

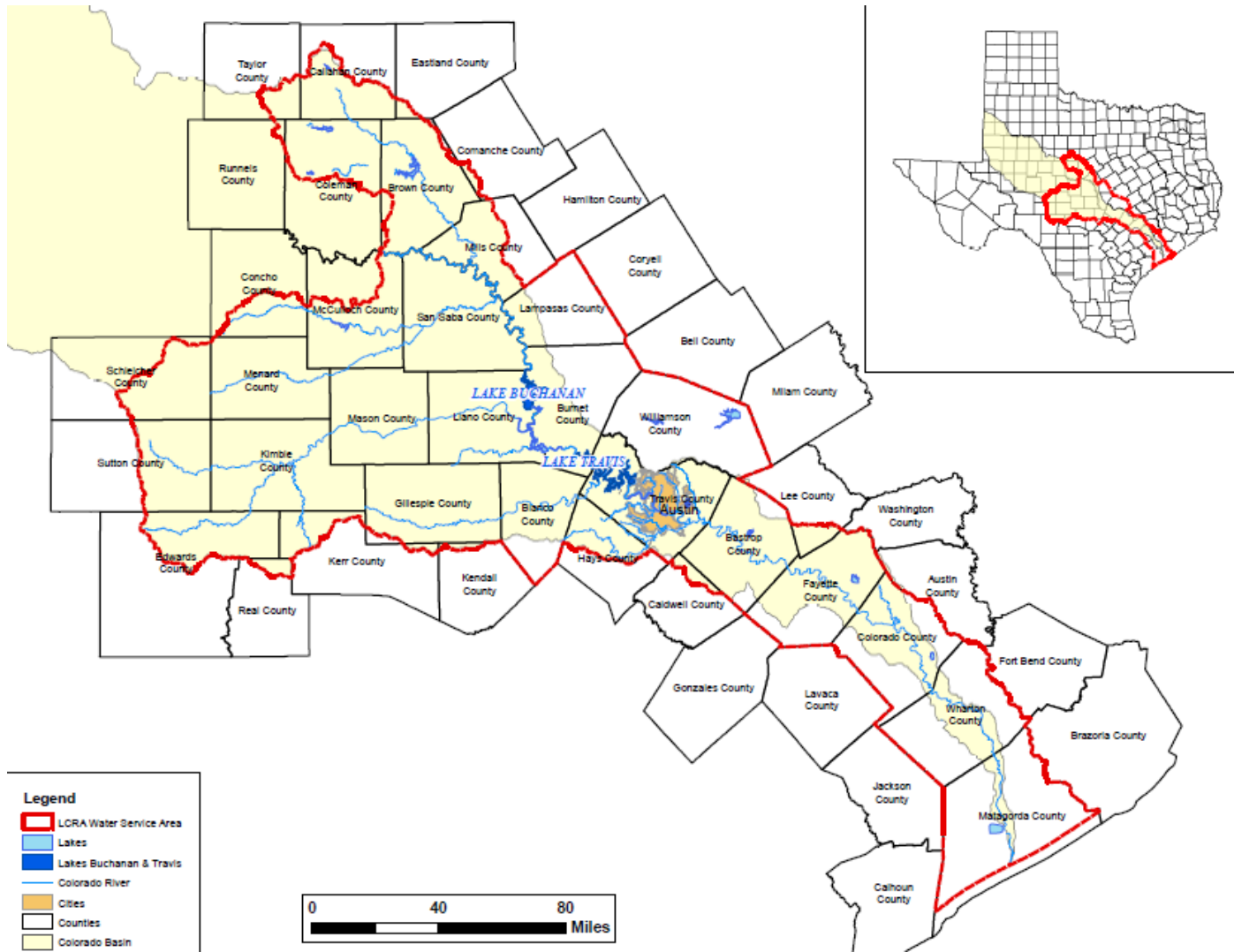
Ripe Research Areas for LCRA Water Supply

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Chief Engineer
Lower Colorado River Authority

February 13, 2012



Lower Colorado River



Highland Lakes Chain

Conservation

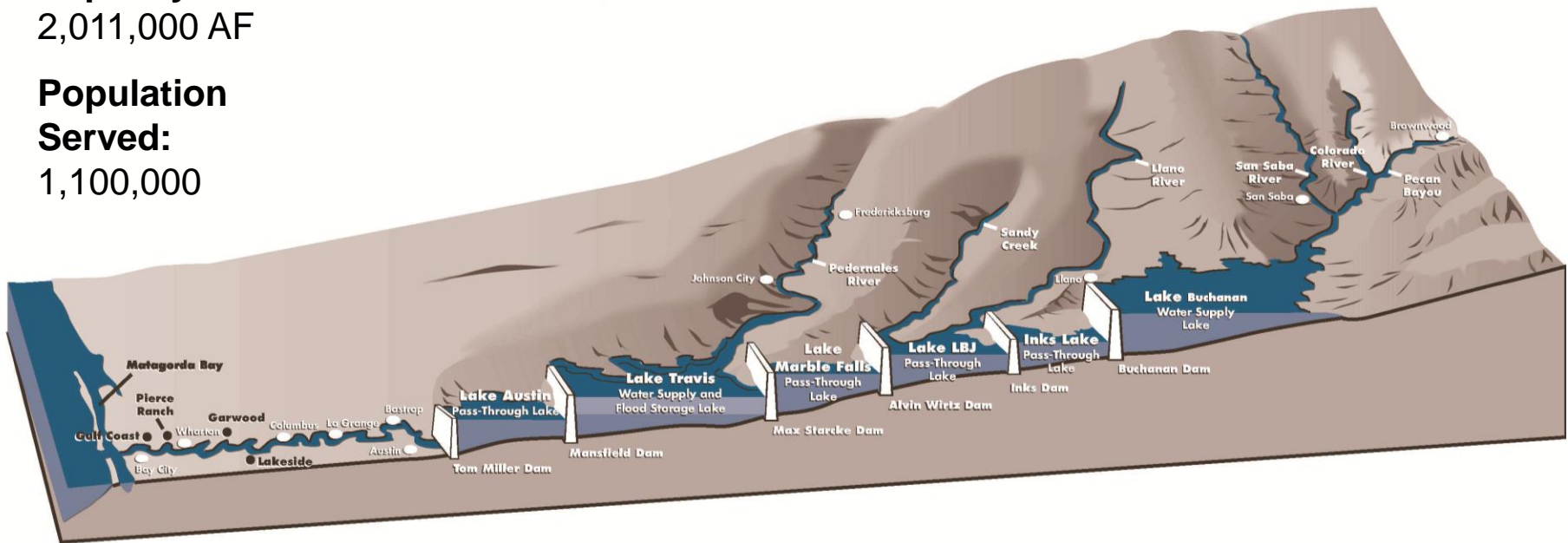
Capacity:

2,011,000 AF

Population

Served:

1,100,000



Lake Travis

Dam:

Mansfield

Completed:

1941

Height:

278 Feet

**Conservation
Capacity:**

1,131,650 AF

**Generation
Capacity:**

102 MW



Lake Buchanan

Completed:
1937

Height:
145.5 feet

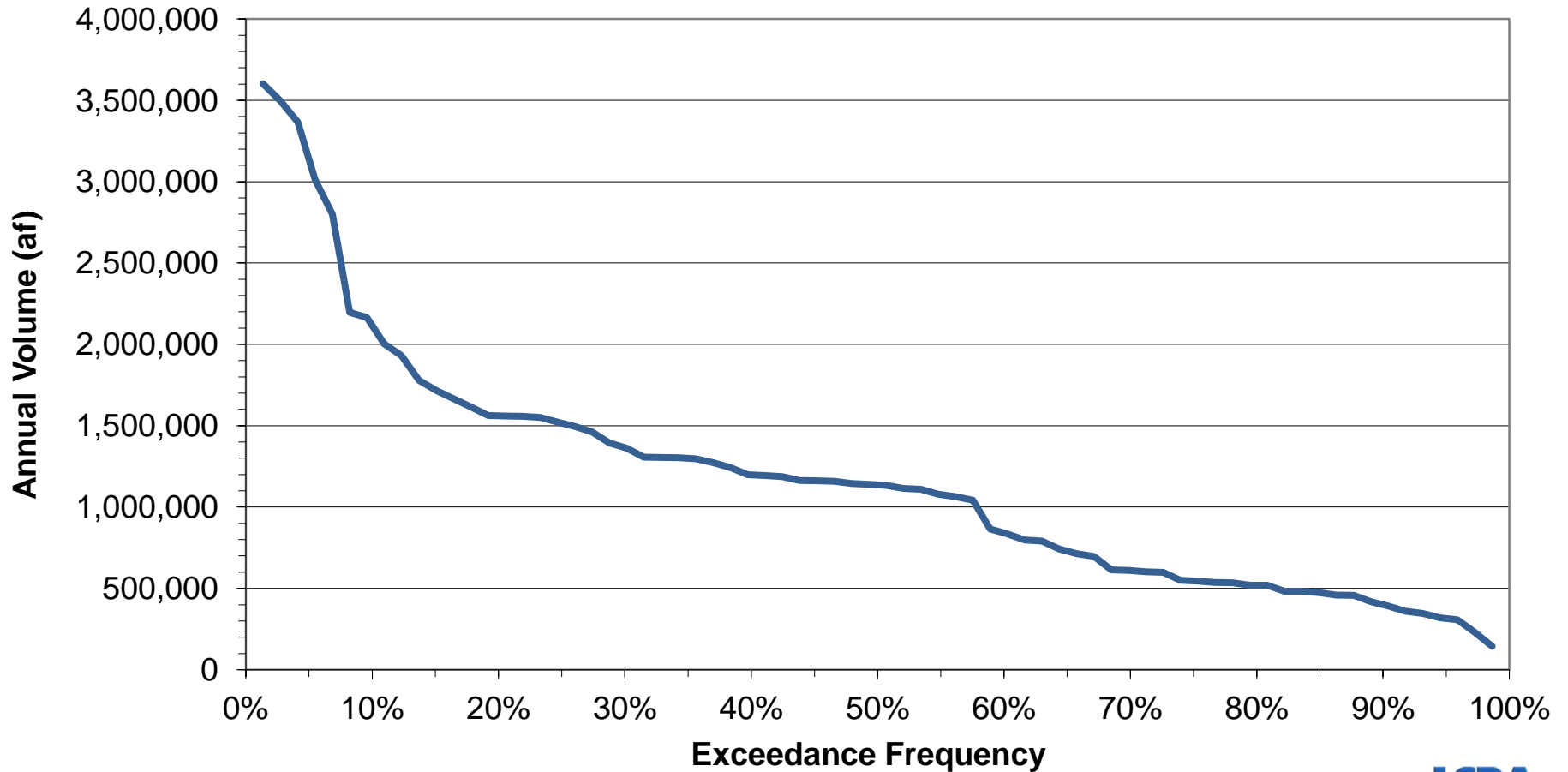
**Conservation
Capacity:**
875,566 AF

**Generation
Capacity:**
51.3 MW



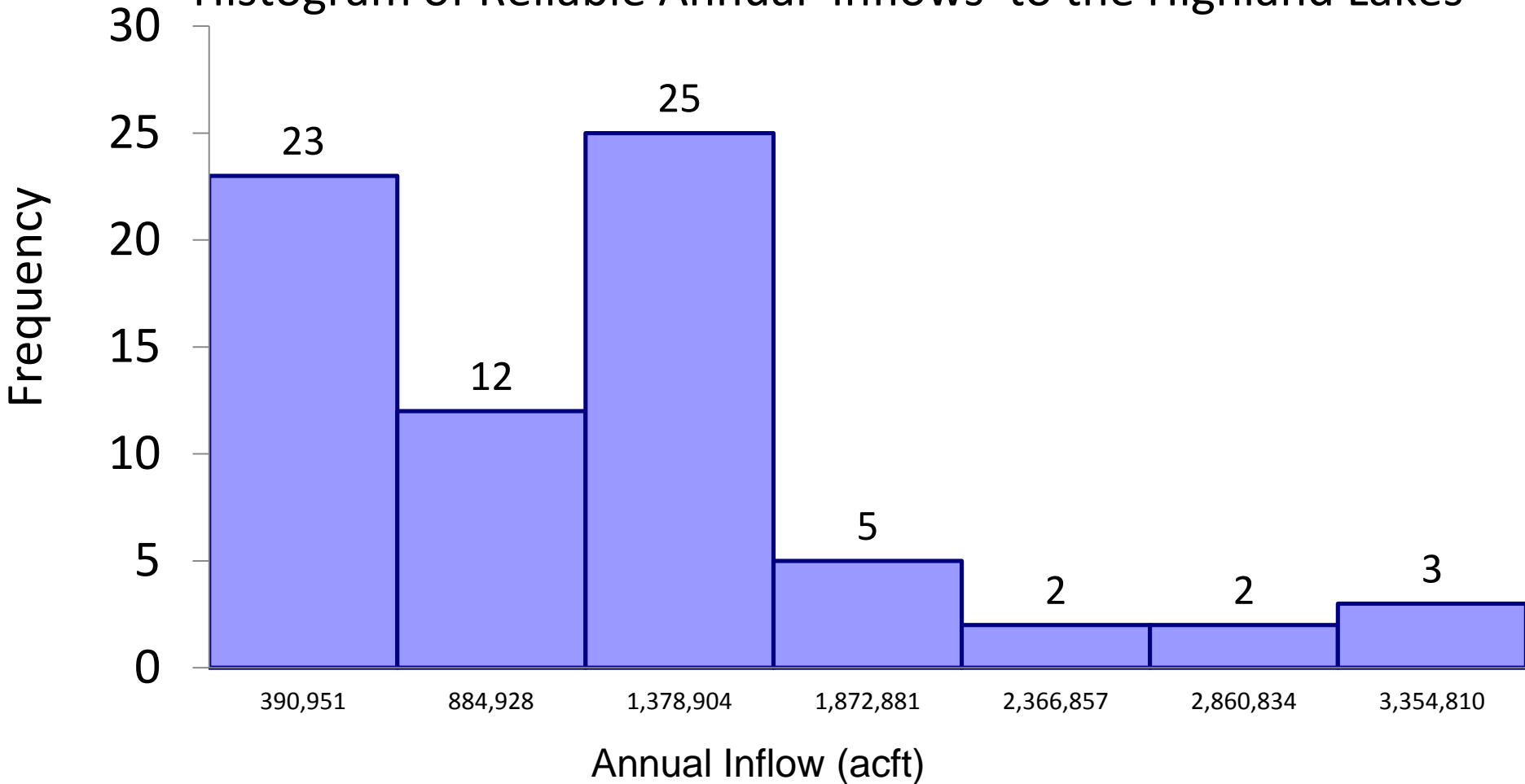
Hydrologic Variability

Highland Lakes Reliable Inflow Frequency 1940-2011



Hydrologic Variability

Histogram of Reliable Annual Inflows to the Highland Lakes



LCRA's Water Management Plan

When water in the lake is ...	On this date ...	Action prescribed in 2010 Water Management Plan
Lake Travis and Buchanan are full at 2.011 million acre-feet		
Less than 94 percent full	Jan. 1 or July 1	Interruptible supplies cease for all customers except irrigation operations.
Less than 1.7 million acre-feet	Jan. 1	Environmental releases for bays and estuaries are reduced to meet 150 percent of critical (to the extent of storable inflows).
Less than 1.4 million acre-feet	At any time	Request firm customers to implement voluntary water use reduction measures to achieve a 5 percent reduction in use.
Less than 1.4 million acre-feet	Jan. 1	Begin gradual curtailment of interruptible supply to irrigation operations. Amount of curtailment increases when water storage levels are lower. Environmental releases for instream flows are reduced to meet critical needs.
Less than 1.1 million acre-feet	Jan. 1	Environmental releases for bays and estuaries are reduced to meet critical needs.
900,000 acre-feet	At any time	Request firm customers to implement mandatory conservation restrictions. Meet with customers to develop curtailment plan should drought worsen.
600,000 acre-feet	At any time	If criteria indicate that drought is worse than the Drought of Record, then begin pro rata curtailment of firm supply after ceasing interruptible supply (timing based on duration of drought).
325,000 acre-feet	Jan. 1	No interruptible supply available.
200,000 acre-feet	At any time	No interruptible supply available.

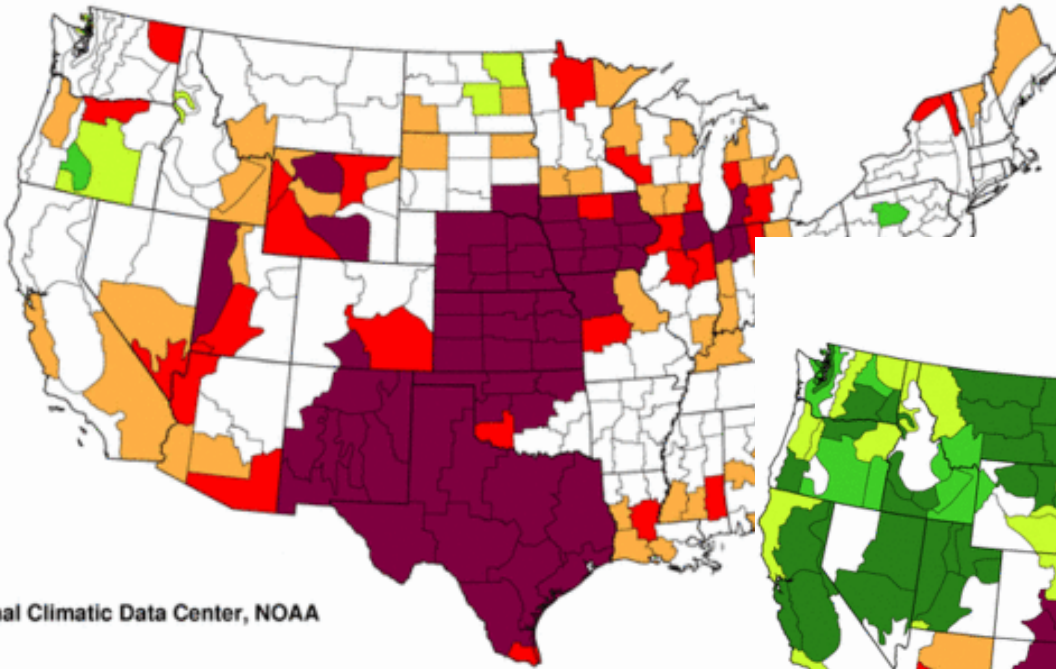
We Are Here

Criteria for Drought Worse than Drought Record

- **24 Months Since Lakes Last Full**
- **Inflow Deficit Exceeds Drought of Record Deficit**
- **Combined Storage Less Than 600,000 Acre-Feet**

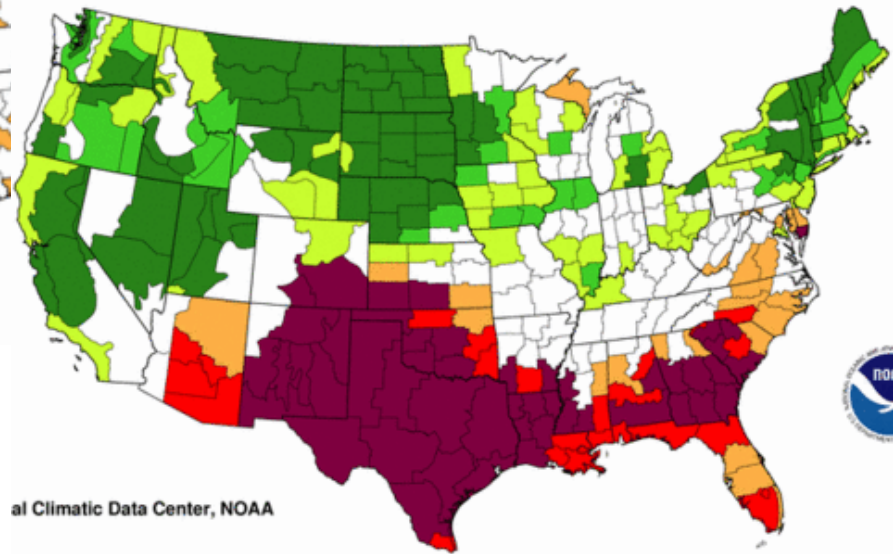
Drought Extents

January, 1957



National Climatic Data Center, NOAA

August, 2011



National Climatic Data Center, NOAA



Municipal Intake Relocations on Lake Travis



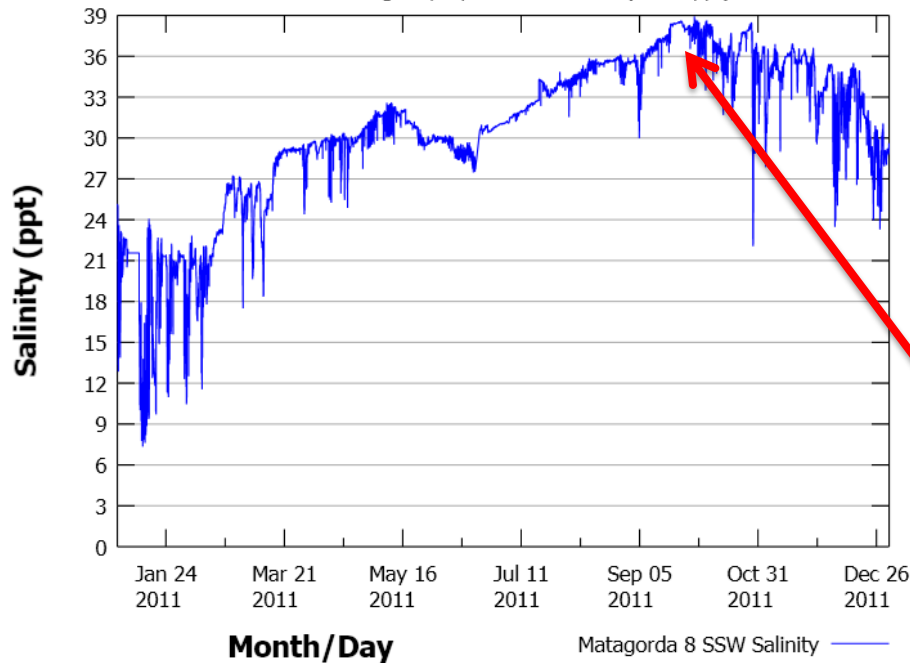
All Boat Ramps Closed



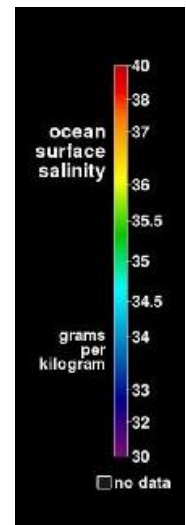
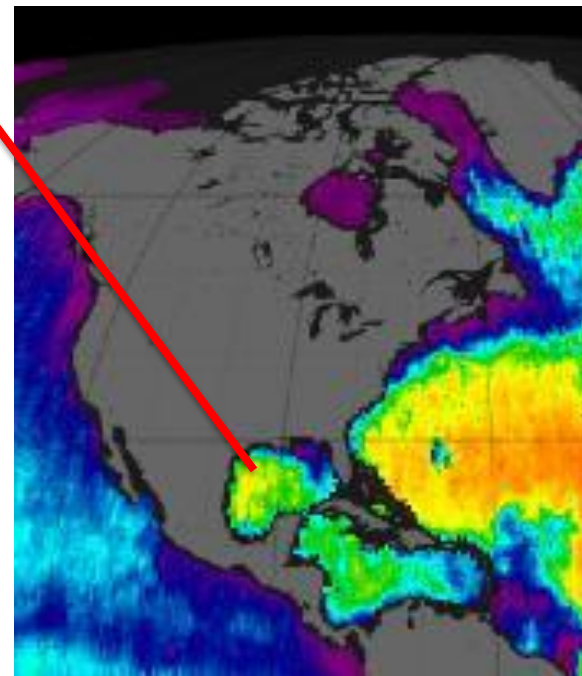
Salinity in Matagorda Bay

Matagorda 8 SSW Salinity

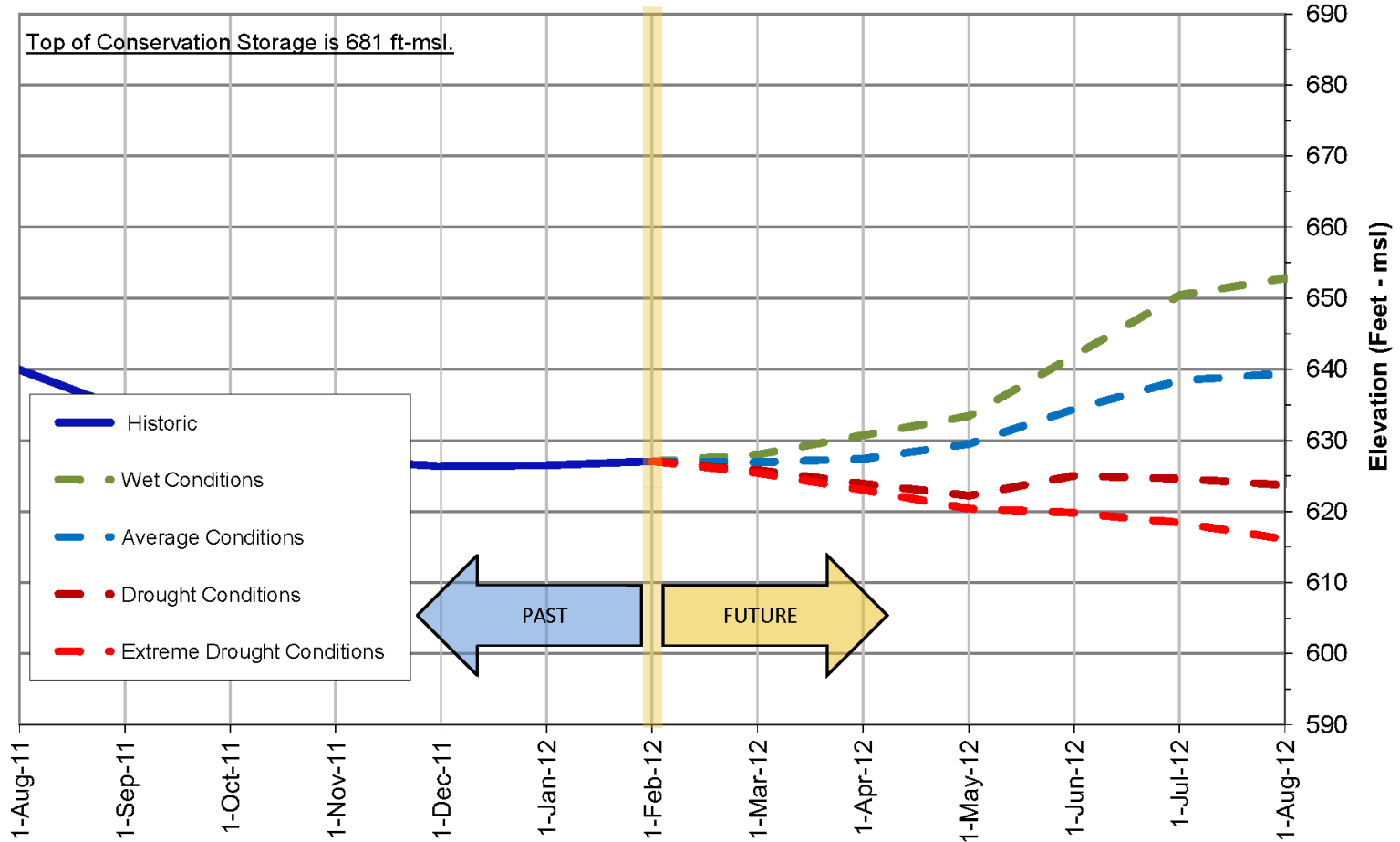
Last Reading: 12/31/2011 11:12 PM (29.62 ppt)



Aquarius



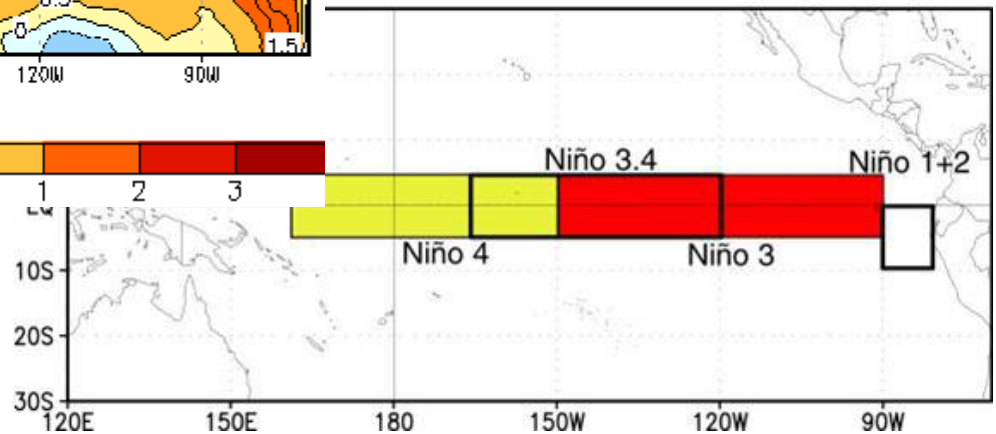
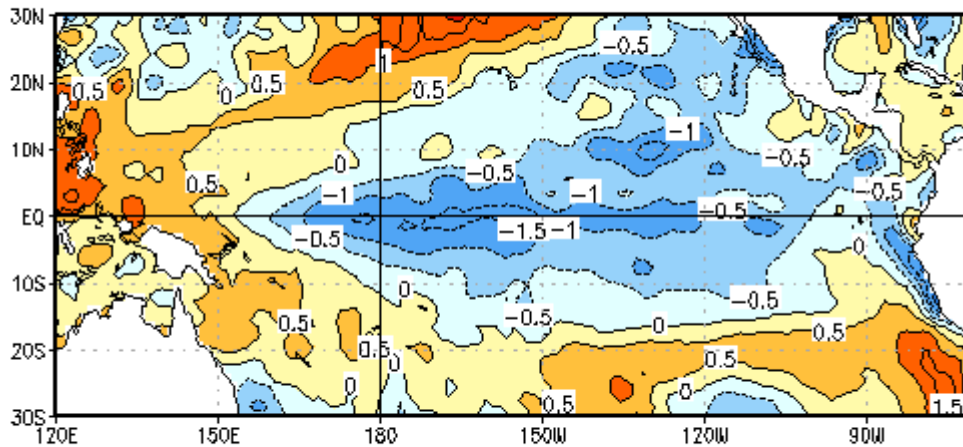
Lake Travis Projections with Persistence and ONI



El Niño/Southern Oscillation

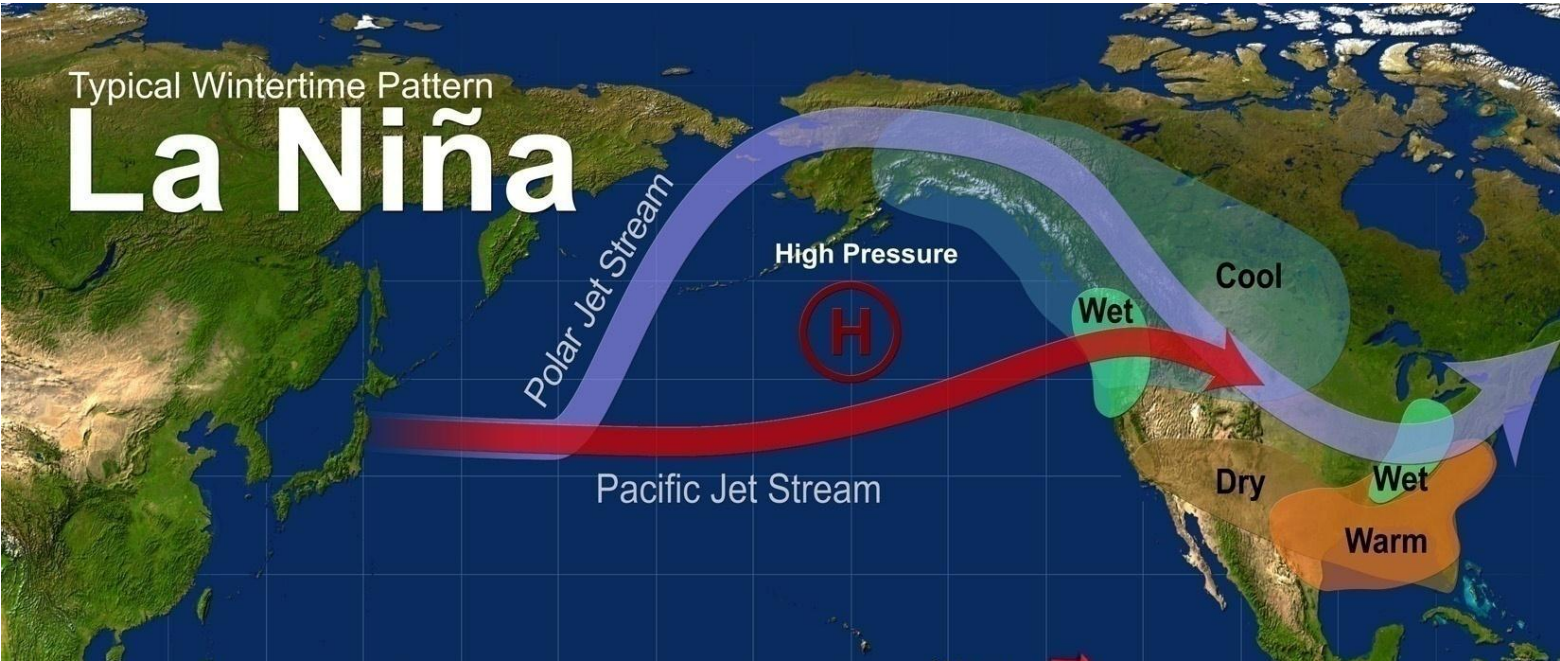
Sea surface temperature SST departure (°C)

Average SST Anomalies
8 JAN 2012 – 4 FEB 2012



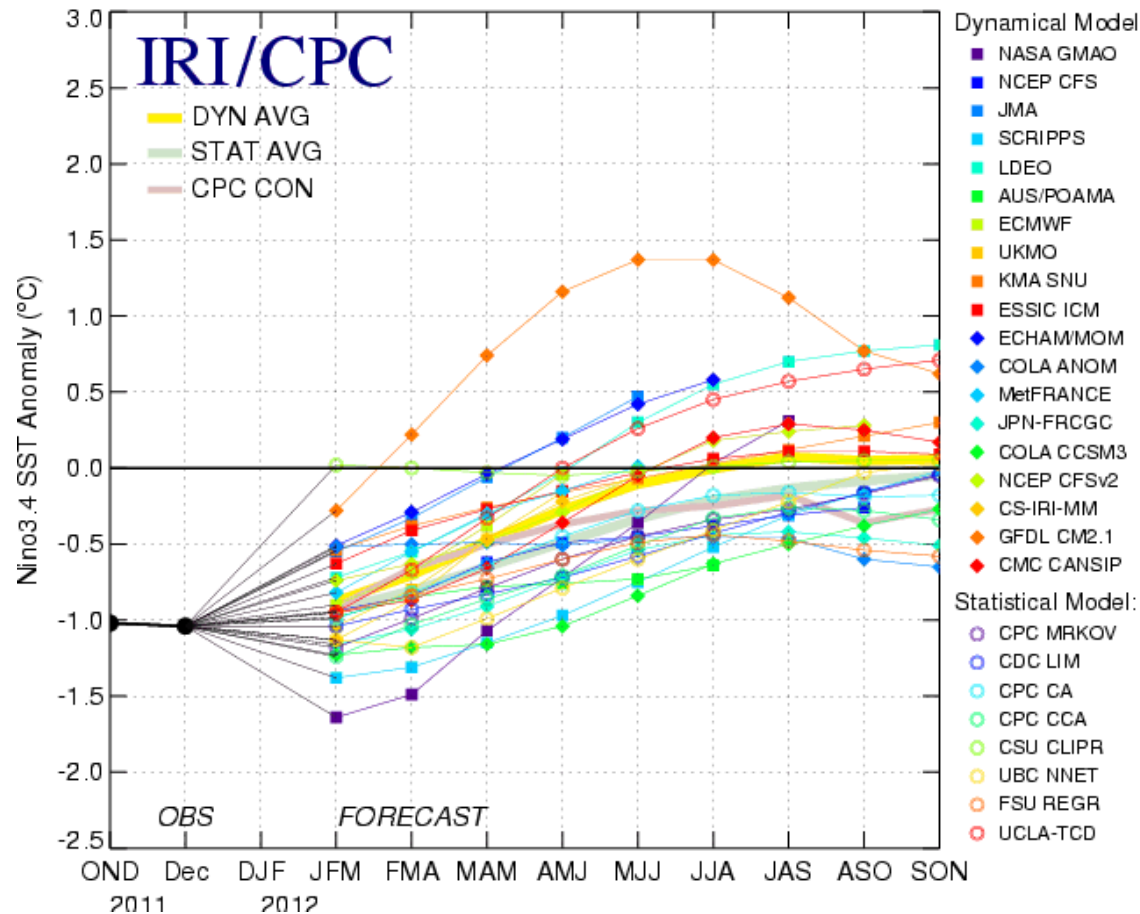
ENSO Effects

Sea surface temperature SST departure (°C)



Oceanic Niño Index (ONI)

Sea surface temperature SST departure (°C)



Ripe Areas for Potential Research

- **Improved foresight relating to streamflows**
 - **Understand hydrologic effects of global processes (PDO, AMO, coupled GCMs)**
 - **Longer range**
 - **Reduced uncertainty**
- **Remote sensing of soil moisture related to streamflows**
- **Remote sensing of salinity in bays and estuaries**
- **Better measurement of evaporation from natural bodies and river courses**
- **Fingerprinting chemical constituents in surface and groundwater supplies**

The Research Gap

- Precipitation
- Temperature
- Wetter/Drier
- PDSI
- SPI
- NAO
- Equal Chances
- Scenarios
- Ensembles



**Streamflow
Magnitude
&
Uncertainty**

?Questions?

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