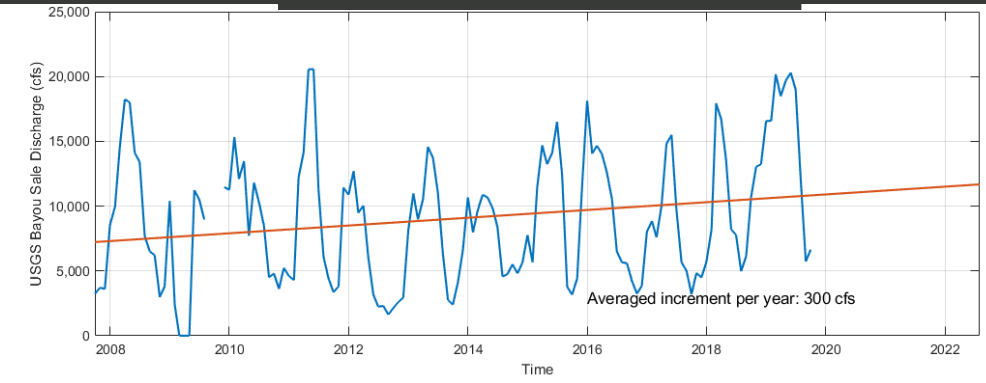
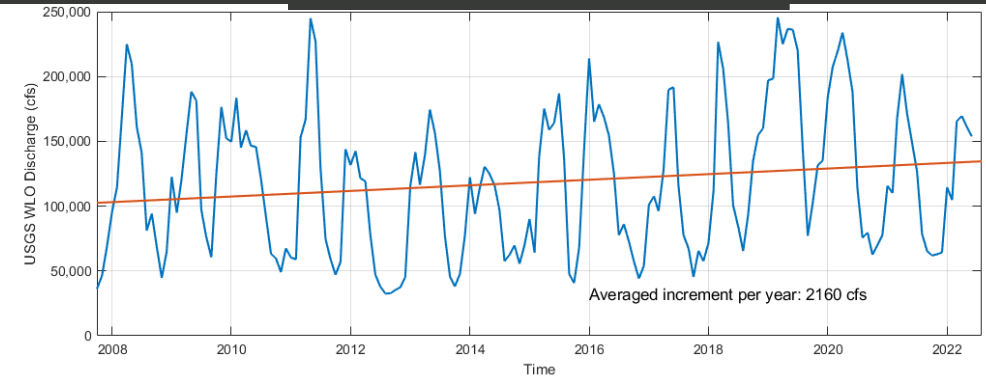
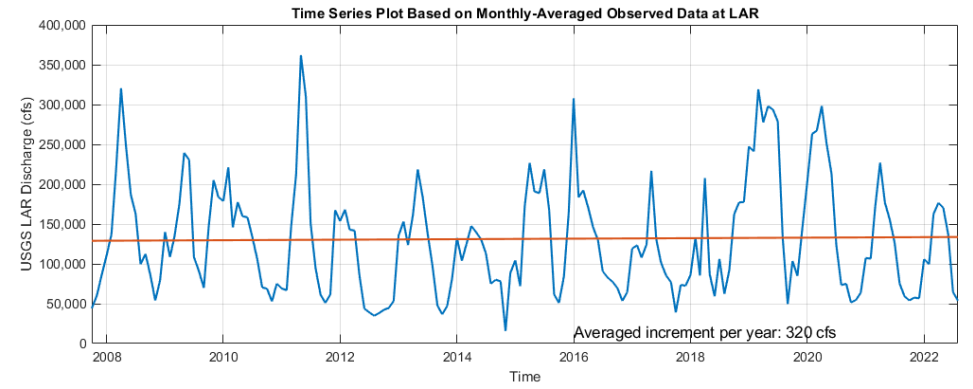
- Left Scale: o — CRMS Coastwide Mean Water Elevation (ft, G12a)
- Right Scale: + — 13\_Galveston, TX    o — 12\_Sabine Pass, TX  
x — 10\_New Canal, LA

(Source: Sharpe, 2021)

# What do historical flow records show?

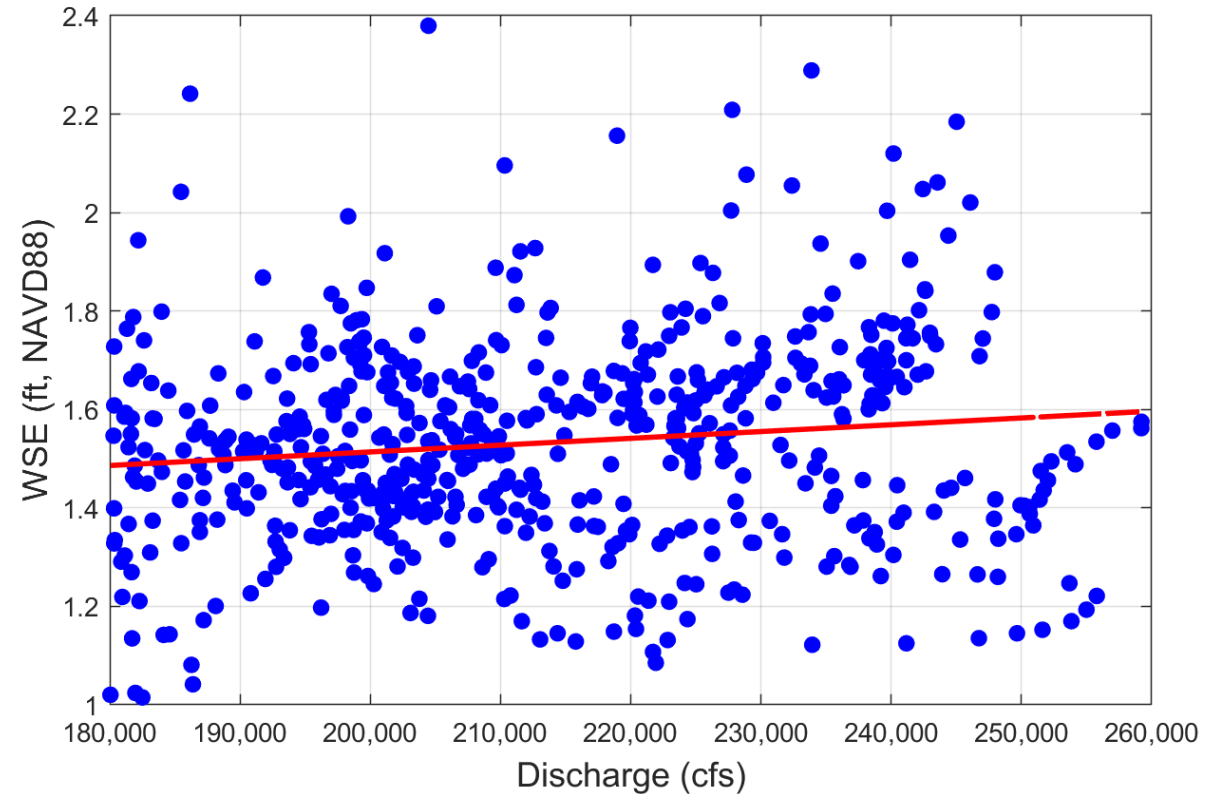


Slight increasing trend in the Atchafalaya river and Wax Lake Outlet flows.



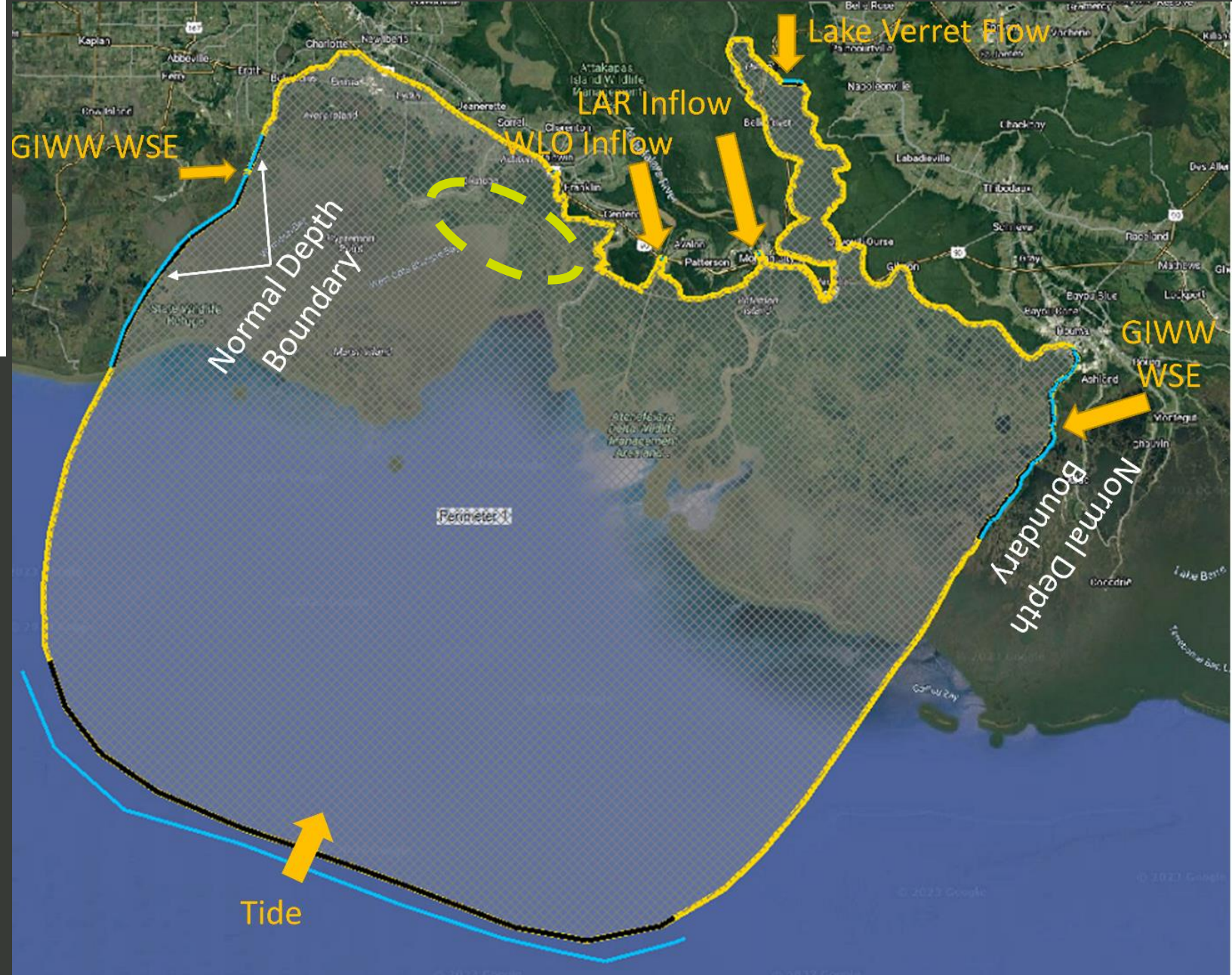
# Is drainage affected by the LAR/ WLO flows?

Weak Correlation



# 2D HEC-RAS Model to Simulate Water Movement

- Includes regional bayous, marsh GIWW, LAR and WLO.
- Water movement responds to river flows and tides.
- Calibrated to 2016, 2019 floods and TS Barry (2019).
- Proposed dredging and structures can be added to evaluate benefits.



# Drainage Study Alternatives



# Alternative 1 – Dredge Wax Lake Outlet Channel

## Result:

No reduction in  
water levels

Dredged WLO canal  
27% larger

Reduced GIWW west  
flow by 30%



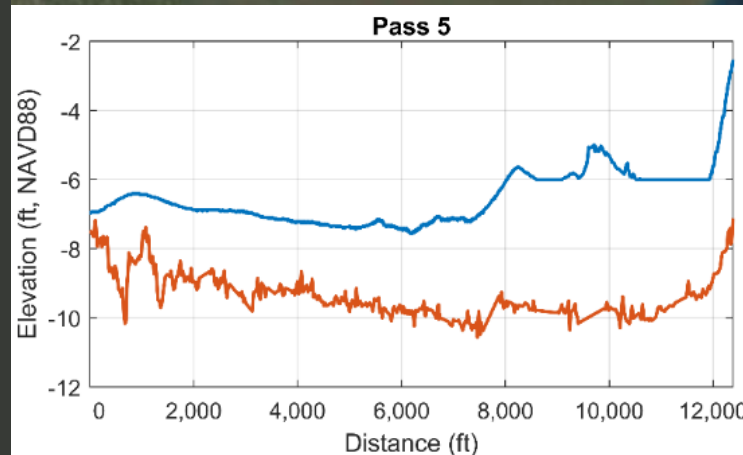
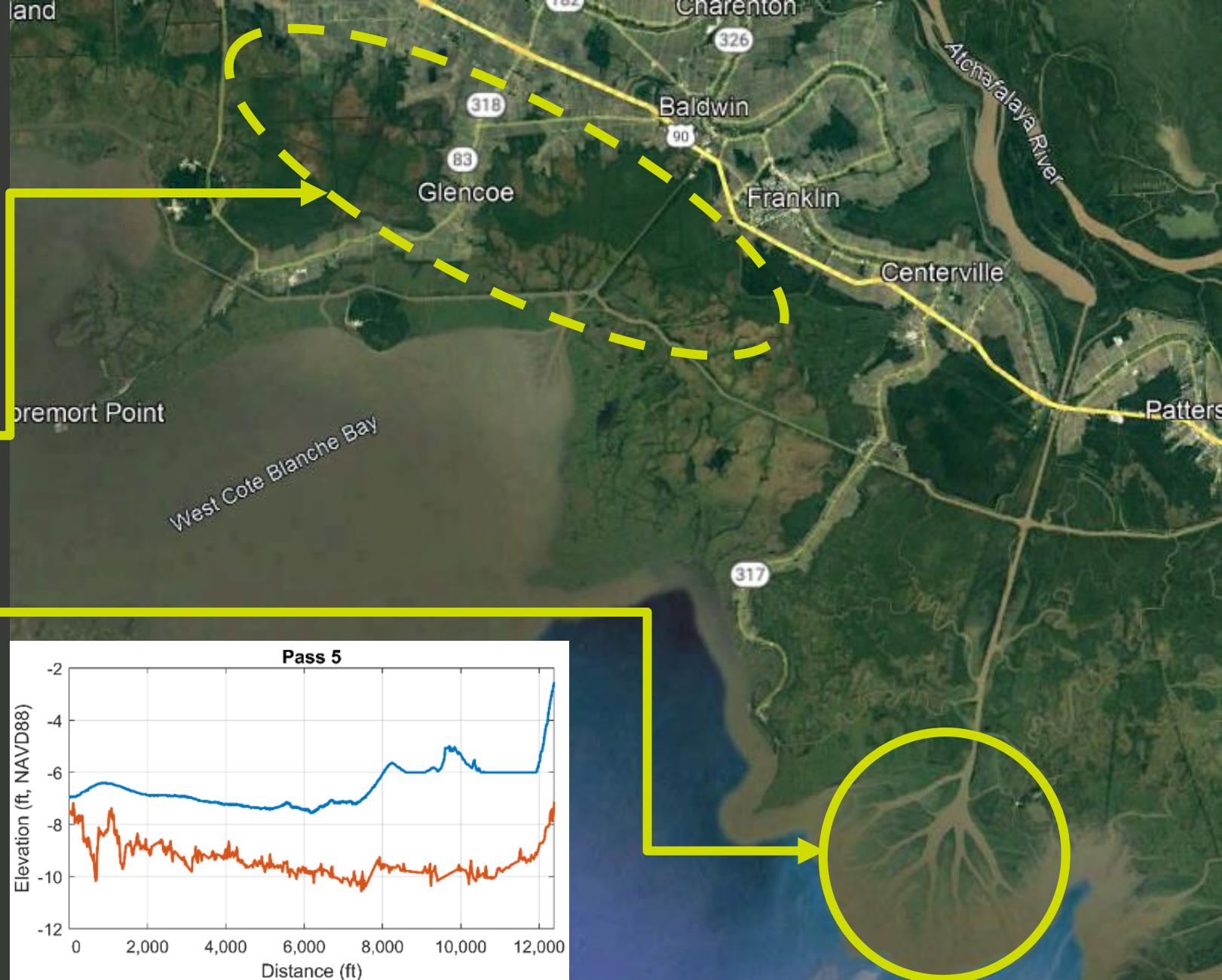
# Alternative 2 – Dredge Wax Lake Delta Passes

**Result:**  
**No reduction in water levels**

Dredged WLD passes  
20% larger

Reduced GIWW west  
flow by 3-4%

Passes deeper than expected



Old Data

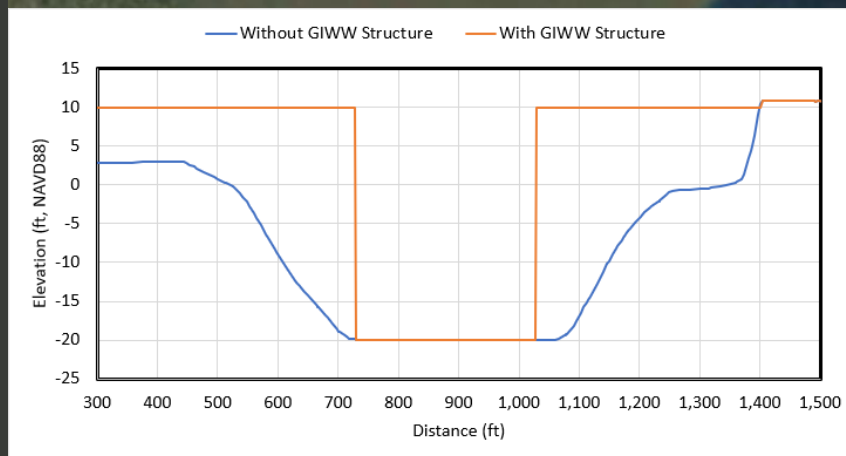
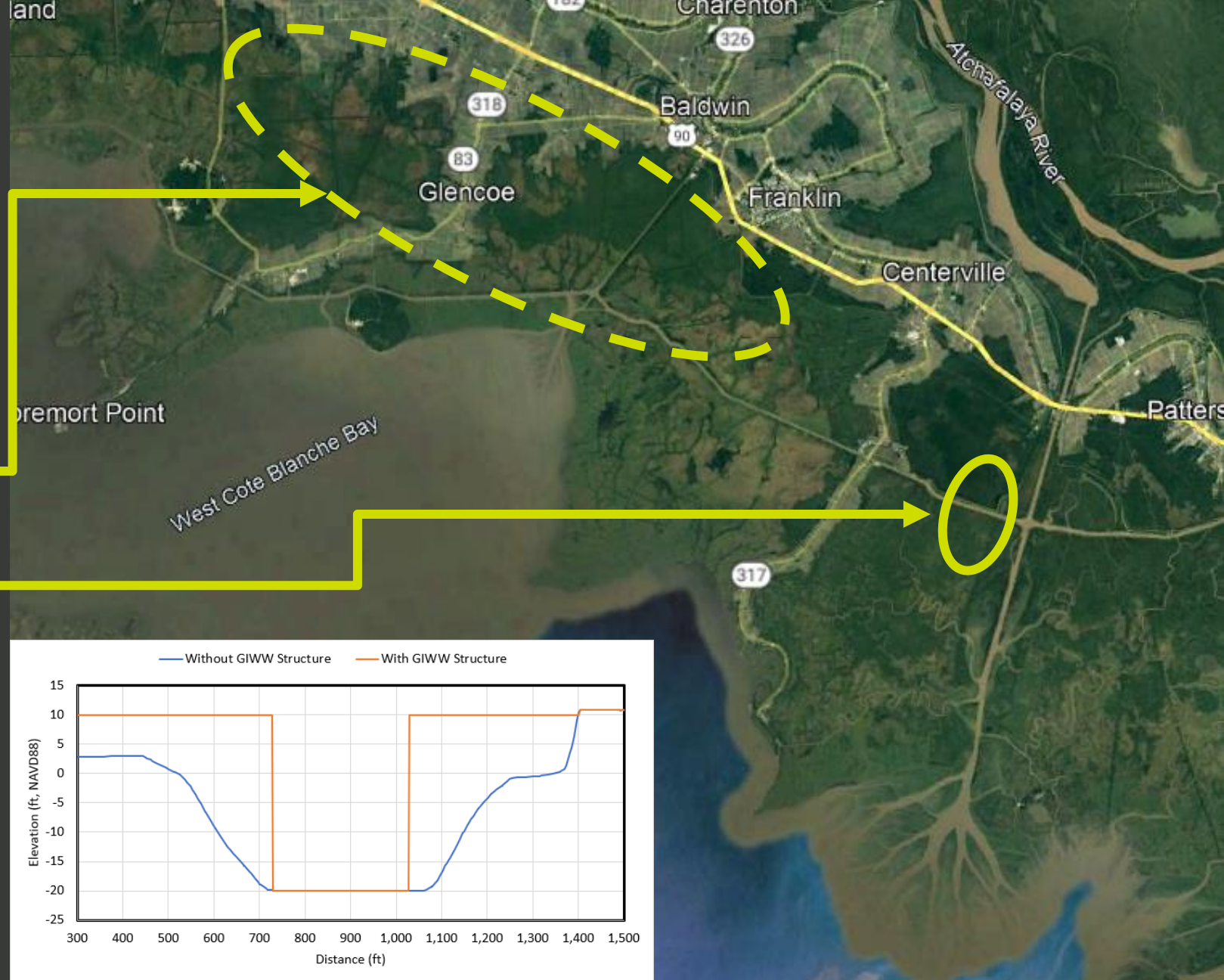
2023 Surveys

# Alternative 3 – GIWW Flow Control Structure

**Result:**  
**No reduction in water levels**

GIWW cross-section  
reduced by 52%

Westward GIWW flow  
decreased by only 1%,  
because velocities  
increased by 60-80%



# Alternative 4 – Complete GIWW Closure “Lock Structure”

**Result:**  
0.2 ft reduction in water levels

Hypothetical scenario to  
evaluate the best-case for  
reducing west GIWW flow



# What Else Can be Done Short of Complete GIWW Closure?

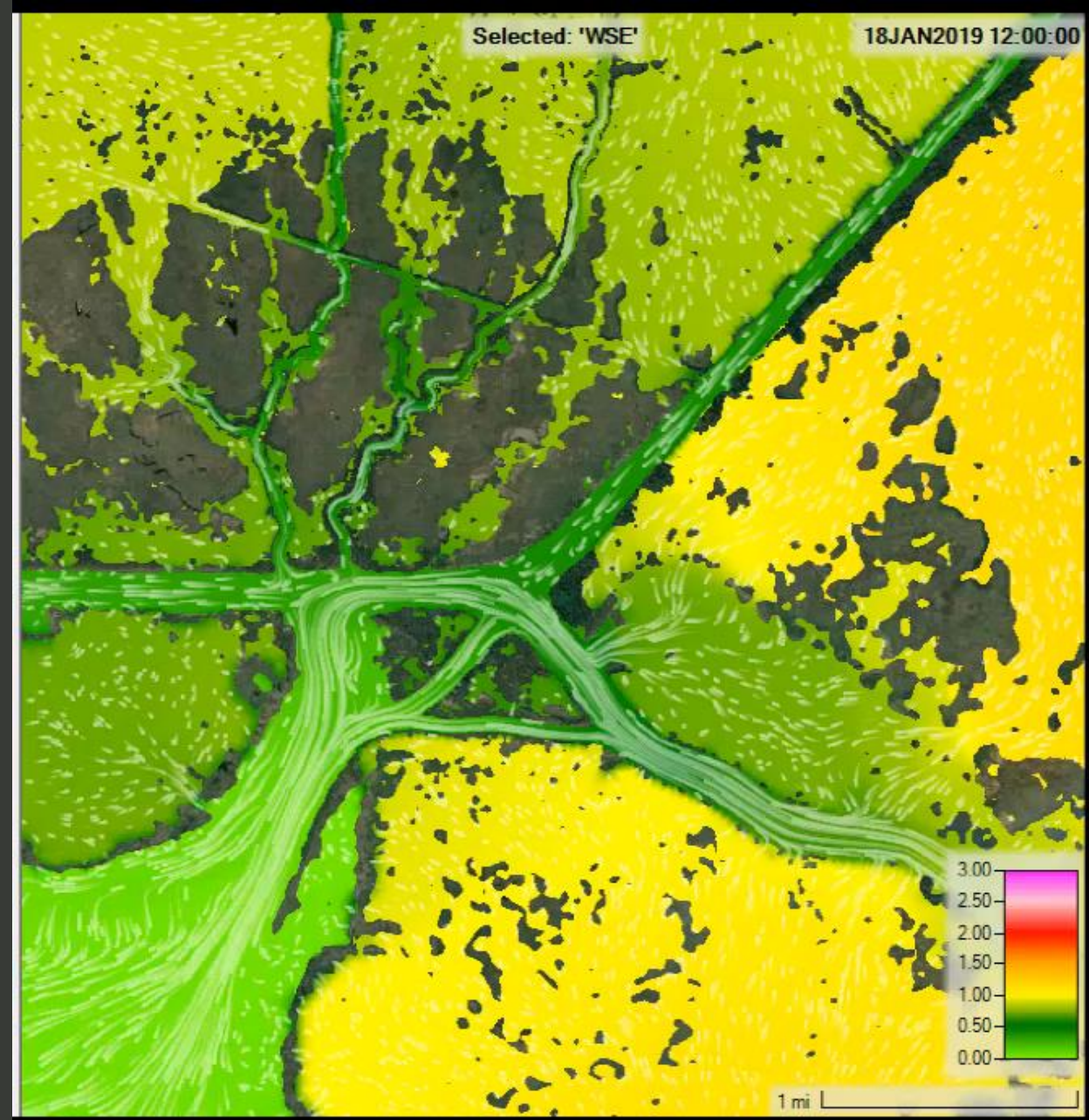
Divert more flow  
out of GIWW  
before it travels  
past Jaws Bay.



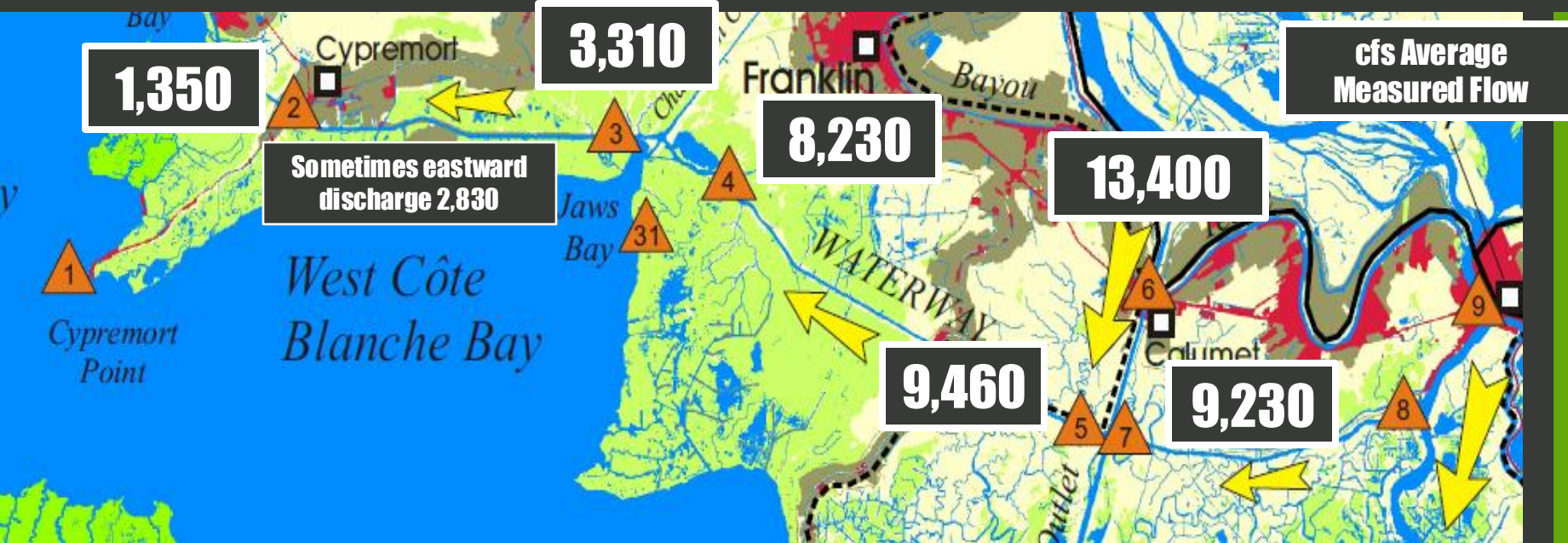
# Model Output: Flow Split at GIWW/ Jaws Bay Intersection

A significant amount of GIWW  
flow leaves through Jaws Bay.

About **60-80%**



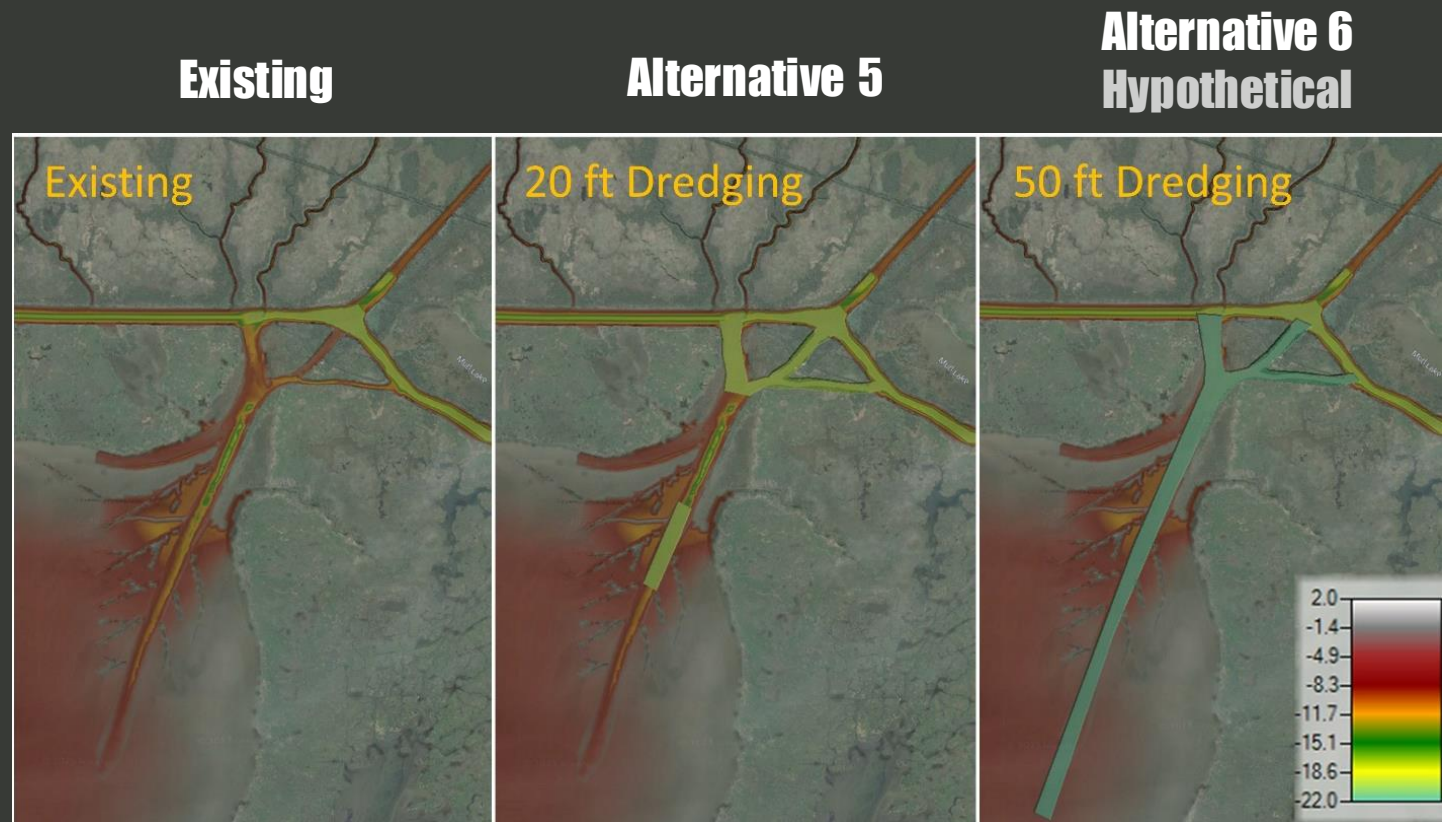
# Average Measured Flows over the 1997-2008 USGS Study



**60-70%**  
of GIWW flow  
leaves through  
Jaws Bay on  
average

(Source: Swarzenski & Perrien, 2015)

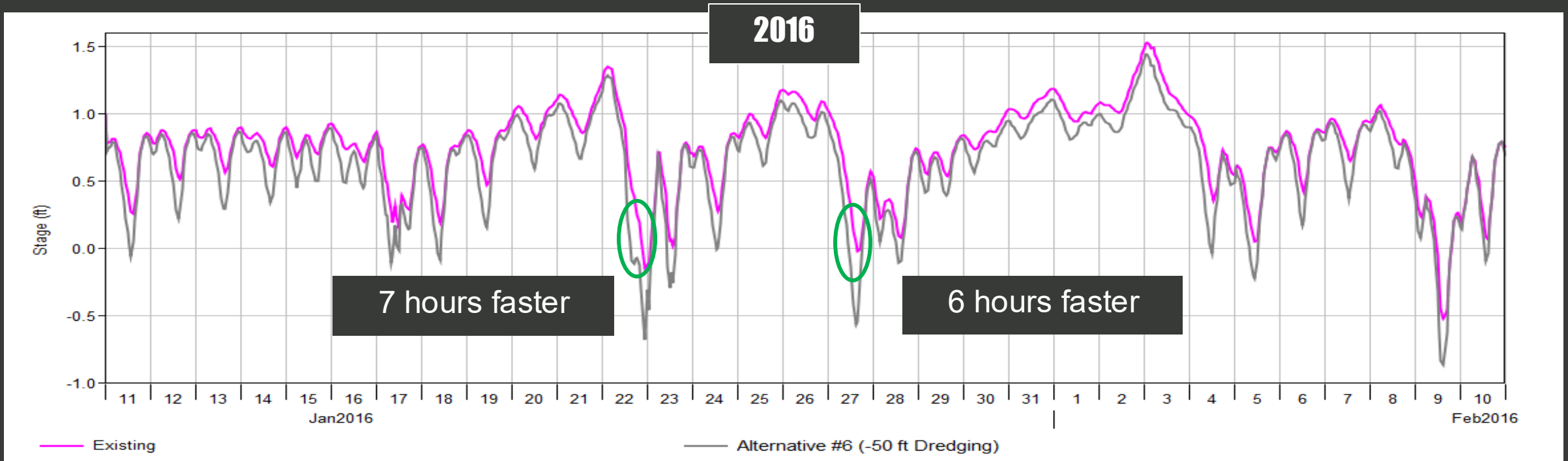
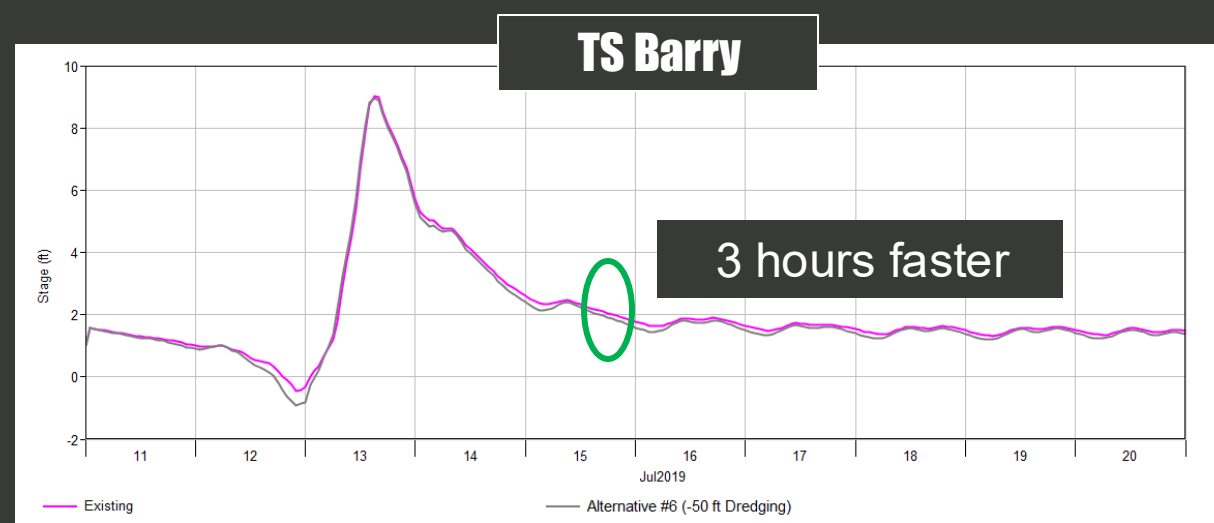
# Alternative 5 & 6 – Dredge Jaws Diamond & Bay



## RESULTS:

GIWW west flow reduction	Up to 25%	Up to 80 %
Water level reduction	Less than 0.1 ft	Less than 0.2 ft
Drainage duration after high water	No change	2-7 hrs faster
Drainage duration after storm surge	No change	3 hrs faster

# Drainage Durations – Existing vs. 50 ft Dredging



# Results Summary

	<b>Alt 1: Dredge WLO</b>	<b>Alt 2: Dredge WLD passes</b>	<b>Alt 3: GIWW dikes</b>	<b>Alt 4: Complete GIWW Closure</b>	<b>Alt 5: Dredge Jaws Bay 20 ft</b>	<b>Alt 6: Dredge Jaws Bay 50 ft</b>
GIWW west flow reduction	30%	3-4%	1%	100%	Up to 25%	Up to 80%
Water level reduction	-	-	-	0.2 ft	Less than 0.1 ft	Less than 0.2 ft

**Water levels in the area have been rising approx. 0.5 inches (0.04 ft) per year  
Or about half a foot in the last 12 years**

# Conclusions

- The region continues to see rising water levels trend of 0.05 ft per year, consistent with Sea Level Rise observed along the rest of the gulf coast.
- Controlling westward Atchafalaya River water shows little to no reduction of water levels.
- Jaws Bay dredging shows little reduction in water levels and drainage duration. Extreme dredging shows some benefits which will not keep up with the sea level rise.
- Alternatives of creating Forced Drainage Areas may need to be evaluated.



# Thank you

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Photo: Hurricane Barry (2019), NOAA NGS aerial image

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