

# USACE Initiatives and InFRM Products Which Might Benefit Public Works

Date: 16 Feb. 2017

Audience: Public Works Council (PWC)

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Corps of Engineers



# Blanco River May 23-24, 2015



12 Lives Lost, \$30M Total Damages

<http://features.texasmonthly.com/editorial/wimberley-floods-memorial-day-weekend-2015/>



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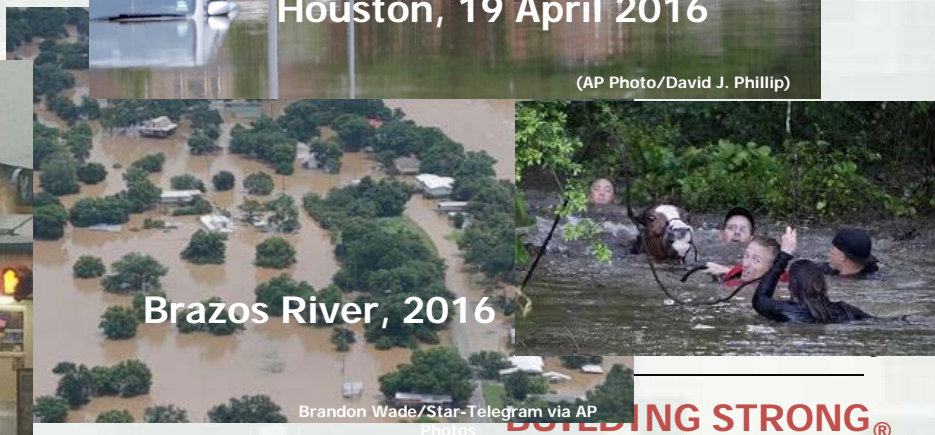
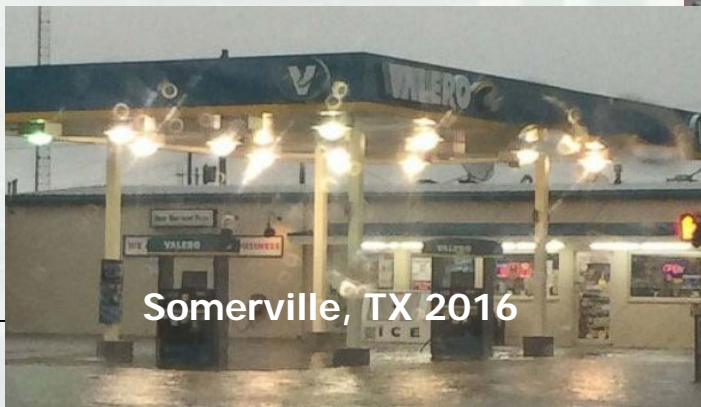
# Flooding Impacts All Layers of Infrastructure

- Road and bridge damages in 2015-2016
- 2015 - TRA and USACE partner to mitigate flood impacts on regional sanitary sewer for DFW
- Availability of potable water
  - ▶ Eastland County and Cisco, Texas loss of potable water system, memorial day 2016 flood
  - ▶ Fort Worth faces water famine, 1949



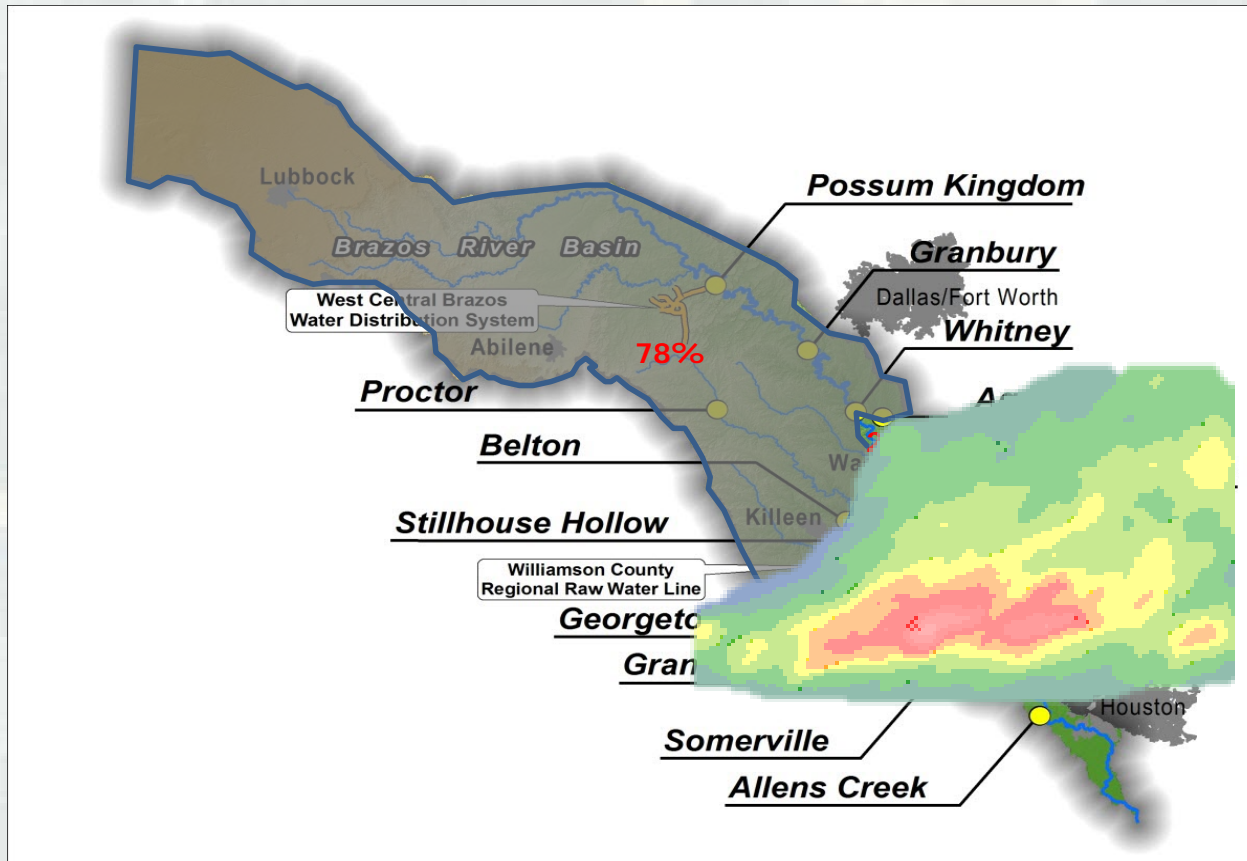
# Texas Is Subject to Extreme Flooding

- 2015-2016 Record flooding
- 1000s of Structures impacted across TX and LA in 2015-2016
- \$850M Damages in 2015 in TX alone



# Brazos River Basin Reservoirs

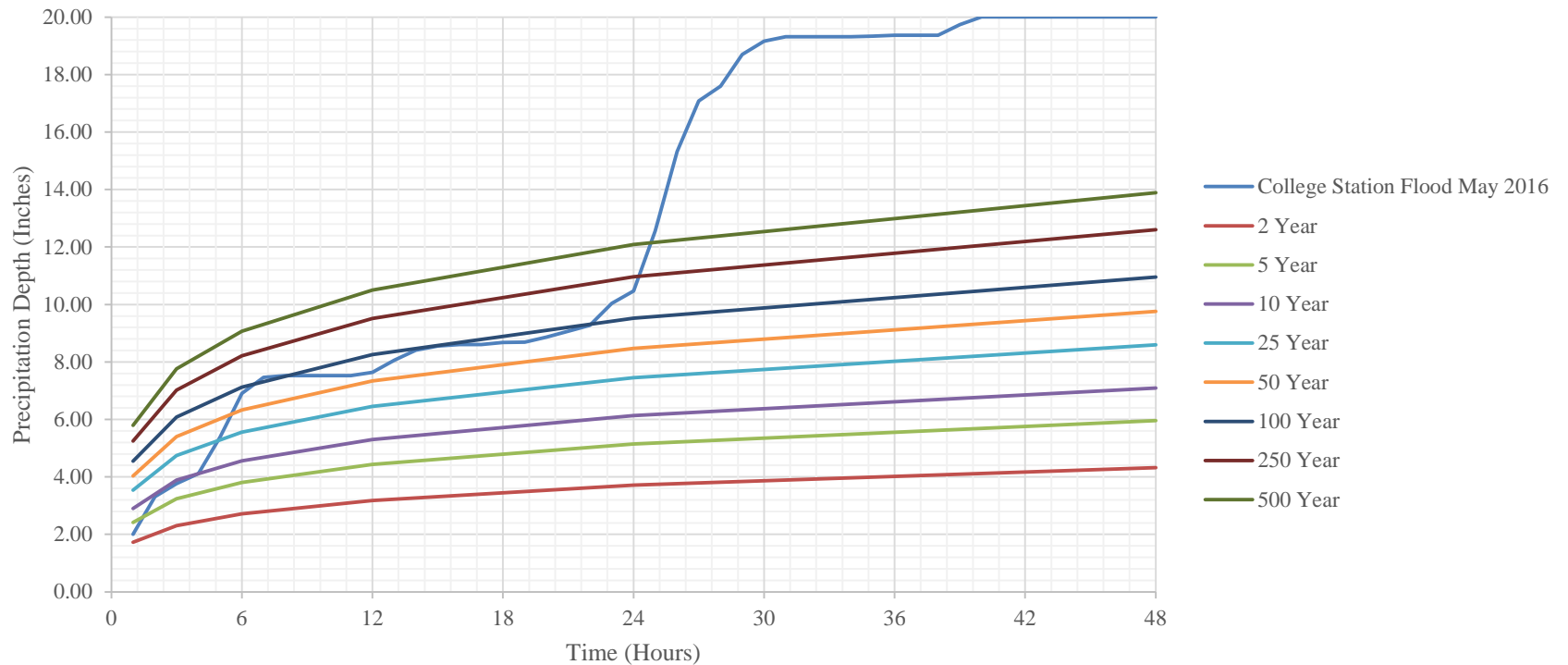
May 26-27, 2016



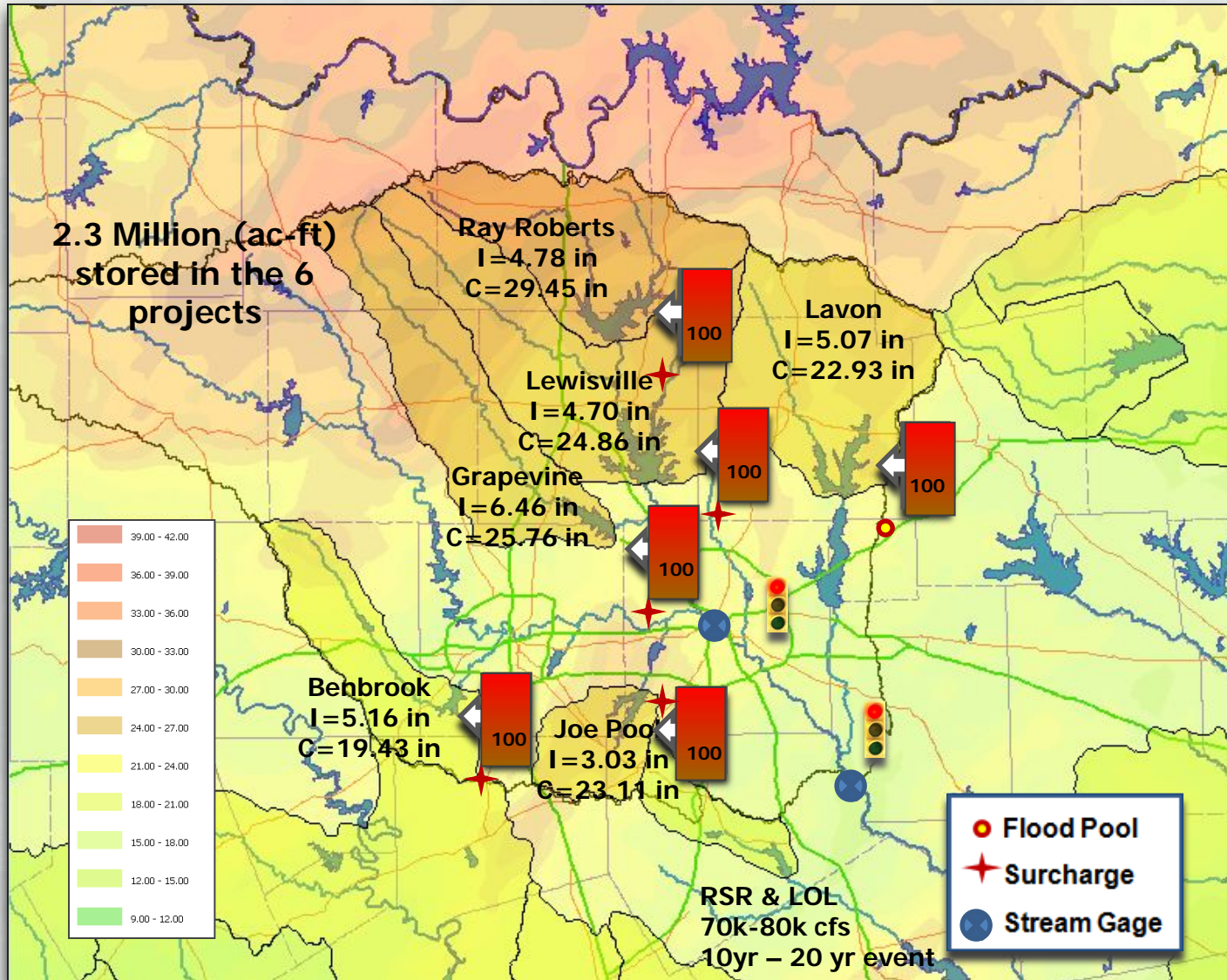
22" @ Brenham, TX



### Comparison of Annual Chance of Exceedance to College Station May 2016 Flood



# May-June 2015 Flooding



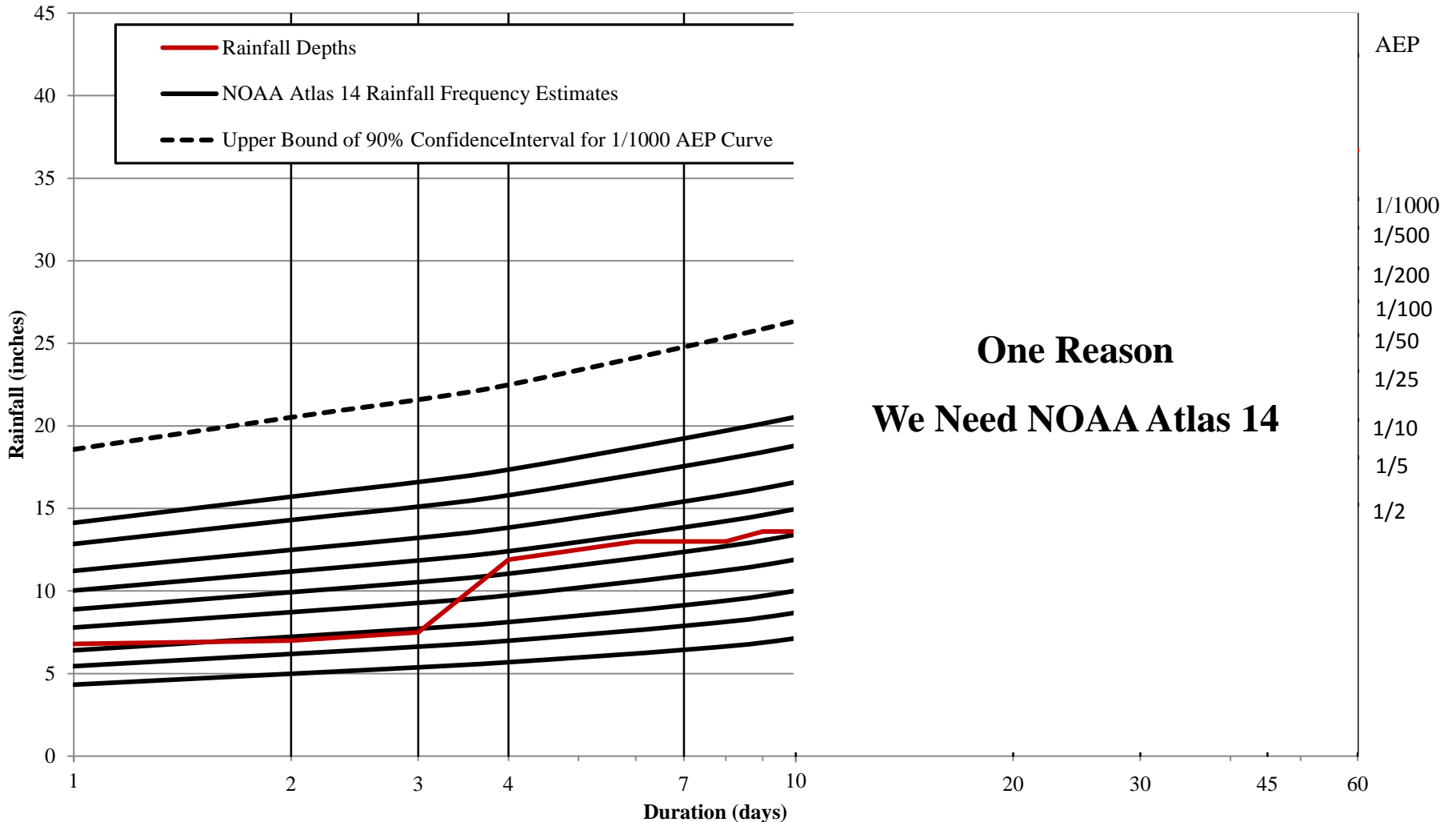
\*Pool percent taken on the last day



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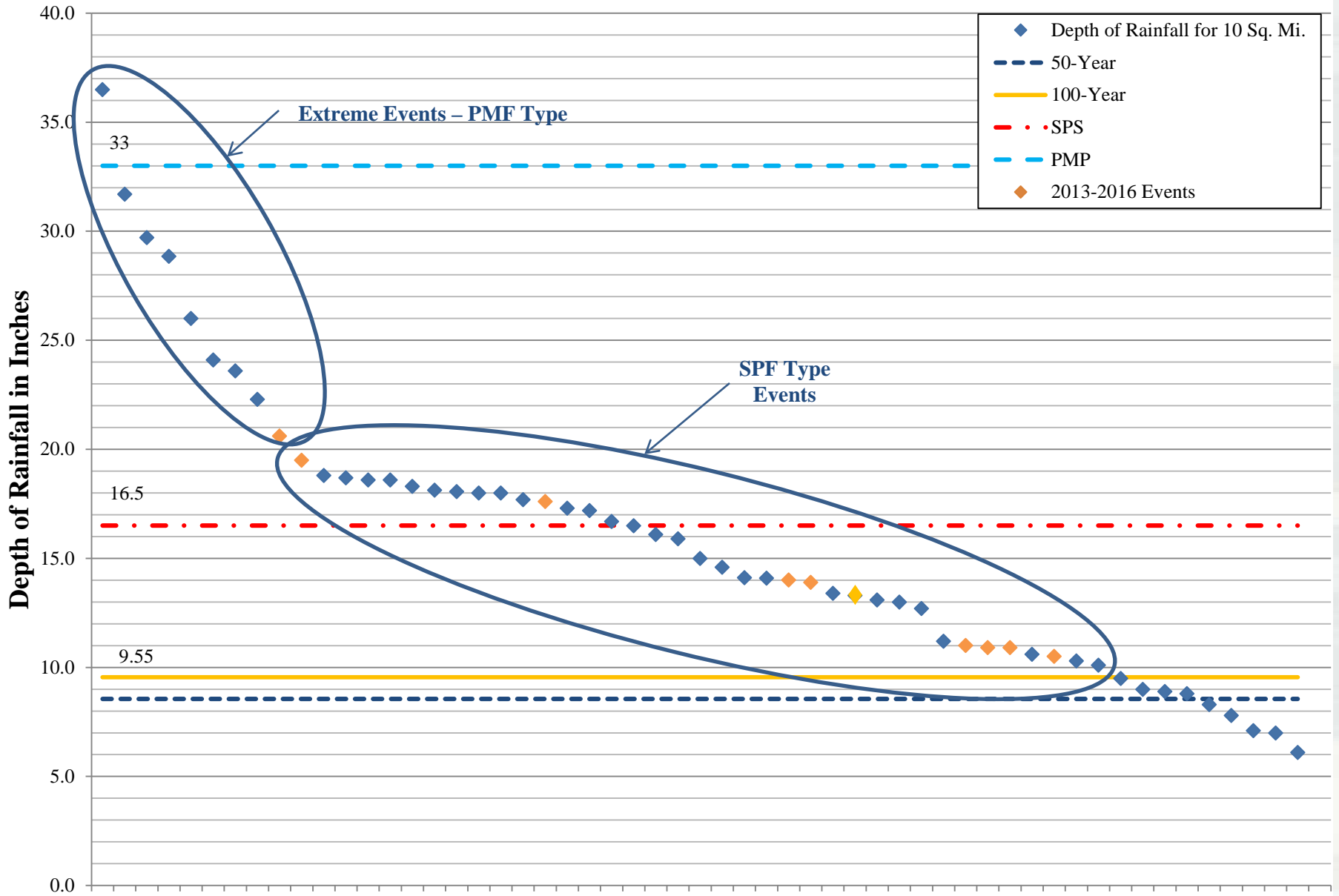
# Rainfall Frequency Data in Texas is limited to TP 40 and 49 (1960s era analysis) which only analyzed precipitation out to a 10-Day Duration

NOAA Atlas 14 update for Texas is in progress. Hendrix, OK is northwest of Lewisville Dam provides a reasonable estimate of what the NOAA Atlas 14 update may look like in North Texas.

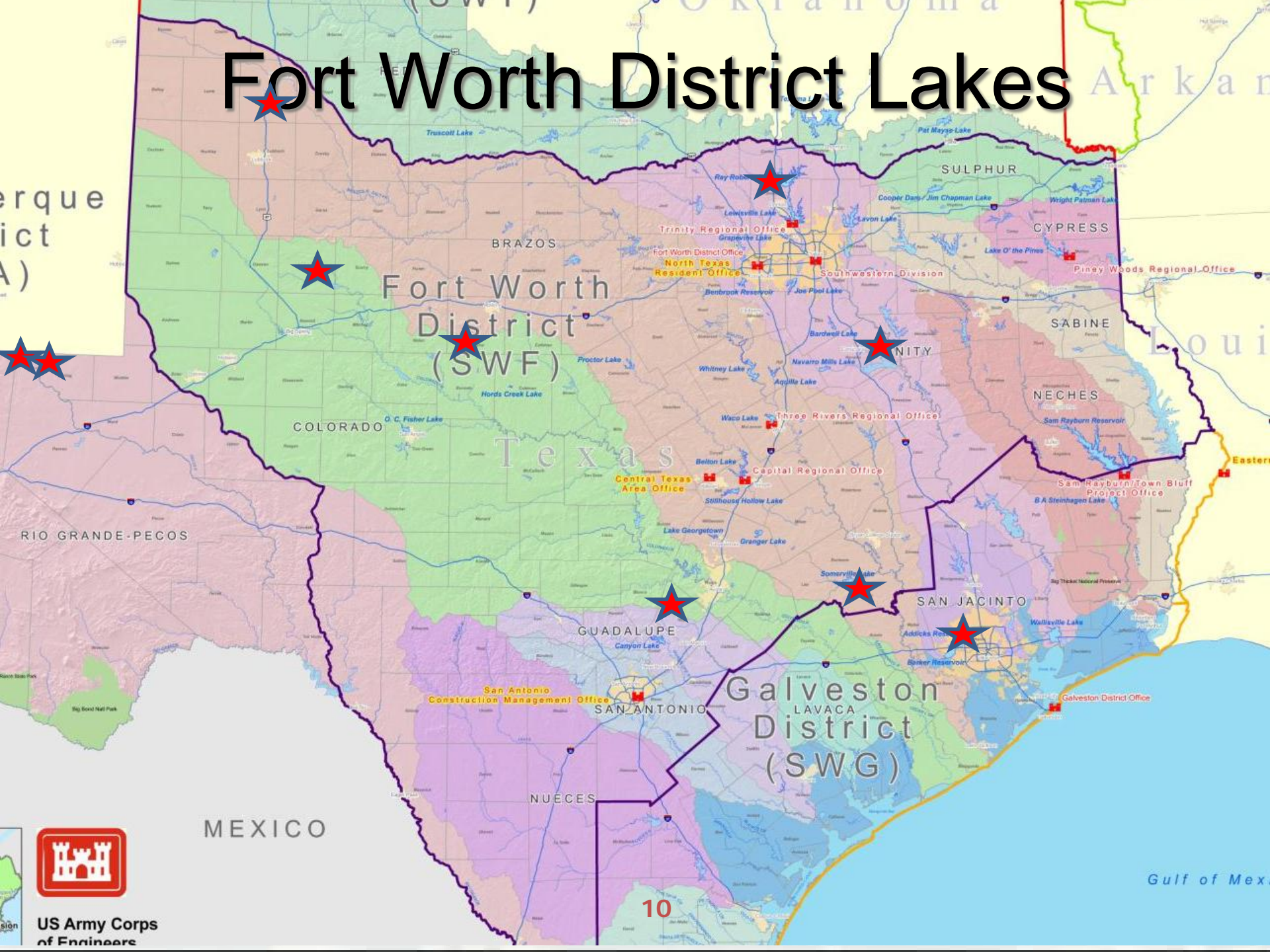




# 24 Hour Rainfall for 10 Sq. Mi.



# Fort Worth District Lakes



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of Engineers

# Decision Pyramid

*Decisions, new policies, better performance, new methods*

**ANALYSIS**, study, performance evaluation

Analysis – models, data from data collection systems against polices/rules

**GUIDANCE**, Policies, criteria, methods, requirements, needs, safety

Development/storm drain/culvert/bridge criteria

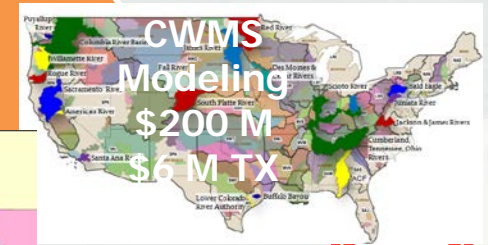
Operational Plans

NFIP 1 Ft. Criteria

**FOUNDATIONAL**, data and data collection, models, Atlas 14

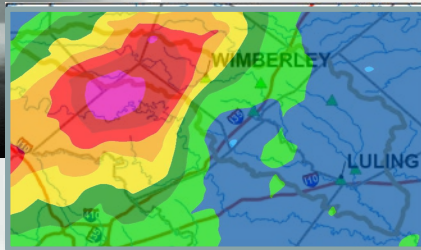
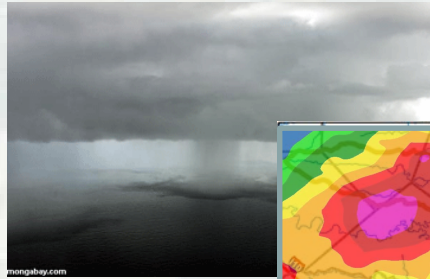


**BRA/TWDB  
Brazos River  
Models**

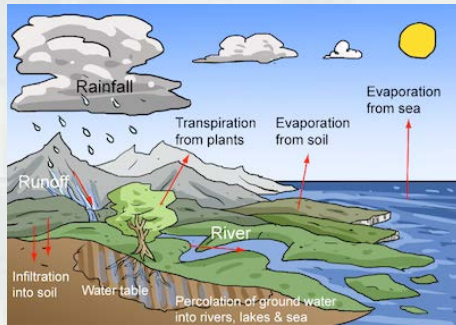


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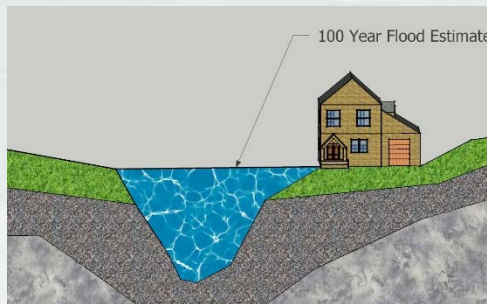
# Components of Flood Impact Determinations



- Meteorology
  - ▶ How much rain



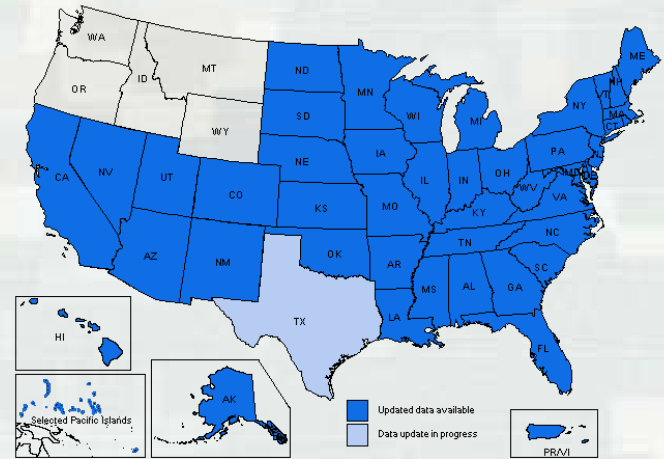
- Watershed Hydrology
  - ▶ How much runoff



- River Hydraulics
  - ▶ How deep will the water get

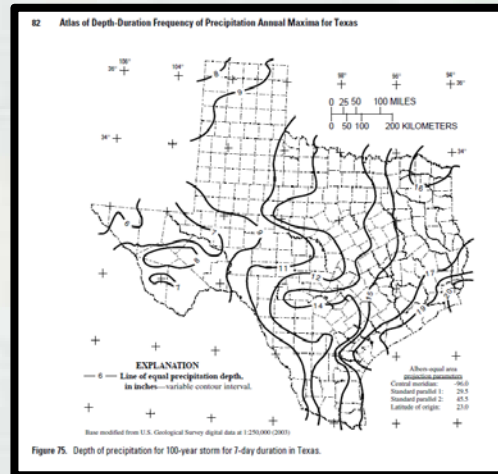
# NOAA Atlas 14 Volume for Texas

- **What is it:**
  - Important tool in storm water management
  - Precipitation frequency intensity estimates 1-yr to 1000-yr
  - How much rainfall in the 100-yr storm
  - Durations – 5 min. to 60 days
- **What is it used for:**
  - All infrastructure designs
  - Engineering and design:
    - Storm water run-off
    - Sizing detention basins and outlet structures
    - Bridges and Culverts
  - Modeling:
    - Flood risk management studies
    - Flood plain mapping (FIRM's)



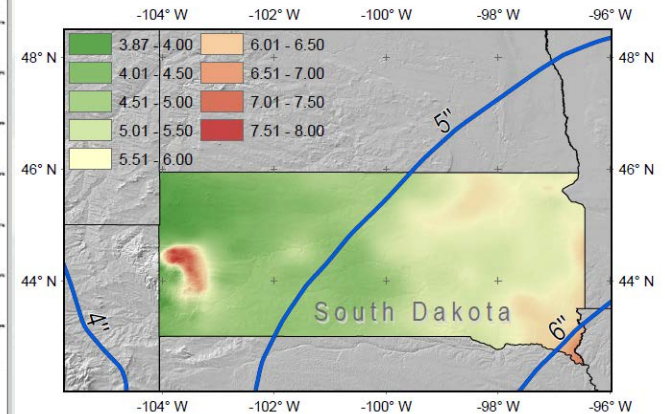
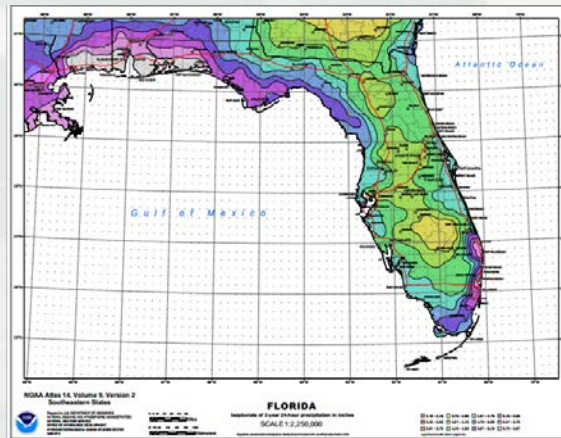
# Improvements

- State of the art technology
- Increased Granularity
- Web based
- GIS formats
- Application accessible



Duration	Average recurrence interval (ARI)									
	1	2	5	10	25	50	100	200	500	1,000
5-min	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10-min	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-min	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30-min	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60-min	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
24-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
45-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Current Duration & Intensities



# Funding and Project Schedule

- **Current Project Schedule**
  - Data collection and initial quality control [complete]
  - Technical and statistical analysis [JUNE 2017]
  - Peer review [AUGUST 2017]
  - Web publication [APRIL 2018]
- **Budget and additional needs**
  - Current contributions of \$1.3M
    - Coalition of federal and state agencies along with municipalities
    - **TxDOT major contributor**
    - **USACE**
  - \$300K needed for base package
  - Depth-Area-Duration Curve scope: \$420K
  - Trend Analysis scope: \$500K-\$1M estimate

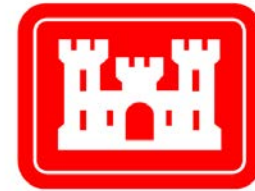
# InFRM Team – Multiple Agencies One Mission



Support our citizens and first responders to ensure that as a nation we work together to build, sustain and improve our capability to prepare for, protect against, respond to, recover from and mitigate all hazards



To provide reliable, impartial, timely information that is needed to understand the Nation's water resources.



Deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation's security, energize the economy and reduce risks from disasters.



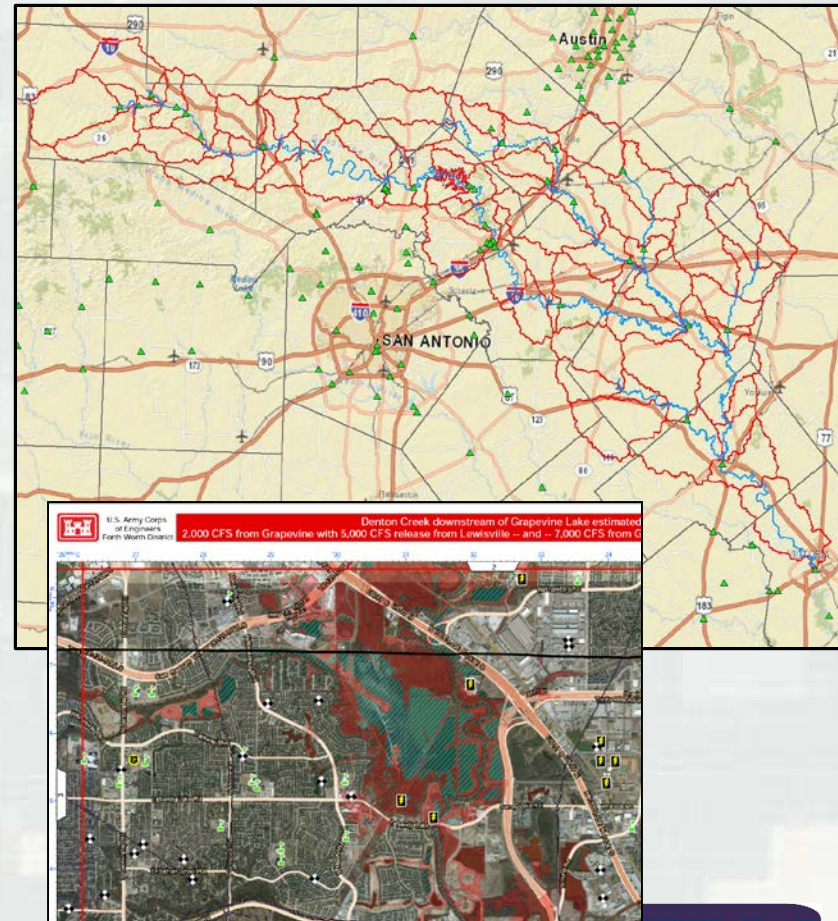
provide the best weather, water, and climate forecasts through international cooperation on hydro-meteorological observations, data exchange, modeling, research, and technology development; and to provide global leadership in setting meteorological standards and building partnerships to save lives and protect property.





# Interagency Flood Risk Management Team (InFRM)

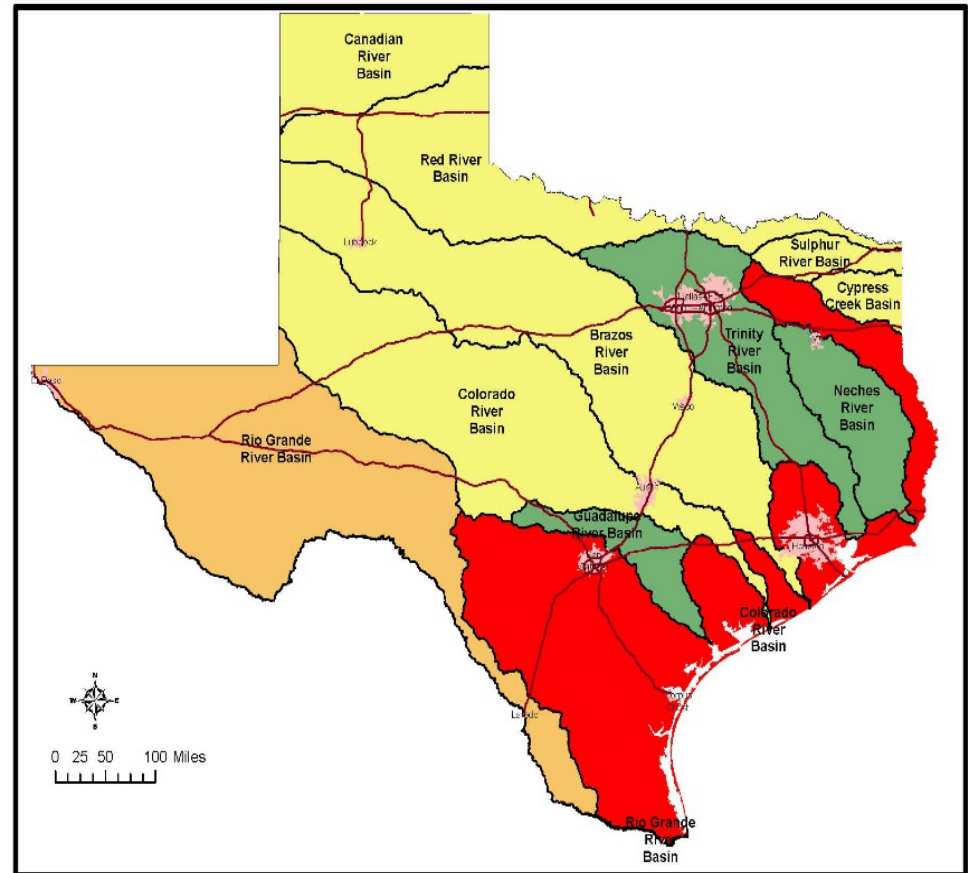
- **FEMA** – Lead, funding, NFIP => FIRM's
- **USGS** – Scientific study resources, historical
- **NWS** – Scientific study resources, historical, forecasting responsibility, public facing
- **USACE** – Funding, resources, historical, program management, HHT's
- **Purpose: Decrease uncertainty**
- **Projects**
  - ▶ \$5 M
  - ▶ Watershed hydrology assessments
    - Guadalupe, Trinity, Neches, Red
  - ▶ Inundation mapping
  - ▶ Web development

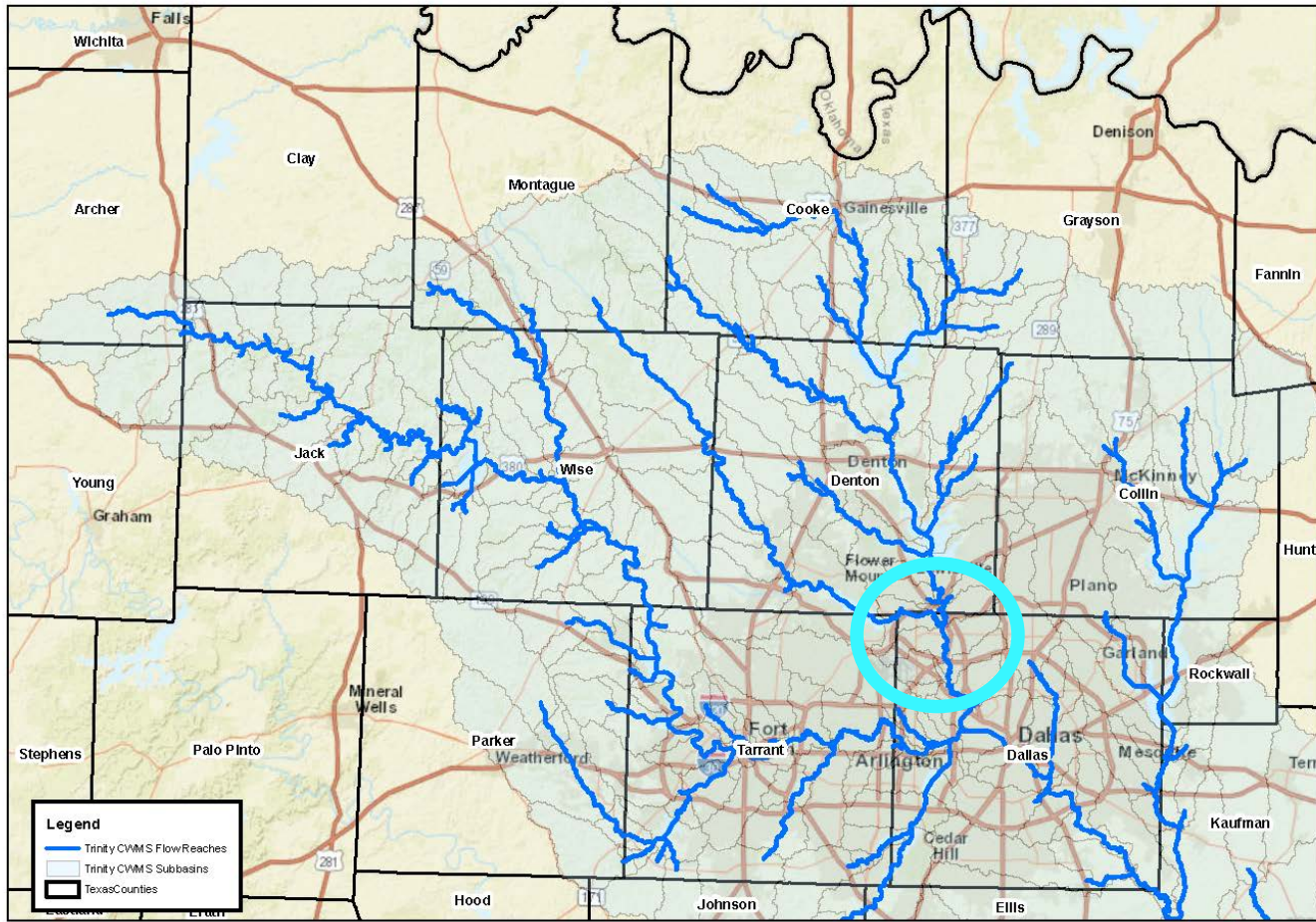


# Watershed Hydrology Assessments

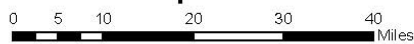
FEMA Region 6

- Infrastructure design and NFIP discharges
  - 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr, 250-yr, 500-yr
- Existing conditions
- Future conditions
- Climate change impacts (DOD funded)
- \$11 million investment





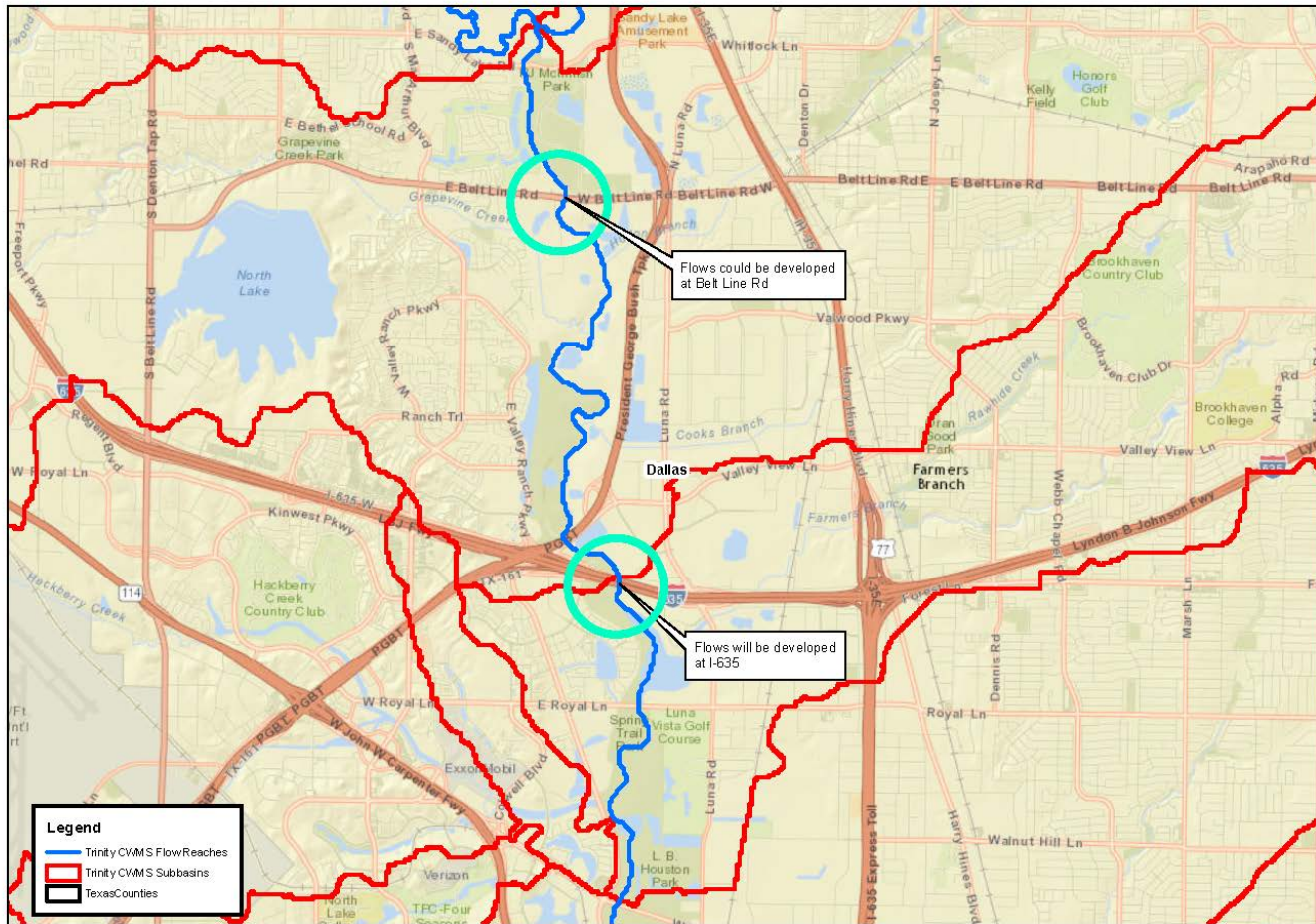
### Trinity River Basin- Upstream of Dallas County



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 US Army Corps of Engineers  
 Fort Worth District  
 Geospatial Services





### Trinity River Basin- Road Crossing



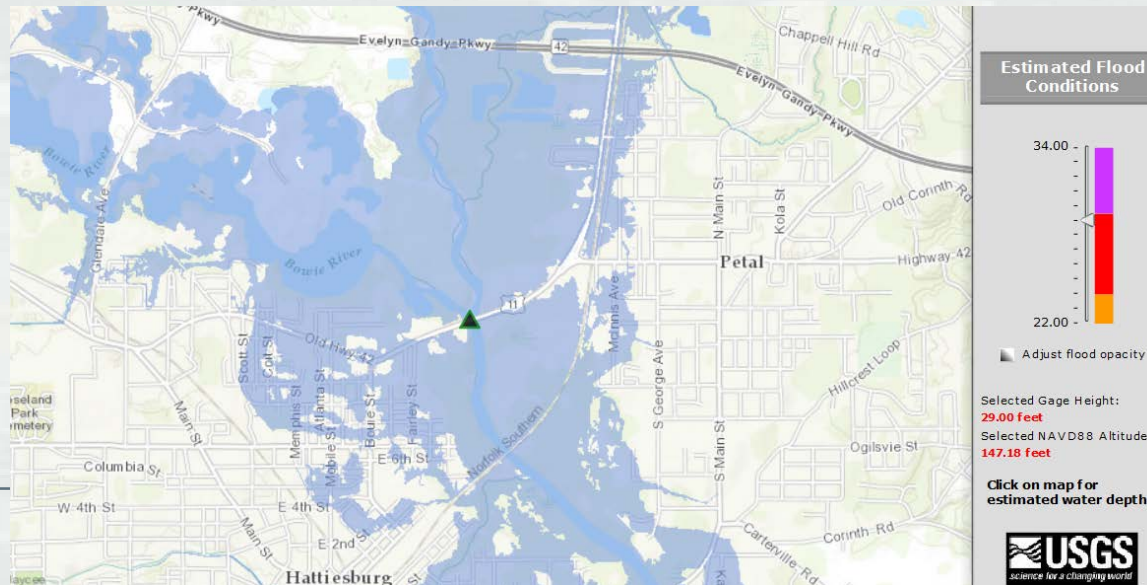
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Fort Worth District  
Geospatial Services

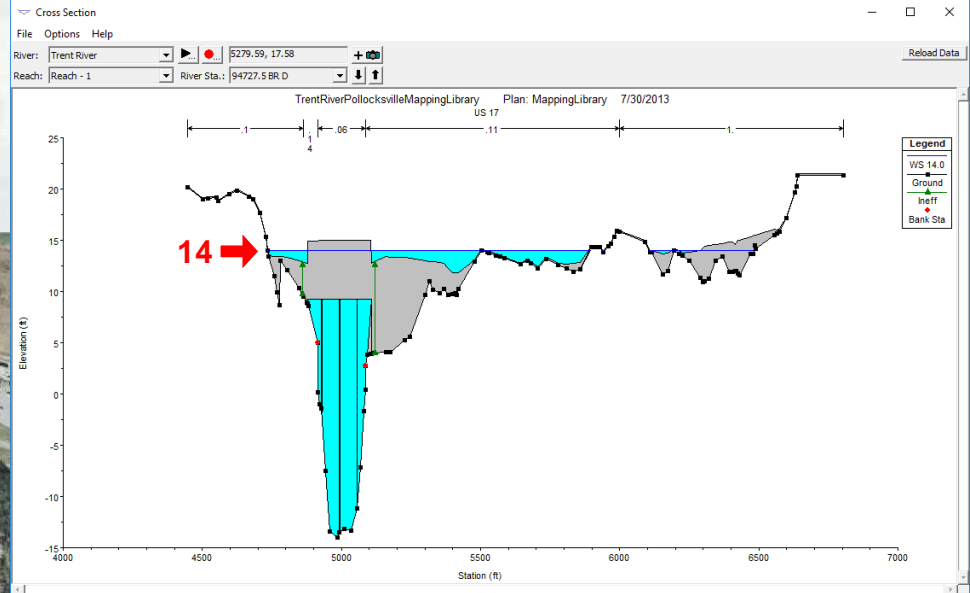


# InFRM Flood Inundation Mapping Program Goals

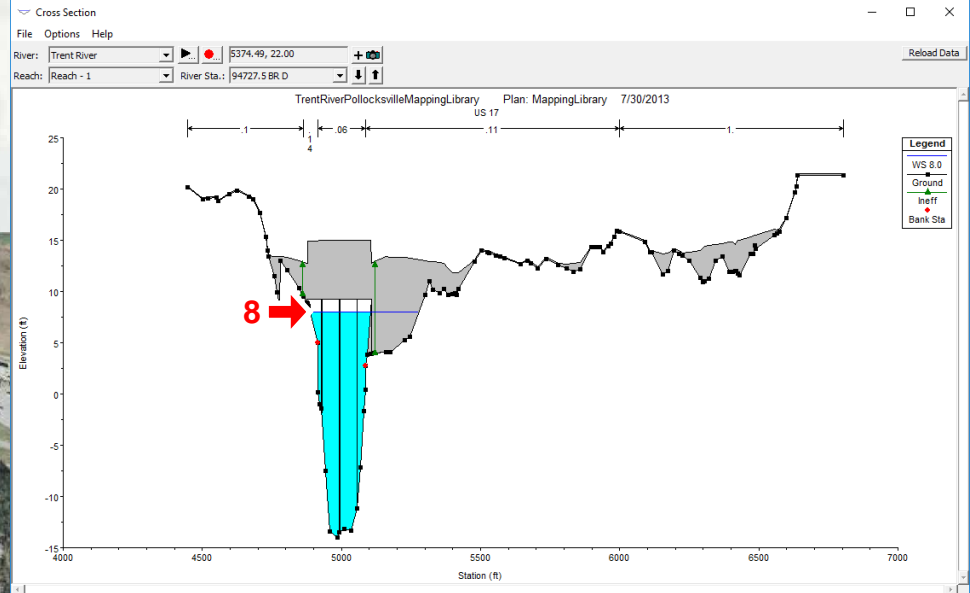
- Develop inundation mapping products for Texas
- Series of inundation maps
  - ▶ Readily available to emergency managers via web
  - ▶ Begin at minor flood state, end at max expected flood
  - ▶ Produced at appropriate intervals for the reach (1' max)
  - ▶ Correlated to nearest NWS-RFC forecast point
  - ▶ Maps automatically update when new forecast is released



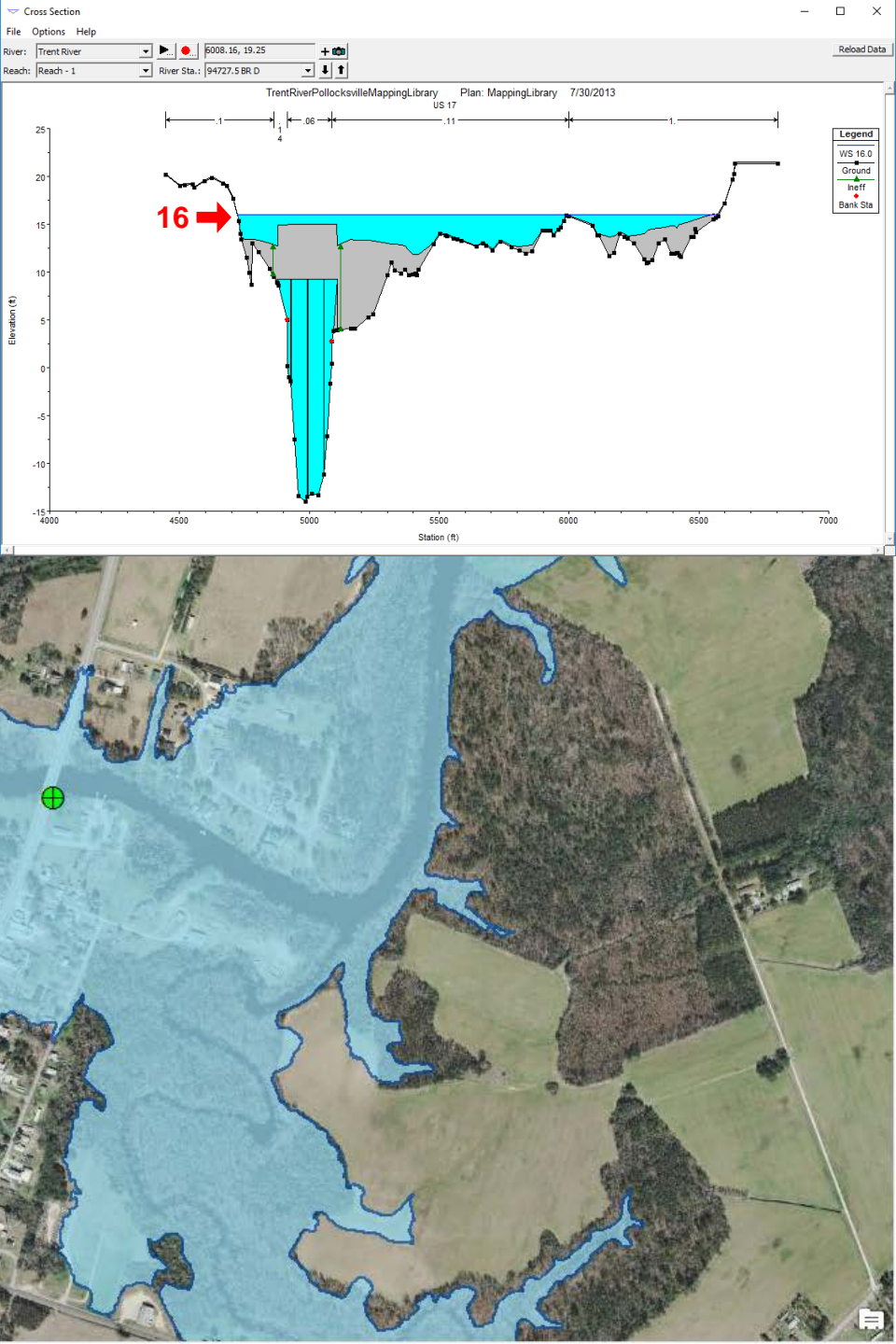
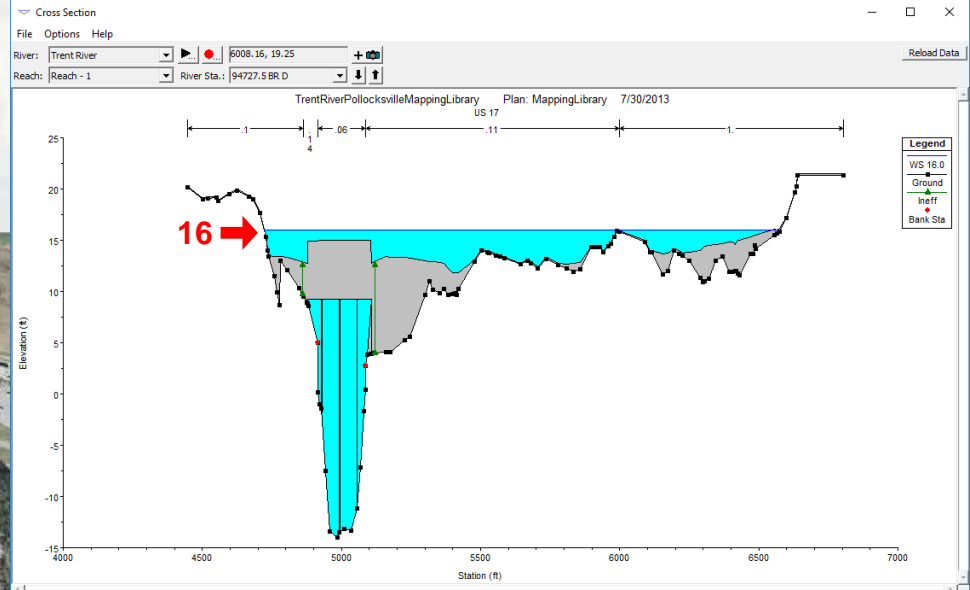
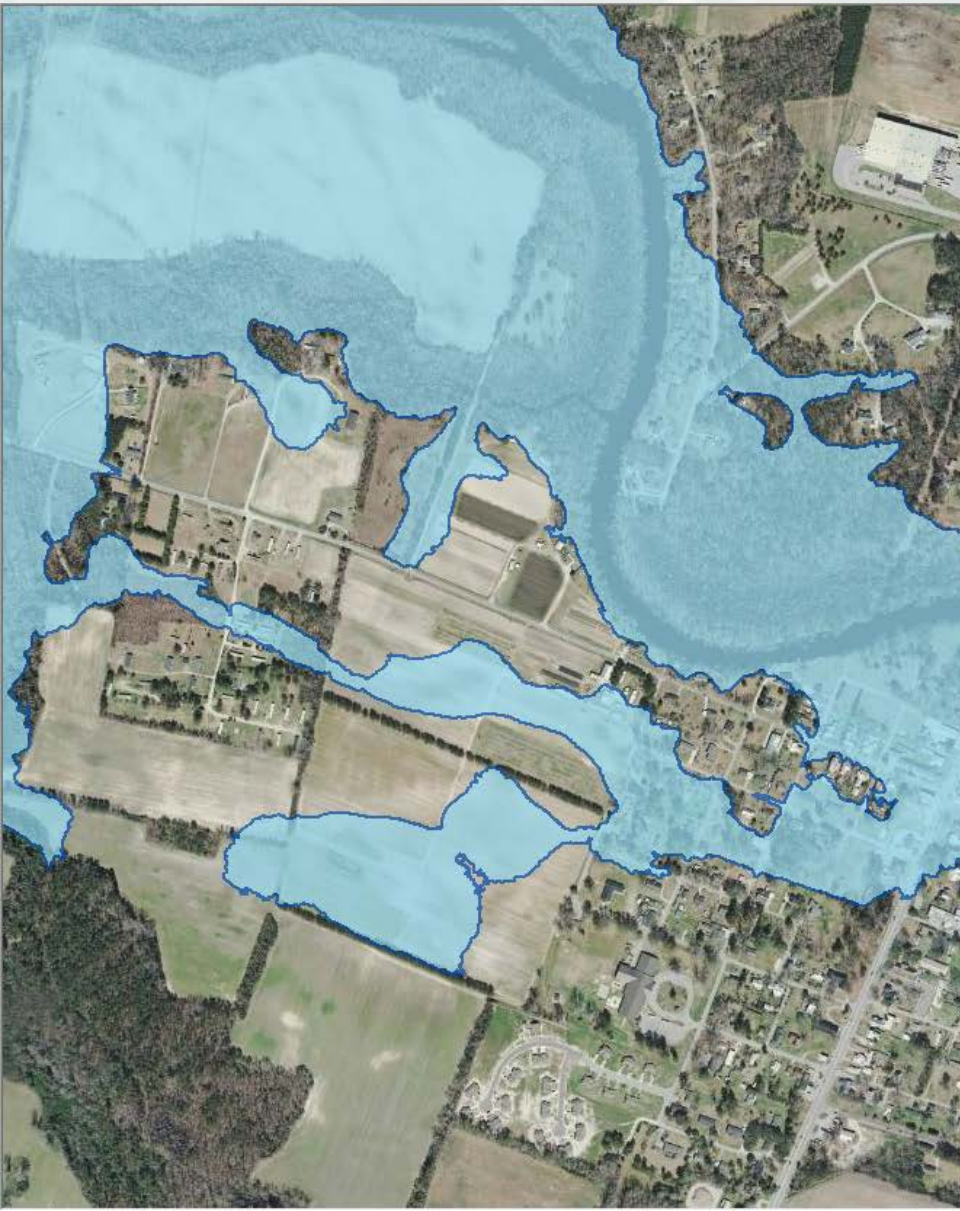
# Library Creation



# Library Creation



# Library Creation





# The Rest of the Story

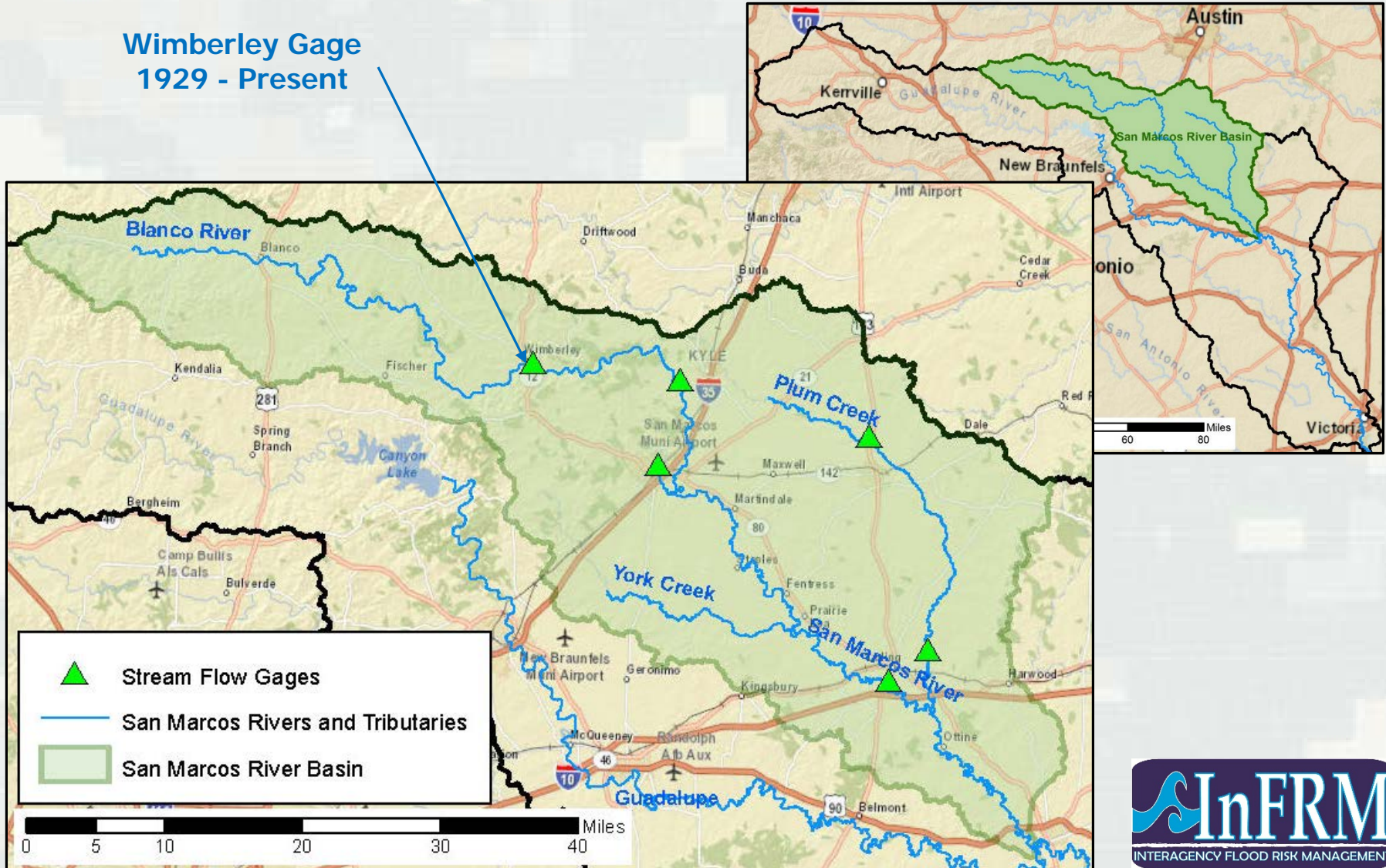


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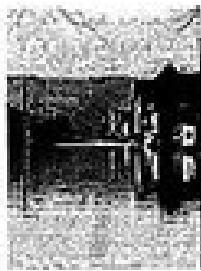
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# San Marcos River Basin Statistical Hydrology

Wimberley Gage  
1929 - Present



# Guidelines for Determining Flood Flow Frequency, Bulletin 17B



Guidelines  
For  
Determining

**Flood  
Flow  
Frequency**

Bulletin # 17B  
of the  
Hydrology Subcommittee

Revised September 1981  
Editorial Corrections March 1982

INTERAGENCY ADVISORY COMMITTEE  
ON WATER DATA



U.S. Department of the Interior  
Geological Survey  
Office of Water Data Coordination  
Reston, Virginia 20192

# Bulletin 17C

- 17C is currently being peer-reviewed
  - Also sought a 45-day public review comment period (February 22, 2016 to April 22, 2016)



Guidelines for Determining Flood Flow  
Frequency  
Bulletin 17C



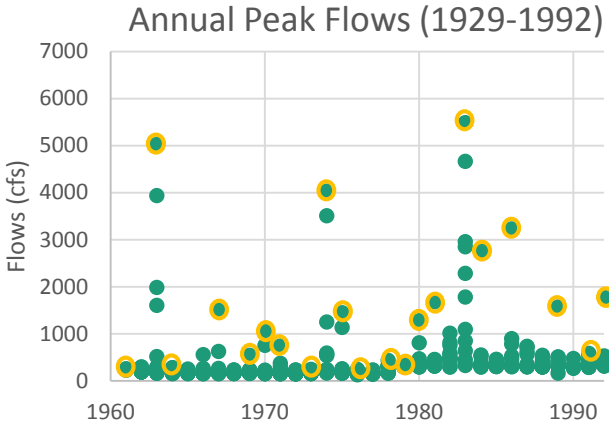
Techniques and Methods 4-BXX

U.S. Department of the Interior  
U.S. Geological Survey

DRAFT: December 29, 2015

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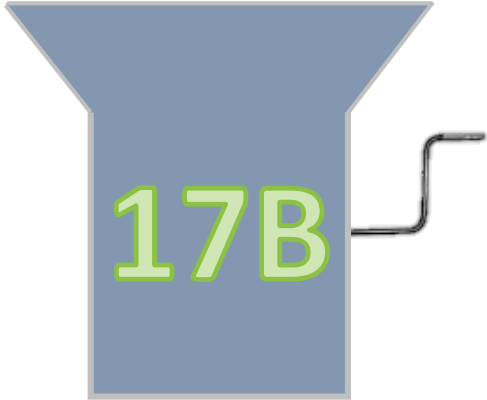
# Statistical Analysis



Frequency	Flow (cfs)
5 Year	3,500
10 Year	6,000
100 Year	15,000
500 Year	35,000

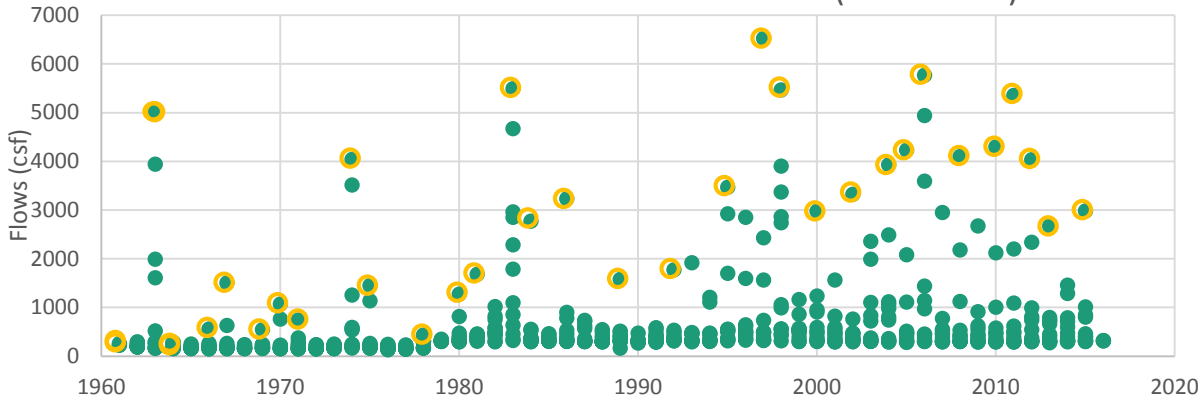


5,000 600 1,600  
 900 5,500  
 4,000 200  
 3,100



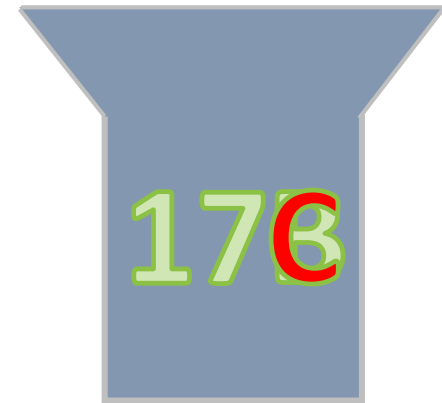
# Statistical Analysis

Annual Peak Flows (1960-2015)



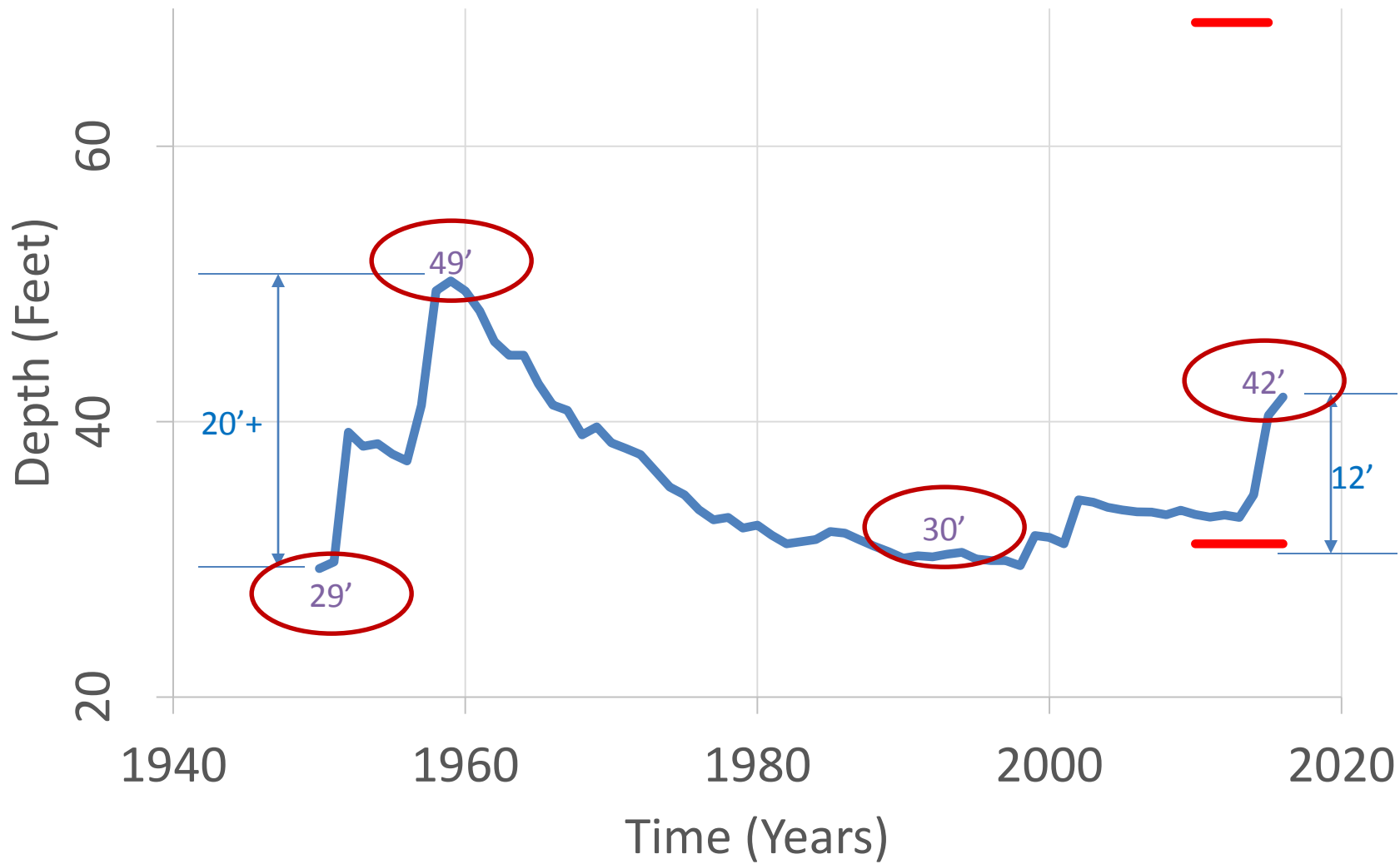
5,000 600 1,600  
 2,900  
 6,500 5,500 5,350  
 4,000 3,000 3,100  
 3,500

Frequency	Flow (cfs)
5 Year	4,500
10 Year	12,250
100 Year	32,000
500 Year	72,000



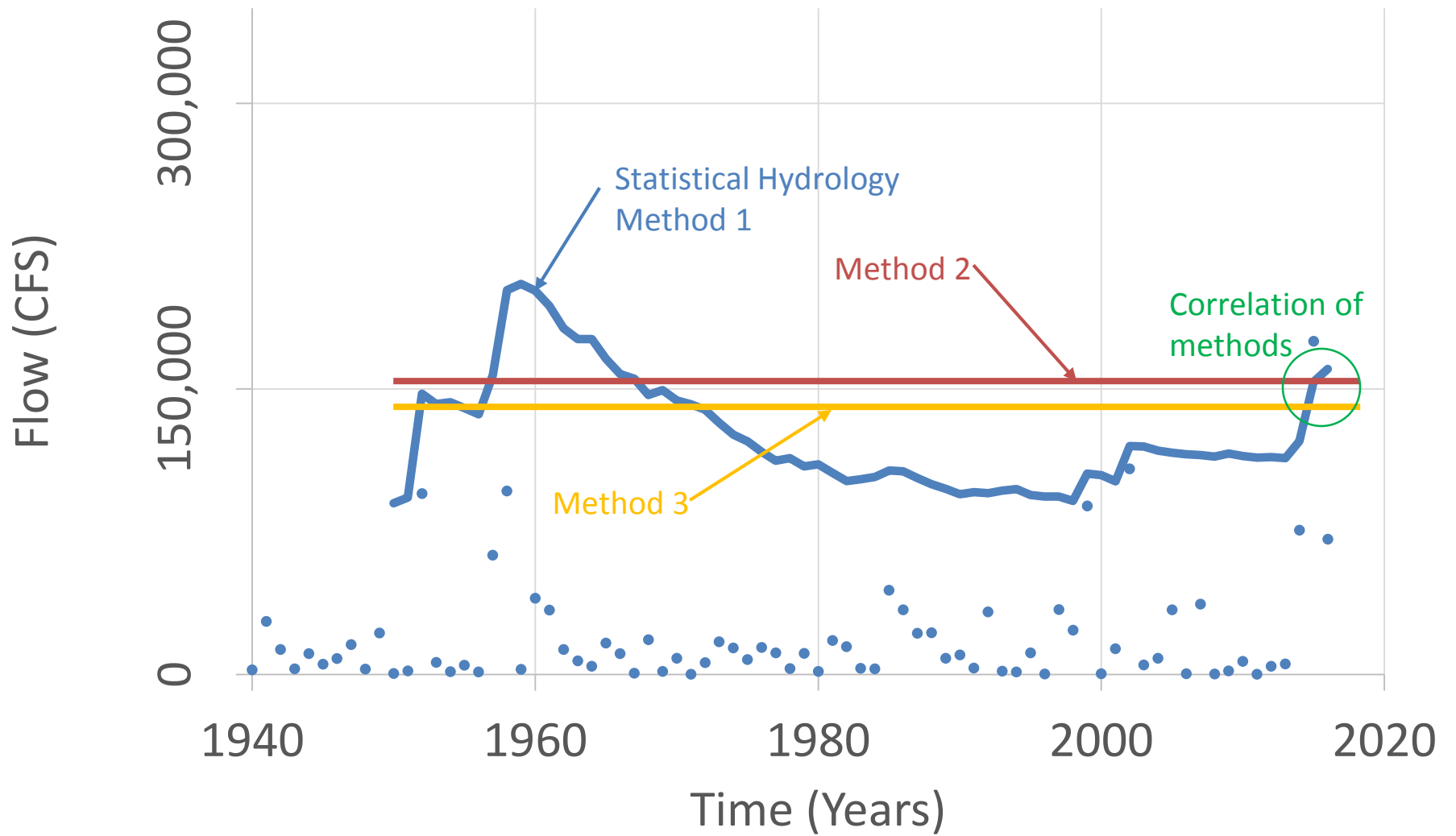
# 100-Year Depth Estimates - Statistical - Wimberley

— 100-Year Estimate — 95% Confidence Limits



# 100-Year Flow Estimates - Model - Wimberley

— 100-Year Estimate      • Annual Peak Flows



# Questions?



**US Army Corps  
of Engineers**

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