Salt Bayou Watershed Restoration

Addressing Marsh Loss at the Landscape Scale in the Texas Chenier Plain

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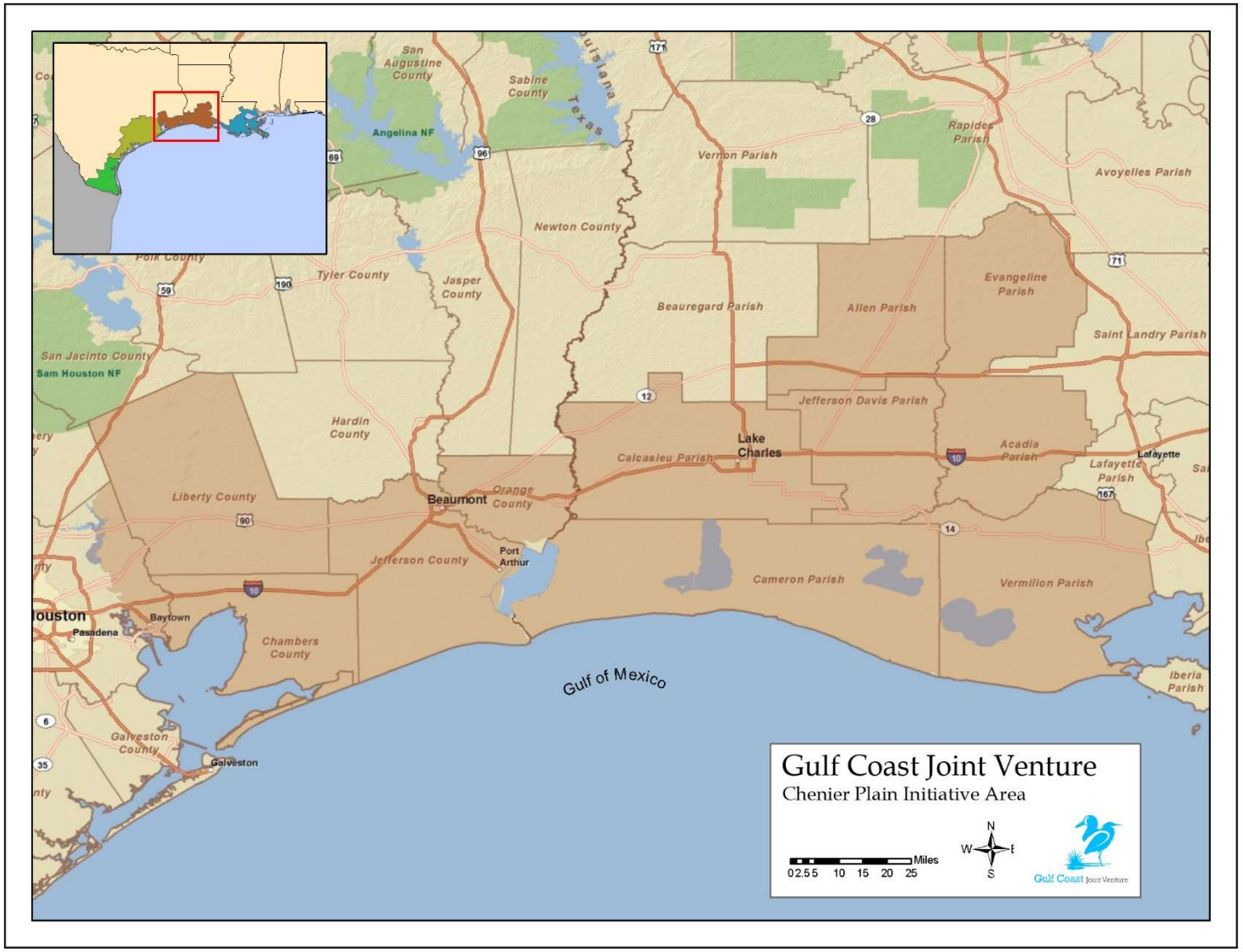
Chenier Plain of Texas



Importance of Chenier Plain

- Continental waterfowl populations
  - 1.25 million wintering waterfowl from Central Flyway
- Non-game birds
  - Summer nesting habitat
  - Migration stopover location
- Fisheries resources
  - Shrimp, menhaden, flounder, others
- Economic
  - Storm surge protections
  - Recreation and Tourism

Conservation Challenges

- Marsh loss and conversion
  - Human activities
  - Natural processes
- Land use changes
  - Industrialization along coast
  - Development upstream in watershed
- Global relative sea level rise
  - Rising water levels in oceans
  - Land subsidence

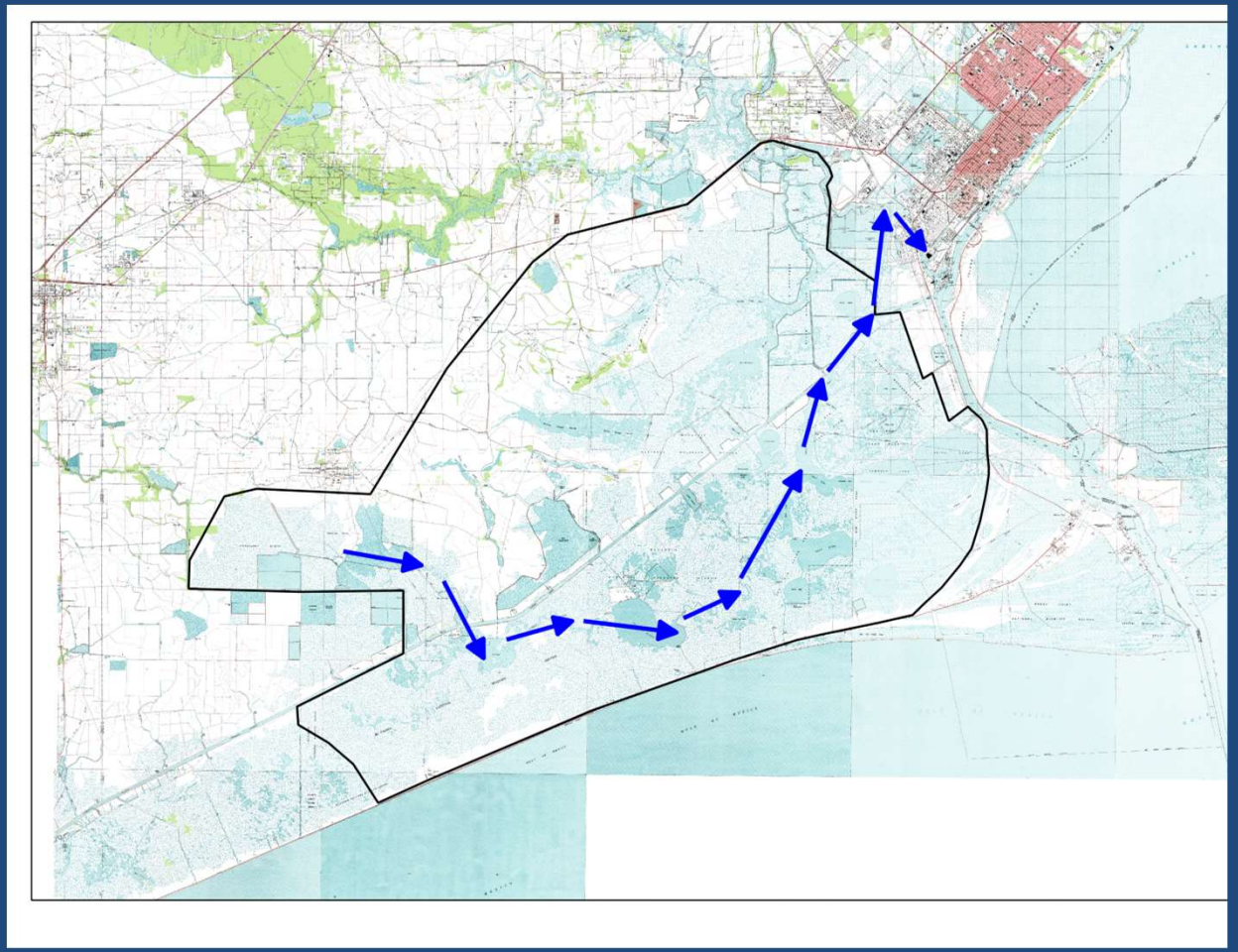
Poll Question

- What is (are) the main driver(s) of marsh loss in the Texas Chenier Plain?
  A. Development around the Sabine Neches ship channel and ports.
  B. Landscape level changes in hydrology and elevation loss.
  C. Recreational activities.
  D. None of the above.

Historic Hydrology

Prior to Gulf Intracoastal Waterway

- Flowed from western part of the county to the east,
- Then flowed south into Salt Bayou
- Flowed east through Clam Lake, 10 Mile Cut, Mud Lake, Shell Lake
- Flowed north from Shell Lake through Salt Bayou and into Taylor Bayou.



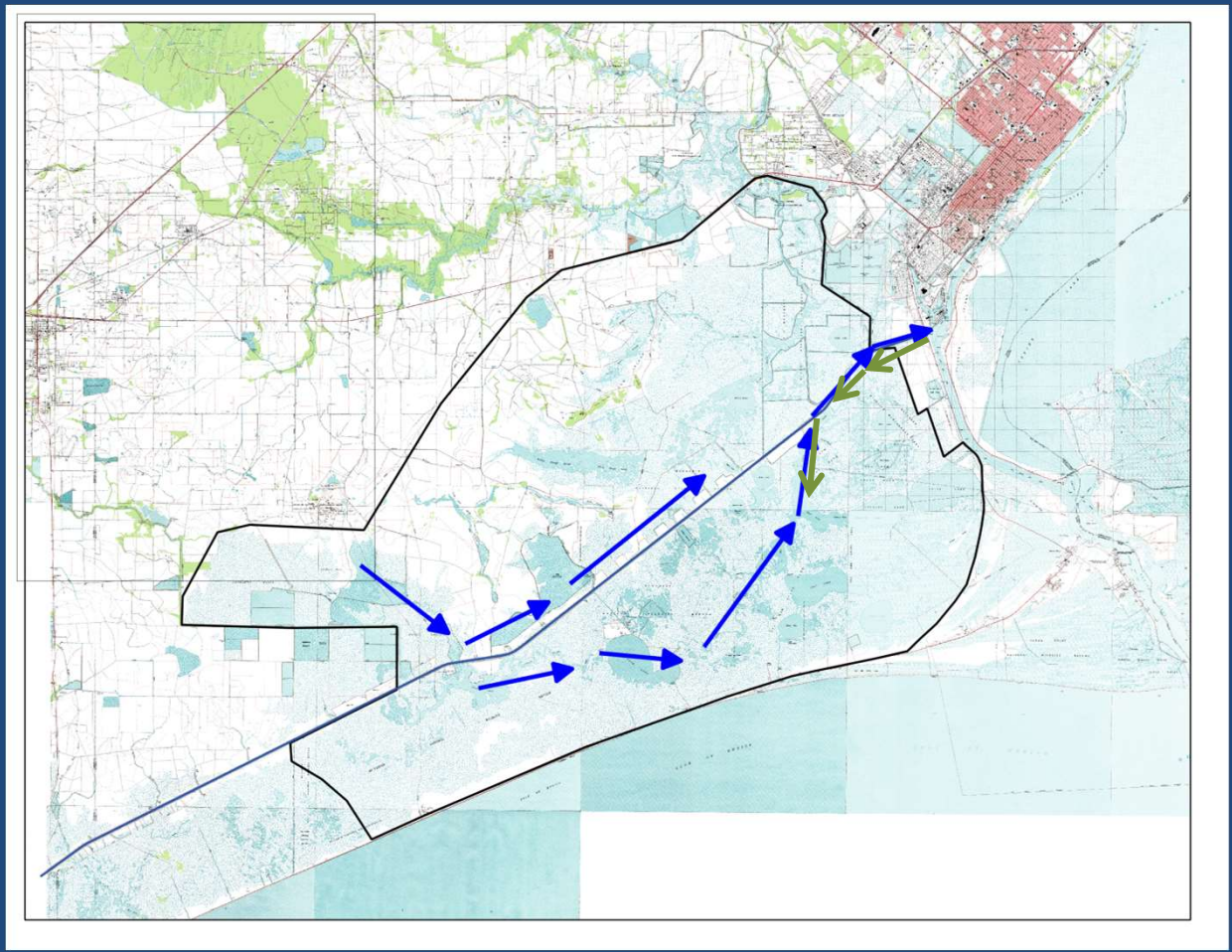
Poll Question

- When did the problems within the Texas Chenier Plain begin?
  A. 1776
  B. 1906
  C. 1930s
  D. 1990s

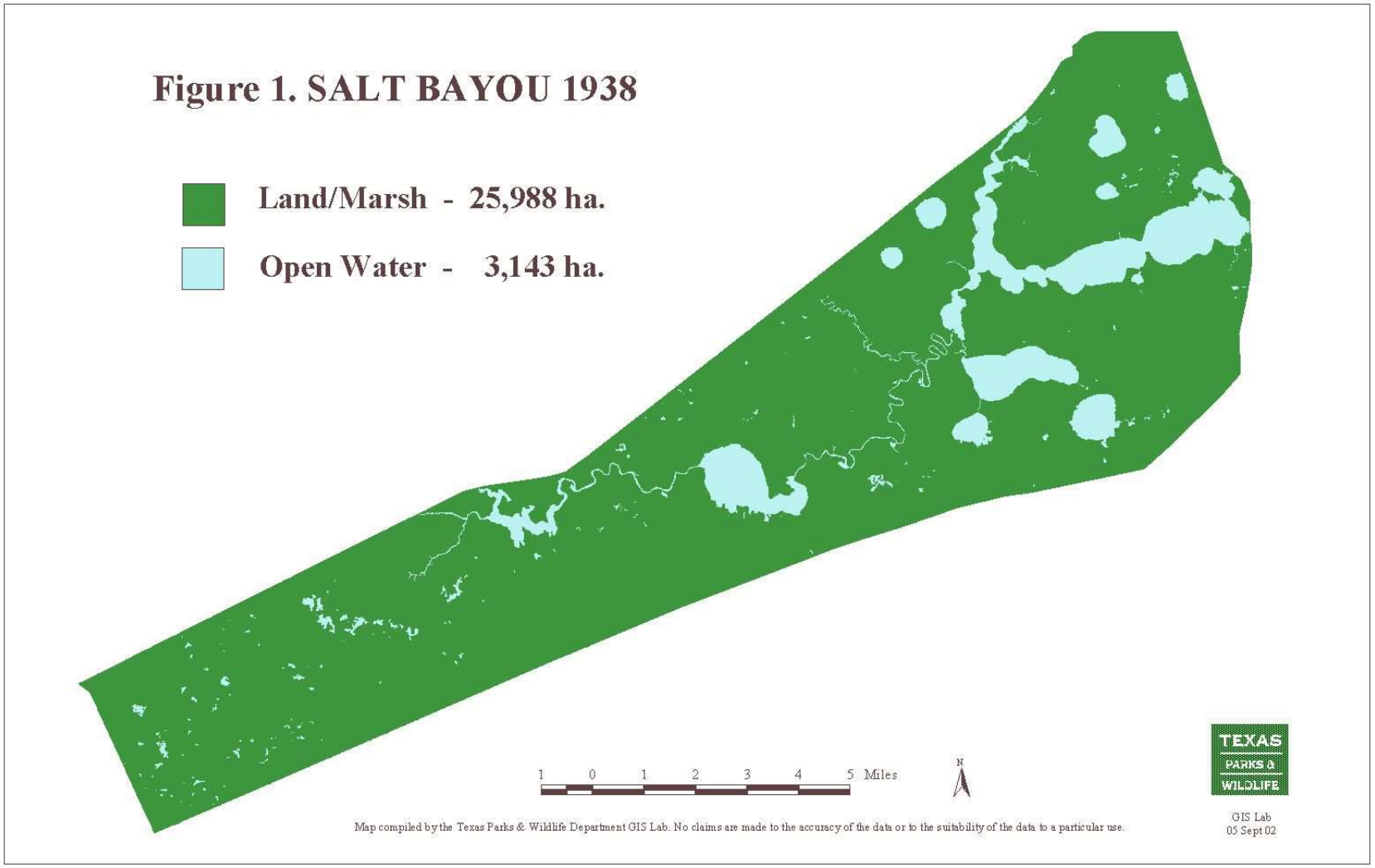
Gulf Intracoastal Waterway

After Gulf Intracoastal Waterway

- Flows from the area north of the canal were trapped behind sidecast material
- Flows in the area to the south of canal still moved as before up to canal.
- Flows were diverted to GIWW until water control structure was built.
- After water control structure, water was able to leave when gates were open.
- Only source of freshwater is precipitation.



Watershed Response to GIWW



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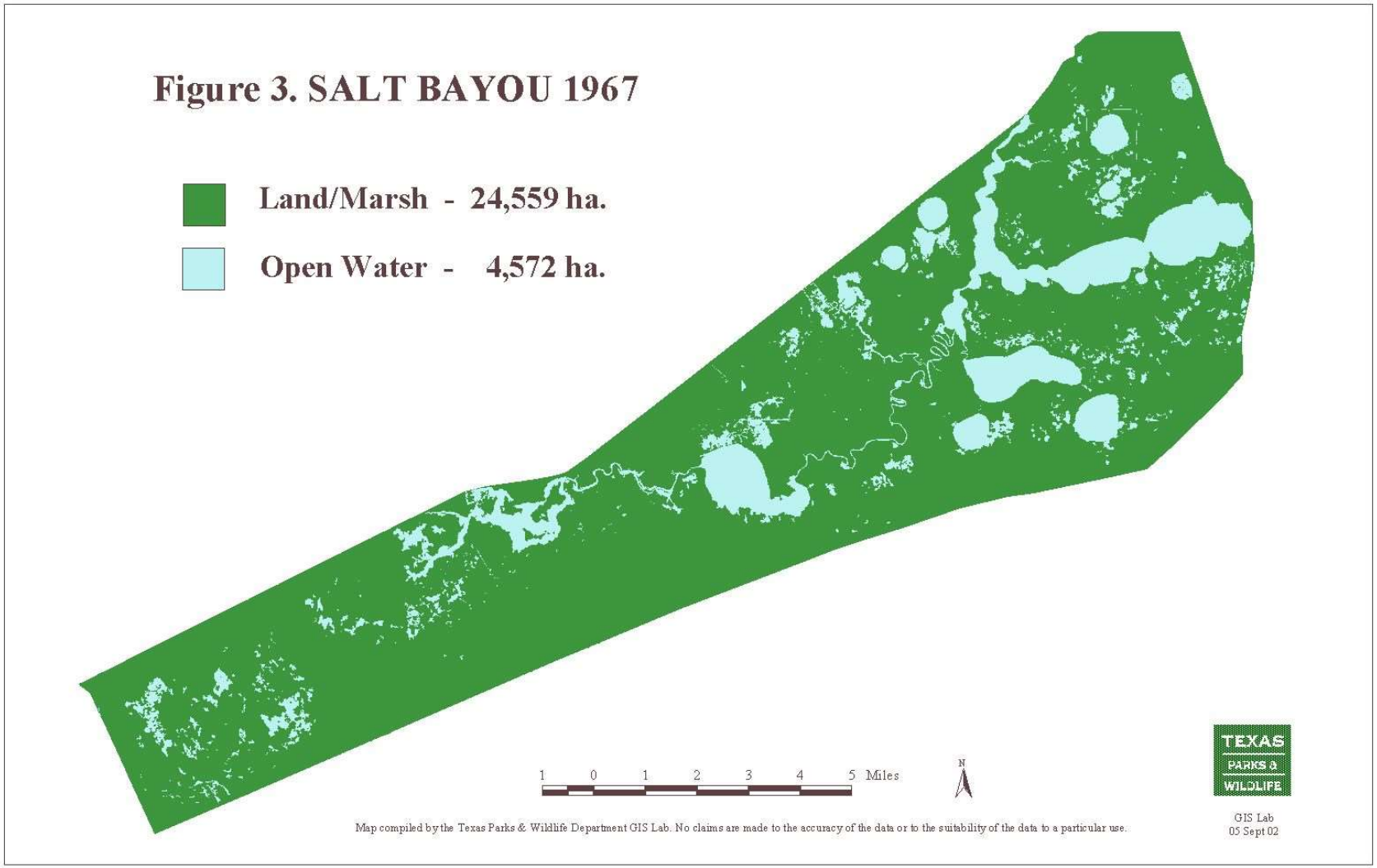
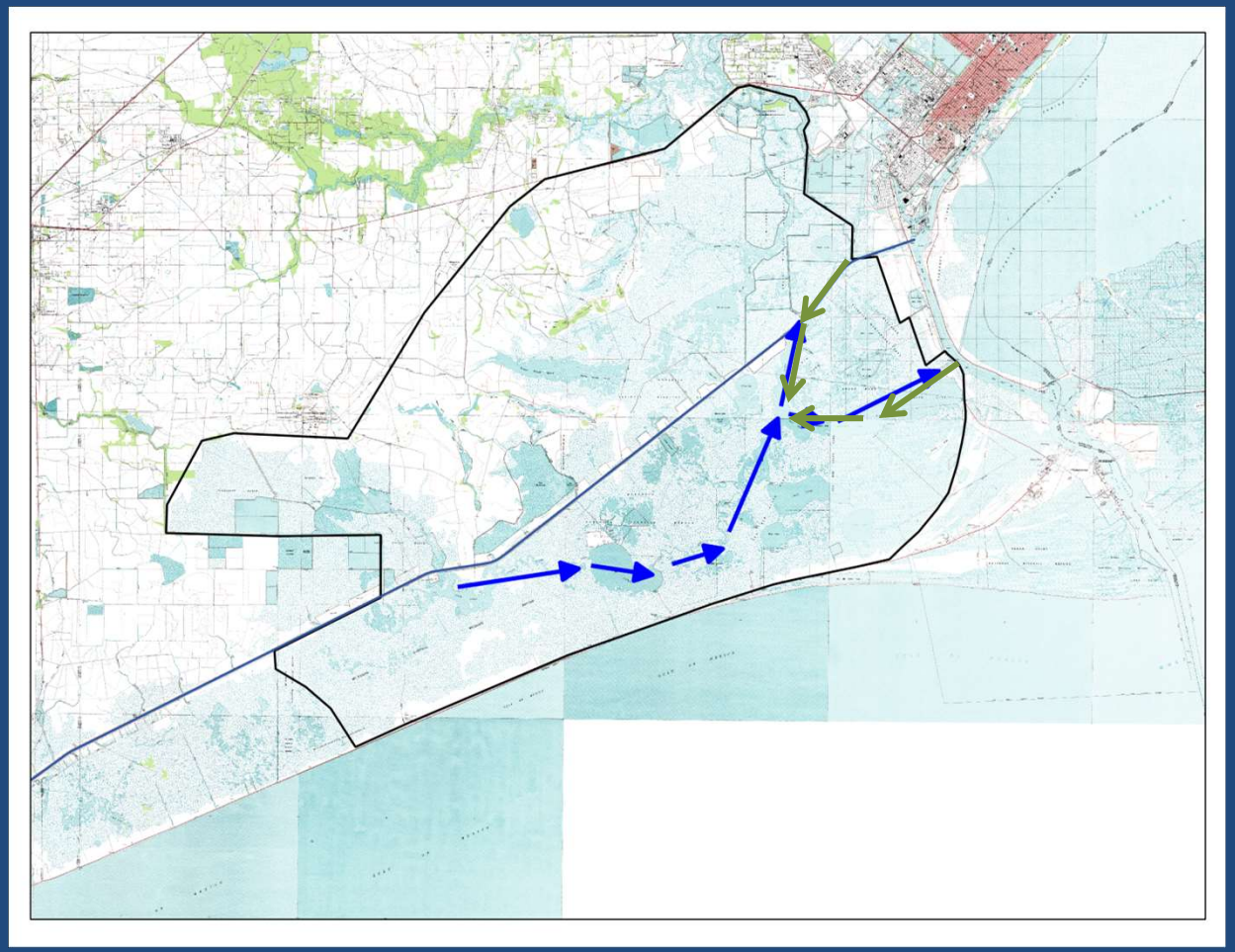


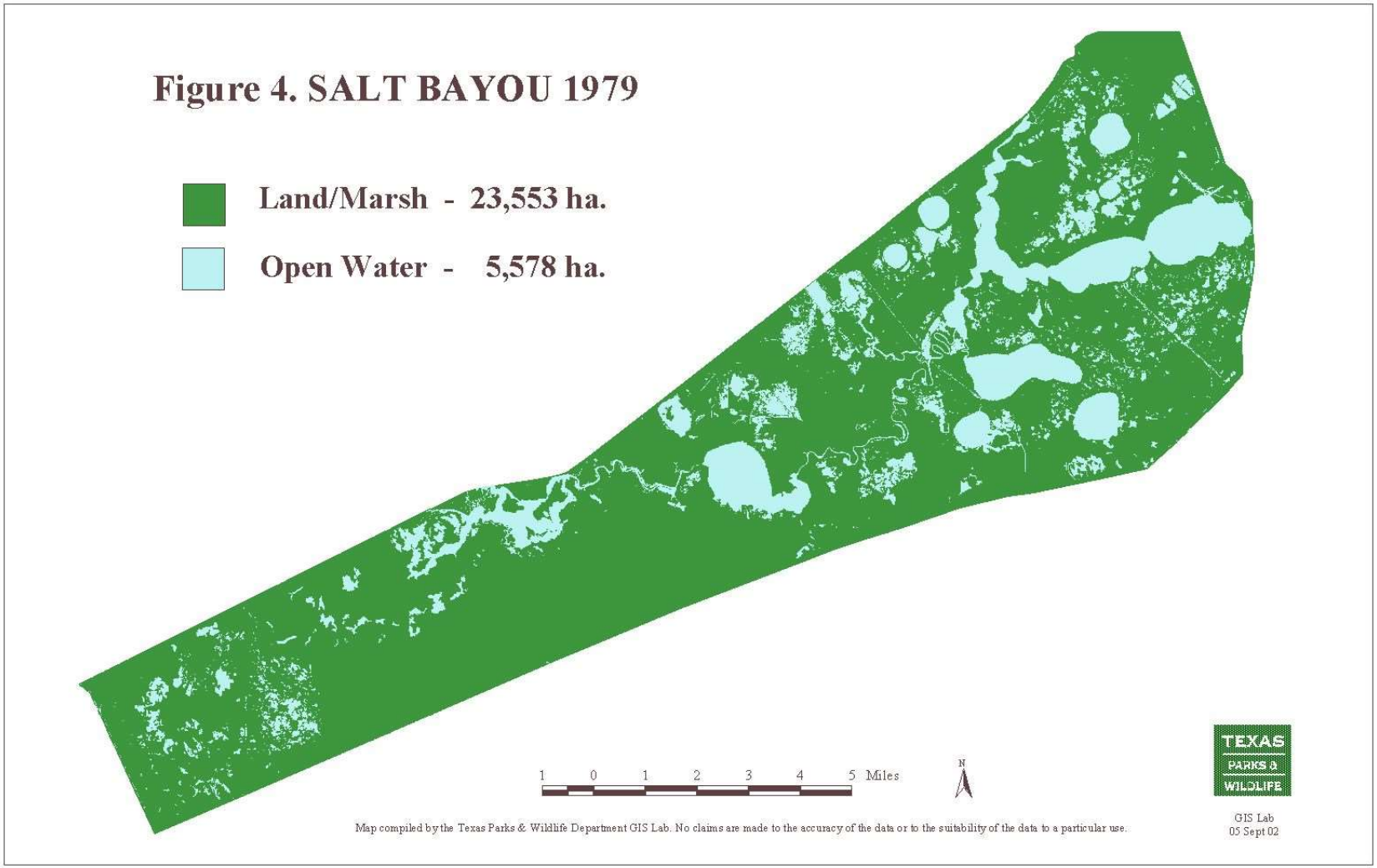
Keith Lake Fish Pass

Keith Lake Fish Pass opened in 1977

- Immediately increased amounts of salt water from shipping channel entering the system.
- Made the formerly intermediate to fresh system brackish to intermediate and tidal
- Until Salt Bayou Structure was built in 1995, salt water entered from 2 points.



Watershed's Response to KLFP



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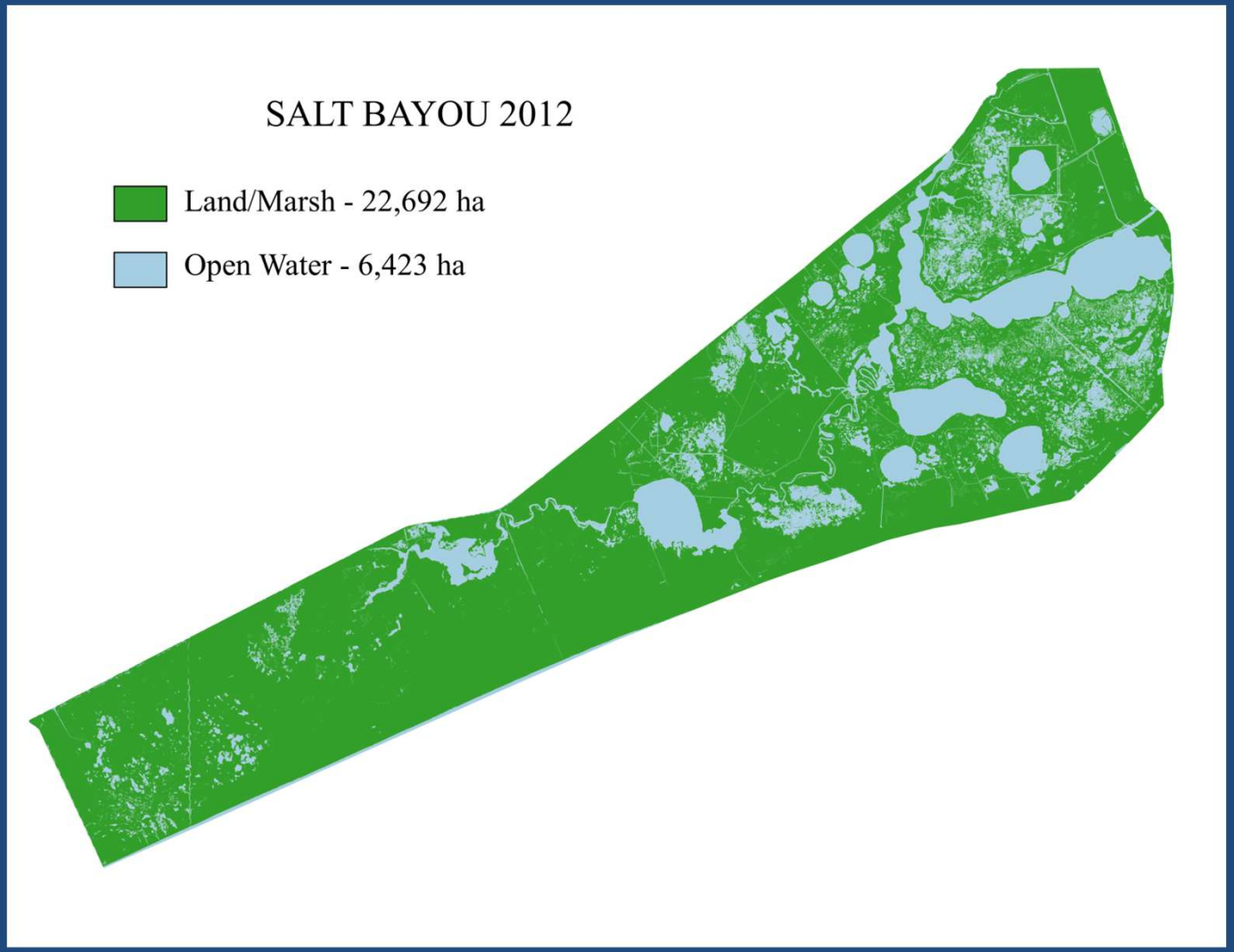
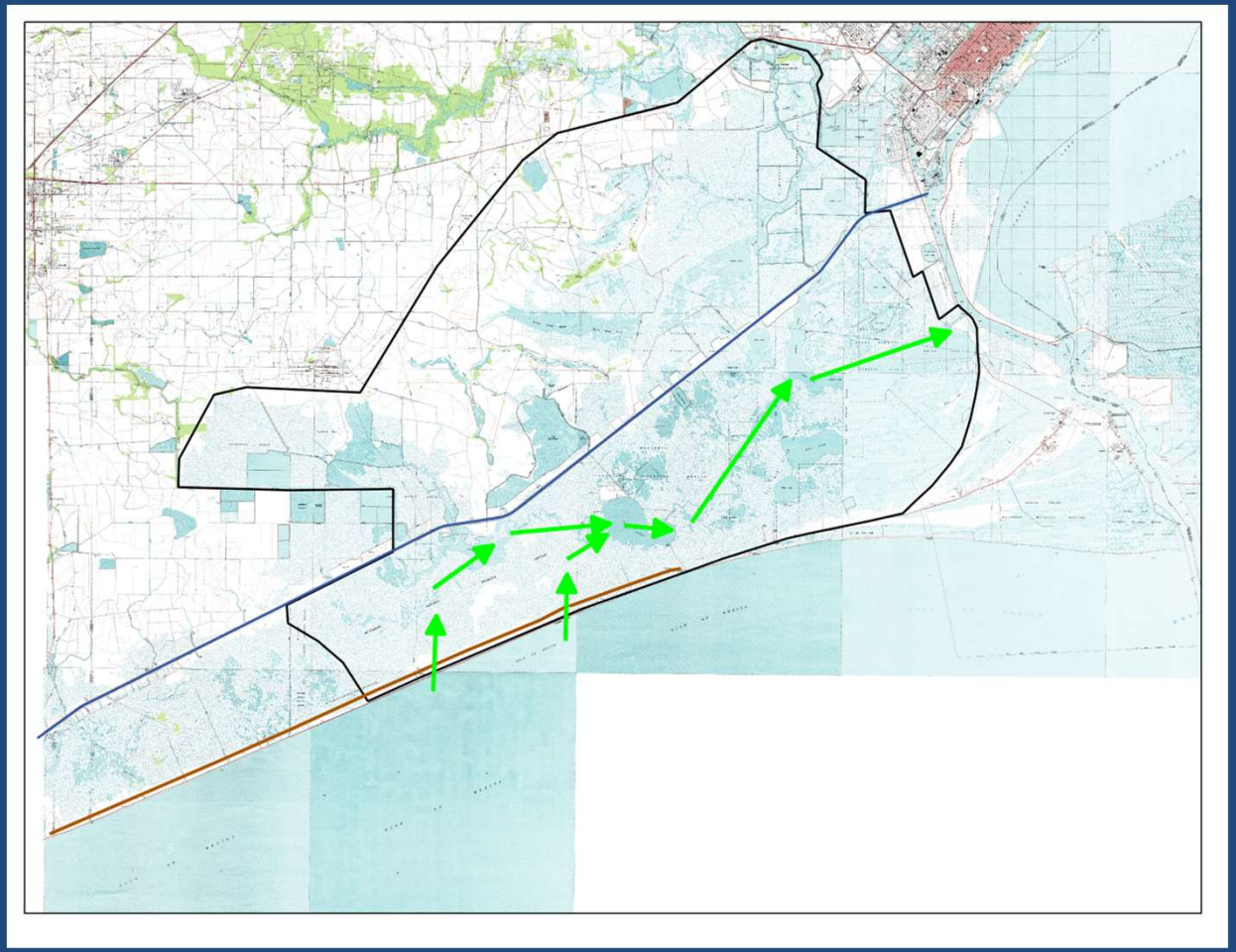


Erosion of Beach Ridge and Dunes

Beach Ridge and Dune system

- Prevented gulf water from entering system except during storm tides
- Are starved for material because of jetties, damming of rivers, and deep channels carrying material far into the gulf.
- Shoreline eroding from 4 to 24 ft per year.
- Most of the ridge and dune system lost after Hurricane Ike
- Sea water now enters the system several times a year (more frequently than historic overtopping rates).



Watershed Response to Eroding Beach Ridge and Dunes

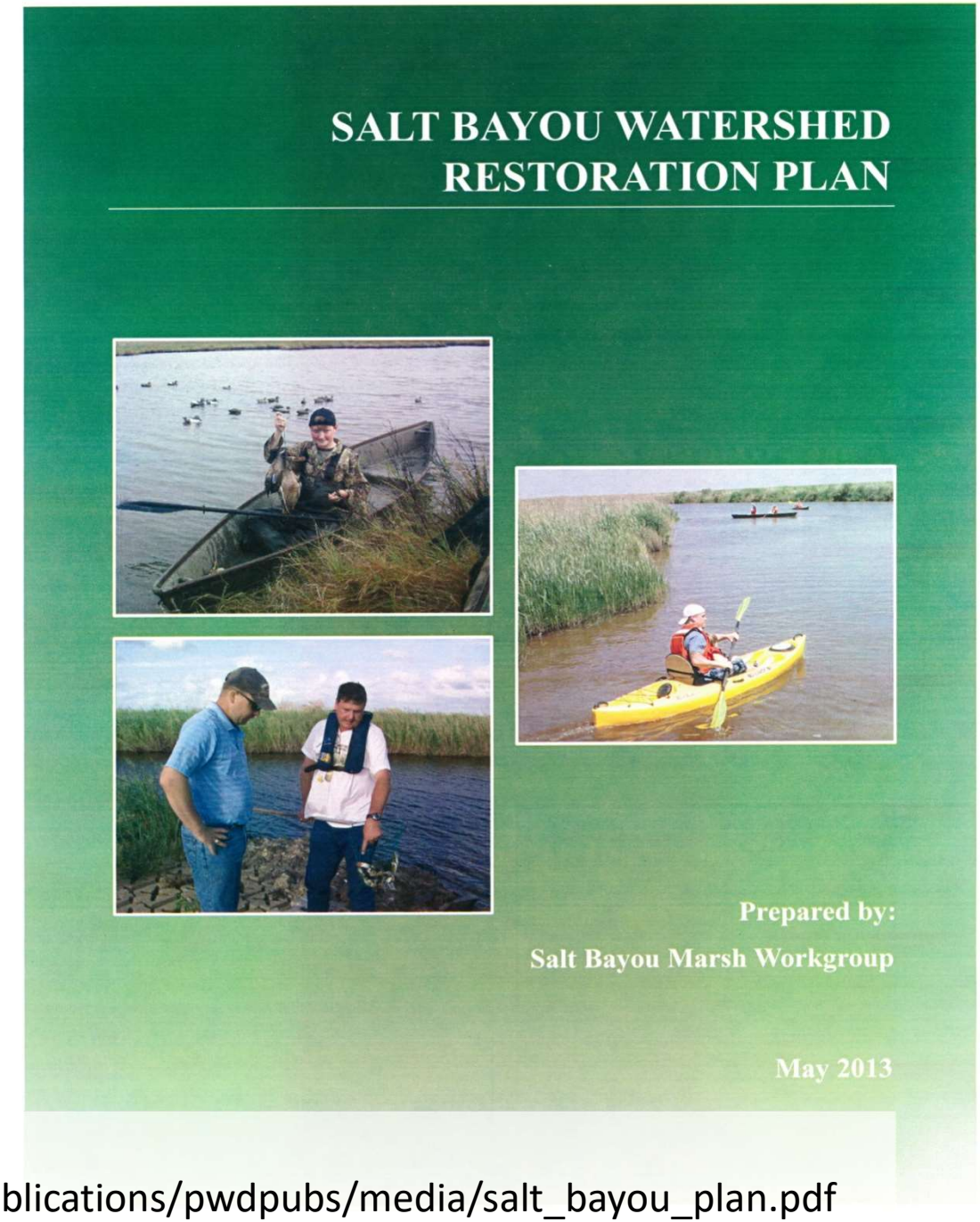
- More frequent overwash of gulf waters
- Large “slugs” of salt water entering predominately fresh to intermediate marsh
- Large-scale die-offs of submerged aquatic vegetation
- Stressed emergent marsh vegetation
- Rapid degradation of habitat quality preceding winter migrations

Poll Question

- What approach seems intuitively more likely to effect restoration to the affected landscape?
  A. Each landowner does their own thing.
  B. Try random solutions in random locations to see which one(s) work.
  C. All landowners agree to do the same things on their land.
  D. Use best available science and modelling to find landscape level solutions.

Salt Bayou Marsh Work Group members:

- Jefferson County Engineering
- Drainage District 6
- Texas Parks and Wildlife
- US Fish and Wildlife
- Ducks Unlimited
- NOAA Fisheries Habitat Conservation Division
- Texas General Land Office
- Texas Water Development Board
- US Army Corps of Engineers



Available for download at:
http://www.tpwd.state.tx.us/publications/pwdpubs/media/salt_bayou_plan.pdf

Watershed Restoration Approach

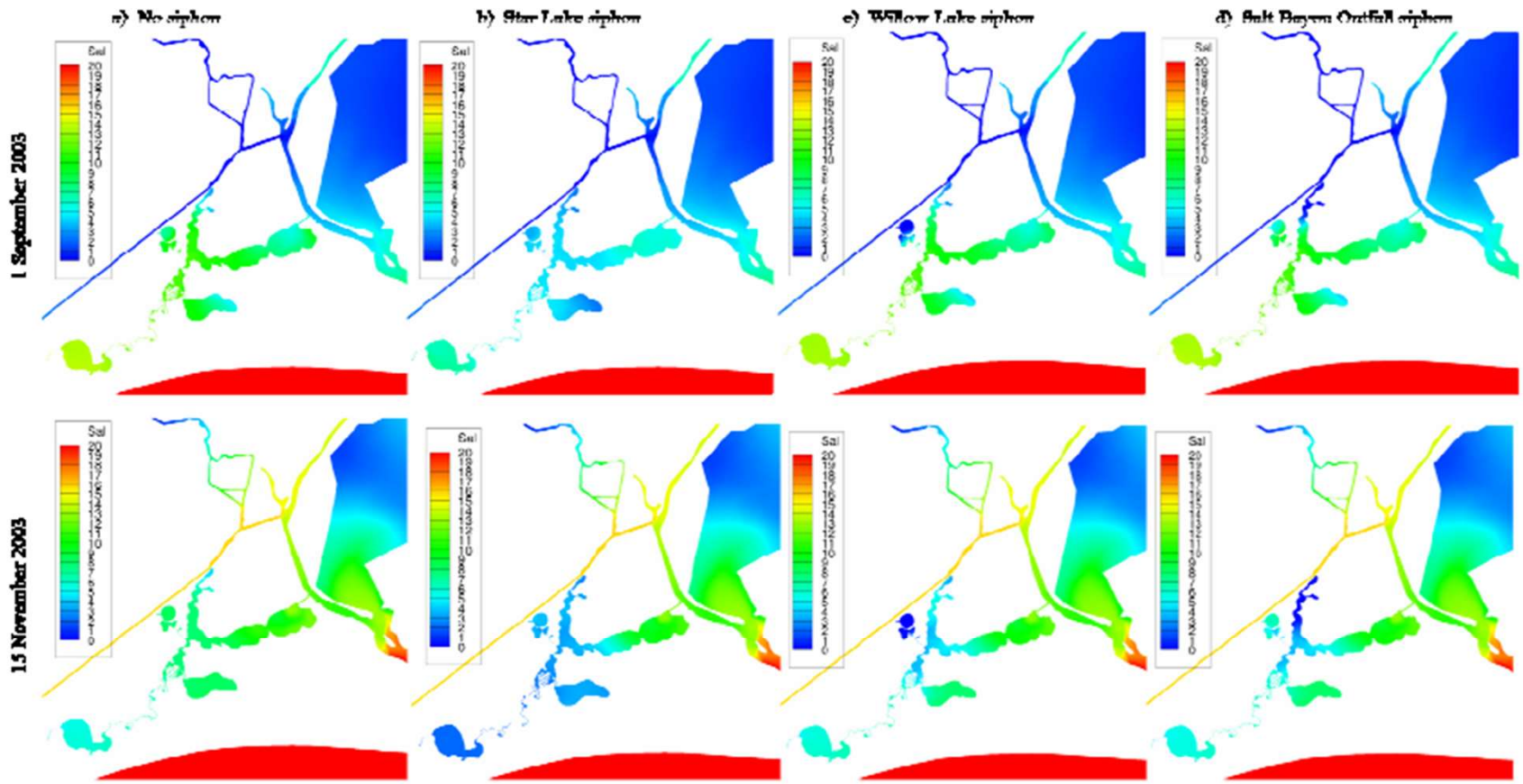
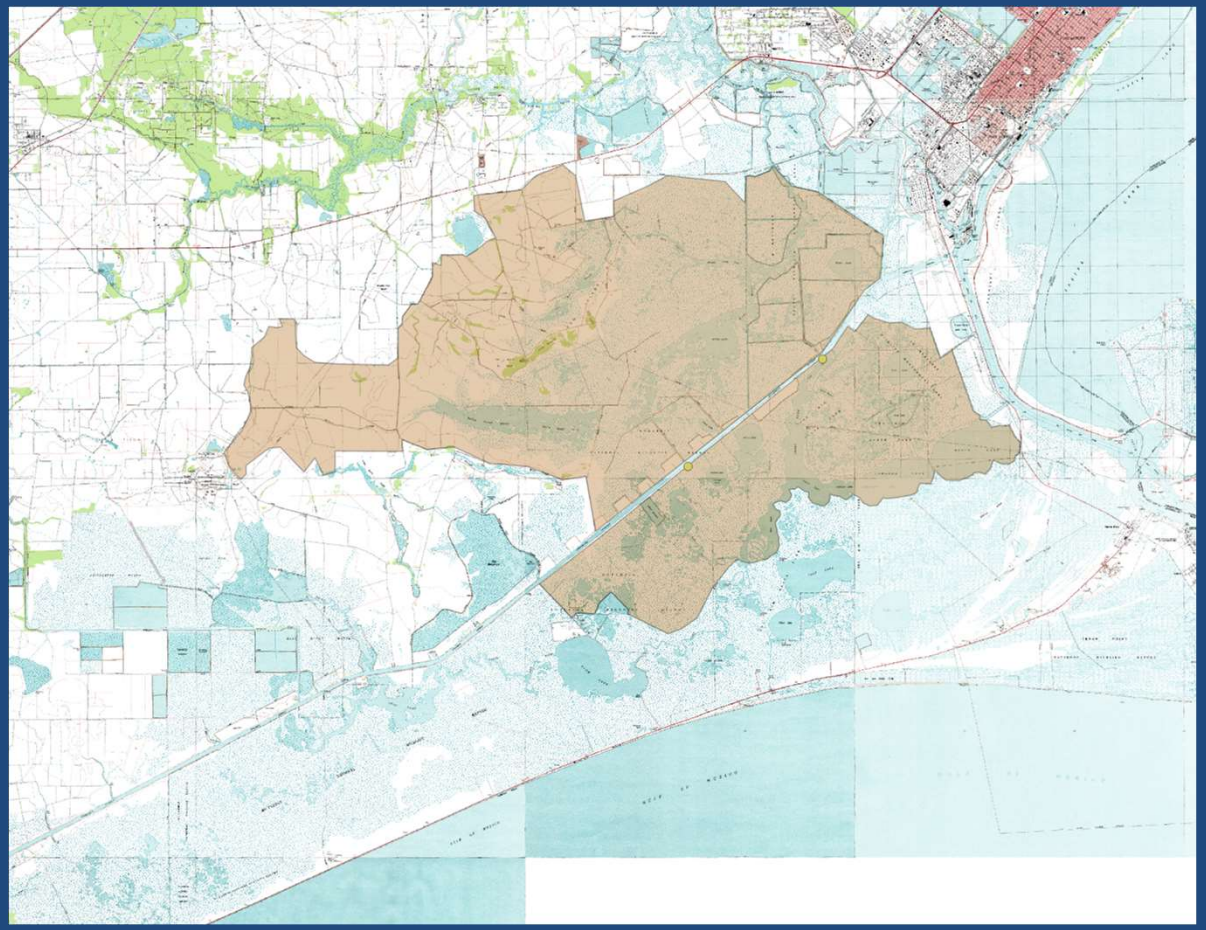


Figure 5.9 Model simulated salinity on September 1 (top row) and November 15, 2003 (bottom row) for Salt Bayou under four siphon-location scenarios; (a) no siphon, (b) Star Lake siphon, (c) Willow Lake siphon, and (d) Salt Bayou Outfall siphon. Siphon flow rates were held constant at 1.42m^3/s.

Watershed Restoration Approach

Inverted siphons on McFaddin NWR and J. D. Murphree WMA

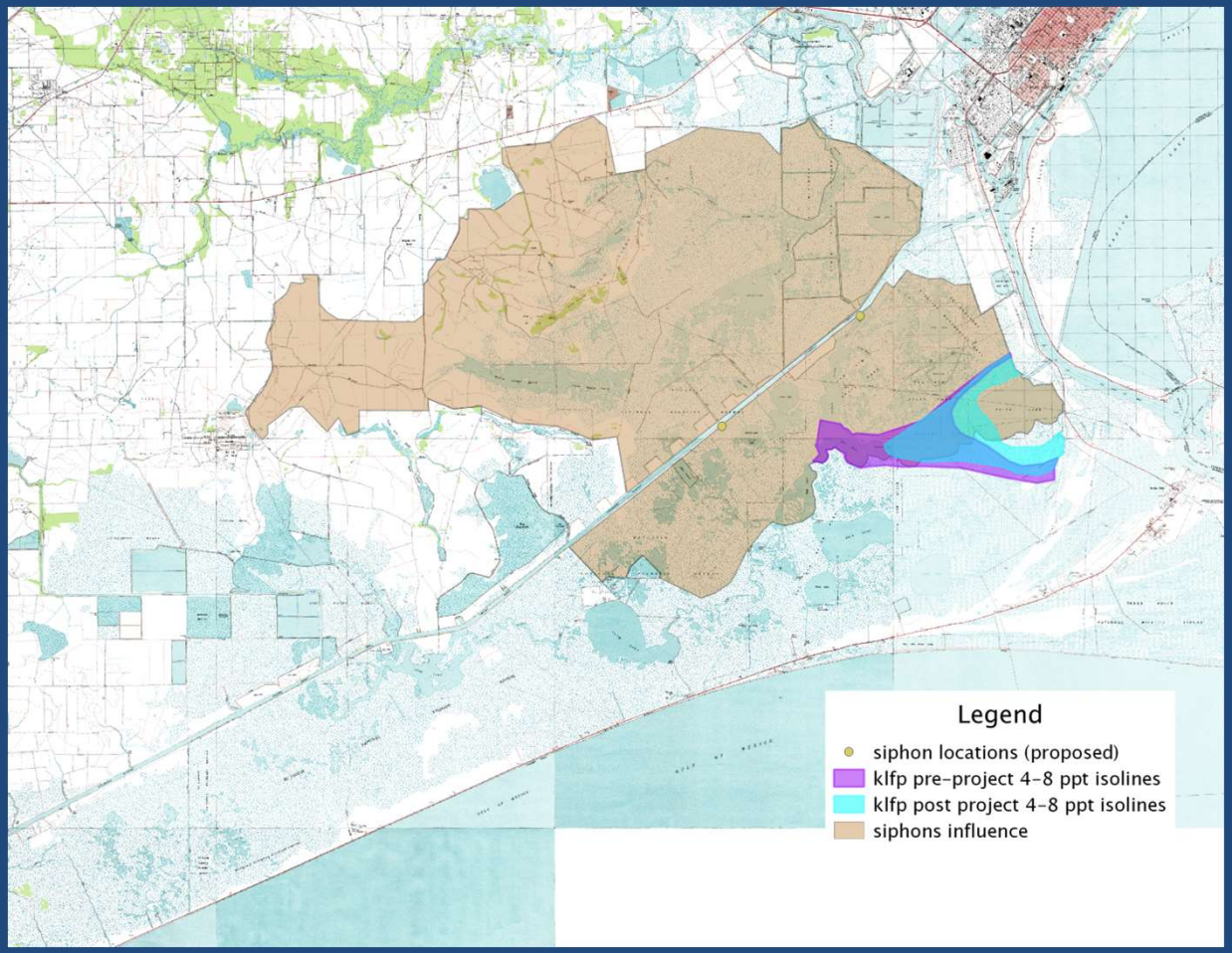
- Move excess freshwater from marshes north of GIWW
- Discharge freshwater in a way that distributes to maximum benefit
- Will have greatest effect on McFaddin NWR
  - Higher in historic drainage pattern
  - Farthest from direct salt water influence



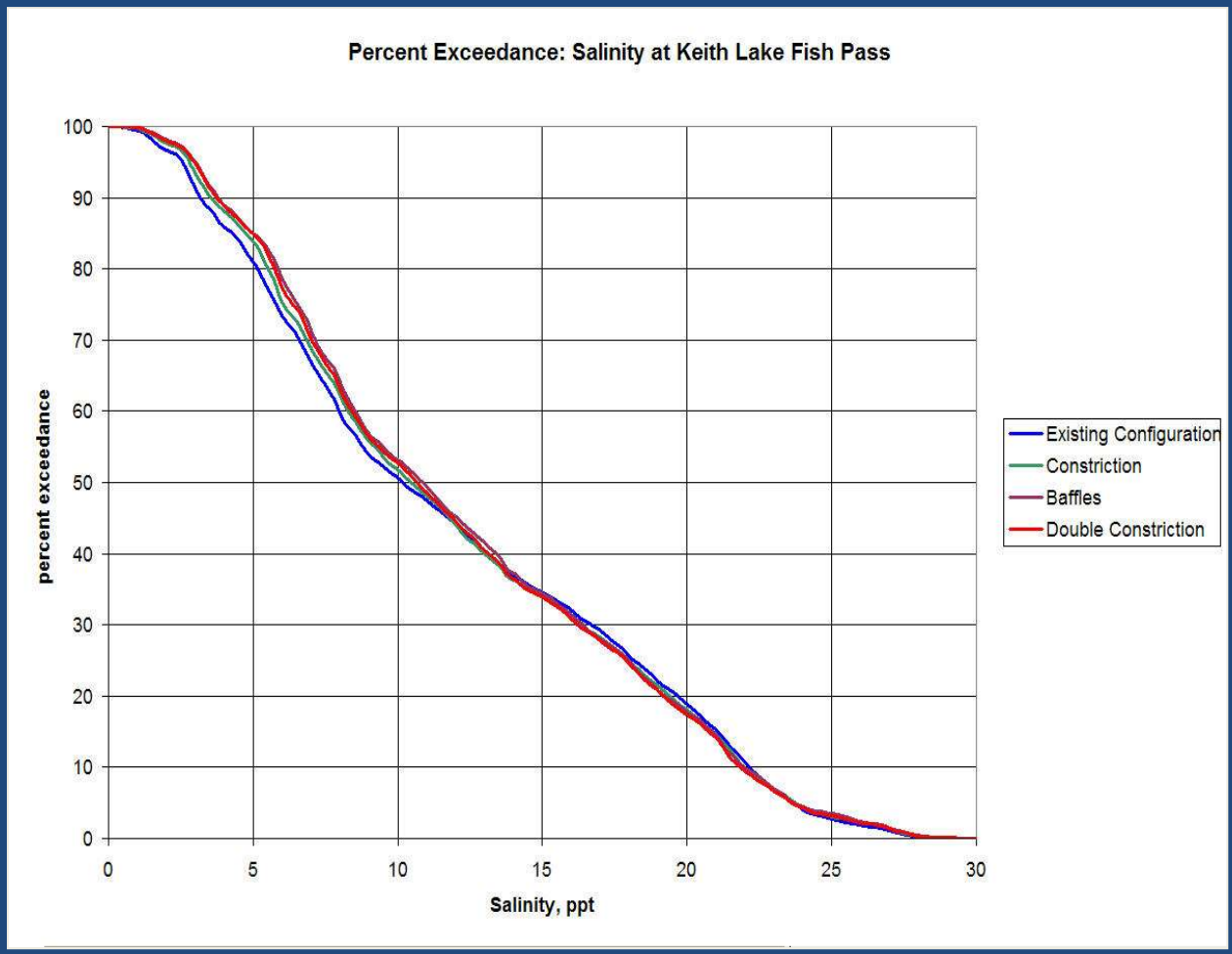
Watershed Restoration Approach

Add Keith Lake Fish Pass Modification Project

- Reduces amounts of salt water entering daily
- Reduces salinity exceedances within Keith and Johnson Lakes and surrounding marsh
- Reduces head pressure of salt water, allowing freshwater from siphons to move deeper into system



Salinity Percent Exceedance Analysis



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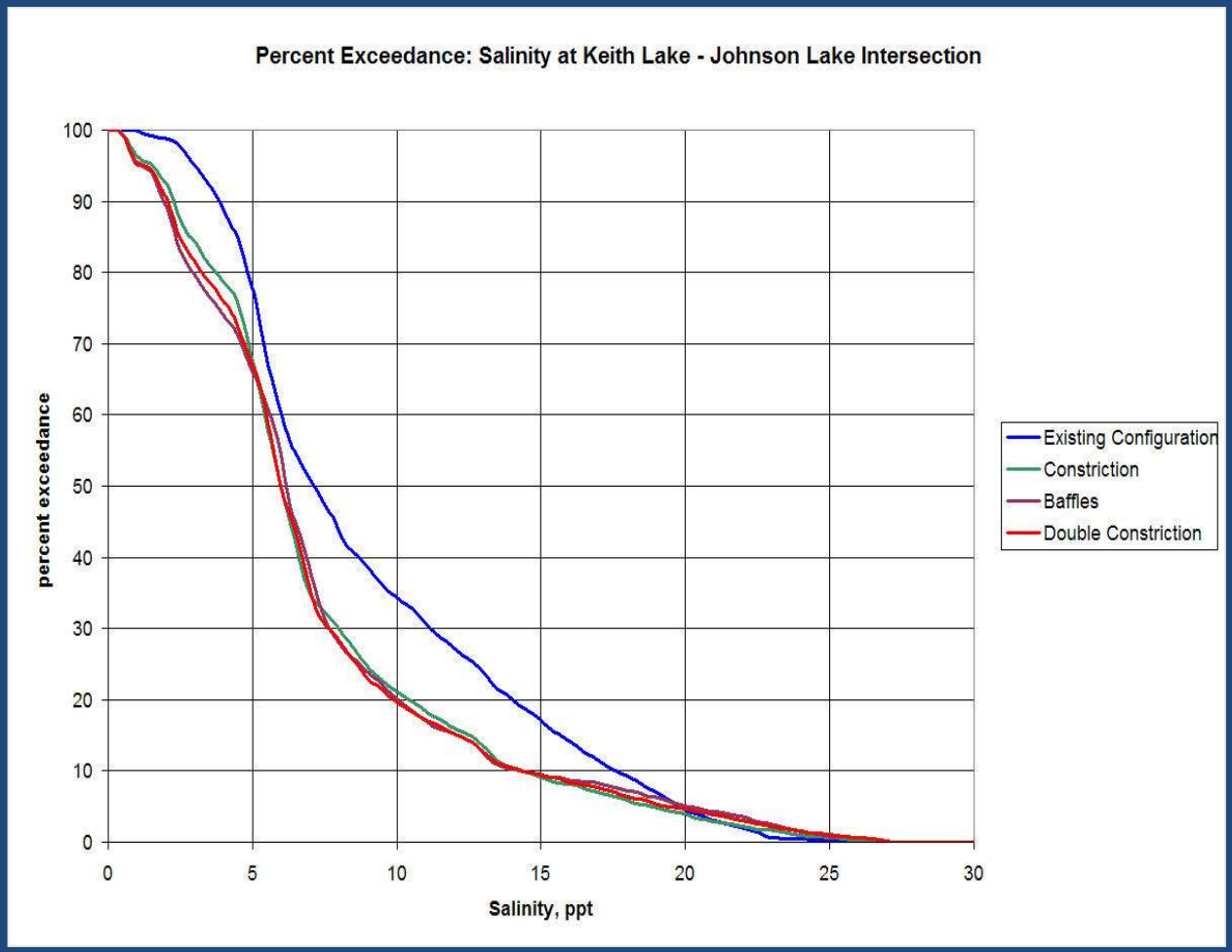

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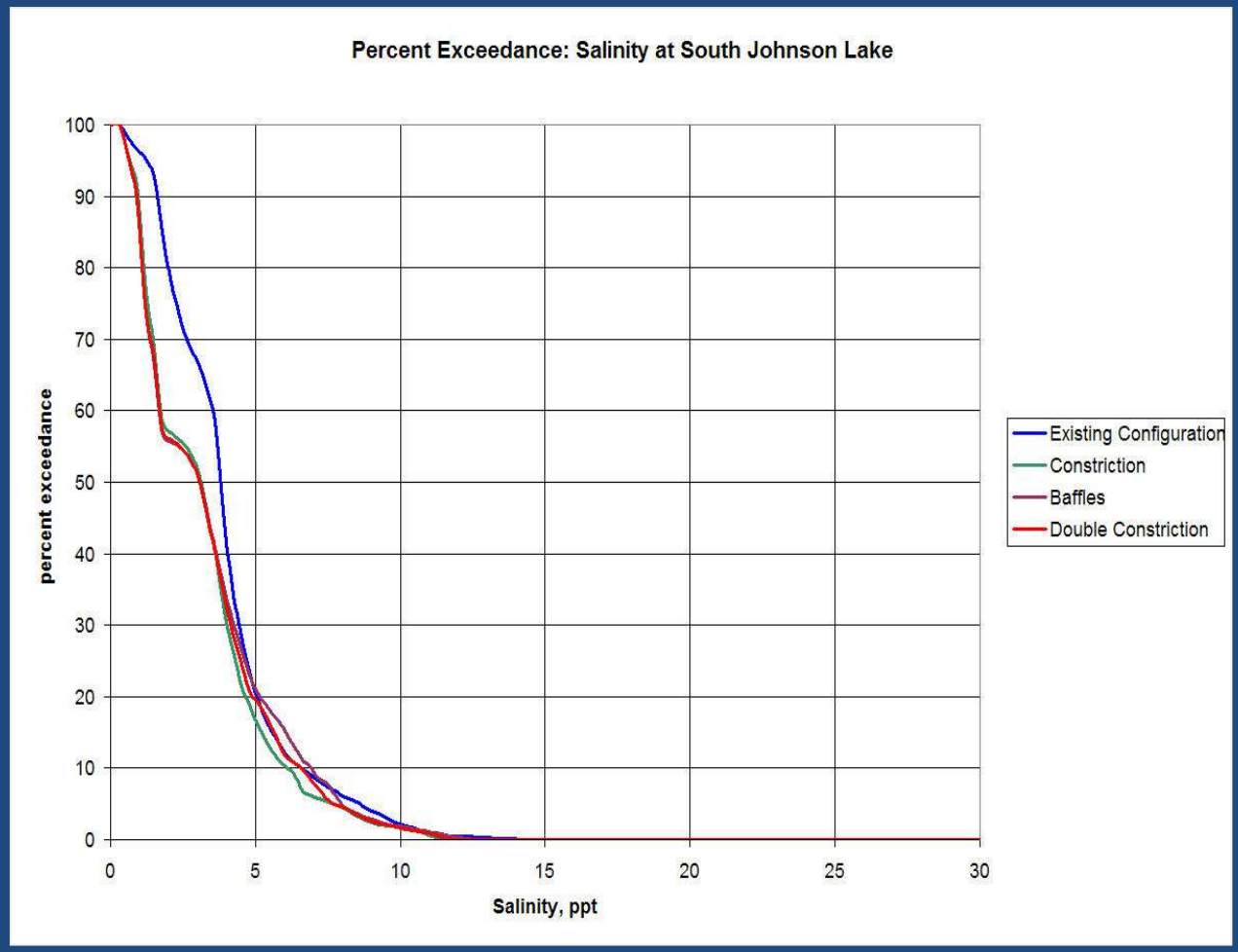

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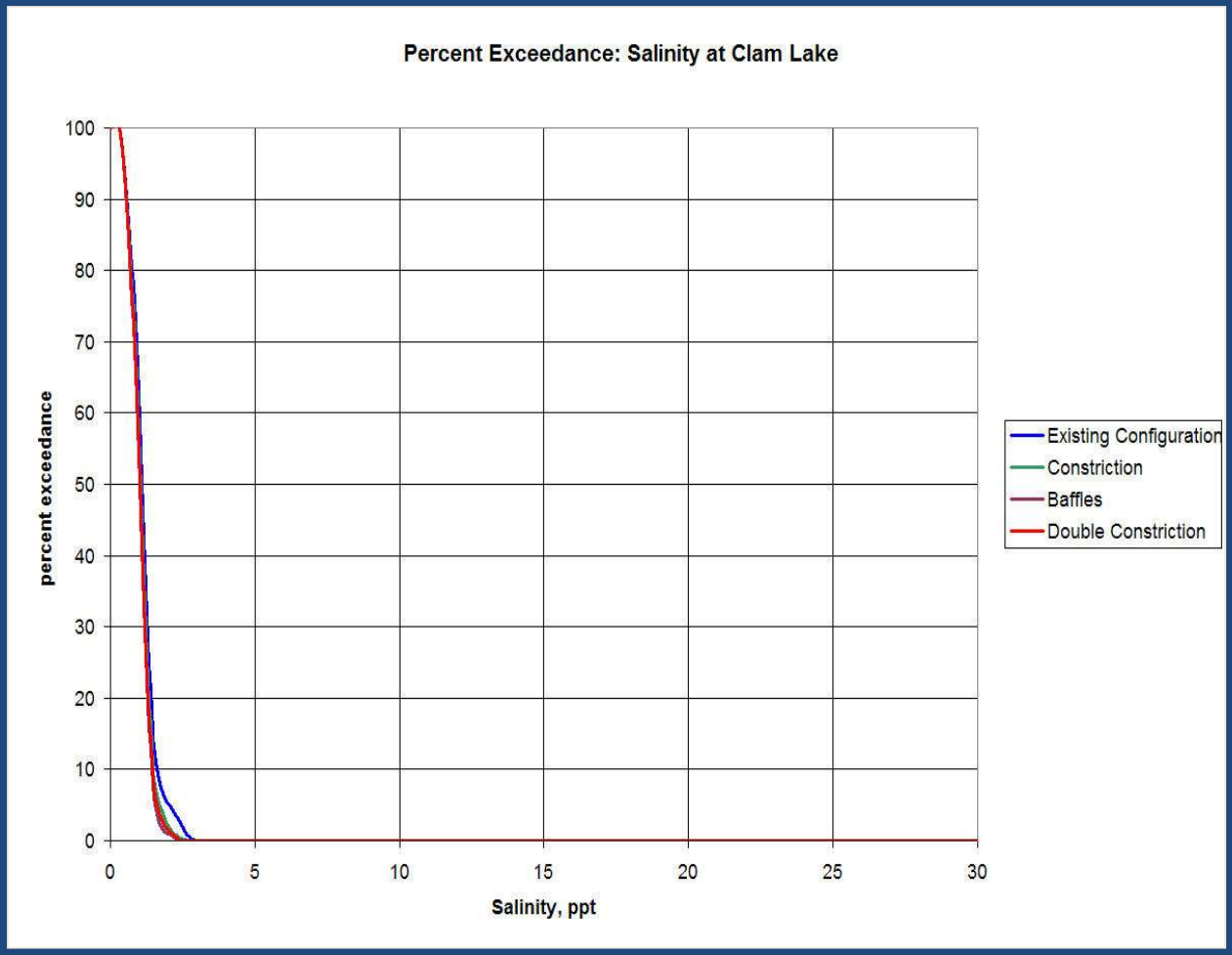


Reduction in Salinity

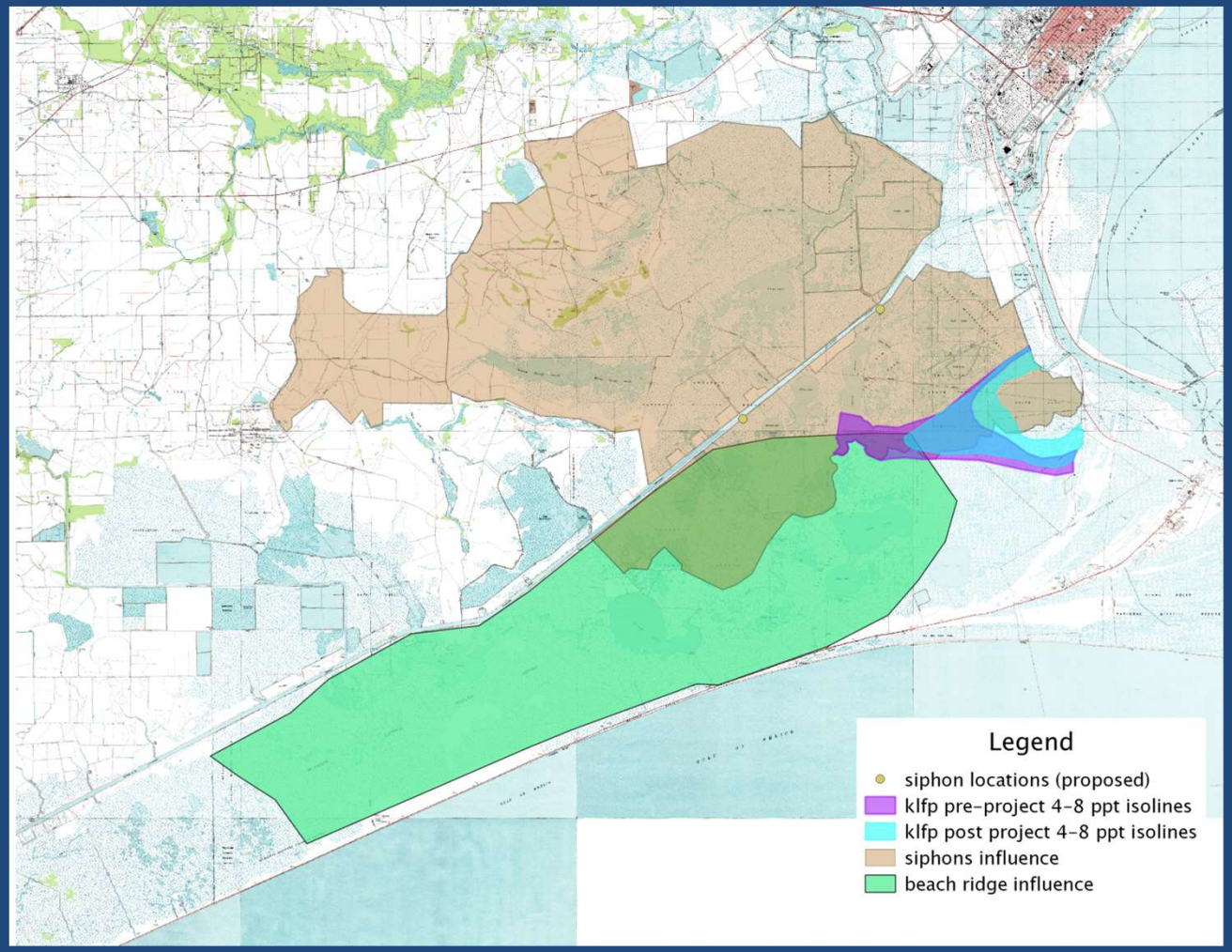
Model predictions for percent of time salinity at each location exceeds 10 ppt within a given year of average precipitation.

Modeled Location	Pre-Project	Post Project
Keith Lake Fish Pass	51	52
Keith-Johnson Lake Intersection	35	21
South Johnson Lake	5	4
Clam Lake	0	0

Watershed Restoration Approach

Beach Ridge and Dune Restoration

- Prevents frequent overwash of gulf waters into system
- Protects fresh to intermediate vegetation from salt stress
- Helps stabilize annual salinity patterns (reduces spikes).



Where are we now?

- Keith Lake Fish Pass
  - Project completed in March 2015
- Siphons
  - Project completed in June 2020
- Beach ridge
  - 3 mile test project completed in 2017
  - Funding is available for rest of planned project

How did we get here?

- Assembled experts
- Documented conditions
  - Historic
  - Current
- Understand alterations to system
- Worked toward common, reachable goals
- “Tweakable” solutions
- Assembled a comprehensive plan