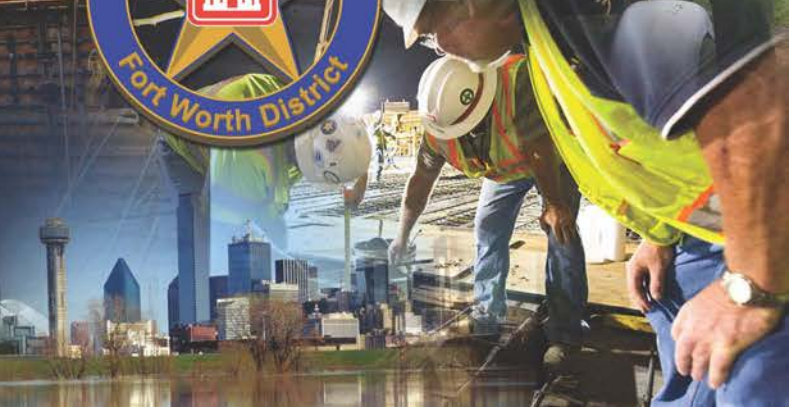


# Water Resources Branch

## Water Management & Hydrologic Investigations

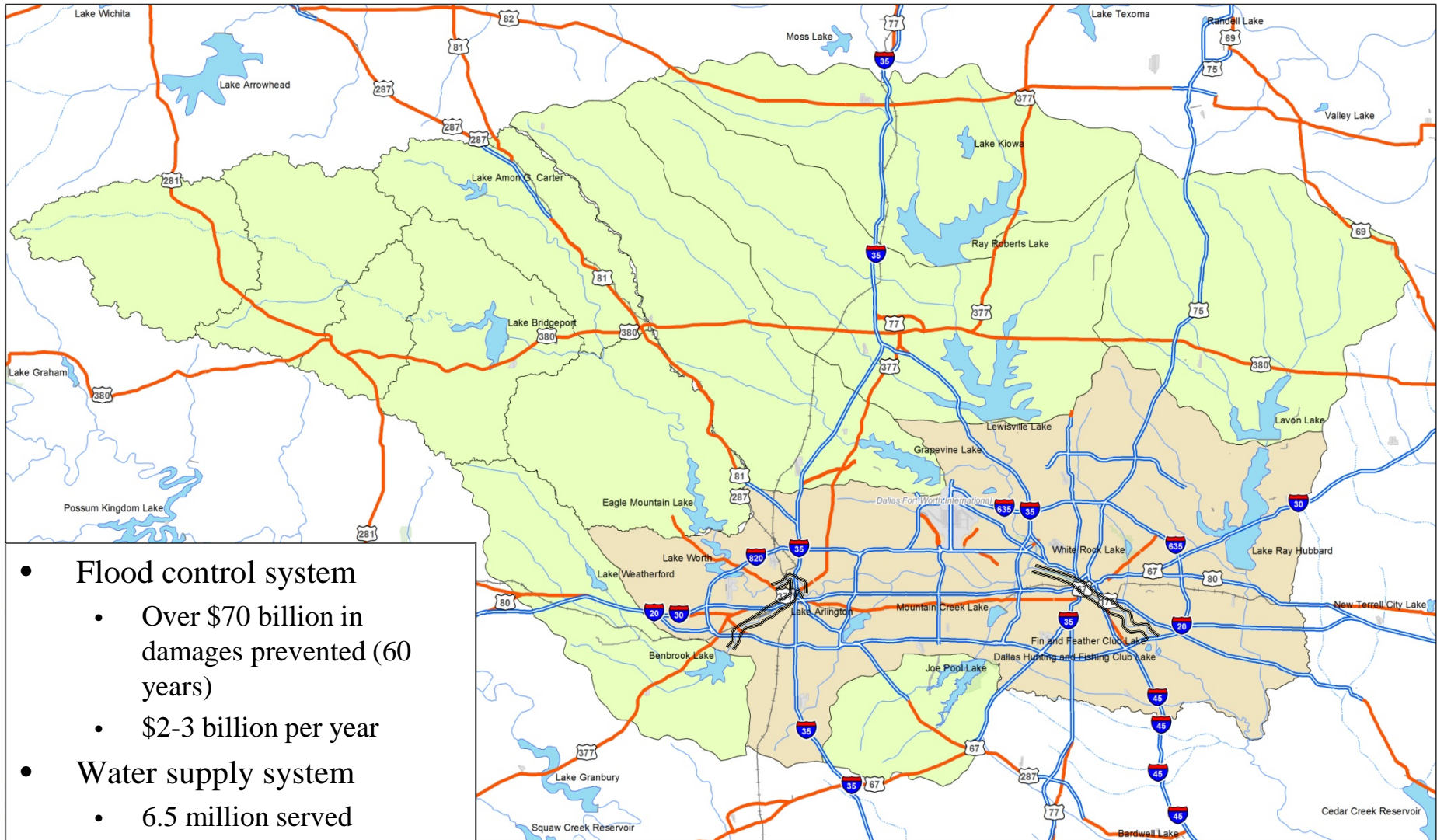


# USACE Overall Mission

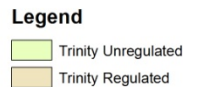
- Water resources
  - ▶ Flood control
  - ▶ Navigation
  - ▶ Water supply
  - ▶ Hydro power
- Recreation
  - ▶ 4,300 parks
  - ▶ 360 million visits
  - ▶ 600,000 jobs directly related
- Environmental
  - ▶ Restoration
  - ▶ Clean Water Act
  - ▶ Environmental flows relating to reservoirs
- Emergency/disaster response (hurricanes, tornados, etc)
- Military construction and deployments
- By 37k employees, 40 offices, 7 laboratories



# What Do You See?



- Flood control system
  - Over \$70 billion in damages prevented (60 years)
  - \$2-3 billion per year
- Water supply system
  - 6.5 million served



# USACE Facts

- What do you know about the USACE FRM mission?
  - ▶ How many flood control reservoirs? 383 (27)
  - ▶ How many miles of levee? 14,500+ (70)
  - ▶ Damages prevented to 1928-2000? \$850 billion (74)
  - ▶ Damages prevented annually? \$37 billion (2-3)
  - ▶ Cost flood control reservoirs? \$110 billion
  - ▶ B/C ratio? 8/1 (increasing)



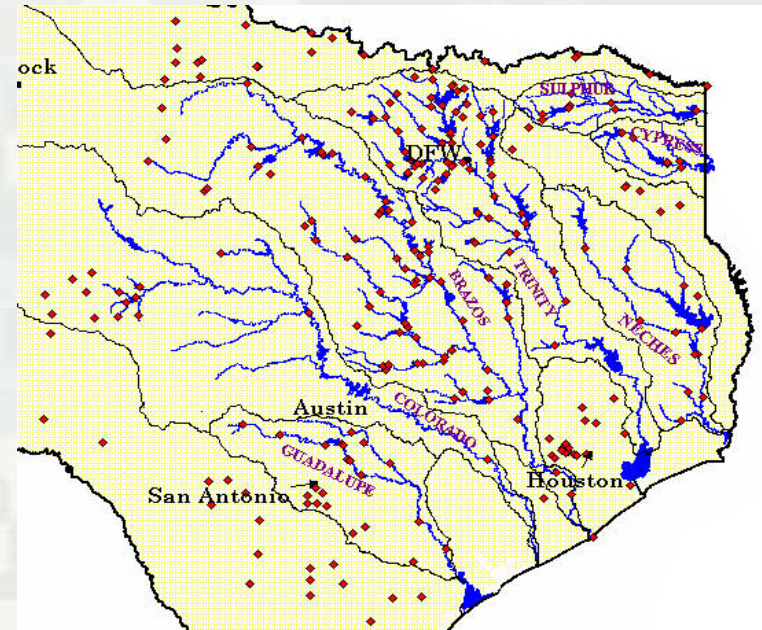
# USACE Facts

- What do you know about the USACE WS mission?
  - ▶ State and non-fed. have primary responsibility
  - ▶ How many reservoirs have WS? 136 in 25 states
  - ▶ How much conservation storage Ac-Ft? 9.8 m (6m)
  - ▶ How much yield? ? MGD (2,175)
  - ▶ How many WS agreements 307 (40)
  - ▶ What does USACE charge annually? (\$5.5 million)
  - ▶ What was the cost of construction? (\$531 million)
  - ▶ FY 15 Pres. budget for WS? \$ 26 million (1-2)
  - ▶ How much hydropower? 24% hydro, 3% energy (neg.)
  - ▶ Cooperative stream gage program?



# Cooperative Stream Gage Program

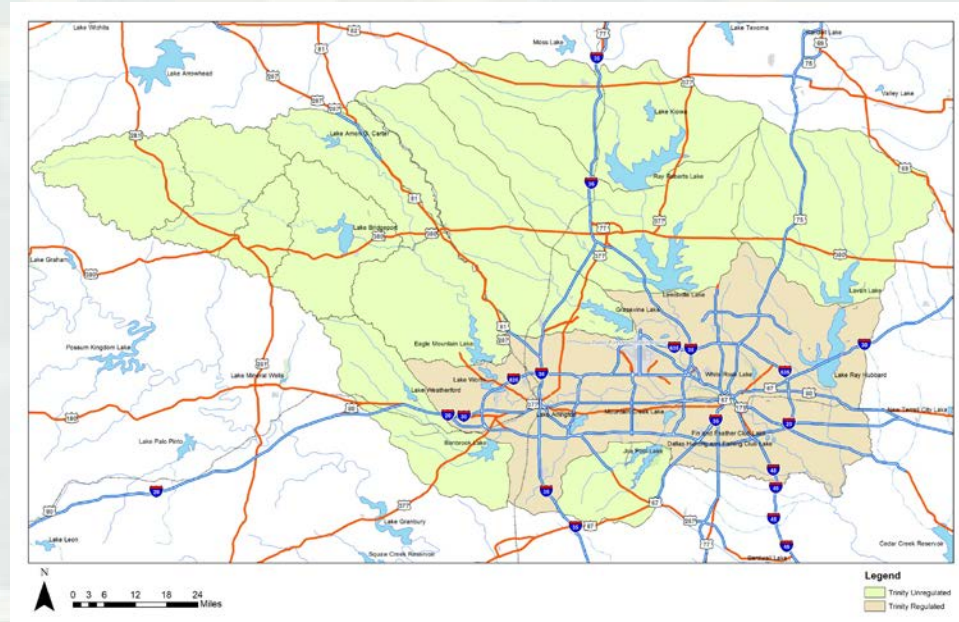
- Over 400 Remote Sensing Stations
- Approximately 2000 Observers
- Critical to safe operation of the projects
- Essential for calibration of NWS precipitation estimates
- Critical dependable yield
- Jointly funded with USACE direct expenditures of close to \$30 million annually, SWF \$1.1 million annually
- Partnerships
  - ▶ USGS, NWS, River Authorities, Counties, Cities, **YOUR ORGANIZATION!**
  - ▶ Coordination and resource sharing to maximize network benefits



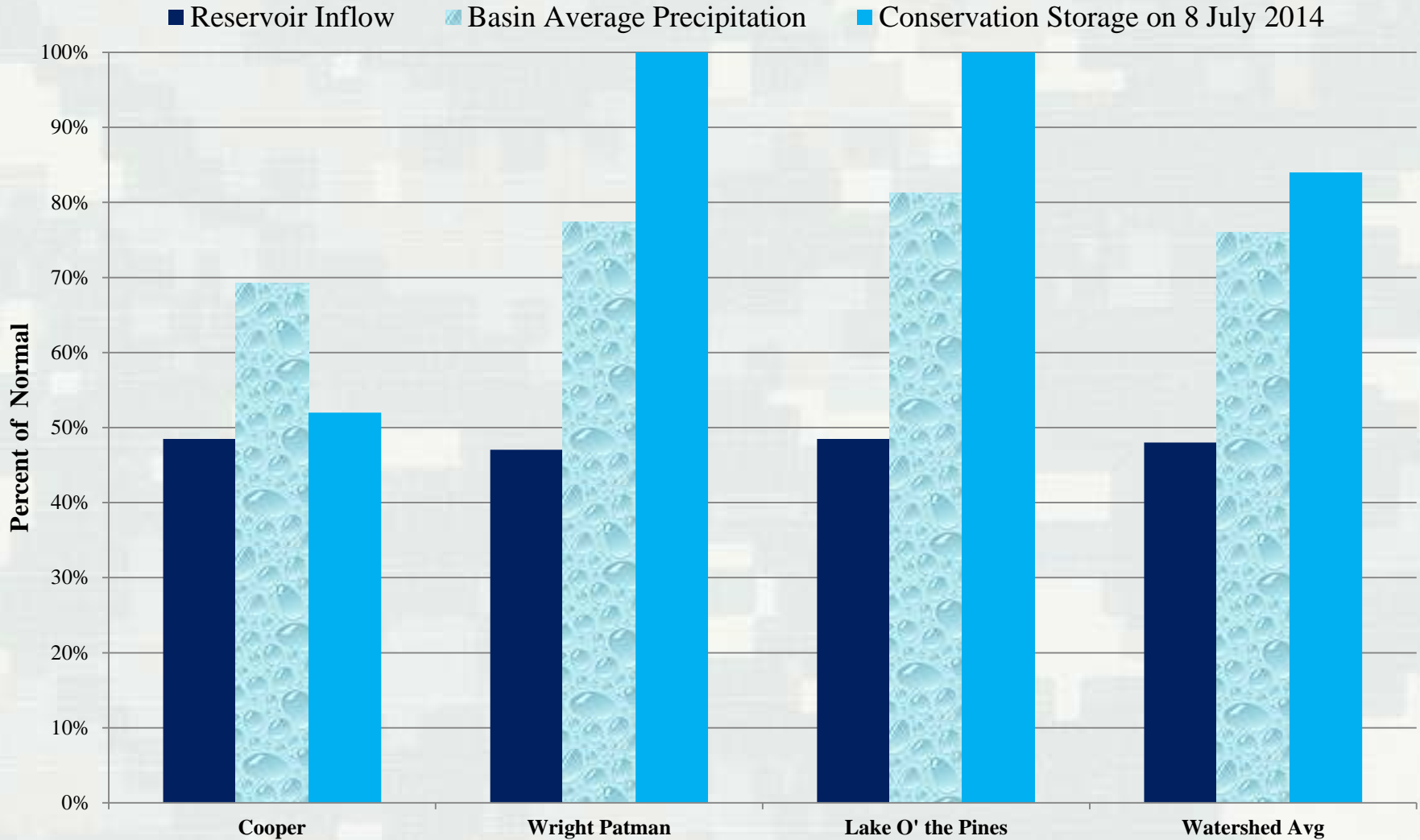
# Reservoir Assessment

Jan.- June 2014

- Periods
  - ▶ Jan. 2014 – Jun. 2014 for comparison period
  - ▶ Jan. – Jun. 1981-2013 for averages
- Rainfall – basin average using Prism Climate Group grids @ Oregon State University
- Inflows – as computed by USACE
- All USACE basins



**Red River Basin**  
**Jan-Jun 2014 Experience vs. Normal**  
(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
**Jan-Jun 2014 Avg PDSI = 0.2    Current PDSI = 0**

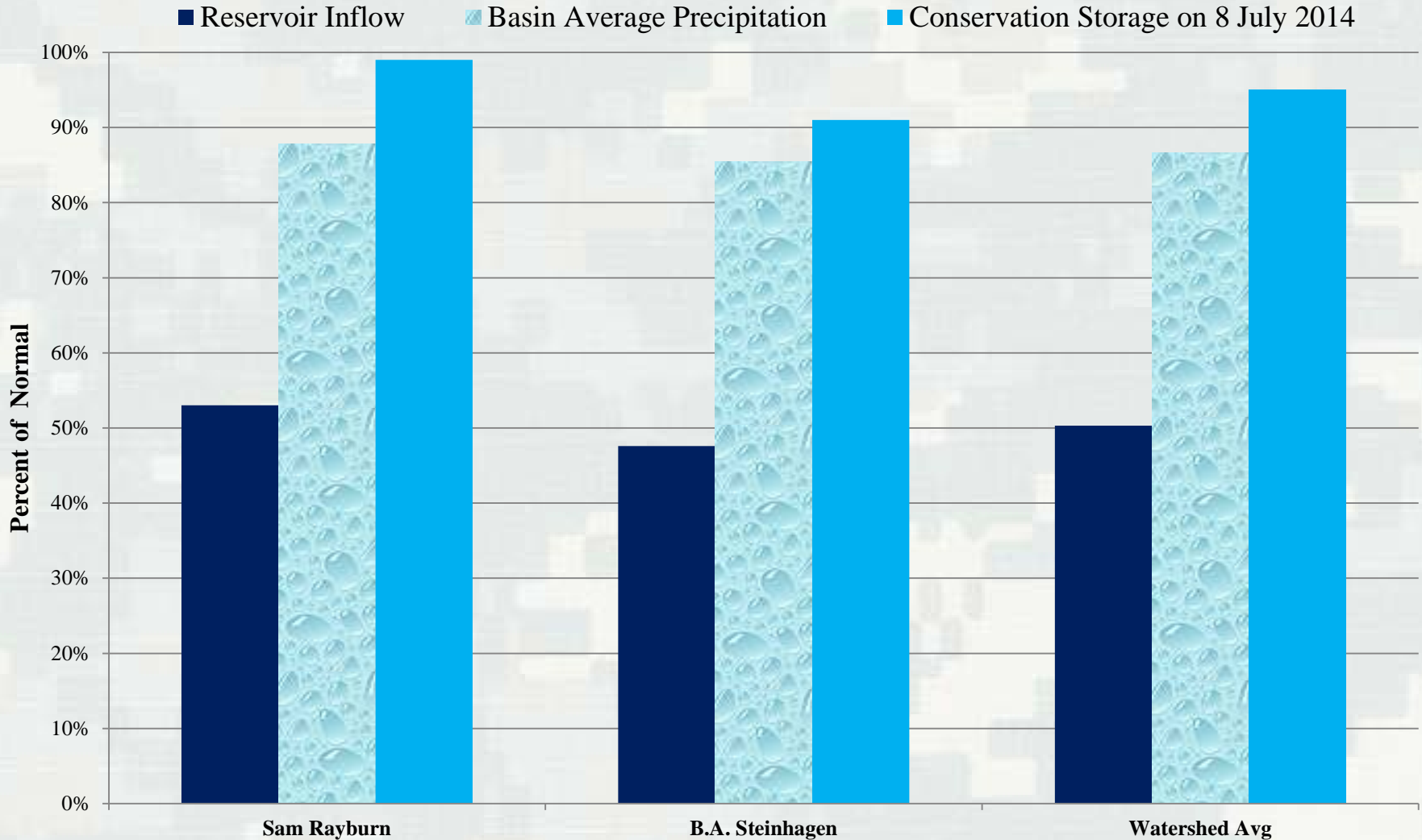




# Neches River Basin

## Jan-Jun 2014 Experience vs. Normal

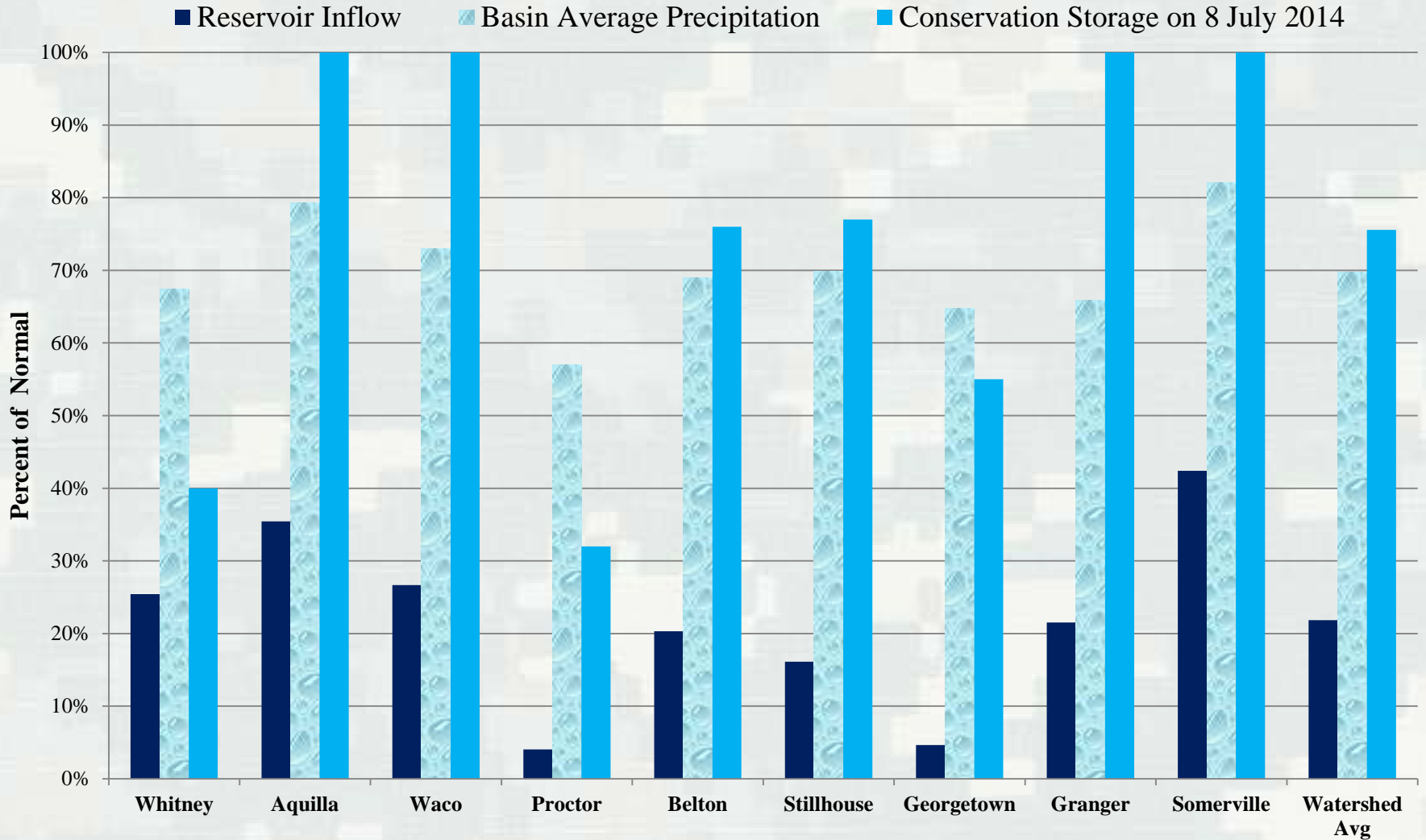
(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
Jan-Jun 2014 Avg PDSI = 0.2    Current PDSI = 0



# Brazos River Basin

## Jan-Jun 2014 Experience vs. Normal

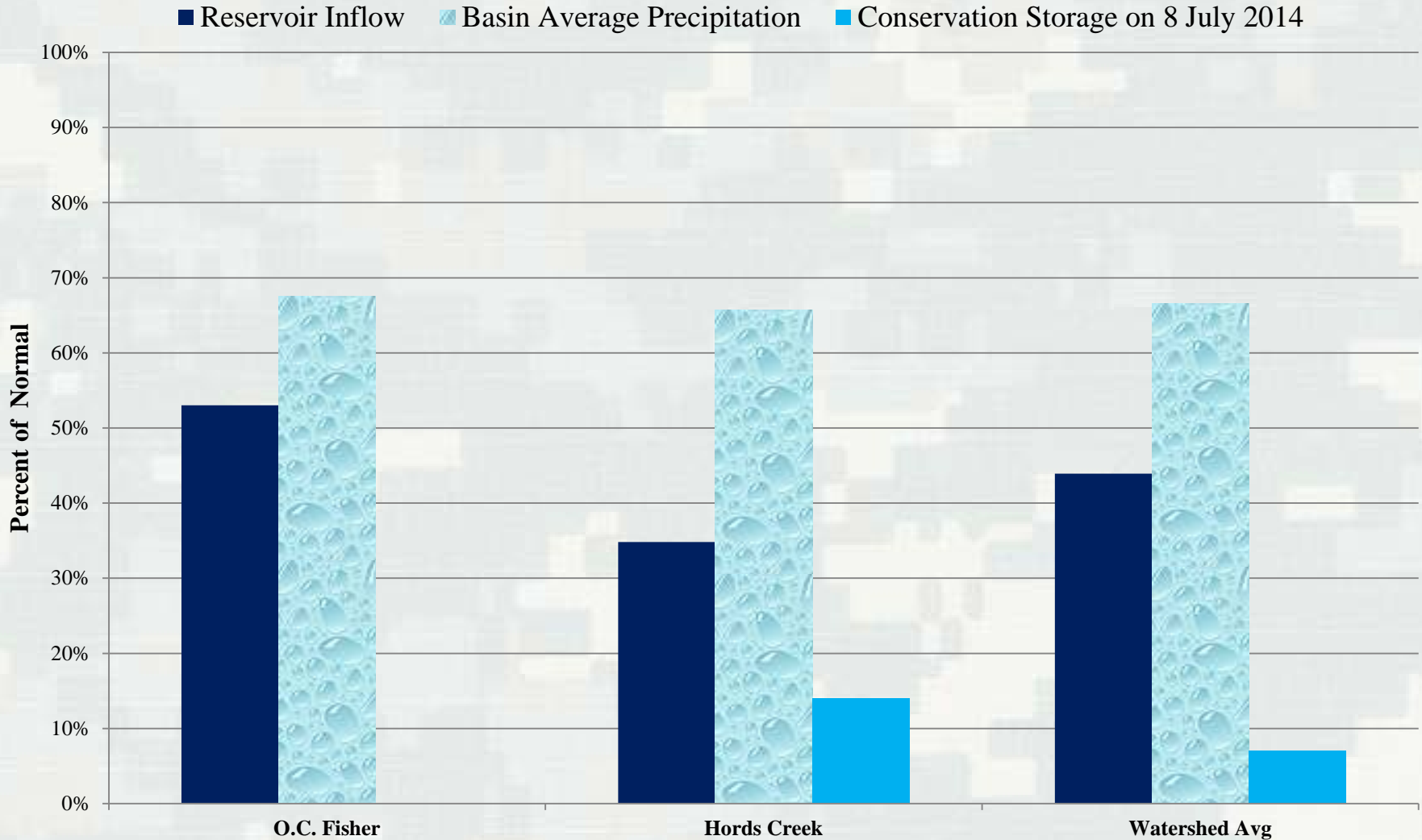
(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
 Jan-Jun 2014 Avg PDSI = -0.7    Current PDSI = -2.5



# Colorado River Basin

## Jan-Jun 2014 Experience vs. Normal

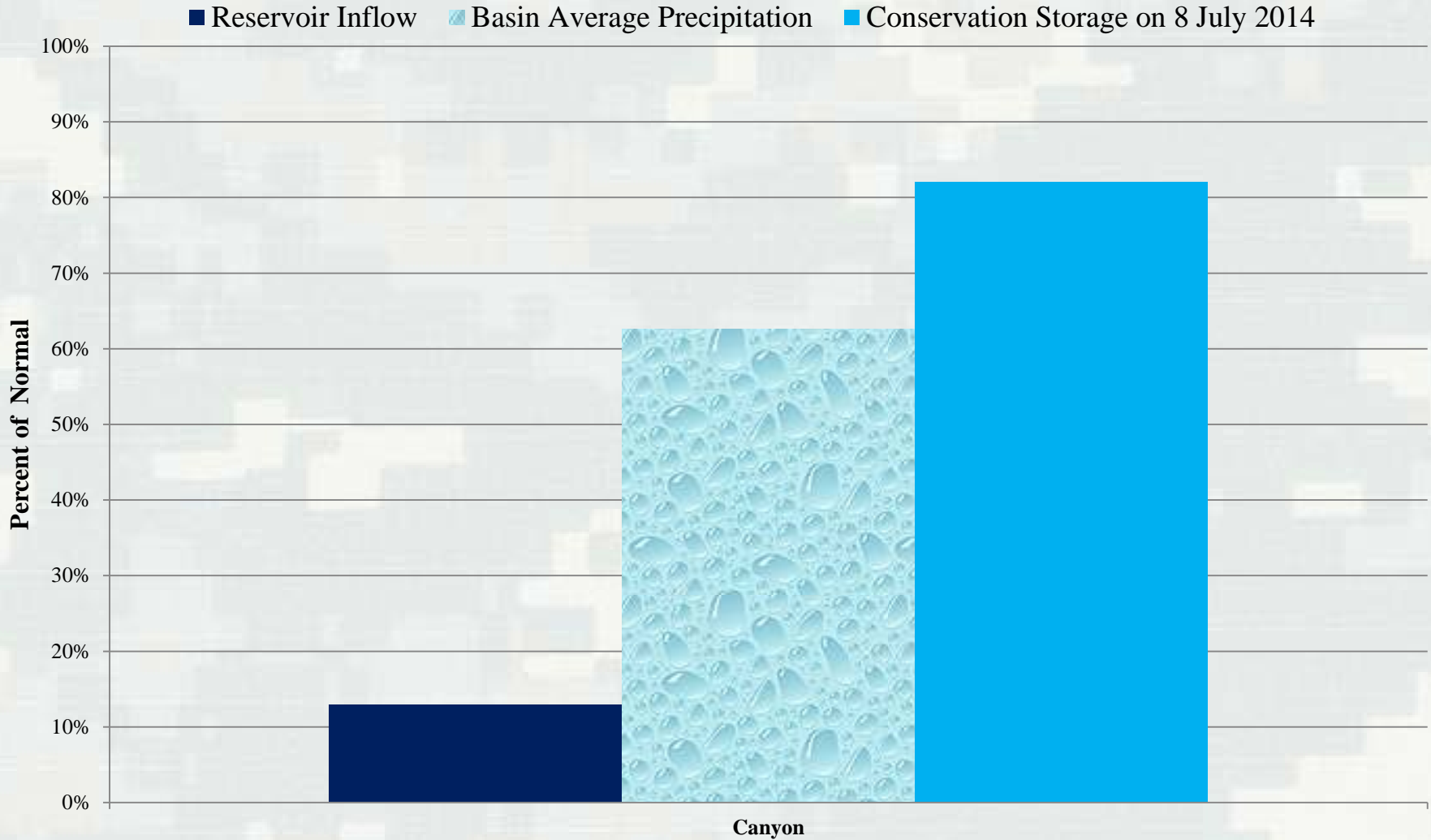
(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
Jan-Jun 2014 Avg PDSI = -2.1    Current PDSI = -3.5



# Guadalupe River Basin

## Jan-Jun 2014 Experience vs. Normal

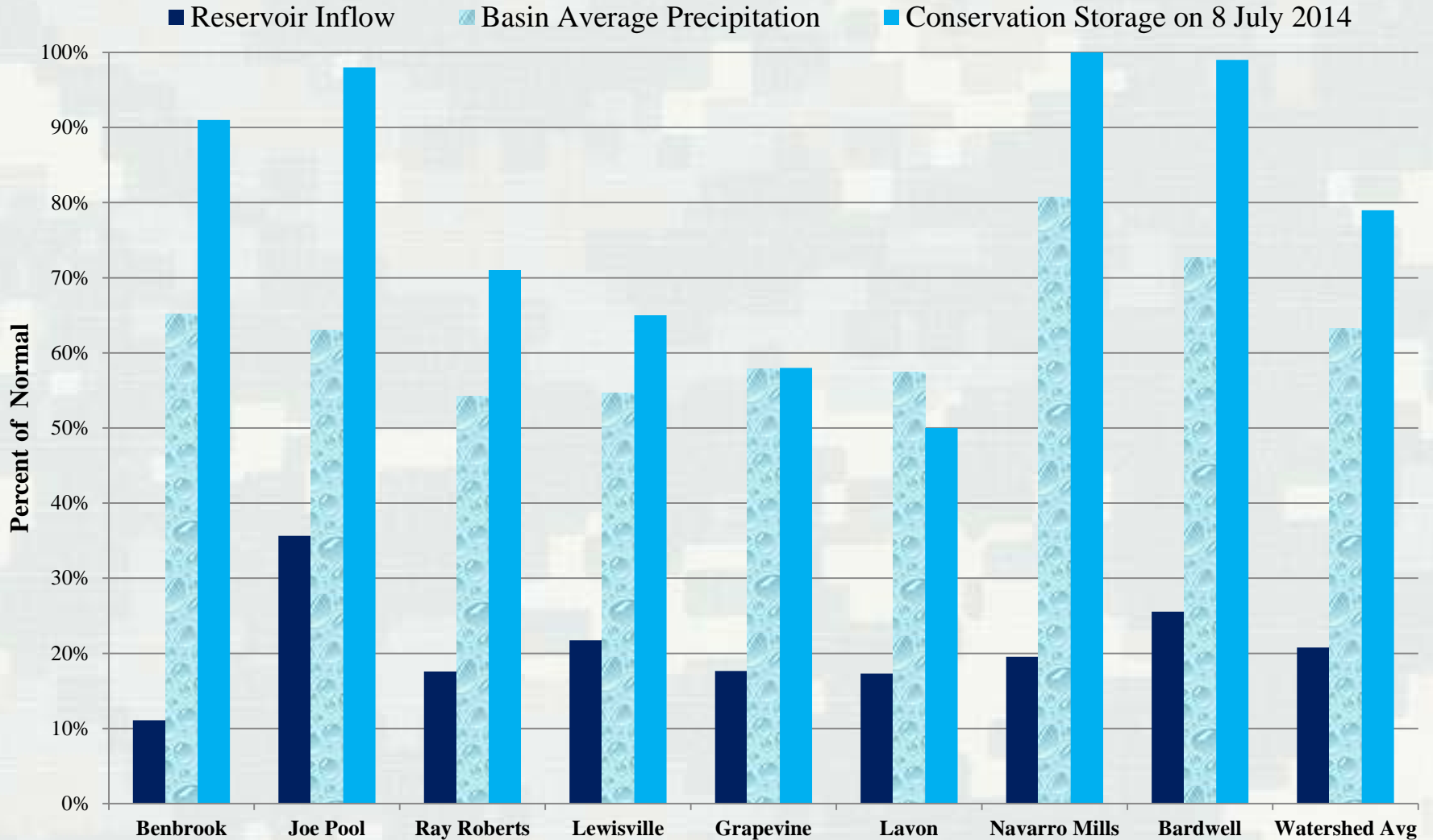
(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
Jan-Jun 2014 Avg PDSI = -0.2    Current PDSI = 0



# Trinity River Basin

## Jan-Jun 2014 Experience vs. Normal

(Normal = Jan-Jun Annual Average for 1981-2010 POR)  
 Jan-Jun 2014 Avg PDSI = -0.7    Current PDSI = -2.5

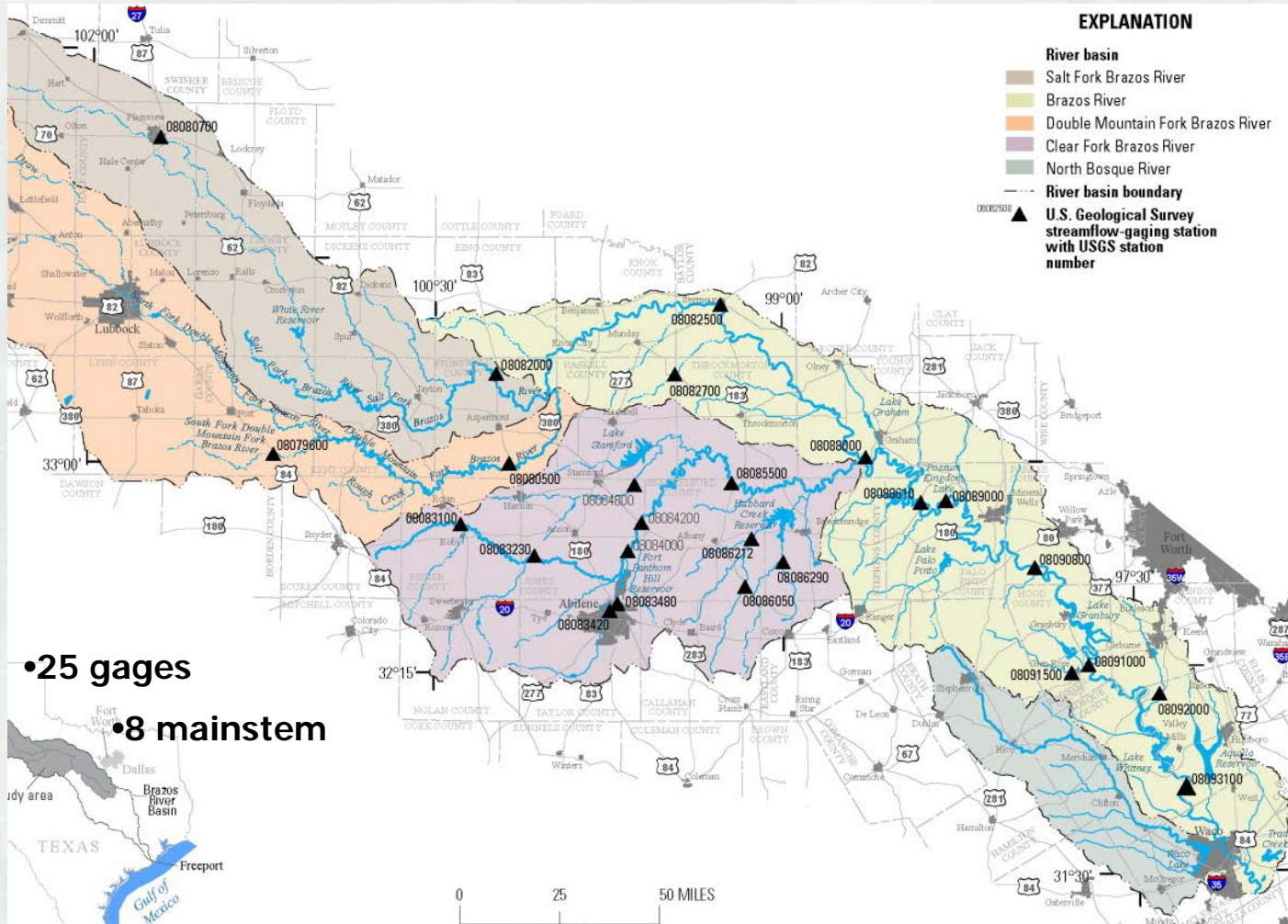


# USACE Regional WS Activities

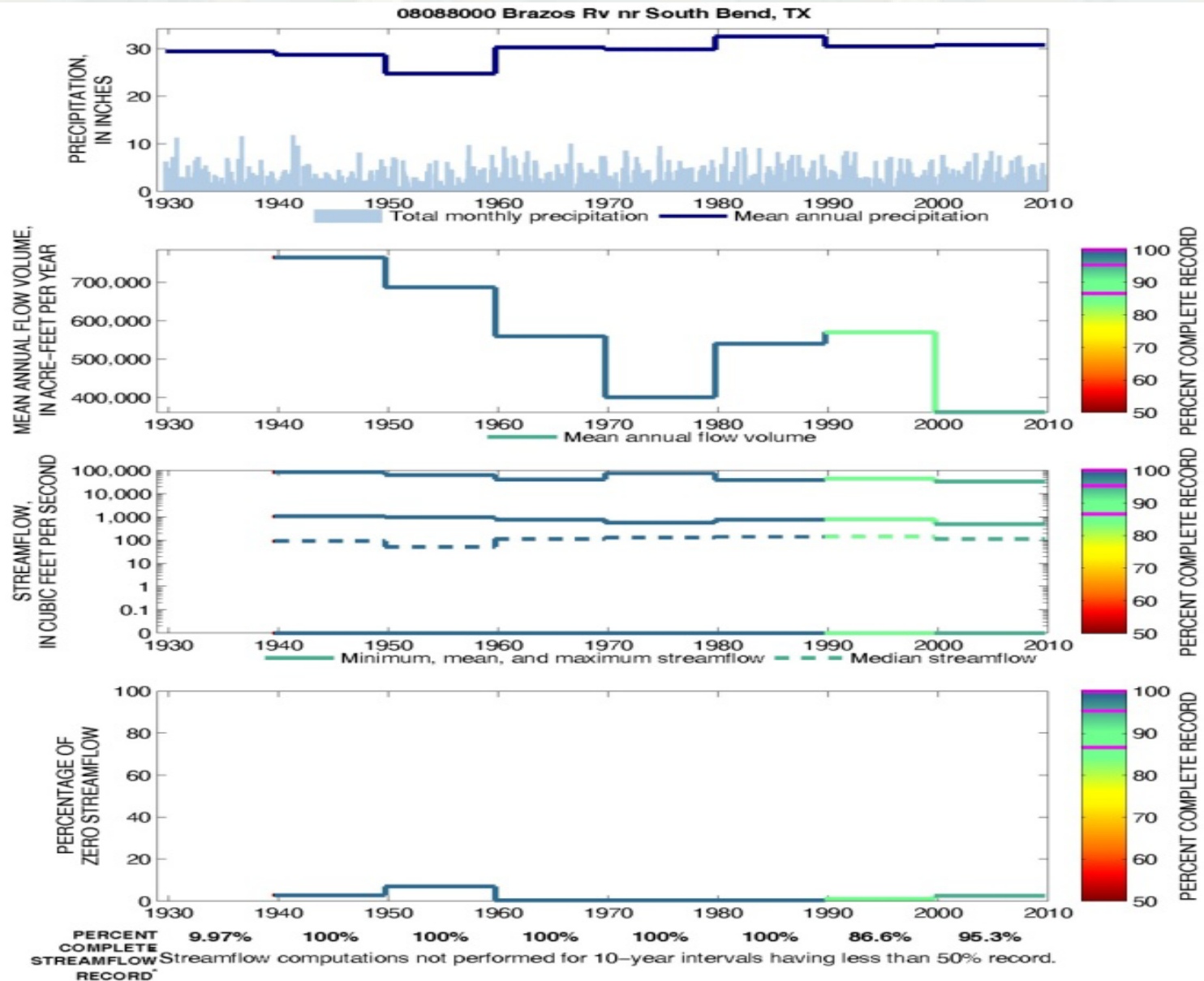
Upper Brazos River Basin  
Declining Streamflow Study



# Brazos River Declining Flow Volume Study



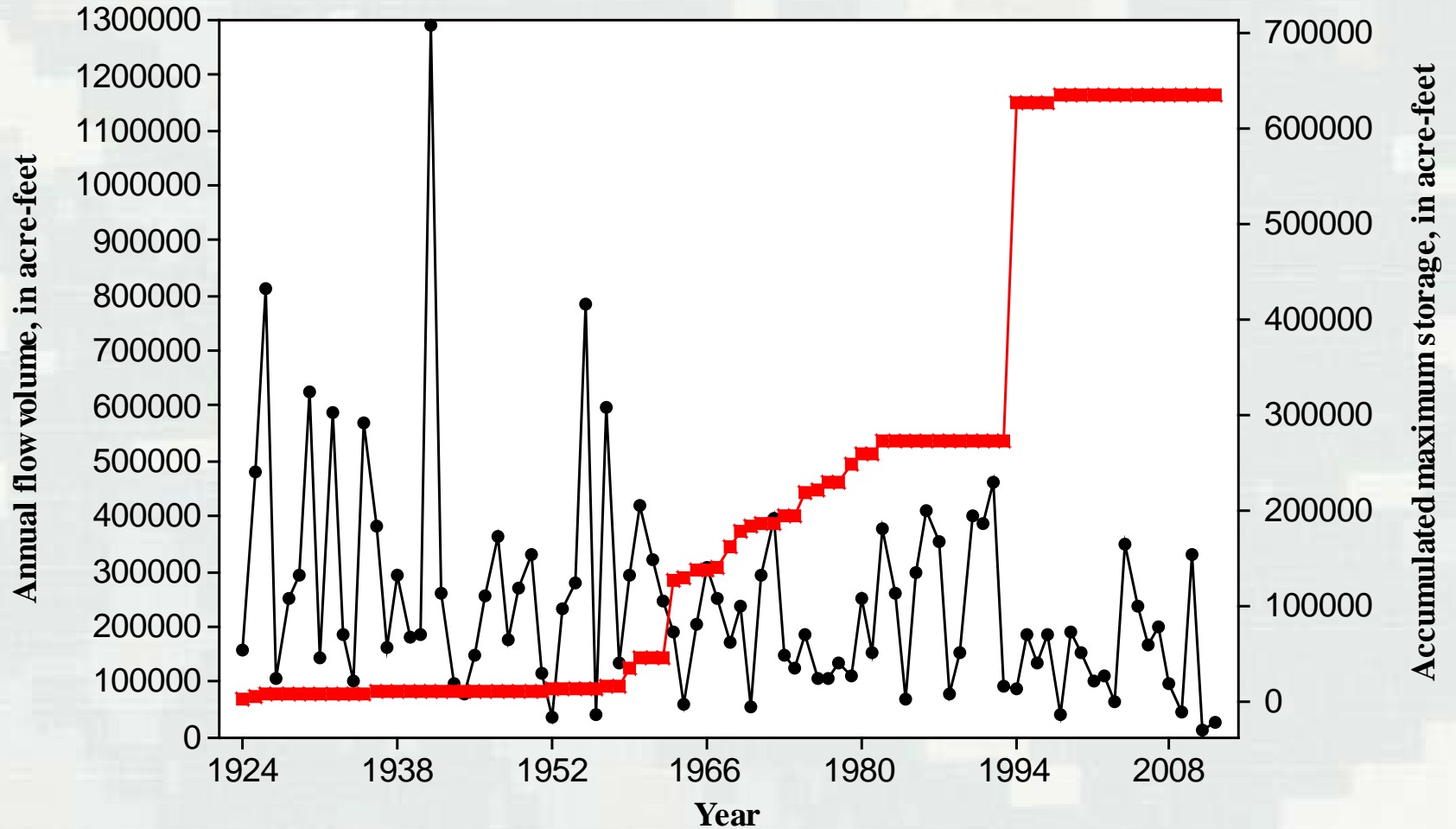
# Brazos River at South Bend, TX from 1924 to 2012.



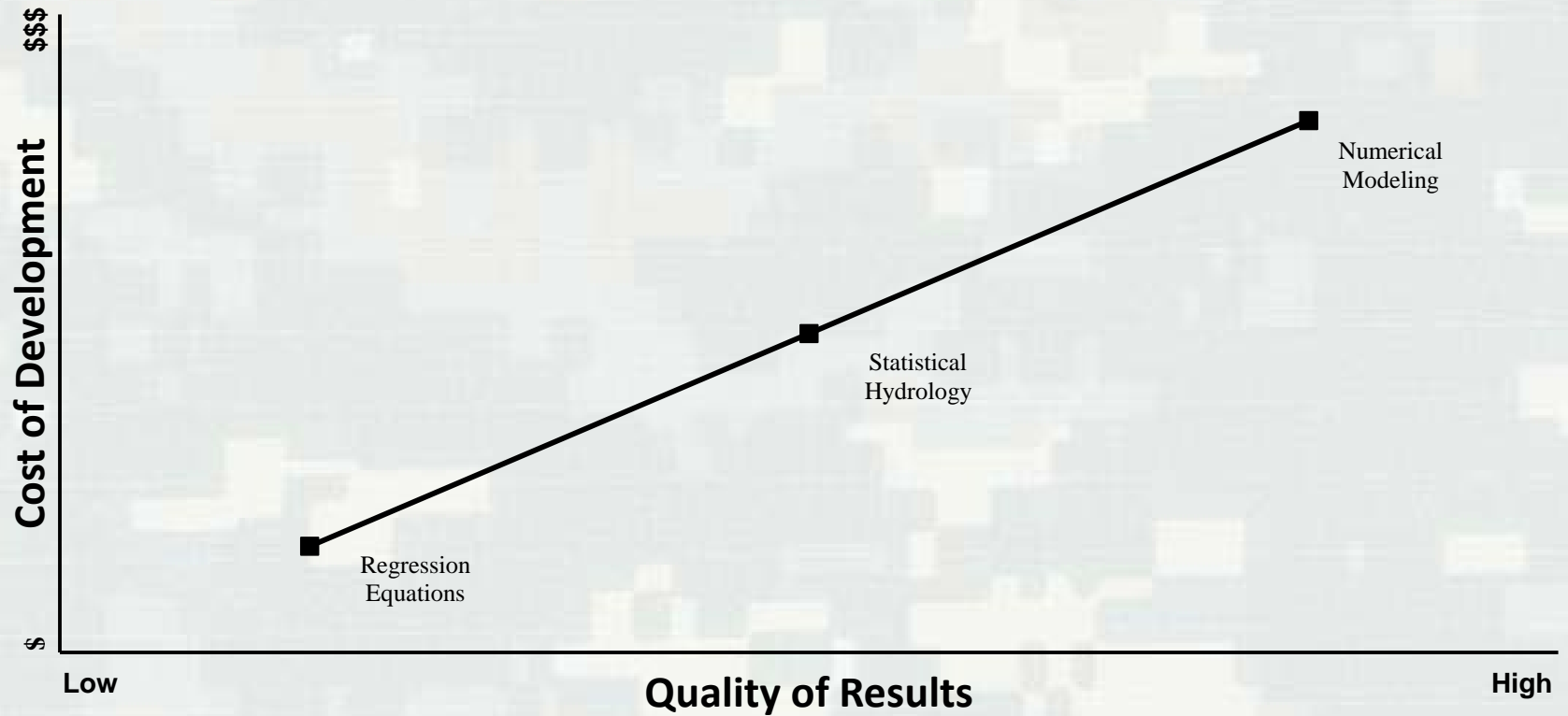


# Brazos River at Seymour, TX from 1924 to 2012

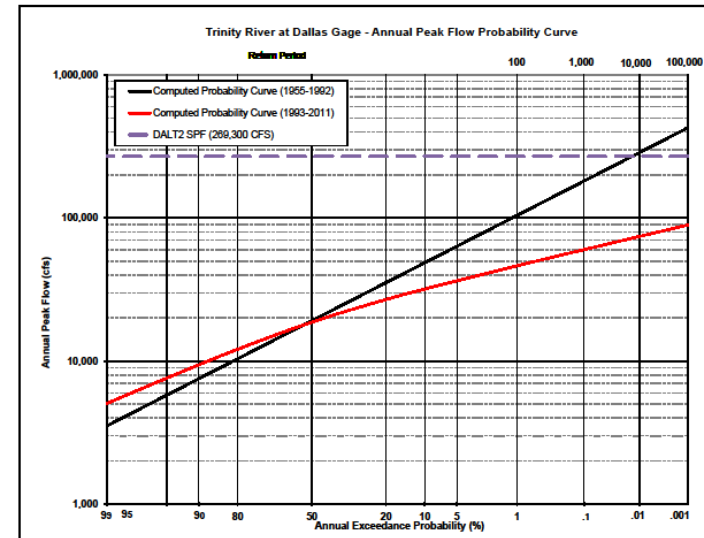
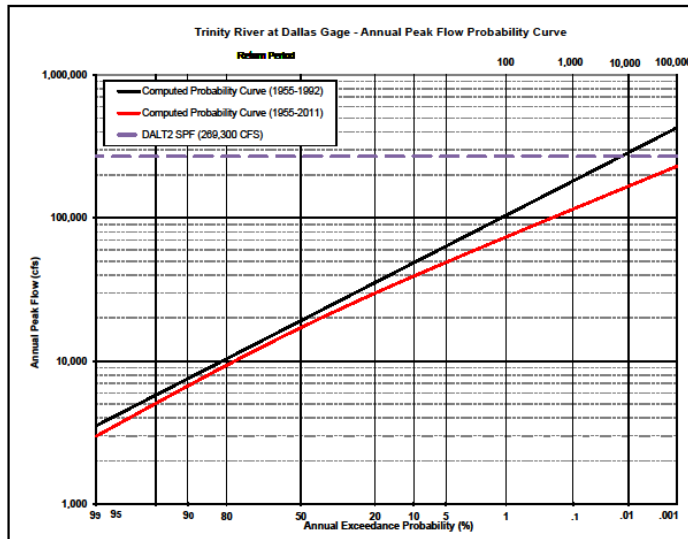
## Annual Flow Volume and Cumulative Upstream Project Storage Volume



# Comparison of Hydrologic Methods



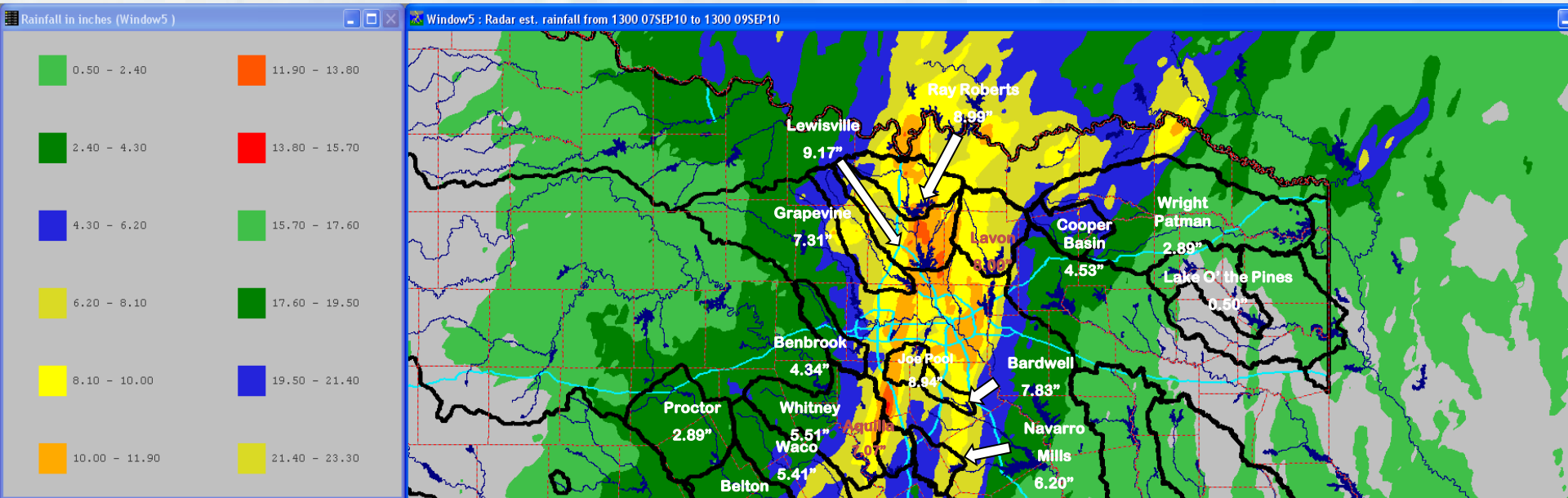
# Statistical Hydrology



- Regulation
- Urbanization (non-homogeneous)
- Climate variability

# Tropical Storm Hermine

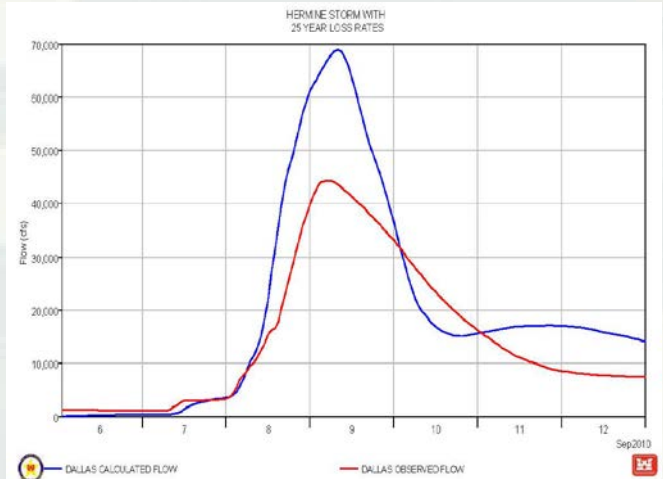
(7-9 Sept. 2010)



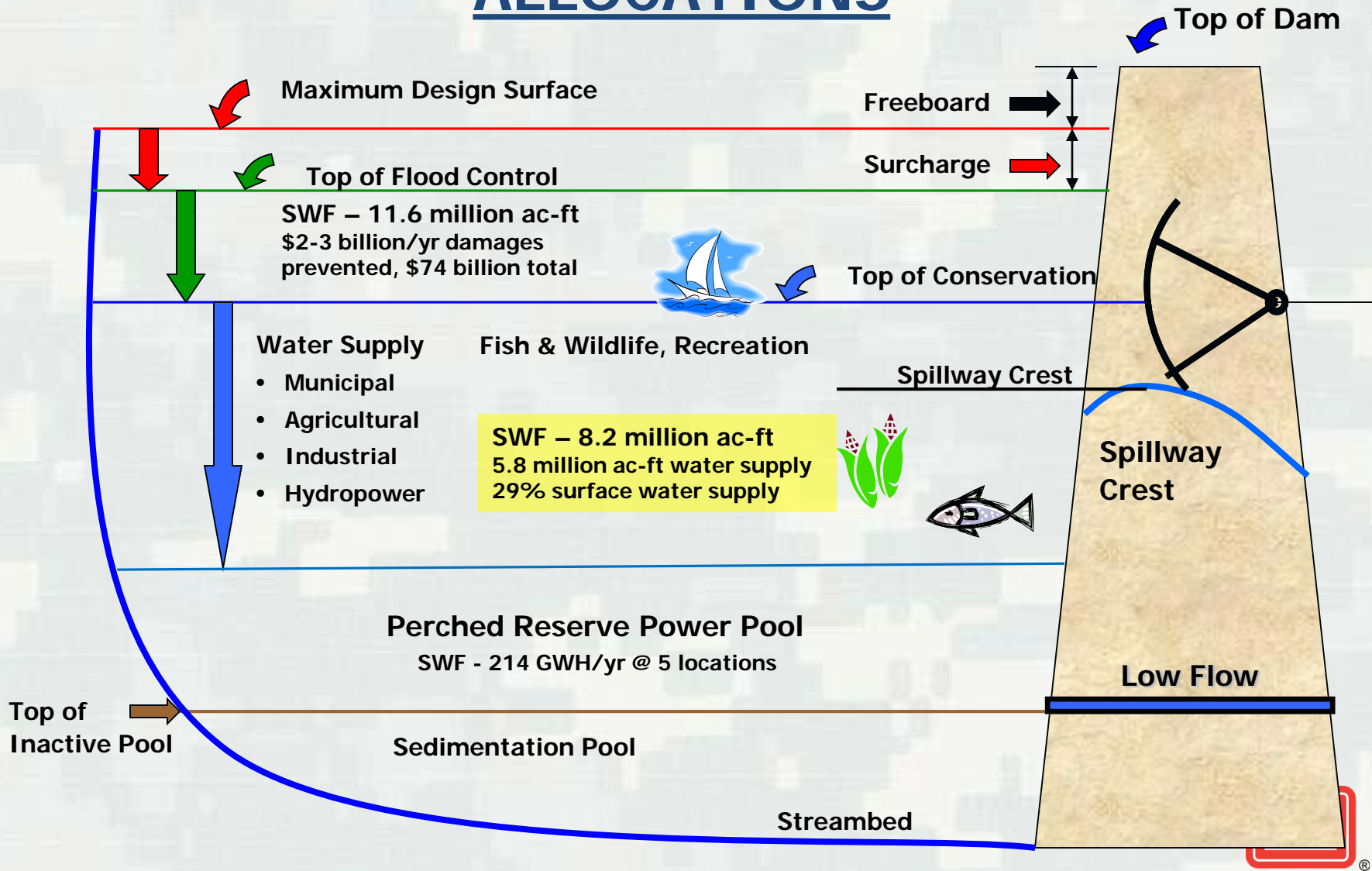
**Extremely dry conditions leading up to storm**

**24 hr 100-yr point rainfall, 25-yr basin average only produced 10-yr runoff**

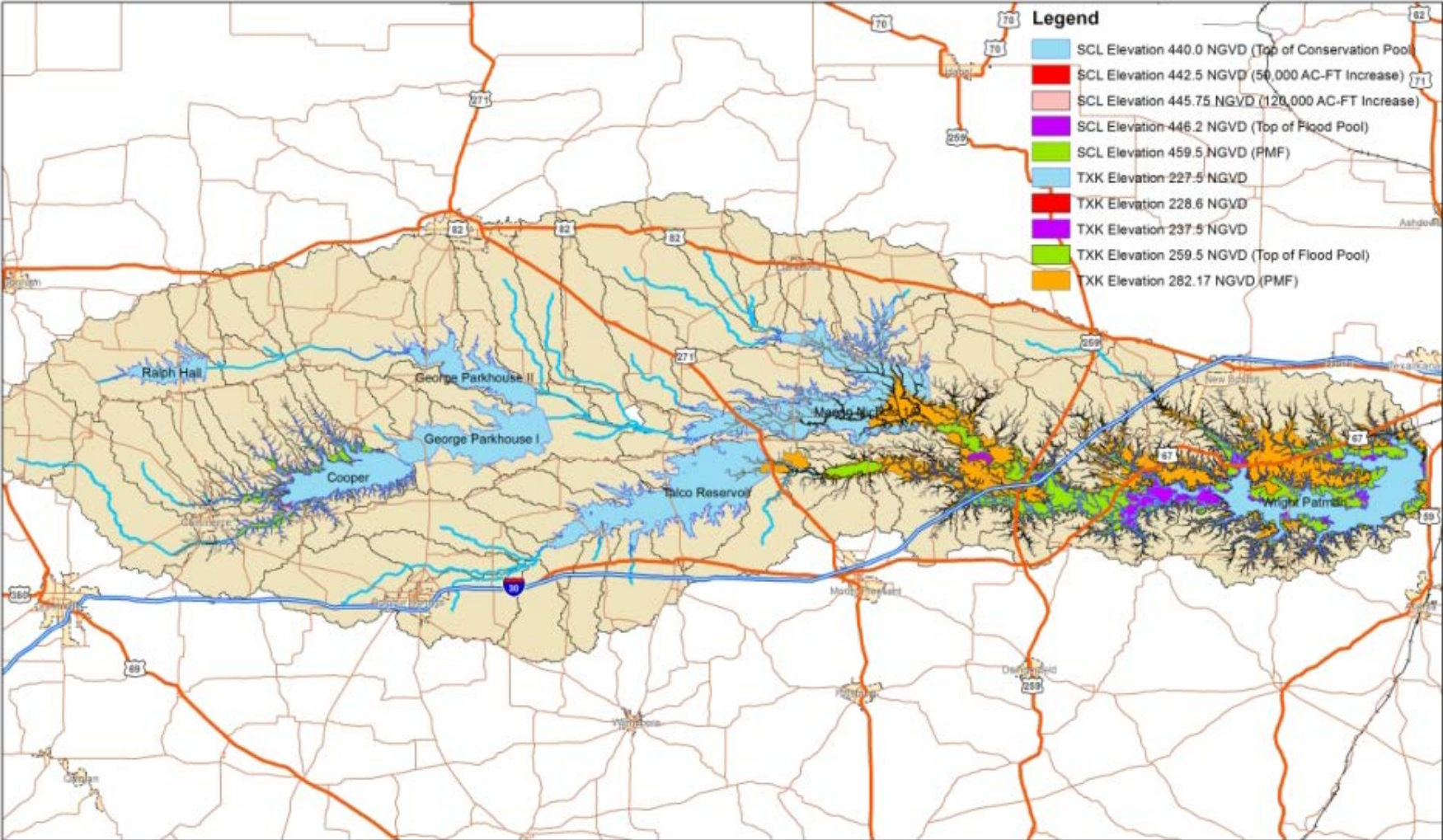
**Observed flow = 44,200 cfs; Adjusted flow = 66,000 cfs**



# RESERVOIR ALLOCATIONS



# Sulphur River Basin Study - Wright Patman Reallocation



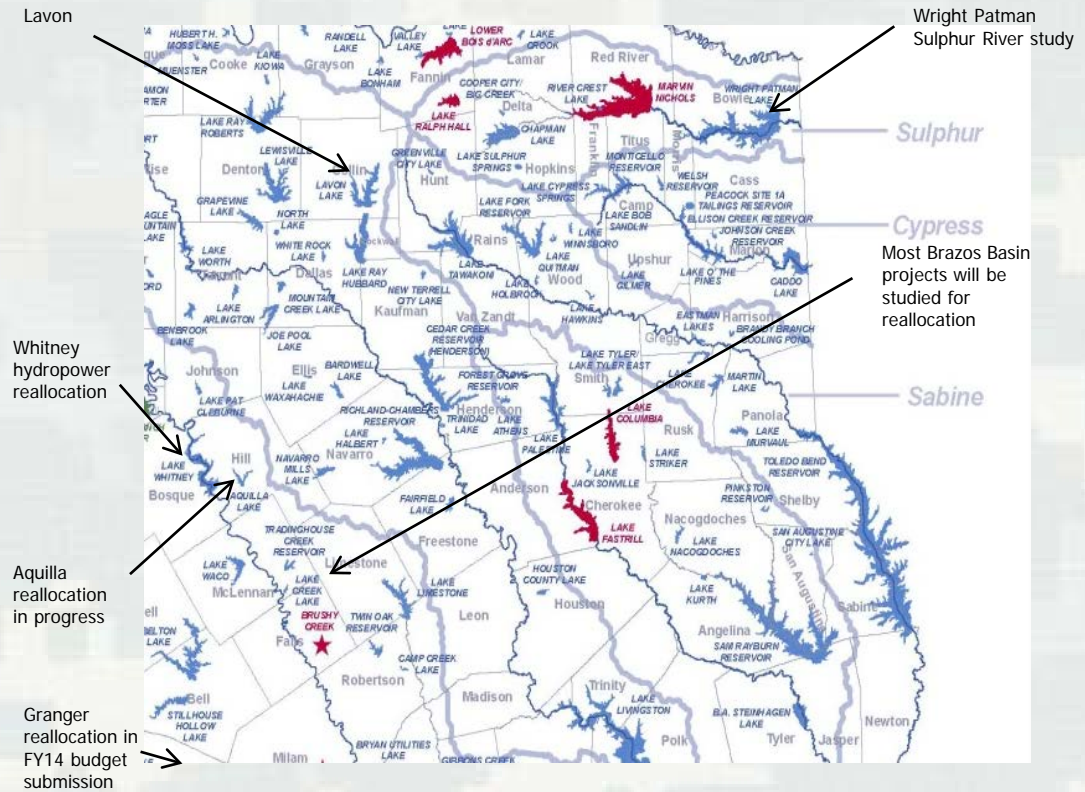
# Reallocations or Modifications

- Completed

- ▶ Waco
- ▶ Whitney
- ▶ Belton
- ▶ Lewisville
- ▶ Lavon

- Ongoing or future

- ▶ Aquilla
- ▶ Whitney
- ▶ Granger
- ▶ Lavon
- ▶ Wright Patman



# USACE Non-WS Activities

- CDC Regulatory Program – NCTCOG, FMTF
  - ▶ Effective in limiting the loss of valley storage
  - ▶ Upland watershed areas not within regulatory footprint
  - ▶ Highlights the need for expanded regional stormwater management
- Dallas Floodway Feasibility – Dallas
- Guadalupe Feasibility – GBRA
- Johnson Creek Feasibility - Arlington
- West Side Creek – SARA
- Leon Creek Feasibility – SARA
- Central City Construction – Fort Worth, TRWD
- Highland Lakes – LCRA

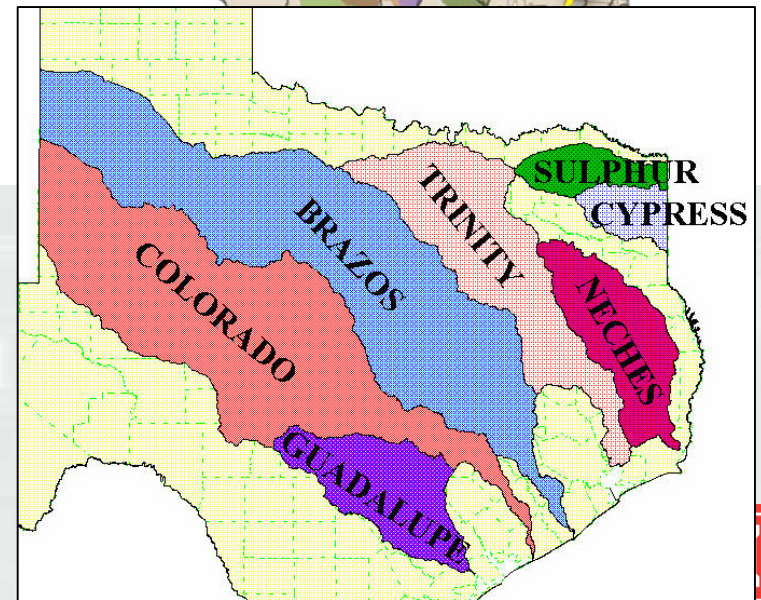
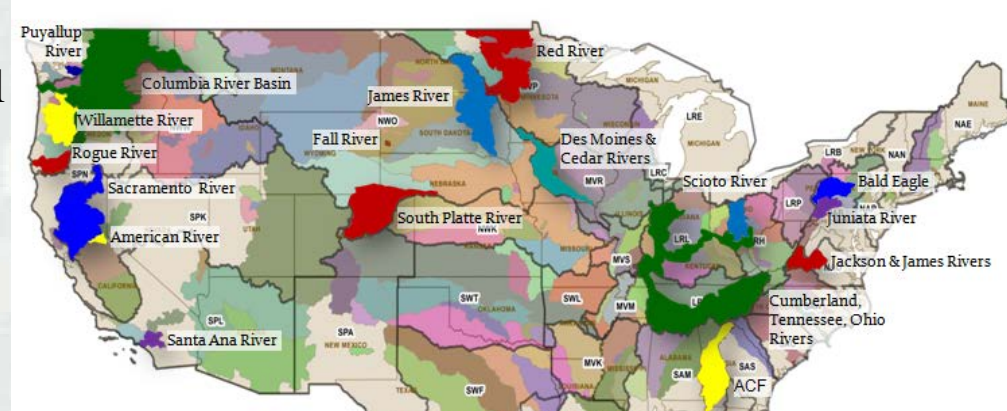




# National CWMS Implementation

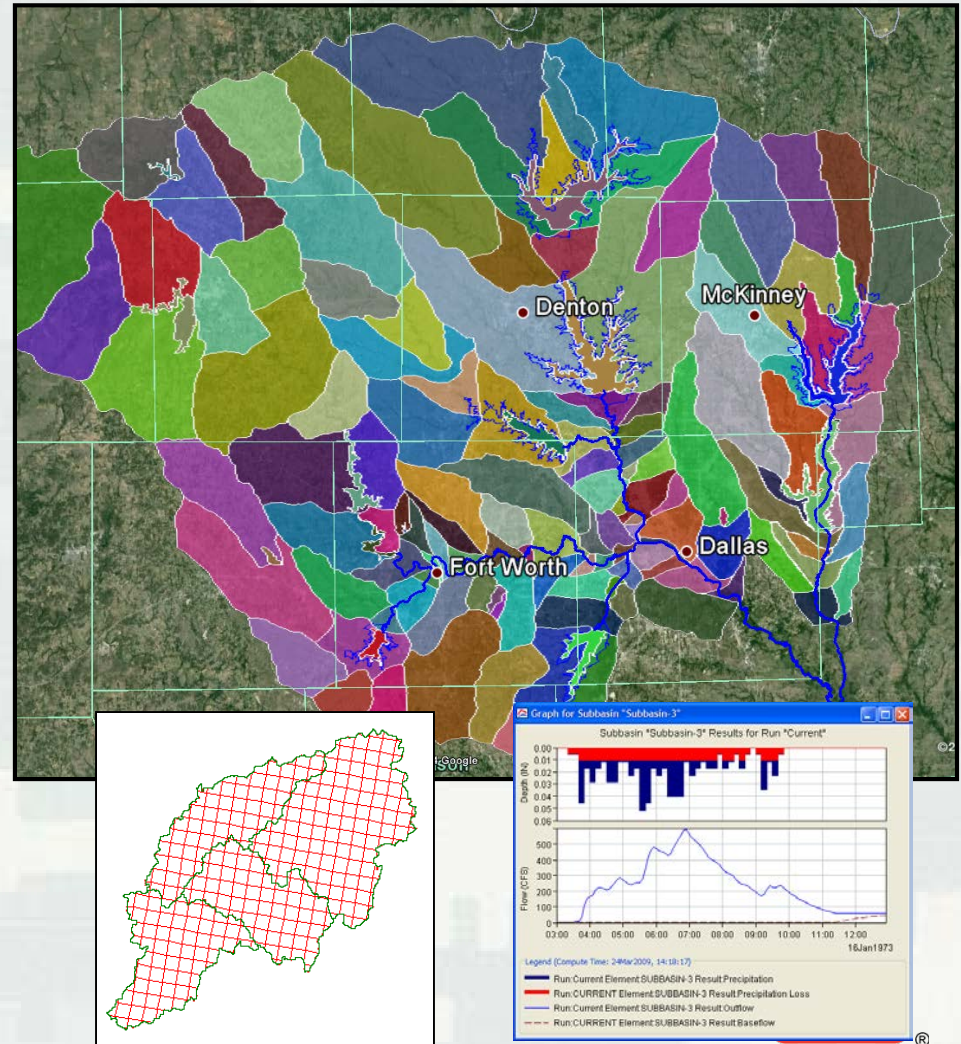
200+ USACE Watersheds

- Modern state of the art models for all watersheds with USACE assets
  - ▶ Rainfall-runoff
  - ▶ River stage
  - ▶ Reservoir system simulation
  - ▶ Economic
- \$125-\$150 million nationally
- Texas (\$5 million)
  - ▶ Current
    - Trinity, Neches, Guadalupe, Colorado
  - ▶ Next FY
    - Brazos, Sulphur, Cypress
- Coordination
  - ▶ FEMA, USGS, NWS, regional and local governments



# CMWS Rainfall-Runoff Modeling

- Basin-wide georeferenced from headwaters to Gulf
- CDC model, TRWD forecasting
- Forecasting USACE reservoirs
- Evaluating USACE assets
- FEMA mapping

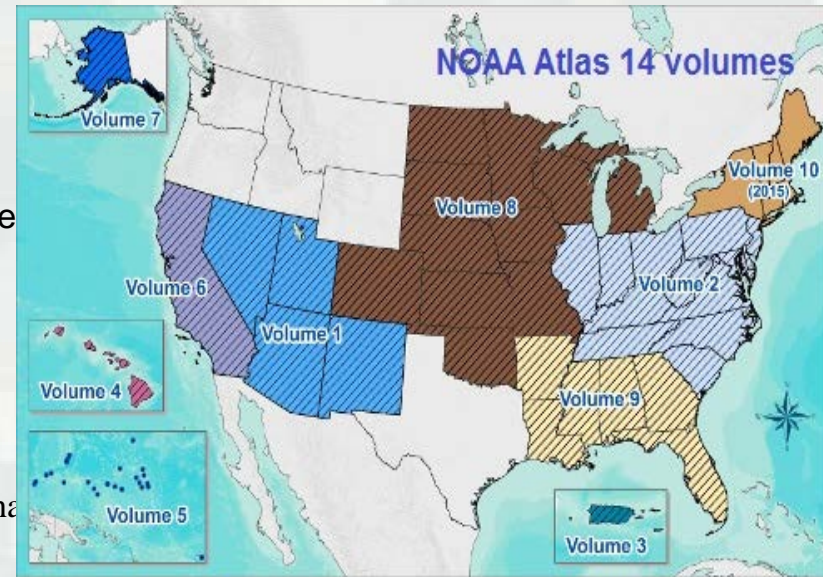


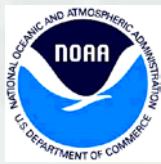
# NOAA Atlas 14 for Texas

- Gridded precipitation frequency estimates for Texas
  - Endorsed by Advisory Committee on Water Information (ACWI), federal water agencies
  - Referenced in many federal, state, and local regulations
- Takes about 3 years to complete
  - Work can begin when funding is in place
- Receipt of funds can be scheduled over 3 years
  - TX: \$1,100,000 over 3 years (\$370,000 per year)

- Project Manager:  
Sanja Perica, Director of Hydro-meteorological Design Studies Center

- Execution:  
**University Corporation for Atmospheric Research (UCAR)** is a nonprofit consortium of more than 75 universities offering Ph.D.s in the atmospheric and related sciences. UCAR manages the National Center for Atmospheric Research (NCAR) and provides additional services to strengthen and support research and education through its community programs.





# Precipitation Frequency Data Server



<http://hdsc.nws.noaa.gov/hdsc/pfds/index.ht>

**Precipitation Frequency Data Server (PFDS)**

Home    Site Map    News    Organization

State:

Choose a state (or click map)

**States**

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida**
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky

Internet Link to USACE Software

Legend:  
■ Updated data available  
■ Data update in progress

PR/VI

**General Info**  
Homepage  
Current Projects  
FAQ  
Glossary

**Precipitation Frequency (PF)**  
PF Data Server

- PF in GIS Format
- PF Maps
- Temporal Distr.
- Time Series Data
- PFDS Perform.

**PF Documents**

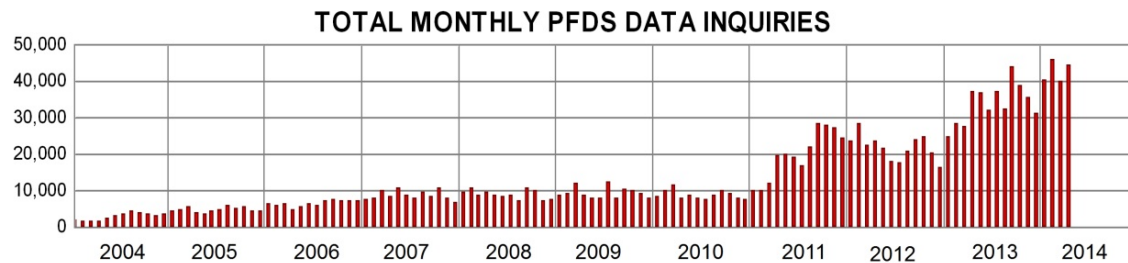
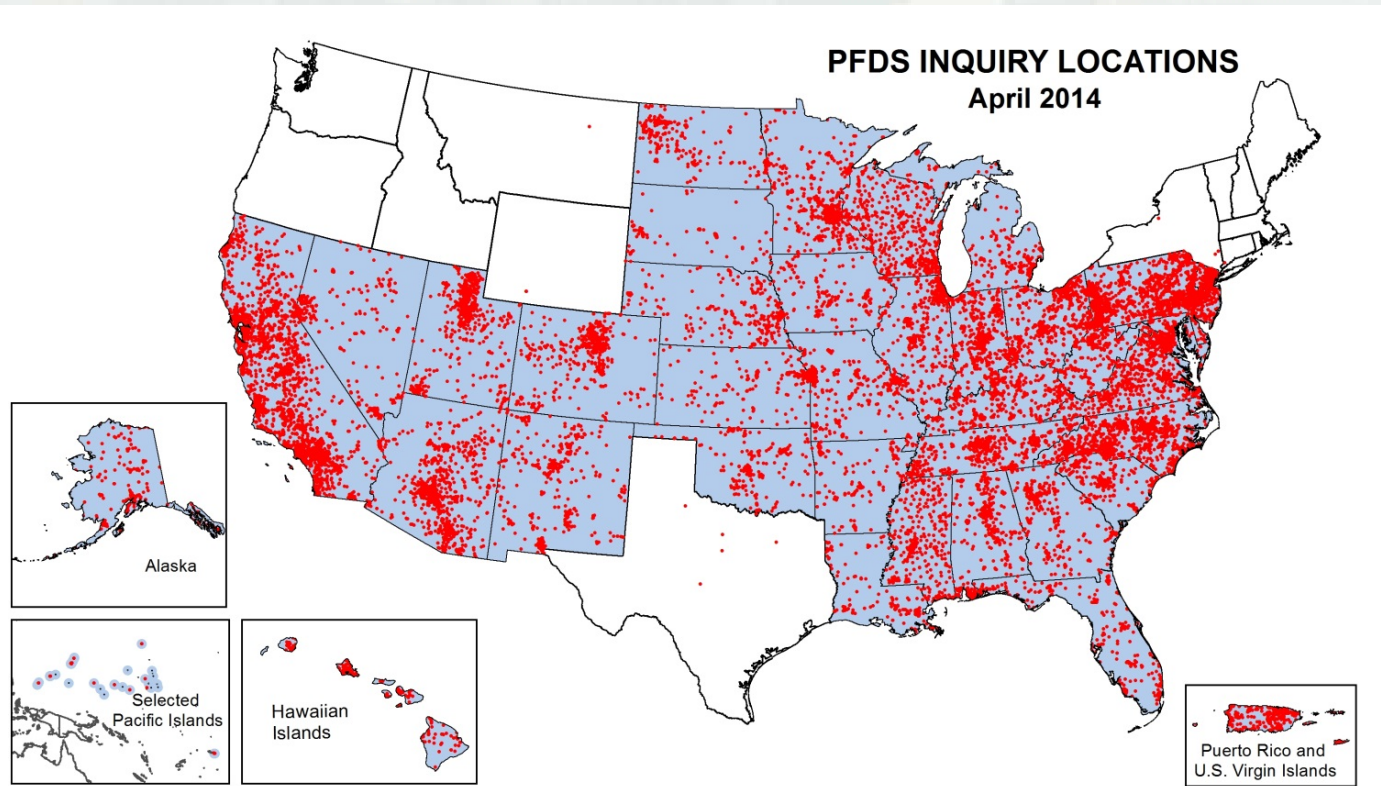
**Probable Maximum Precipitation (PMP)**  
PMP Documents

**Miscellaneous Publications**  
AEP Storm Analysis  
Record Precipitation

**Contact Us**  
Inquiries  
List-server

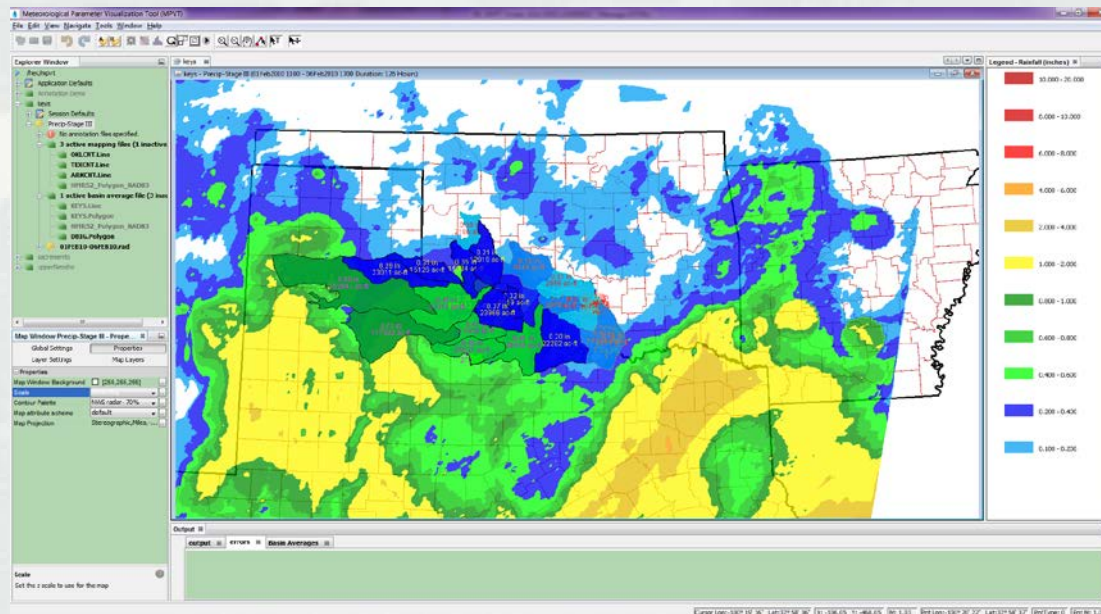


# Data inquiry locations and monthly statistics



# USACE Software Development

- RiverWare \$3 million
- Corps Water Management System (CWMS)
- State of the art tools for:
  - ▶ Rainfall-runoff, river stages, reservoir system sim., FDR economics



# WEB Sites

[www.usace.army.mil](http://www.usace.army.mil)

[www.swf.usace.army.mil](http://www.swf.usace.army.mil)

[www.swf-wc.usace.army.mil](http://www.swf-wc.usace.army.mil)

## Questions?



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