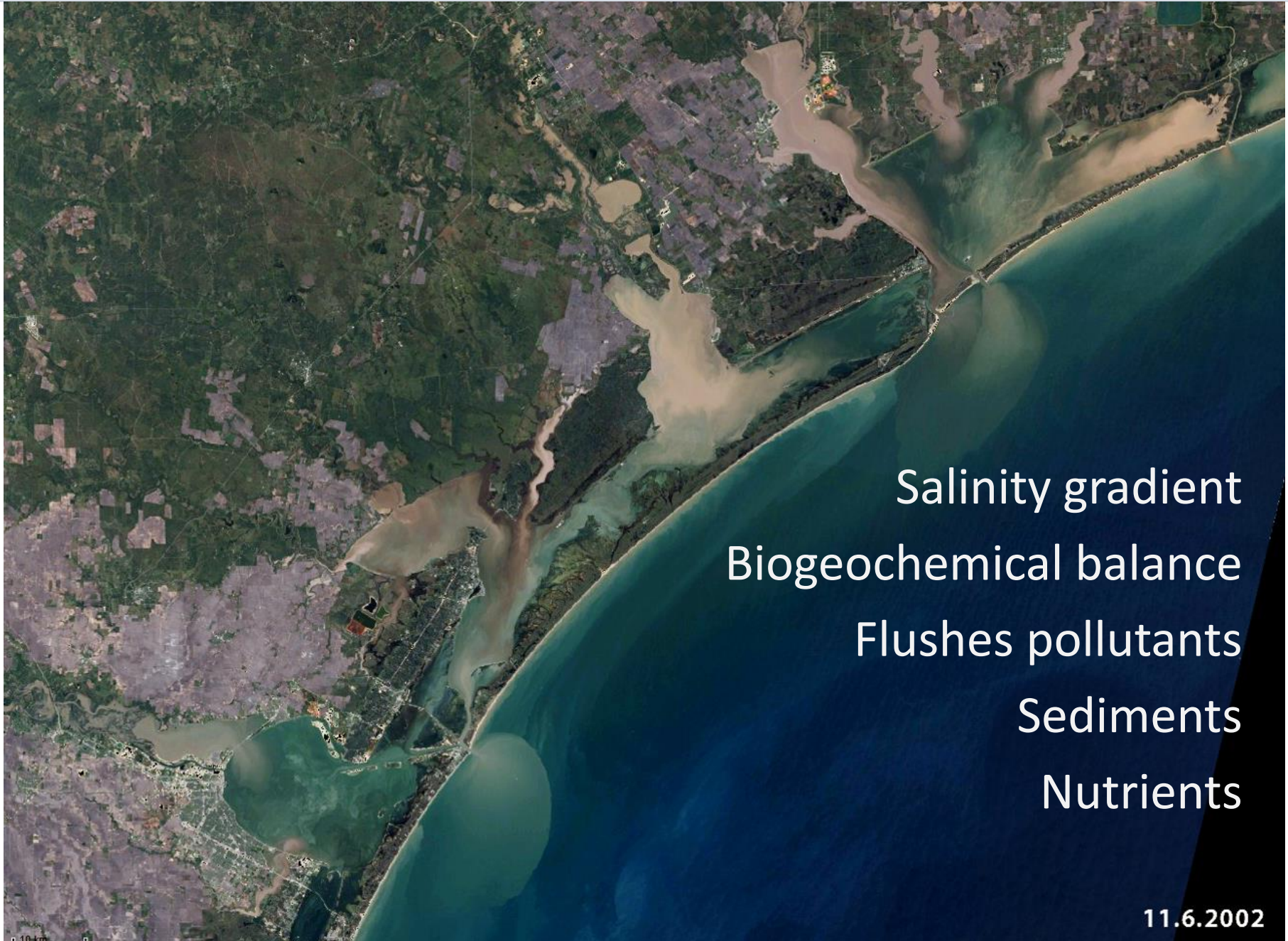


From Droughts to Floods: An Overview of Freshwater Inflows to the Trinity-San Jacinto Estuary

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Texas Water Development Board
November 28, 2017

The statements contained in this presentation are my current views and opinions and are not intended to reflect the positions of, or information from, the Texas Water Development Board, nor is it an indication of any official policy position of the Board.

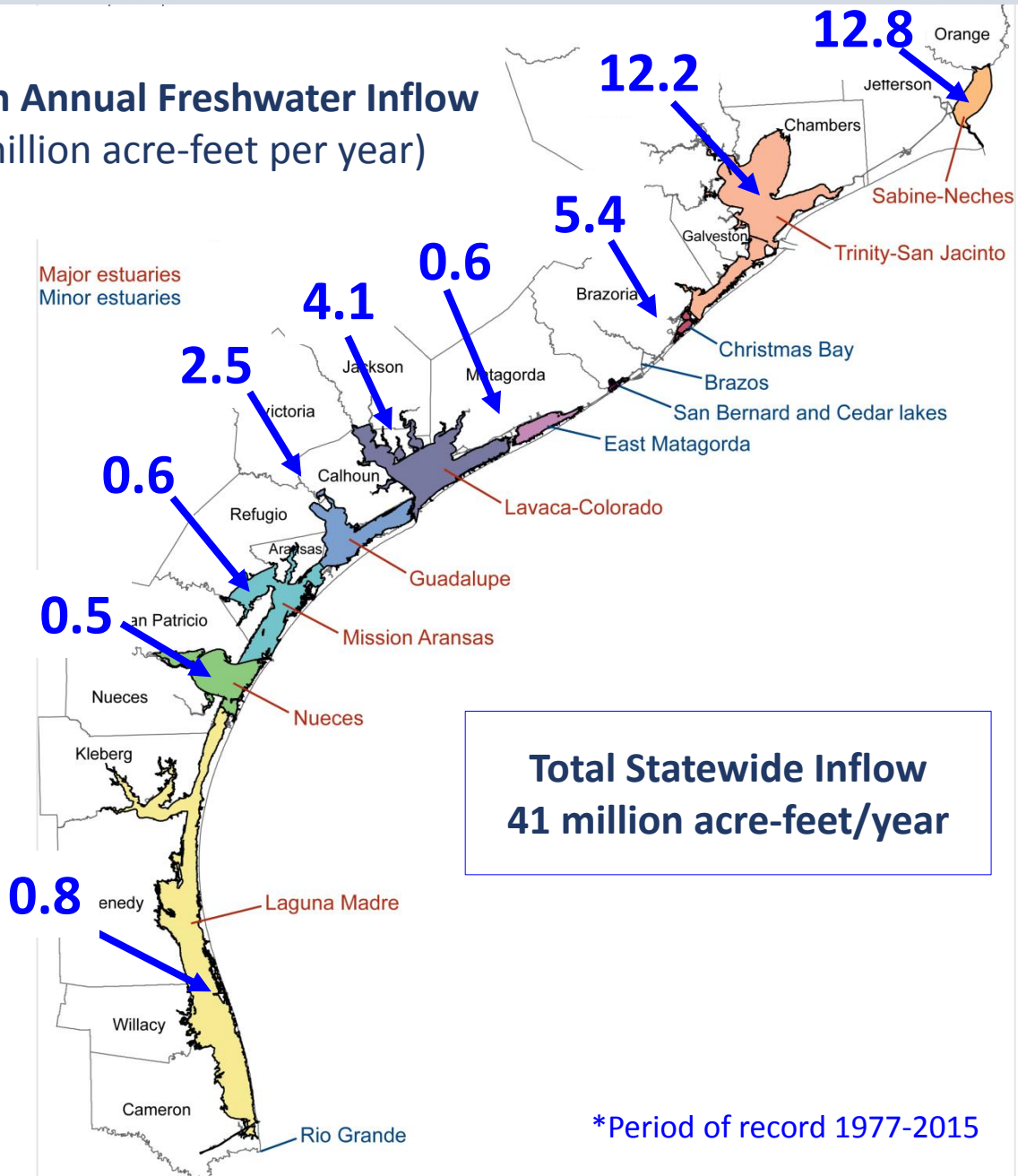
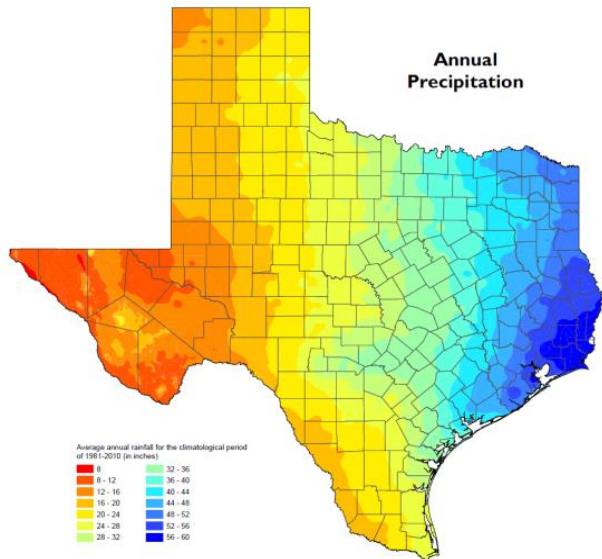
Importance of Freshwater Inflow to an Estuary



Salinity gradient
Biogeochemical balance
Flushes pollutants
Sediments
Nutrients

Coast-wide Freshwater Inflow Gradient

Mean Annual Freshwater Inflow
(million acre-feet per year)



TWDB Coastal Hydrology Dataset

Gaged Watershed Flows

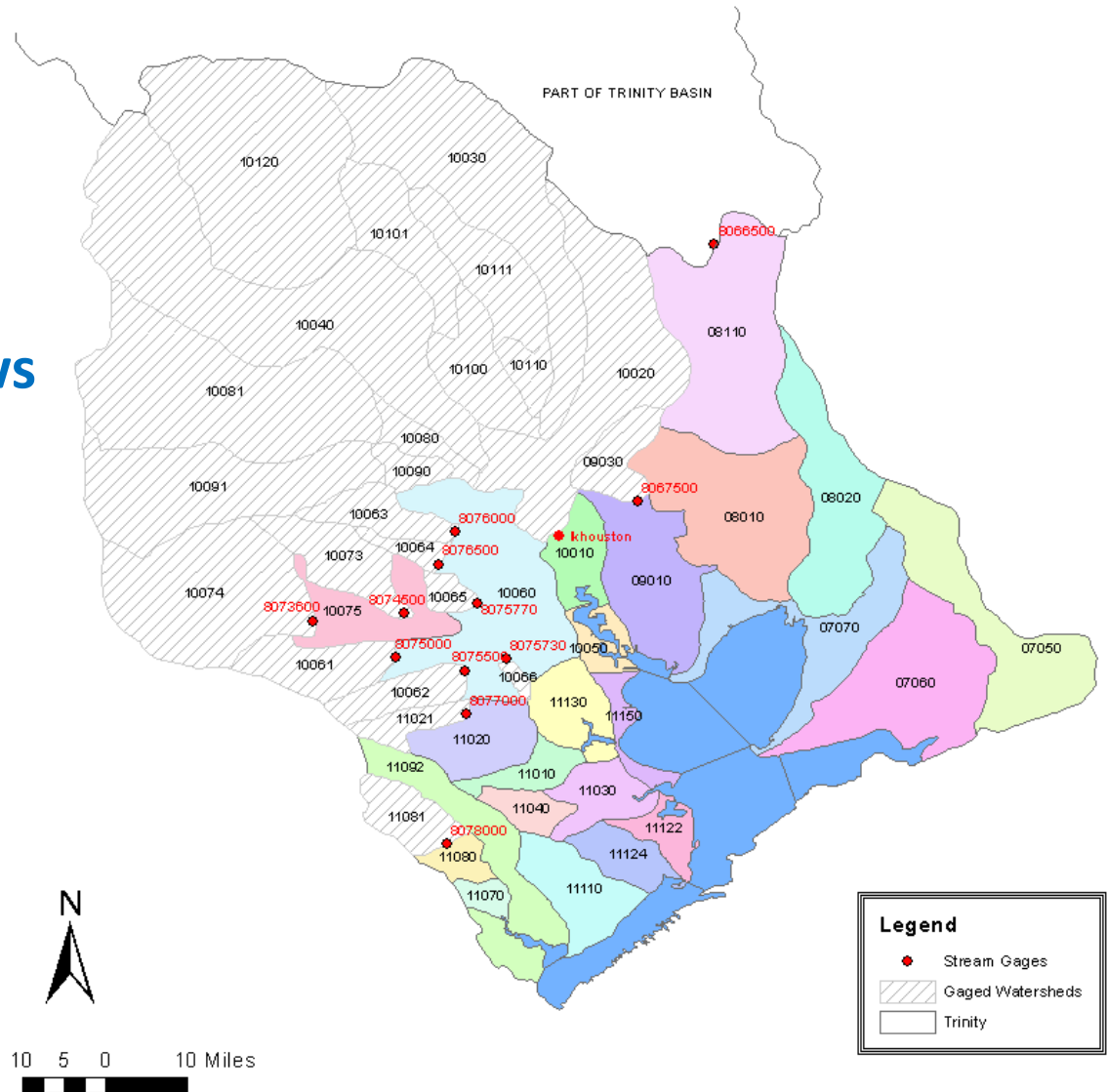
Ungaged Watershed Flows

+ Modeled (TxRR)

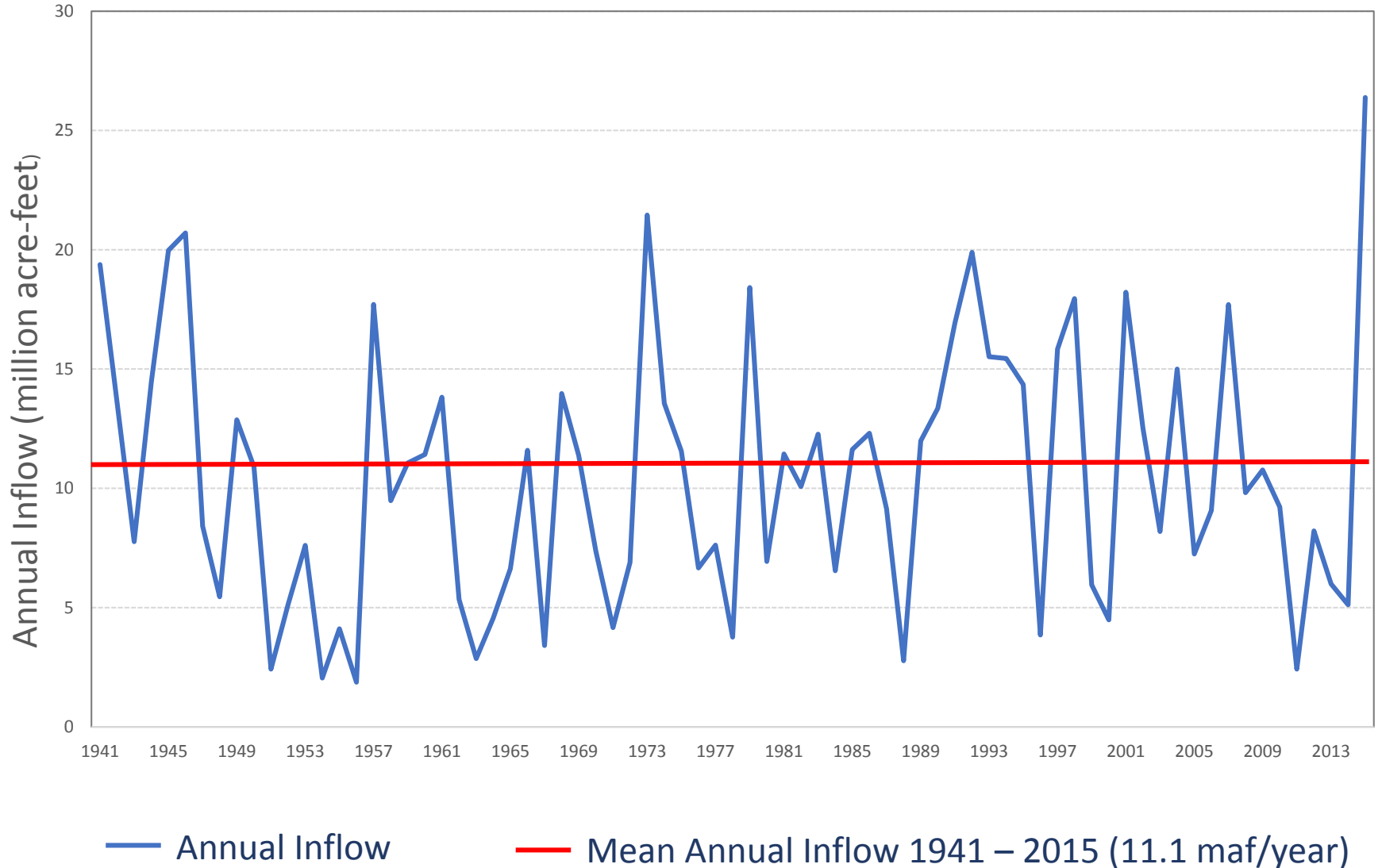
- Diversion

+ Return

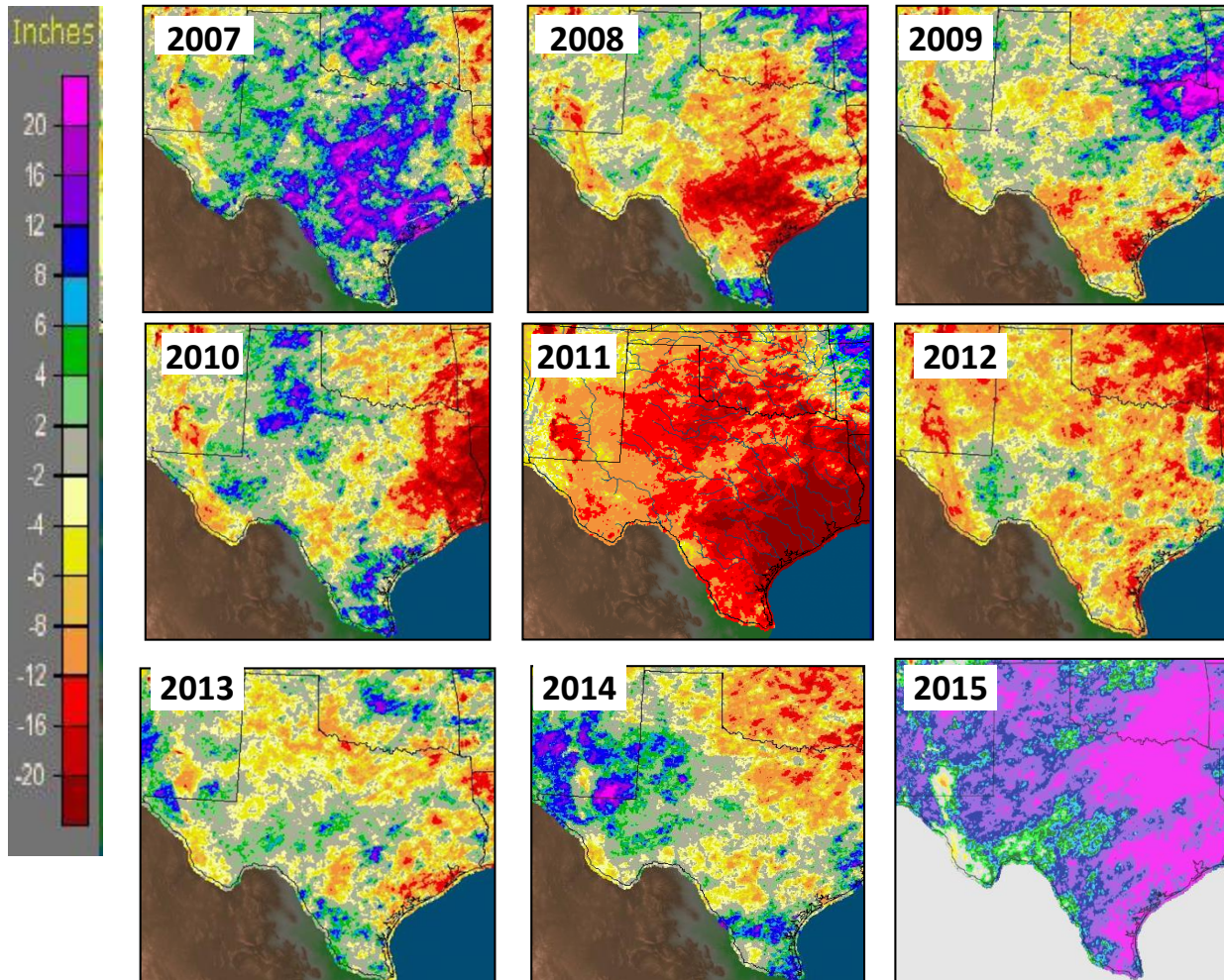
= Surface Inflows to Bay

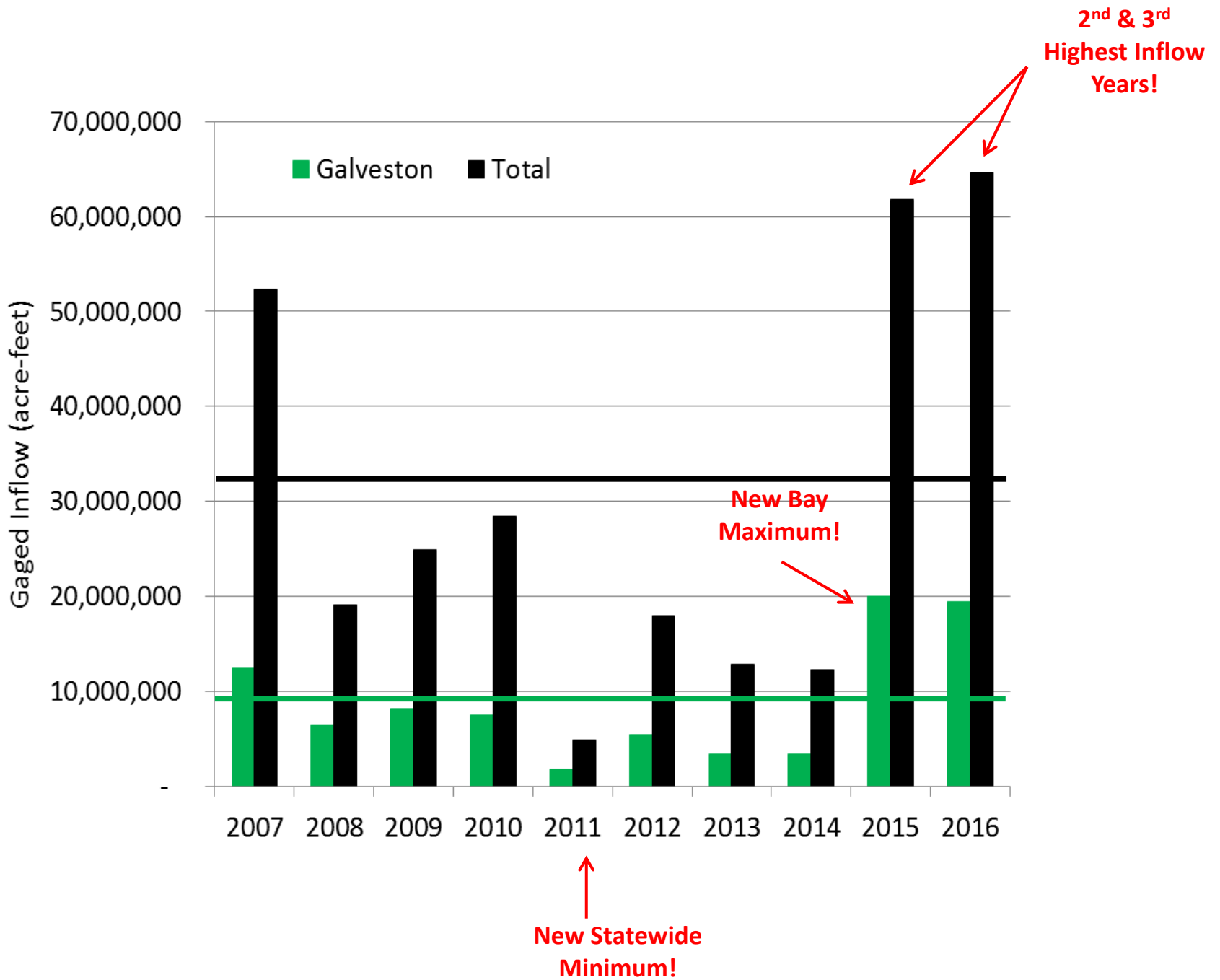


Annual Inflow to the Trinity-San Jacinto Estuary (Galveston Bay) from 1941 - 2015



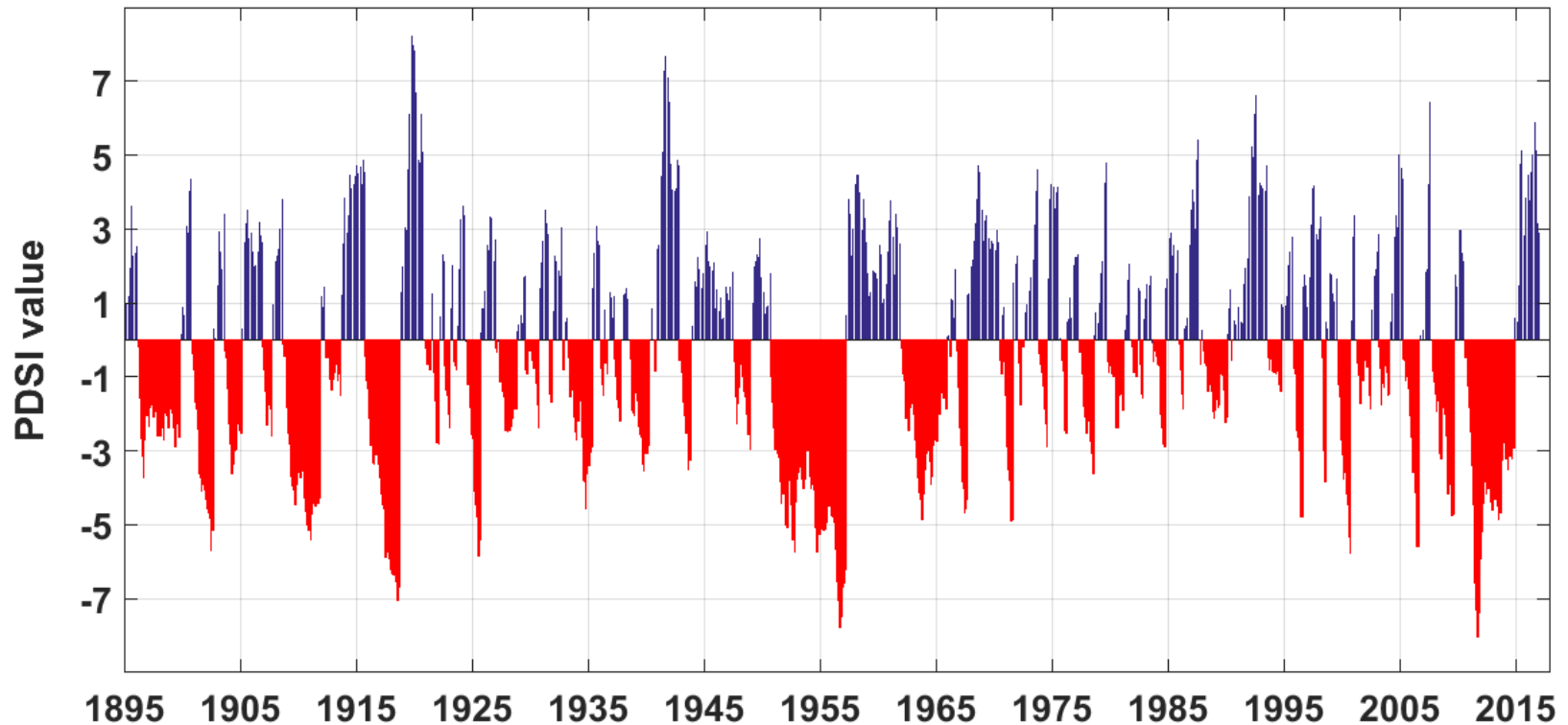
Precipitation, Drought, and Flood





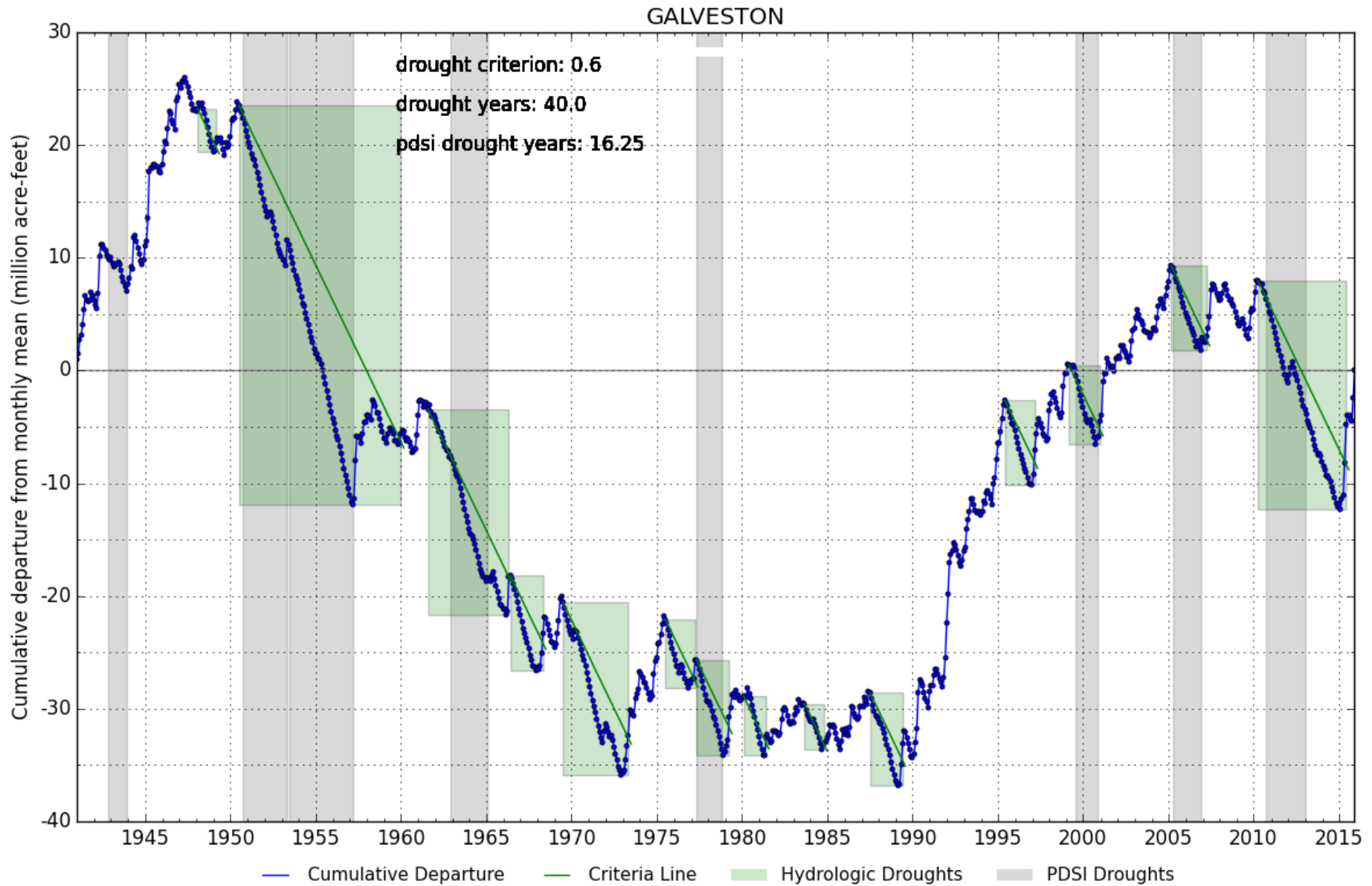
Hydrologic Swings Between Drought and Flood: 1895 - 2015

Monthly Palmer Drought Severity Index (PDSI) over Texas

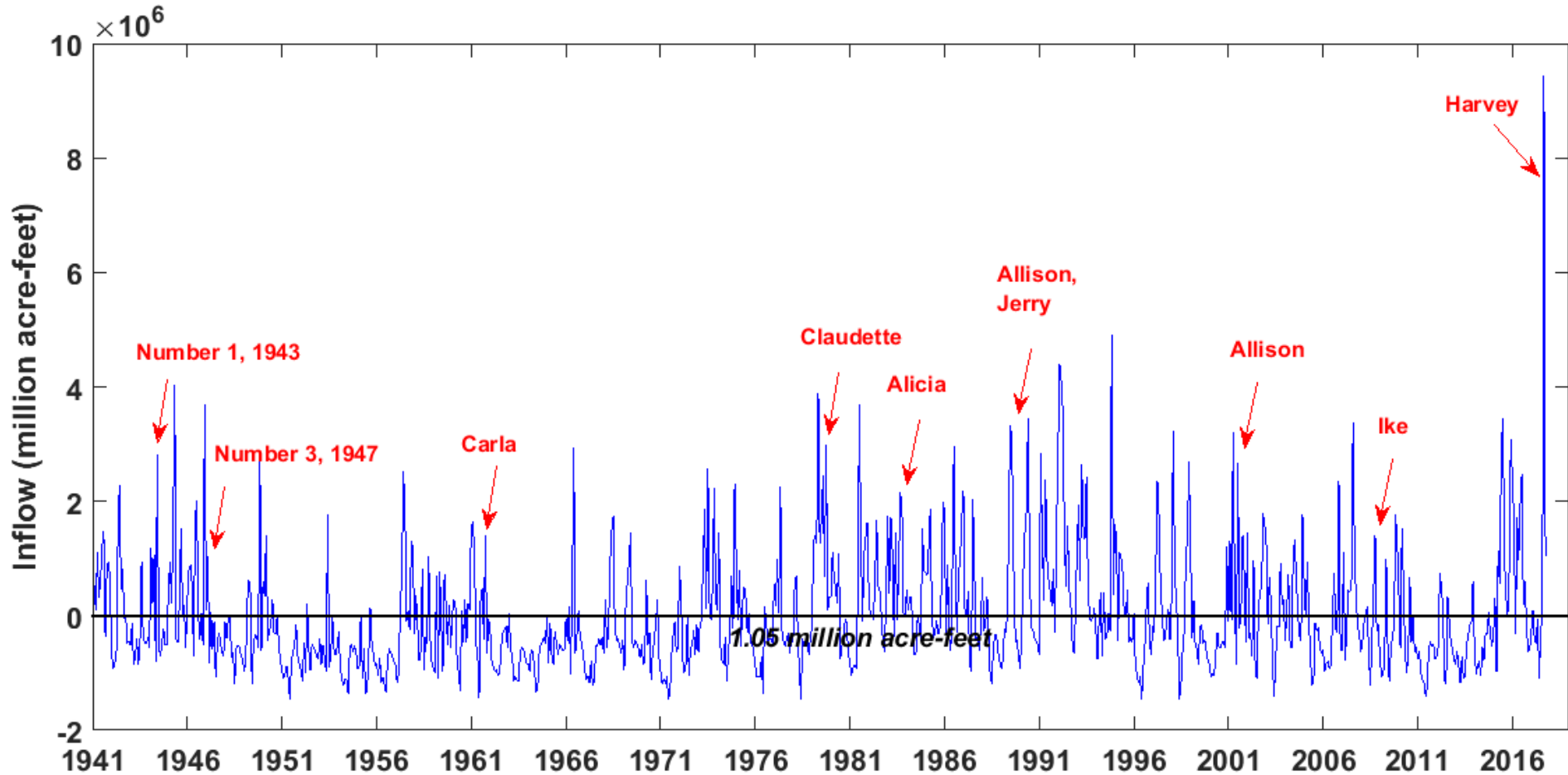


PDSI data source: National Centers for Environmental Information

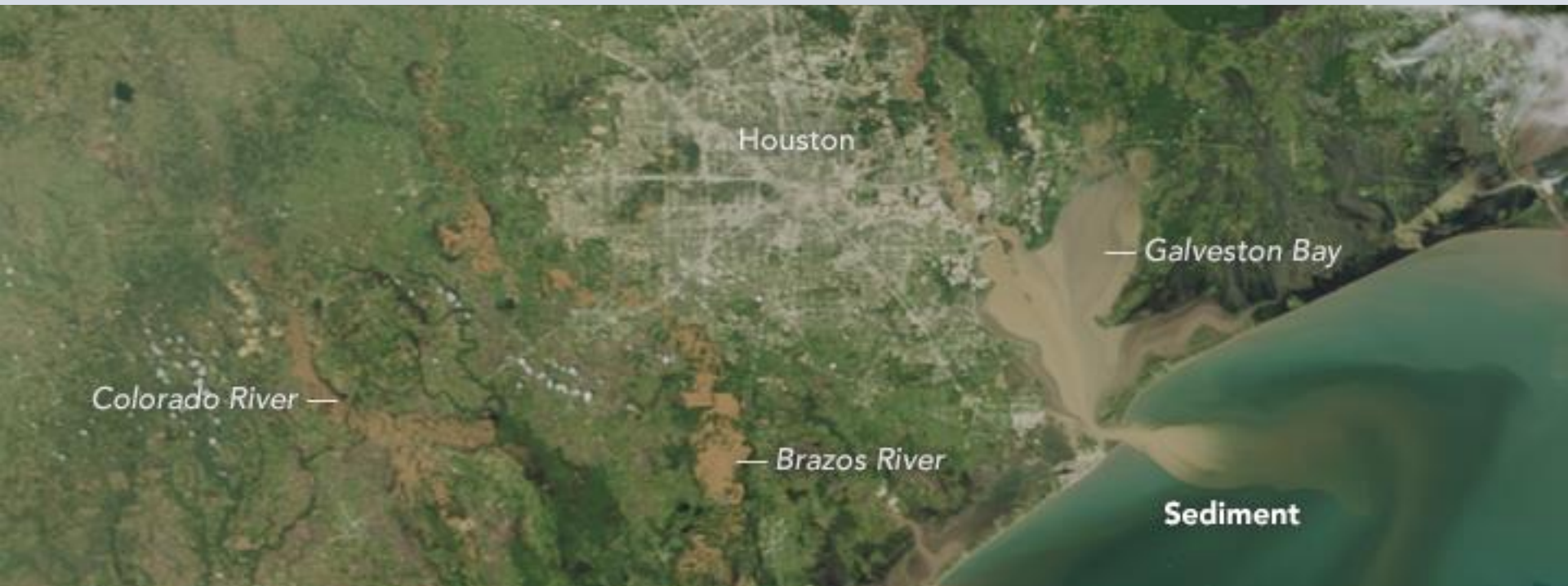
Drought Events in Galveston Bay



Monthly Inflow and Hurricane Landfalls: 1941 – 2017

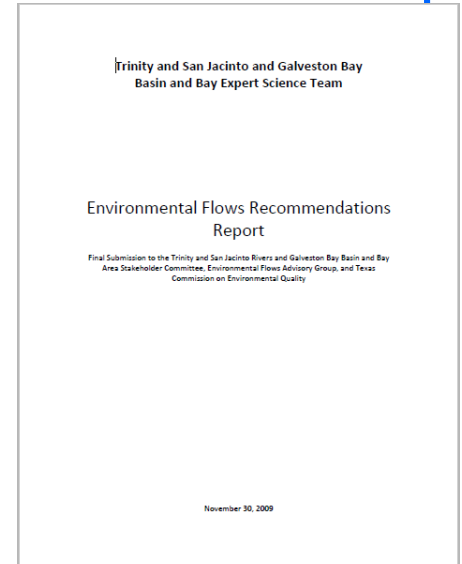
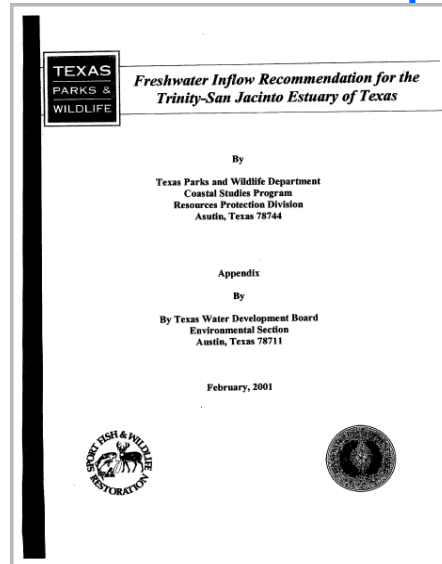
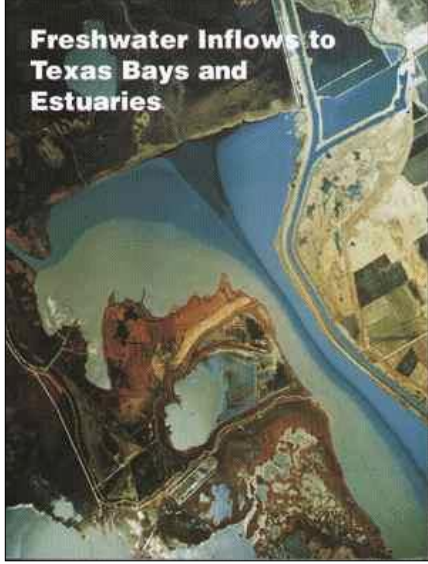
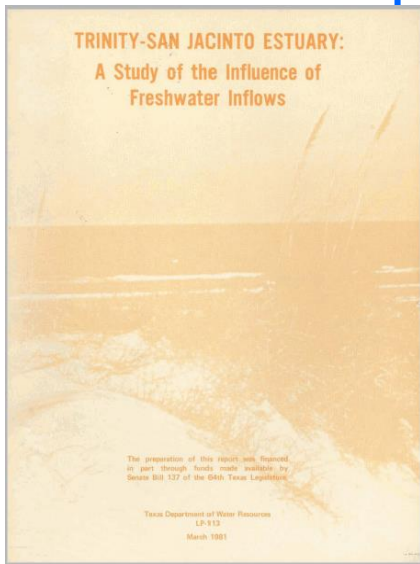
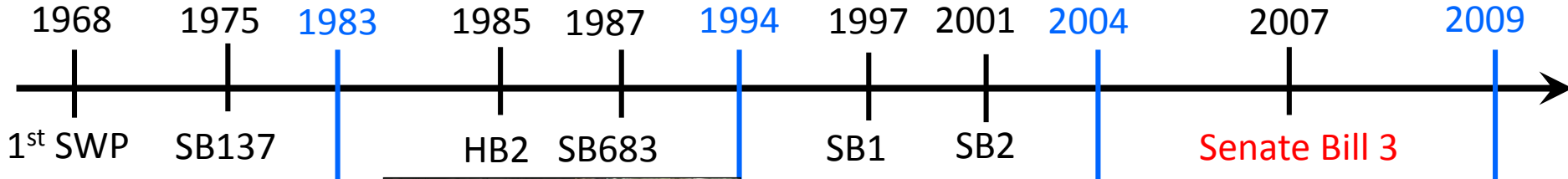


Freshwater Inflow During Hurricane Harvey Exceeded the Mean Annual Inflow of 12.2 Million Acre-Feet



- Aug. 25 – Sep. 30: 14.3 million acre-feet (88% of 2017 inflow)
- Highest August inflow on record (13.9 million acre-feet)
 - Previous wettest August was 1983 (2.7 million acre-feet)
- 2017 (Jan.1 - Sept. 30th) is the 13th wettest year on record (16.2 million acre-feet)
 - 2015 is the wettest year on record (28.2 million acre-feet)

How Much Freshwater Inflow is Needed to Maintain a Healthy Galveston Bay?



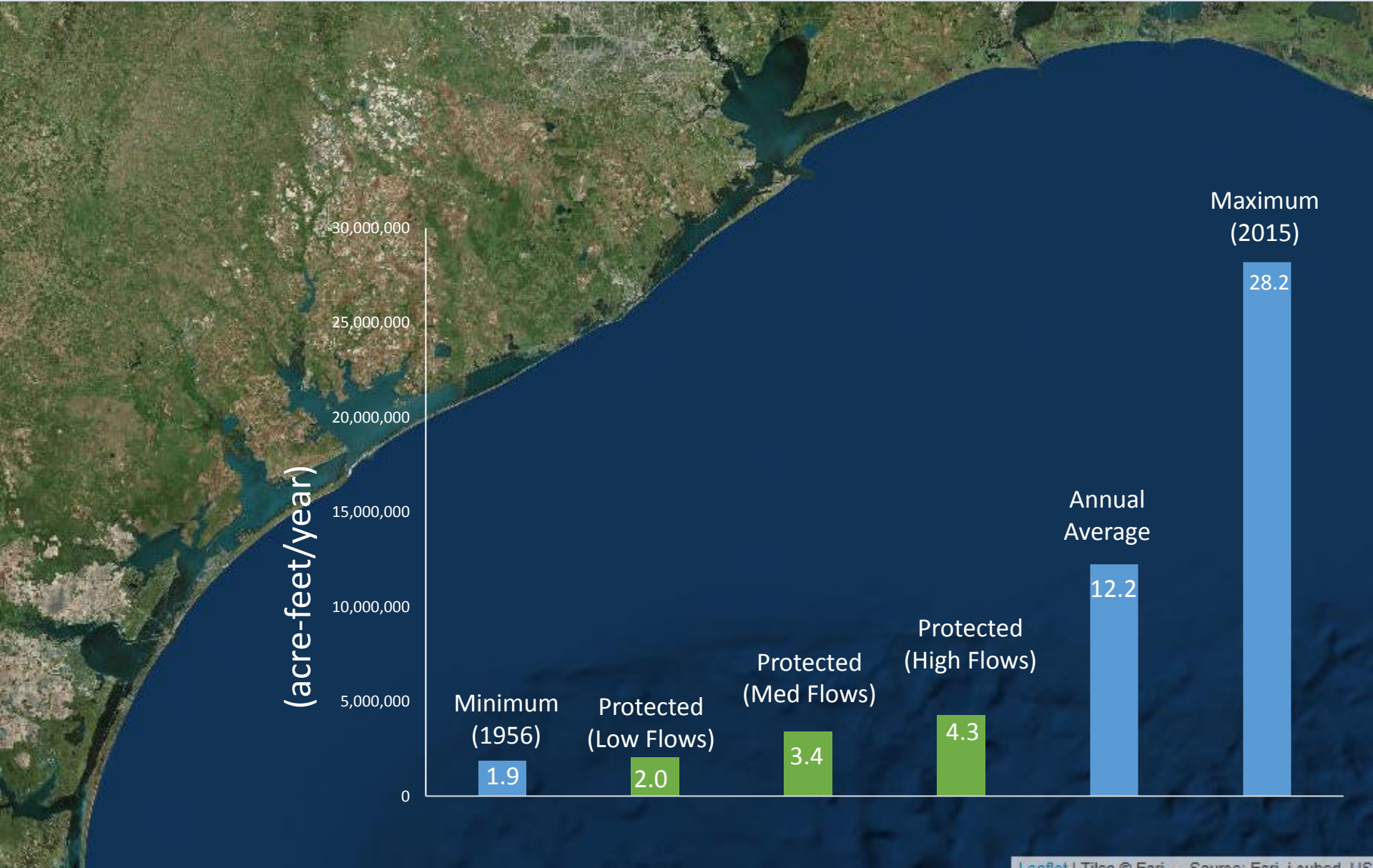
Senate Bill 3 (2007) Freshwater Inflow Standards for the Galveston Bay System

Basin	Annual Inflow Quantity	Annual Target Frequency	Winter Inflow Quantity	Winter Target Frequency	Spring Inflow Quantity	Spring Target Frequency	Summer Inflow Quantity	Summer Target Frequency	Fall Inflow Quantity	Fall Target Frequency
Trinity	2,816,532	50	500,000	40	1,300,000	40	245,000	40	N/A	N/A
	2,245,644	60	250,000	50	750,000	50	180,000	50	N/A	N/A
	1,357,133	75	160,000	60	500,000	60	75,000	60	N/A	N/A
San Jacinto	1,460,424	50	450,000	40	500,000	40	220,000	40	200,000	40
	1,164,408	60	278,000	50	290,000	50	100,000	50	150,000	50
	703,699	75	123,000	60	155,000	60	75,000	60	90,000	60

30 Texas Administrative Code §298.225

Freshwater Inflow Standards for Galveston Bay

30 Texas Administrative Code §298.225



Summary of Freshwater Inflows to Galveston Bay

- Droughts and floods are frequent factors affecting estuarine health and productivity
- Three major drought events occurred: 1950s, 1960s, & Recent (2010 – 2014)
- Hurricane Harvey delivered an unprecedented amount of freshwater inflow
- Senate Bill 3 established freshwater inflow standards for Galveston Bay
 - While providing consistency in flow protections for water permitting and water planning, they are one tool in the environmental protection toolbox
- Standards are based on best available science, but need continued validation
- Additional voluntary strategies will be important



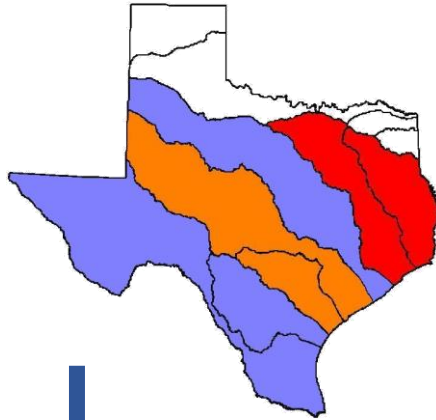
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**For access to TWDB water data, visit:
<https://waterdatafortexas.org/coastal>**

Environmental Flows Allocation Process



More

Environmental Flow Regime
Complexity

Less



Advisory
Group

Science
Advisory
Committee

Science Team

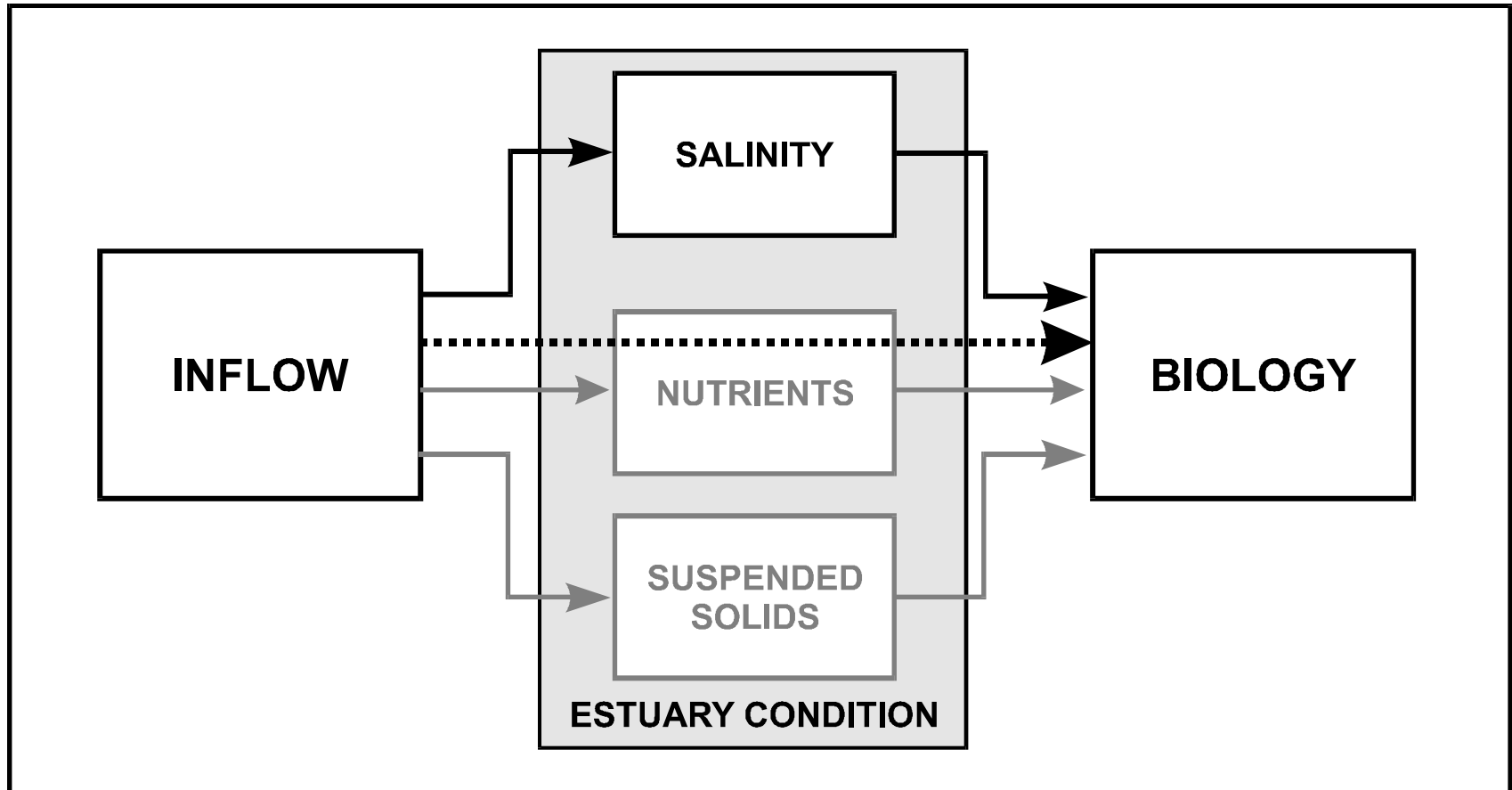
Stakeholders

Regulatory Agency

Adopted Standards



Freshwater Inflow Regime – the quantity, quality, and timing of river flow into estuaries



Source: Methodologies for Establishing a Freshwater Inflow Regime for Texas Estuaries, Science Advisory Committee 2009

http://www.tceq.state.tx.us/permitting/water_supply/water_rights/eflows/resources.html

(Variations of this conceptual model in Alber 2002, Sklar and Browder 1998, and Copeland 1966)

Senate Bill 3 (2007) Environmental Flow Adaptive Management Work Plan Studies

FY 2014-2015

LiDAR Acquisition and Flow Assessment for the Middle Trinity River	\$112,000
Defining bioindicators for freshwater inflow needs studies	\$105,000
Determination of freshwater inflow volume from the Trinity River into Trinity Bay	\$165,000

FY 2016-2017

Continue evaluation of adopted Senate Bill 3 environmental flow standards	\$110,000
Analysis of streamflow and nutrient and sediment concentrations in the Lower Trinity River watershed	\$100,000
Continue defining bioindicators for freshwater inflow needs studies	\$90,000

Hydrodynamic Model for the Trinity River Delta (Interagency contract with UT-CRWR, Dr. Ben Hodges)

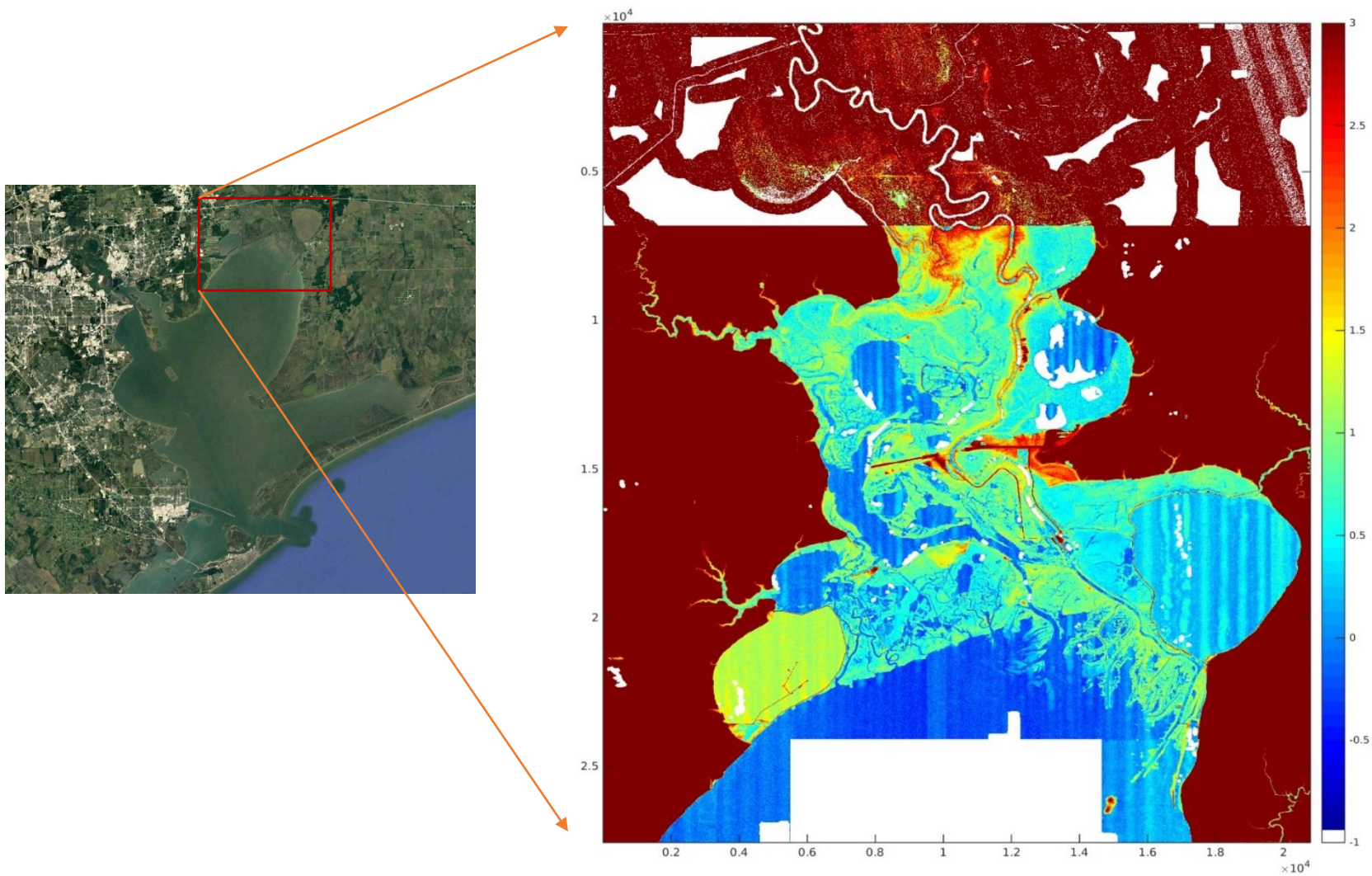


Fig.1 Raw Bathymetry of the Trinity Delta from Lidar (NaNs included, colorbar adjusted to show detailed flow paths)