

# San Jacinto Basin Environmental Flow Analysis

## TWDB Presentation to T-SJ Stakeholders

April 15, 2010



# San Jacinto Basin Environmental Flow Analysis

- Objective
- Why We Don't See The Perfect Year
  - HEFR and seasonal computations
  - IHA and Pulses identification
- Methodology
  - Pulse Flow Analysis
  - Base Flow Analysis
- Results
- Conclusion

# Objective

## **Requested Analysis:**

Evaluate the T-SJ BBEST's Instream Flow Recommendations in the context of (present and future) water availability for human use and for water planning purposes.

## **Question:**

Do existing and future river flows accommodate the recommended instream flow targets at the selected gage locations?

# Data Required for this Analysis

- Hydrologic Environmental Flow Regime (HEFR)
- Published USGS Daily Discharge
- WAM Model and Associated Inputs
- Daily Flows Derived From WAM Model Runs

# Why don't we see a perfect year?

- HEFR performs base and pulse flow analysis based on seasons
- Inter-annual and Intra-annual variability of rainfall events
- Statistical representation of environmental flows in HEFR table values...

# Why don't we see a perfect year?

YEAR	2000	2001	2002	2003	2004
Number of Seasonal PULSE	0	1	3	1	0

If you had 5 Pulses in a 5 year Period of Time –  
an average of 1 per Year

IF this event was recommended to be a 1/Yr pulse,  
We would calculate a pulse 3 out of 5 years or 60%  
of the time

# METHODOLOGY :: San Jacinto River Basin

5 gage locations, 4 Scenarios

Location	USGS Reference Gage	WAM Control Point
Cleveland	8070000	ESCL
Conroe	8068000	WSCN
Spring	8068500	SPSP
Buffalo Bayou at Piney Point	8073700	A5257Z
Brays Bayou at Houston	8075000	BRHO

Development Period	WAM 3	WAM 8	WAM 9
Gaged Flows	Full Utilization	Current Utilization	Future
Period depends on gage location	No return flows	Return flows	Water Mgmt Strategies Future demand Future reservoir capacity

# TCEQ Recommended Updates Made to WAM 9 for San Jacinto

- ❖ Storage Area Correction for Lake Conroe
- ❖ Added a second diversion right at Lake Houston
- ❖ Changed priority dates as recommended
- ❖ Added four City of Houston diversions from the four bayous

# Methodology

## Pulse Flow Analysis:

- Monthly WAM output converted to daily flow pattern: Based on the historical record (differs at each location).
- Peak, Volume, and Duration AND Peak Only pulse identification
- Top-down method (cumulative) used to count pulses.

## Base Flow Analysis:

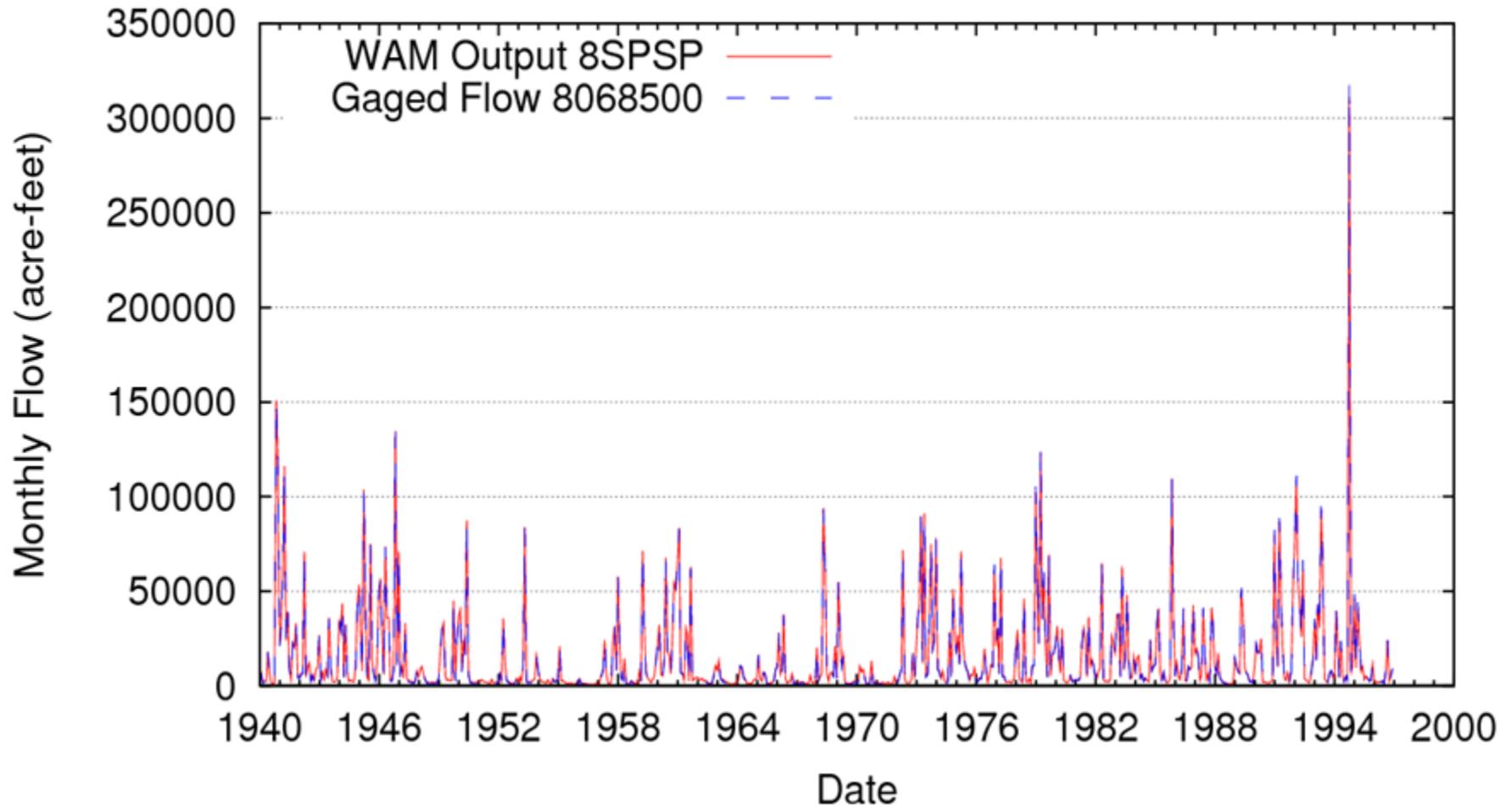
- Attainment frequencies of subsistence and base flows under each scenario

# Why Convert Monthly WAM Output to Daily Flows?

- Instream environmental flows are developed from daily flows
- Pulses can be extremely small compared to monthly volumes
- Base flow attainment frequencies can best be analyzed using daily flows
- Response of riverine ecology is better represented with daily flows
- Monthly analysis is limited to 12 distinct time periods and cannot account for pulses that do not start and end in the same month (i.e. Oct 25-Nov 5)
- Monthly flow pattern analysis in Trinity and San Jacinto Basins shows that existing infrastructure has not significantly changed flow patterns.

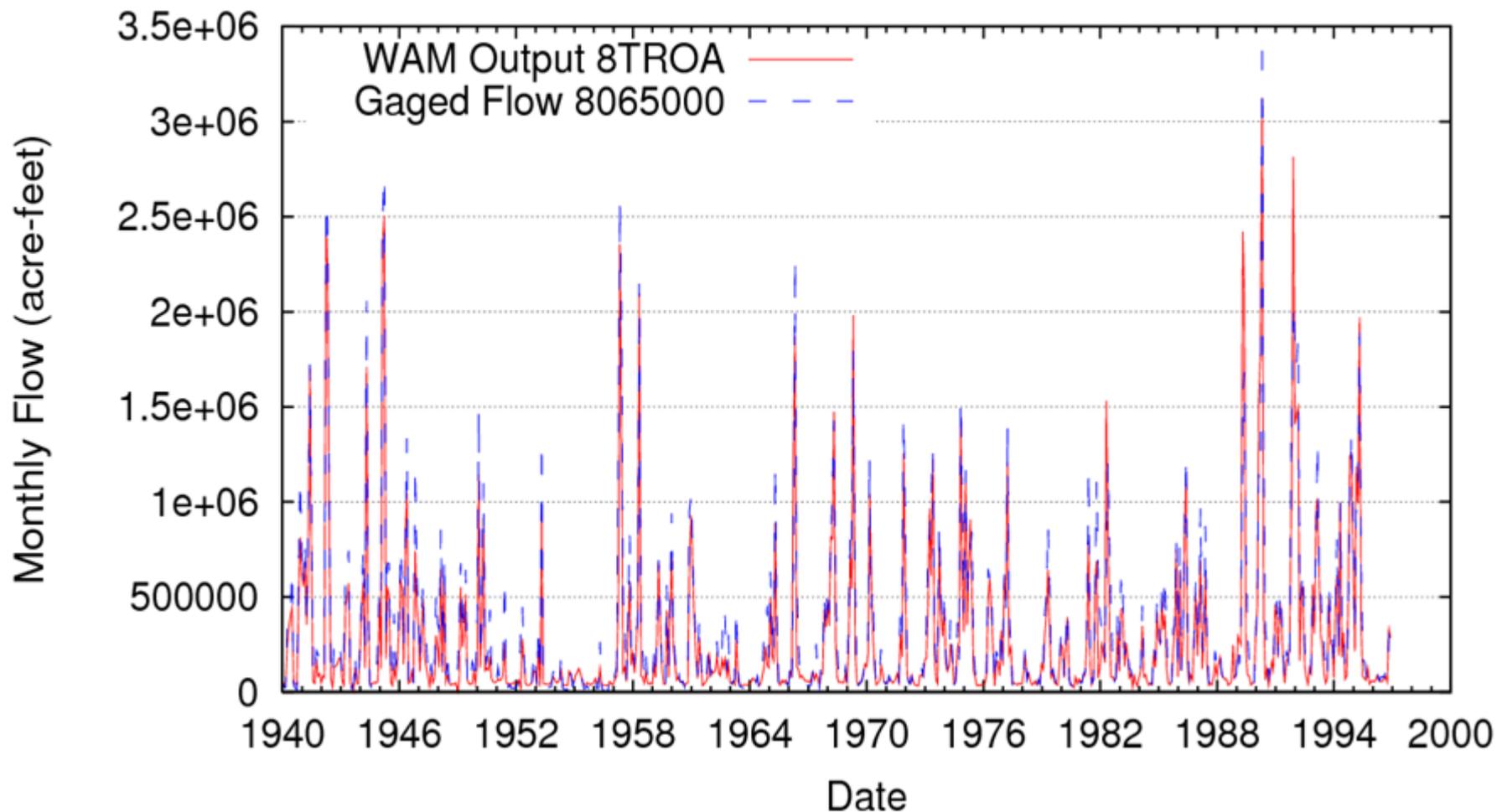
# San Jacinto Basin Environmental Flow Analysis

WAM Output vs. Monthly Gaged Flow  
Spring Creek nr Spring



# San Jacinto Basin Environmental Flow Analysis

WAM Output vs. Monthly Gaged Flow  
Trinity River nr Oakwood



# PULSE FLOW ANALYSIS



# Pulse Counting Method: Top-Down (Cumulative)

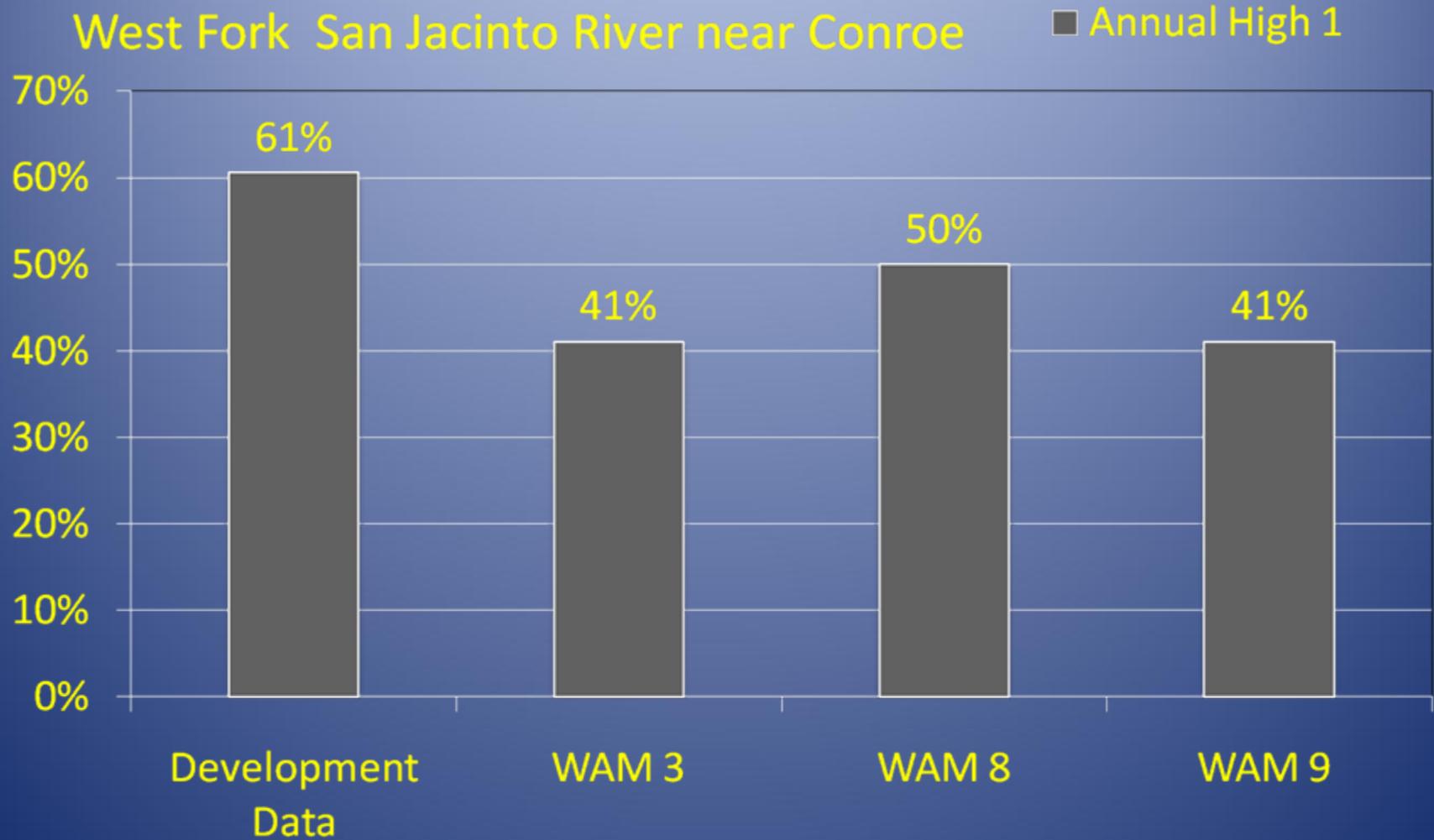


Overbank	
High Annual Pulse 1	High Annual Pulse 2
High Seasonal Pulse	
Low Seasonal Pulse 1	Low Seasonal Pulse 2

# Pulse Flow Analysis at Conroe

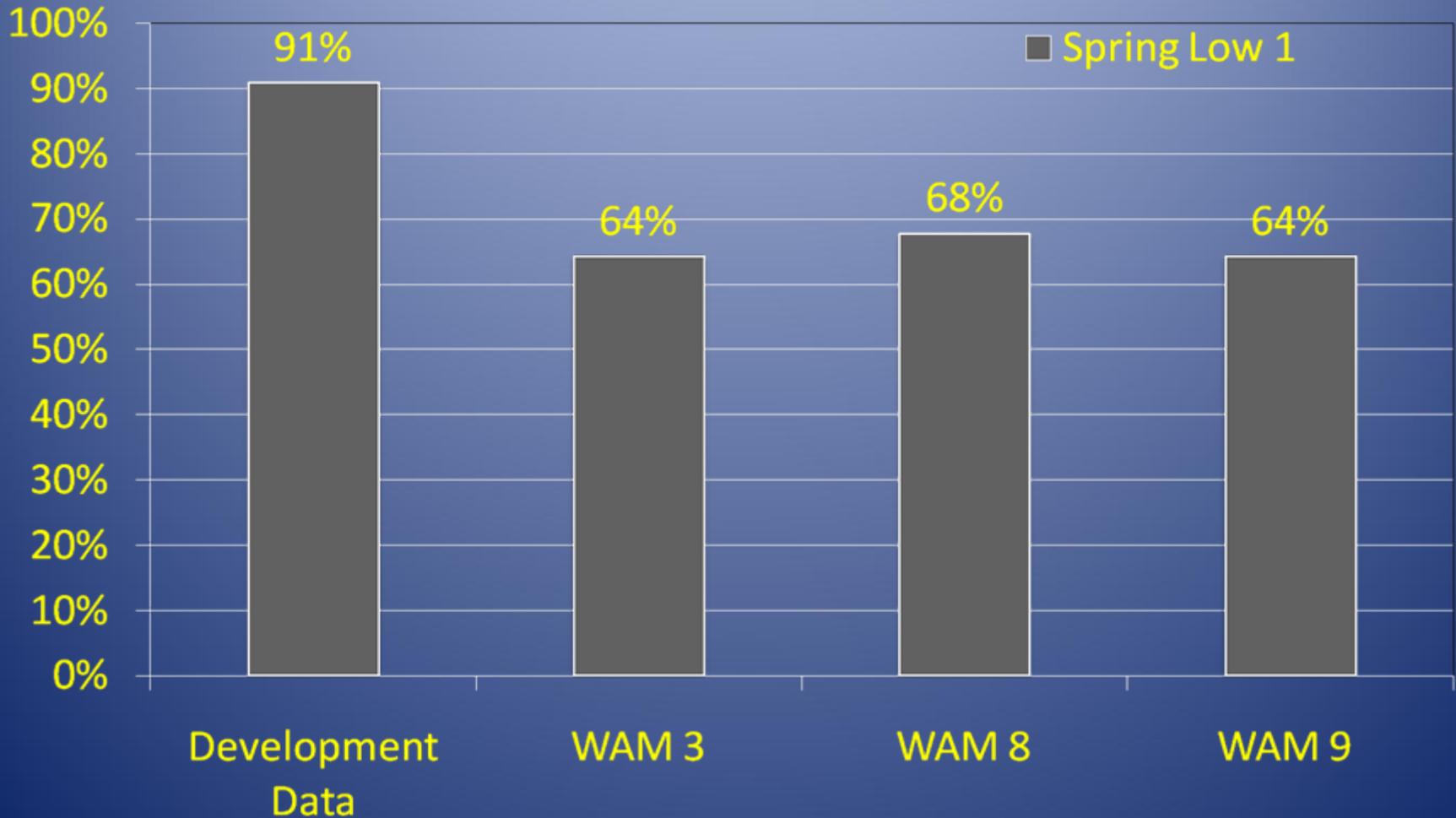
Conroe	WAM 8: Current			
	1940-1995			
	Peak, Volume and Duration		Peak Only	
	Total	%	Total	%
Overbank	1	2%	11	20%
Annual High 1	28	50%	45	80%
Annual High 2	16	29%	30	54%
Winter High	29	52%	36	64%
Winter Low 1	44	79%	49	88%
Winter Low 2	32	57%	44	79%
Spring High	19	34%	36	64%
Spring Low 1	38	68%	48	86%
Spring Low 2	24	43%	35	63%
Summer High	25	45%	32	57%
Summer Low 1	27	48%	32	57%
Summer Low 2	14	25%	15	27%
Fall High	21	38%	24	43%
Fall Low 1	-	-	-	-
Fall Low 2	-	-	-	-
Total Number of Pulses	318		437	
Number of Years for this Condition	56			

# Pulse Flow Analysis at Conroe



# Pulse Flow Analysis at Conroe

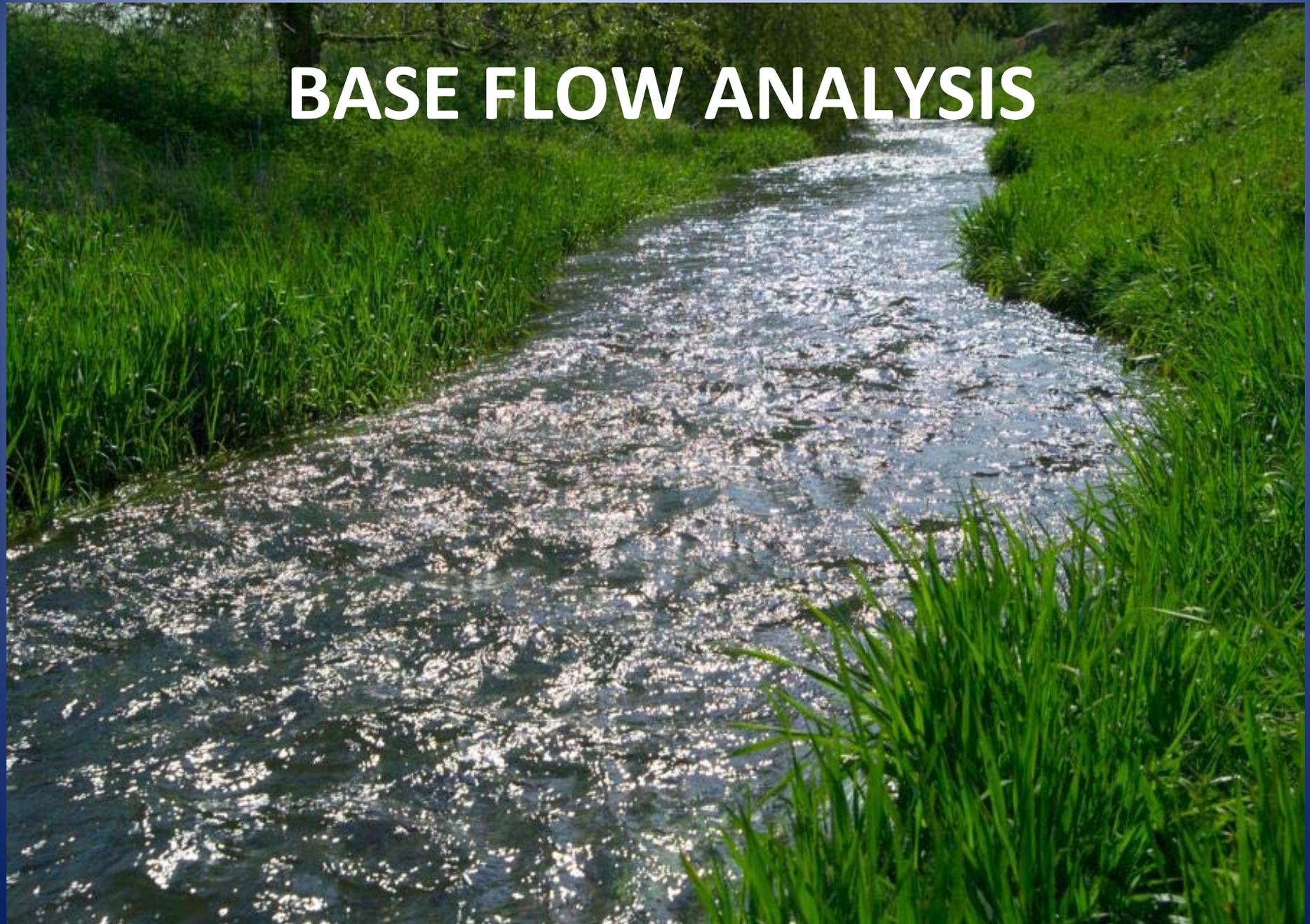
## West Fork San Jacinto River near Conroe



You should not expect “PERFECT YEARS” from HEFR generated Environmental Flow regimes



# BASE FLOW ANALYSIS



# Attainment Frequencies of Subsistence and Base Flows at Spring

Season	Condition	Recommended Flow (cfs)	Recommended Frequency	Development 1940-2007	WAM 3 : FULL 1940-1996	WAM 8: CURRENT 1940-1996	WAM 9: FUTURE 1940-1996
Winter	Subsistence	14	95%	96%	94%	98%	98%
	Dry	22	86%	86%	83%	92%	92%
	Average	36	74%	74%	70%	74%	75%
	Wet	59	60%	60%	56%	58%	59%
Spring	Subsistence	14	96%	96%	94%	98%	98%
	Dry	24	86%	86%	81%	89%	89%
	Average	36	72%	72%	67%	74%	74%
	Wet	52	57%	57%	53%	58%	58%
Summer	Subsistence	6	95%	94%	93%	100%	99%
	Dry	17	71%	71%	62%	83%	83%
	Average	24	56%	56%	47%	65%	64%
	Wet	35	39%	39%	31%	42%	41%
Fall	Subsistence	6	95%	95%	93%	100%	100%
	Dry	17	75%	75%	66%	84%	84%
	Average	24	61%	61%	52%	68%	68%
	Wet	37	45%	45%	38%	45%	45%

## For Next Time...

- Perform Base and Pulse Flow Analysis for the Trinity River Basin
- WAM implementation With Environmental Flows added for San Jacinto and Trinity