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Storm Surge Protection: *Concepts & Concerns*



*Bob Stokes, President
Galveston Bay Foundation*

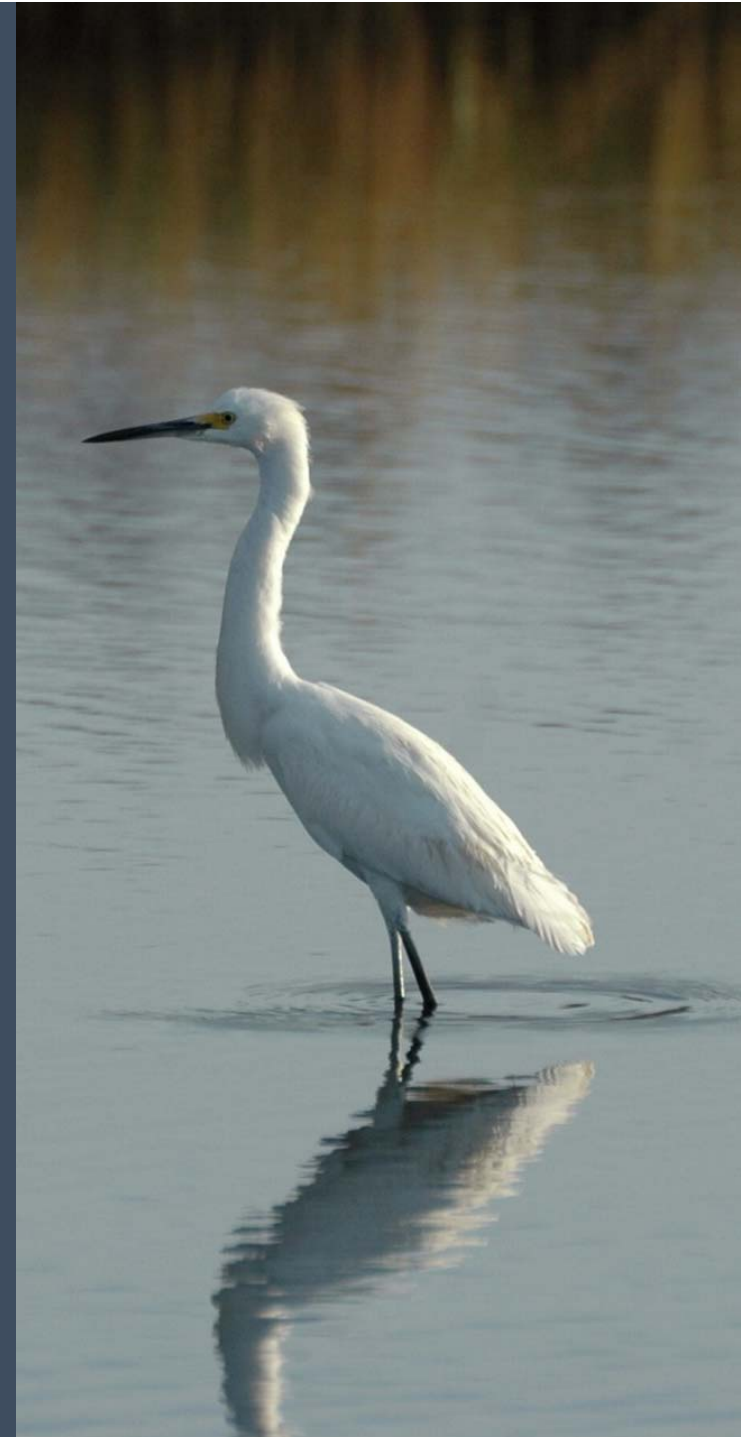
Galveston Bay Foundation

Mission:

*To preserve and enhance
Galveston Bay as a healthy and
productive place for generations
to come*

Program Areas:

- *Advocacy*
- *Education*
- *Land conservation*
- *Habitat restoration*
- *Water quality and quantity*



Our Vision for Galveston Bay

We envision a future Galveston Bay that is brimming with vitality, connected to people and contributing to the community in every way.

-- GBF Strategic Plan, 2016

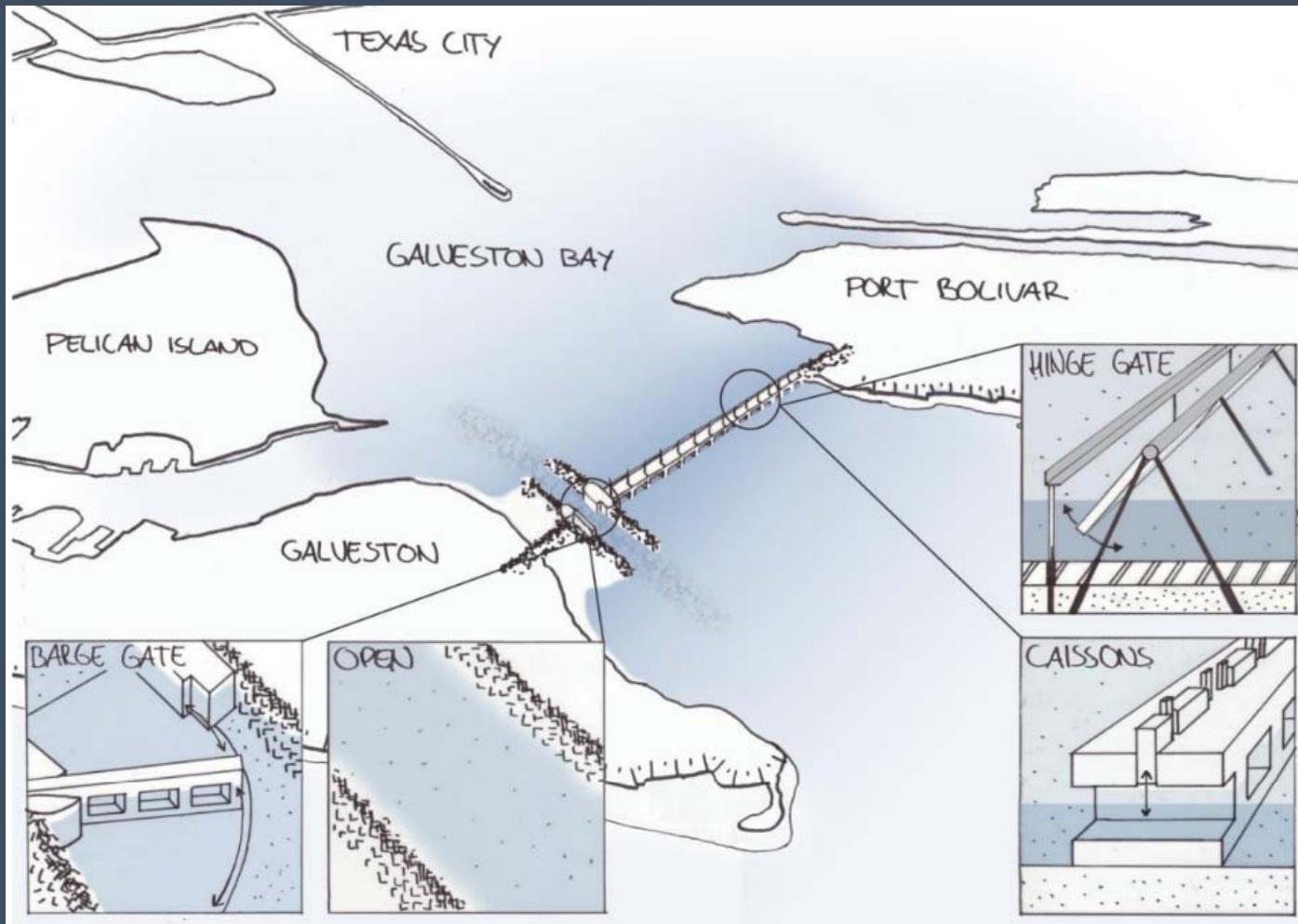


So what do we need to protect?



Concepts

Ike Dike Concept – Gates



TAMUG

SSPEED Center – H-GAPS

“Mid-Bay” Strategy

- Coastal Spine (**F**, 1 and **G**)
- HSC Gate in middle of Galveston Bay (**M**)
- Backside Galveston Levee (**H**)
- In-bay Berms with small gates (**E**)



Note: SSPEED focusing studies with Coastal Spine on existing roadways

SSPEED Center – Mid-Bay Strategy



SSPEED

GCCPRD Phase 3 Study Recommended Actions

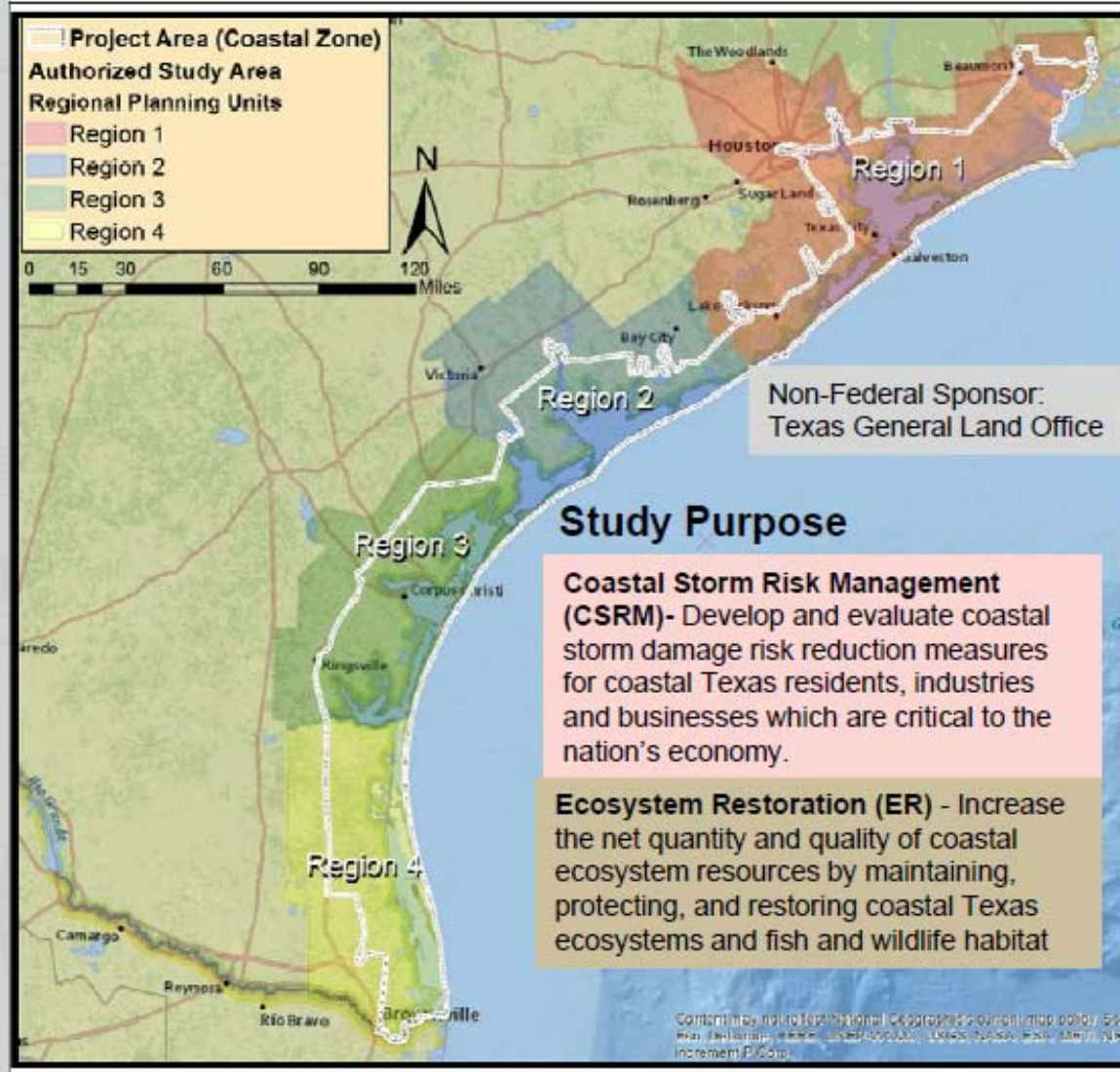


Figure 2: Recommended Central Region Alternative (CR#1) - Coastal Spine

- High Island to San Luis Pass Coastal Spine* *parallel to Hwy 87 and FM 3005
- Gate at Bolivar Roads
- Navigation Gate at Clear Lake
- Galveston Ring Levee

GCCPRD

Coastal Texas Protection and Restoration Study



Milestone		Date
Scoping	Exemption Approval by USACE	Sep 2015
	Exemption Approval by ASA(CW)/OMB	Nov 2015
	Execute FCSA w/GLO	Nov 2015
Alt. Eval/ Analysis	Alternatives Milestone	June 2016
	Tentatively Selected Plan (TSP) Milestone	May 2018
Feasibility Level Analysis	Agency Decision Milestone (ADM)	Oct 2018
	Feasibility Report Complete	Oct 2020
	Civil Works Review Board (CWRB)	Jan 2021
	S&A Review	Feb 2021
	Chief's Report	Apr 2021

Fiscal Year*	Total Funding (\$)	Federal Funding (\$)	Non-Federal Funding*** (\$)
2016	2,506,000	1,253,000	1,253,000
2017	3,650,000	1,825,000	1,825,000
2018	3,950,000	2,175,000**	1,775,000
2019	5,350,000	2,675,000	2,675,000
2020	4,244,000	2,122,000	2,122,000
2021	100,000	50,000	50,000
Total	19,800,000**	10,100,000	9,700,000

Corps of Engineers – Coastal Texas Protection and Restoration Feasibility Study

Region 1: Alternative A - Coastal Barrier/Nonstructural System

Coastal Texas Protection and Restoration Study

Alternative A

- High Island to Bolivar Peninsula
- Bolivar Roads and Houston Ship Channel/Gates
- Galveston Seawall
- Galveston Ring Levee
- Saraland to San Luis Pass
- Clear Lake - Gates
- West Side of Galveston Bay Nonstructural Improvements
- Galveston Island Nonstructural Improvements
- Galveston State Bay Area Protection will select one of these measures



Corps of Engineers – Coastal Texas Protection and Restoration Feasibility Study

Region 1: Alternative B - Coastal Barrier

Coastal Texas Protection and Restoration Study

Alternative B

- High Island to Port Galveston
- Bolivar Roads and Houston Ship Channel Gates
- Existing Texas City Dike
- Existing Texas City Hurricane Flood Protection Level (HFPL)
- West Extension of Texas City HFPL
- Galveston Seawall
- Galveston Bay Levee
- Clear Lake Gate
- West Side of Galveston Bay Structural Improvements



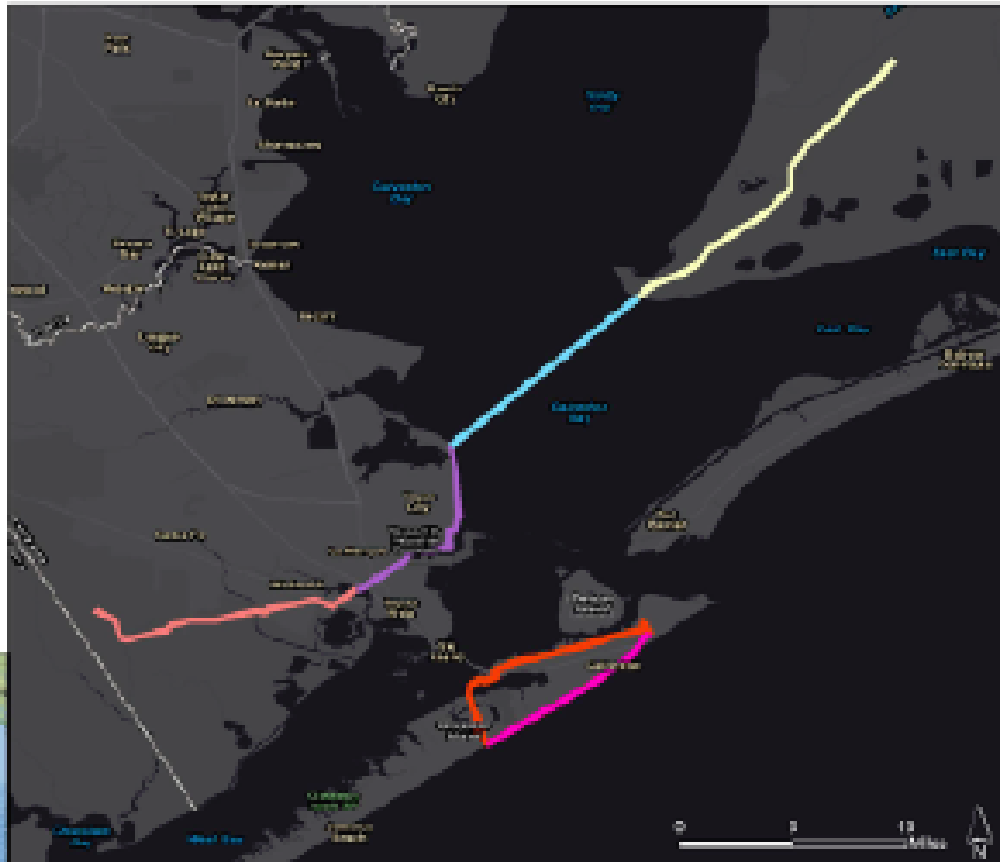
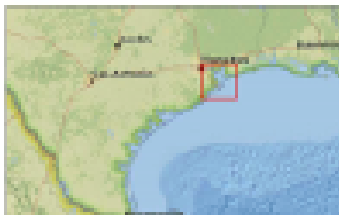
Corps of Engineers – Coastal Texas Protection and Restoration Feasibility Study

Region 1: Alternative C – Mid Bay

Coastal Texas Protection and Restoration Study

Alternative C

- Double Bayou to Smith Point
- MidBay Navigation and Environmental Gates
- Existing Texas City
- Hurricane Flood Protection Levee (HFPL)
- West Extension of Existing Texas City HFPL
- Galveston Seawall
- Galveston Ring Levee



Corps of Engineers – Coastal Texas Protection and Restoration Feasibility Study

Region 1: Alternative D Upper Bay Barrier/ Nonstructural System

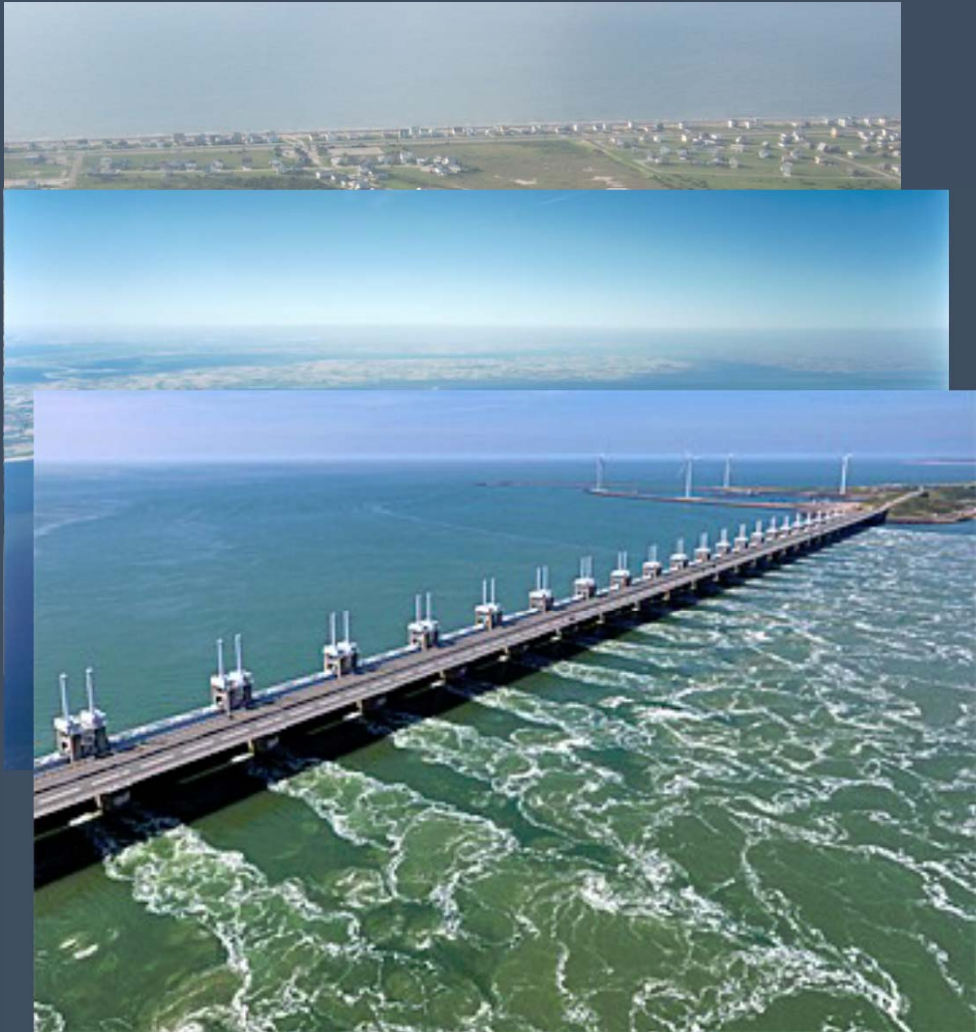
Coastal Texas Protection and Restoration Study

Alternative D

- Baytown to Tule Bay
- Tule Bay Environmental Gate
- Hog Island
- No side Ship Channel Gulls
- Optimal Island
- Highway 101 Alignment
- San Joaquin Alignment
- Existing Texas City Hurricane Flood Protection Level (HFPL)
- Extension of Texas City HFPL
- Galveston Seawall
- Galveston Ring Levee
- West Side of Galveston Bay
- No structural improvements
- Alternative D will select one of these features.

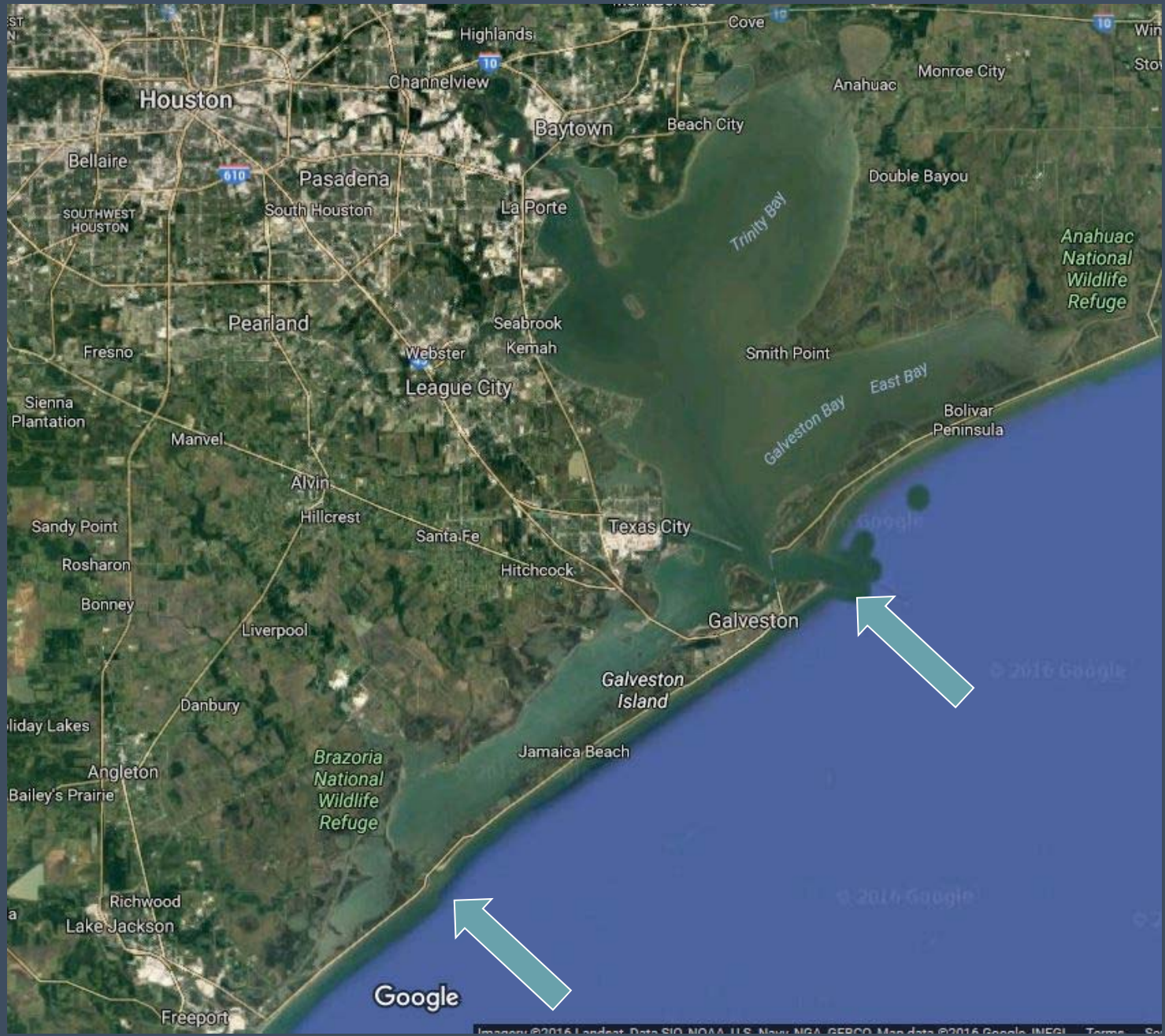


Environmental Questions & Concerns for *All* Concepts



- Direct and indirect impacts to habitat and bay species including water column changes
- Changes to bay circulation and salinity

SSPEED



GALVESTON BAY
FOUNDATION





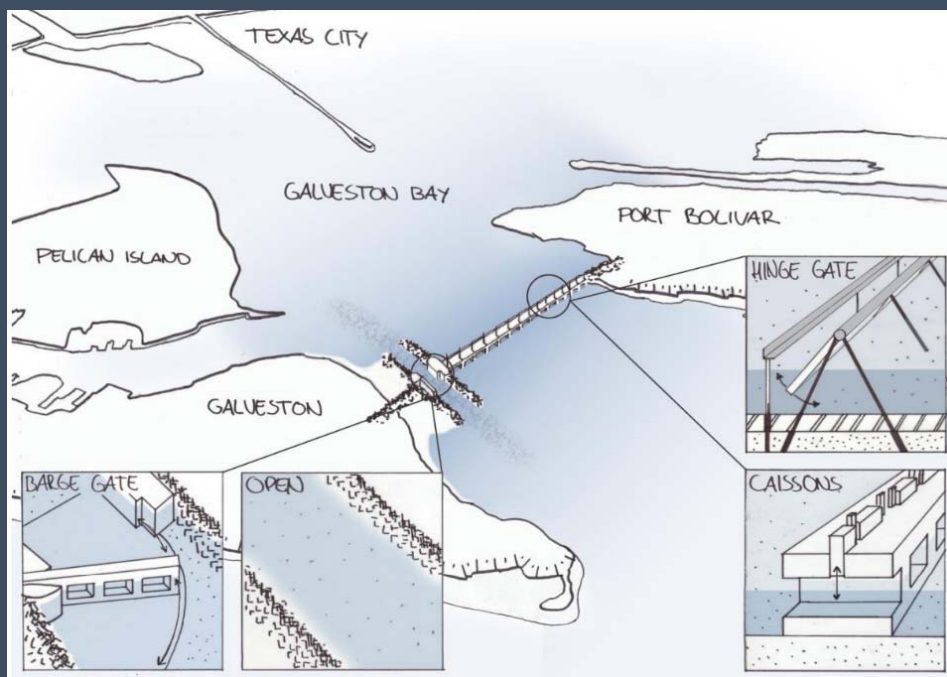
Impacts Seen in The Netherlands – Eastern Scheldt (De Ronde, 1990)



- Tidal range decreased by 15-20%
- Tidal prism (volume) decreased by 30%
- Intertidal area decreased by 30%
- Salt marsh area decreased by 60%
- Loss of intertidal and salt marsh destroyed large feeding area for birds

Potential Impacts in Galveston Bay from Ike Dike

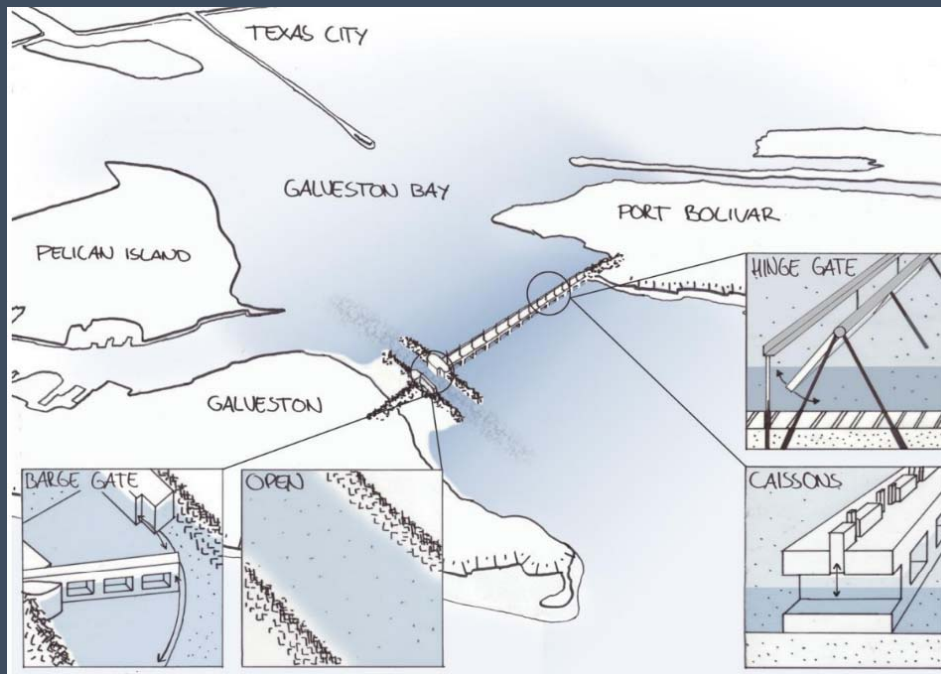
(M. Ruijs, 2011 Master's Thesis – 2D Modeling)



- Reduction in flow area of Bolivar Roads
- Reduction in tidal prism (volume)
- Increased speeds in Bolivar Roads resulting in scour
- Decreased speeds inside the Bay resulting in sedimentation of channels

Potential Impacts in Galveston Bay from Ike Dike

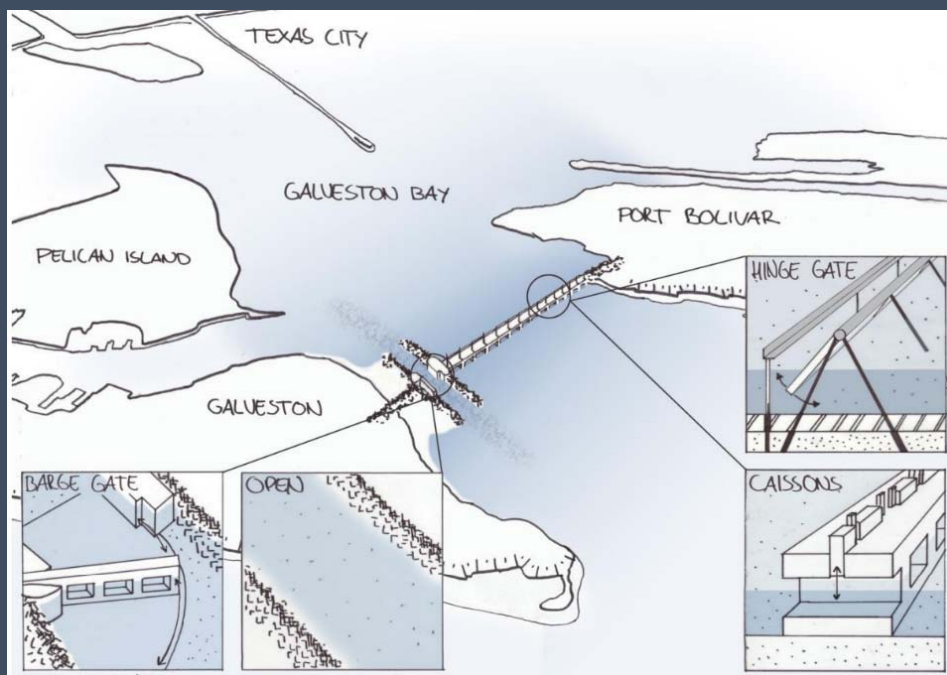
(M. Ruijs, 2011 Master's Thesis – 2D Modeling)



- More of the ebb flow is directed to HSC
- More of the flood flow is directed to sides of Bay
- Blocking of sediment by barriers and redistribution of sediment due to decrease in tidal prism could exacerbate the sediment deficit problem in the Bay

Potential Impacts in Galveston Bay from Ike Dike

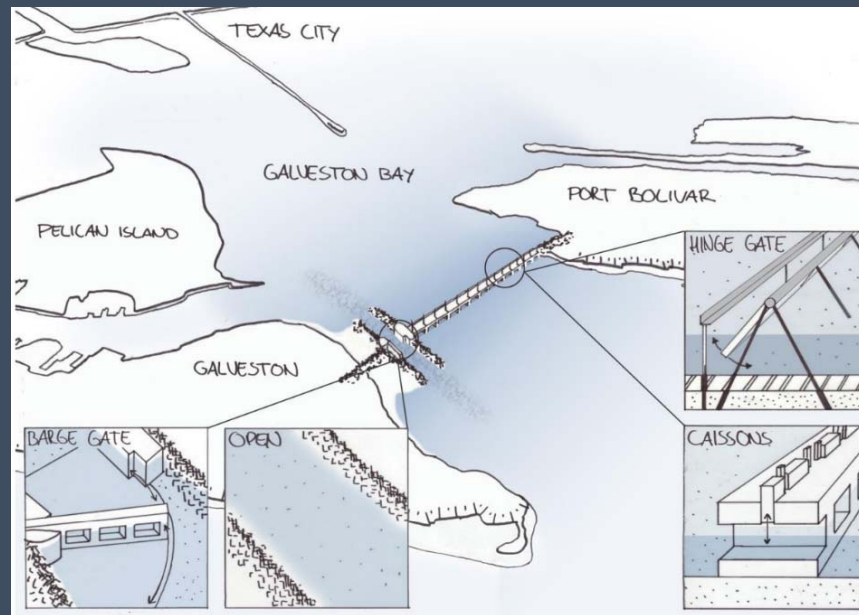
(M. Ruijs, 2011 Master's Thesis – 2D Modeling)



- Residence time of water in the Bay will increase – decreased salinity, increase in concentration of contaminants
- Changes to habitats – tidal flats and marshes MAY decrease – needs more investigation

Ruijs' Recommendation

"The effects of the changing hydrodynamics, water quality and morphology on the ecology should further be investigated by an ecologist. It should be investigated what the effects are on the habitats and its flora and fauna."



Study and Understand Environmental Impacts

- Ensure that we fully evaluate impacts to make an informed decision
- Fiscally responsible to understand those impacts ahead of time
- Consistently heard that we would learn lessons from the Dutch
- Mitigate impacts where necessary

Questions?

Bob Stokes, President

281-332-3381 x211

bstokes@galvbay.org

Scott Jones, Director of Advocacy

281-332-3381 x209

sjones@galvbay.org

www.galvbay.org

