

Environmental Functions of Base and Subsistence Flows

Presentation to Brazos BBASC

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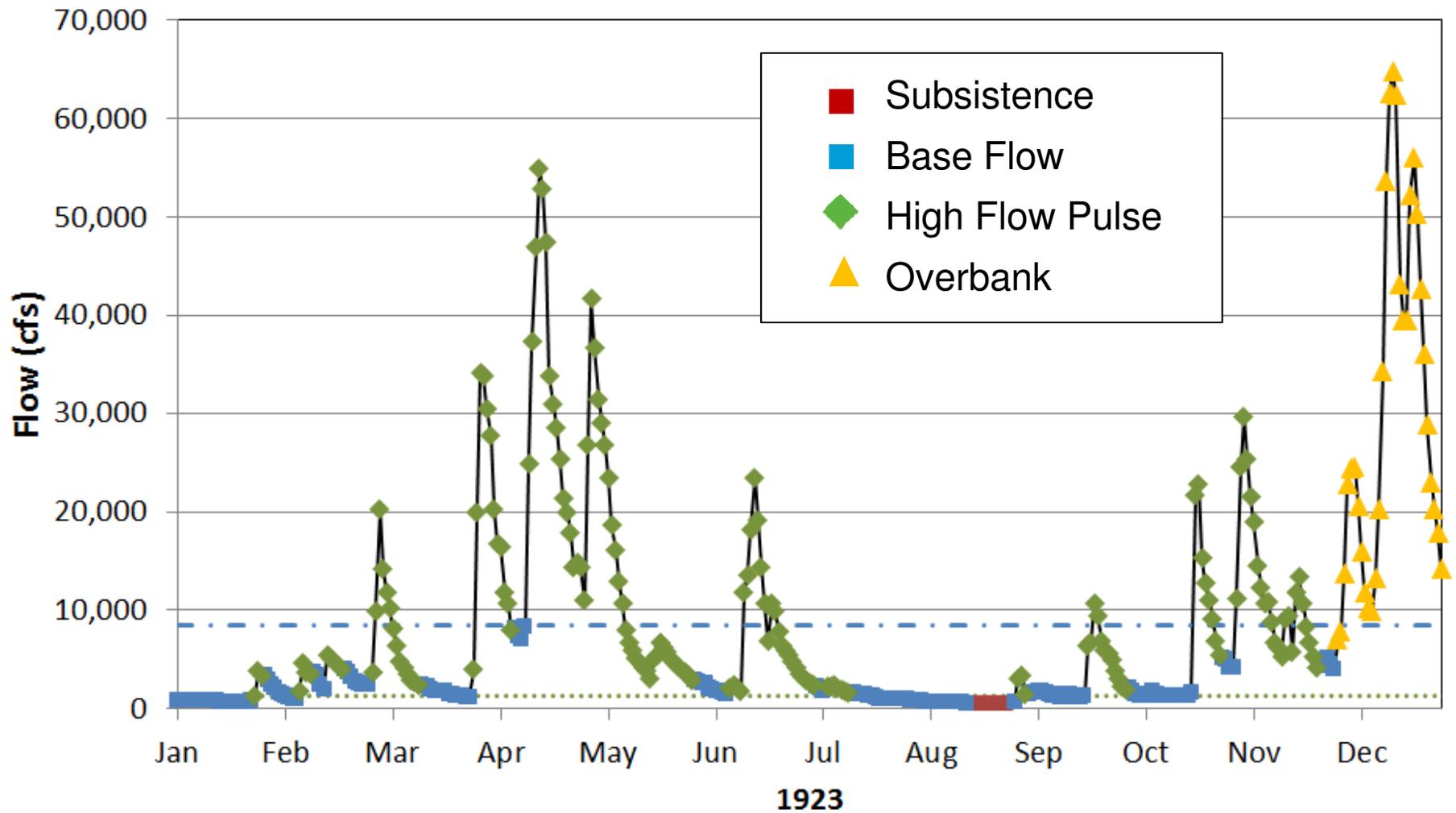
Basic Approach of Brazos BBEST

- Adopted Environmental Flow Regime
- Mimic Natural Flow Patterns
- Critical Flow Components:
 - Magnitude
 - Frequency
 - Timing (seasonality)
 - Duration
 - Rate of Change in Flow

Basic Approach of Brazos BBEST

- Recommendations Protect Environmental Flow Regime by:
 - Subsistence Flows
 - Base Flows
 - High Flow Pulses
- Each Element Has Environmental Functions**
- Recommended Environmental Flows Vary:
 - With Season
 - Hydrologic Condition (wet, average, dry)

IHA Flow Separation - Richmond



BBEST Environmental Flow Recommendation – Brazos River near Richmond

Overbank Events	Qp: 68,100 cfs with Average Frequency 1 per 2 years Regressed Volume is 1,487,000 Duration Bound is 41											
High Flow Pulses	Qp: 51,600 cfs with Average Frequency 1 per year Regressed Volume is 1,019,000 Duration Bound is 35											
	Qp: 24,600 cfs with Average Frequency 1 per season Regressed Volume is 383,000 Duration Bound is 23				Qp: 35,000 cfs with Average Frequency 1 per season Regressed Volume is 617,000 Duration Bound is 29				Qp: 12,900 cfs with Average Frequency 1 per season Regressed Volume is 144,000 Duration Bound is 15			
	Qp: 12,400 cfs with Average Frequency 2 per season Regressed Volume is 150,000 Duration Bound is 16				Qp: 16,300 cfs with Average Frequency 2 per season Regressed Volume is 215,000 Duration Bound is 19				Qp: 5,430 cfs with Average Frequency 2 per season Regressed Volume is 46,300 Duration Bound is 10			
	Qp: 6,410 cfs with Average Frequency 3 per season Regressed Volume is 60,600 Duration Bound is 11				Qp: 8,930 cfs with Average Frequency 3 per season Regressed Volume is 94,000 Duration Bound is 13				Qp: 2,460 cfs with Average Frequency 3 per season Regressed Volume is 16,400 Duration Bound is 6			
Base Flows (cfs)	3,310				3,980				2,190			
	1,650				2,140				1,330			
	990				1,190				930			
Subsistence Flows (cfs)	550				550				550			
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	Winter				Spring				Summer			

Base Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

Pulse volumes are in units of acre-feet and durations are in days.

Period of record used : 1/1/1923 to 12/31/2010.

Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 1260cfs, or when the flow is below 8430 cfs and the flow drops from one day to the next by less than 5%.



Environmental Functions

- Subsistence (Report page 4-7)
 - Minimum flow in drought
 - Maintain water quality
 - Provide minimal aquatic habitat for survival
 - 95th percentile low flow
 - Minimum of 1 cfs
 - Not to artificially sustain 1 cfs
 - Prevent increase of very low flows
 - Zero flows will occur naturally in some areas

Environmental Functions

- Base Flows (Report page 4-7)
 - Normal flows between storm events
 - Provide adequate habitat for aquatic communities
 - Maintain groundwater levels to support riparian vegetation
 - Lower Brazos – provide mix of shallow and deep habitats
- Recommendations Vary with Season and Hydrologic Condition
 - Wet 75th percentile of seasonal base flows
 - Average 50th percentile (median)
 - Dry 25th percentile



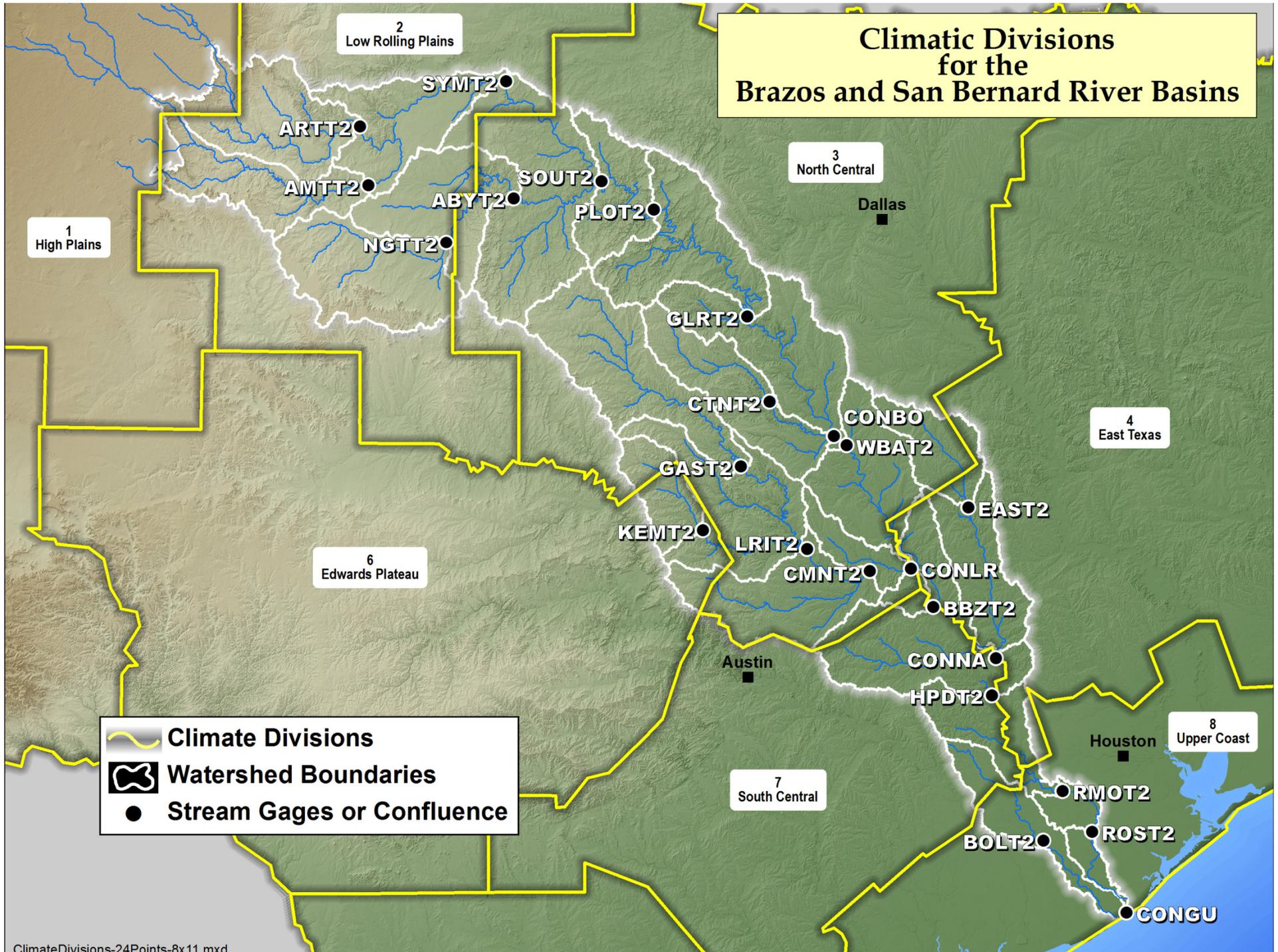
Environmental Functions

- High Flow Pulses/Overbank Flows (Page 4-8)
 - Shape physical habitat
 - Sediment and nutrient transport
 - Flushing of silt
 - Other geomorphic and water quality functions
 - Increase success of fish reproduction
 - Lateral connectivity (oxbows, marshes, floodplains, etc.)



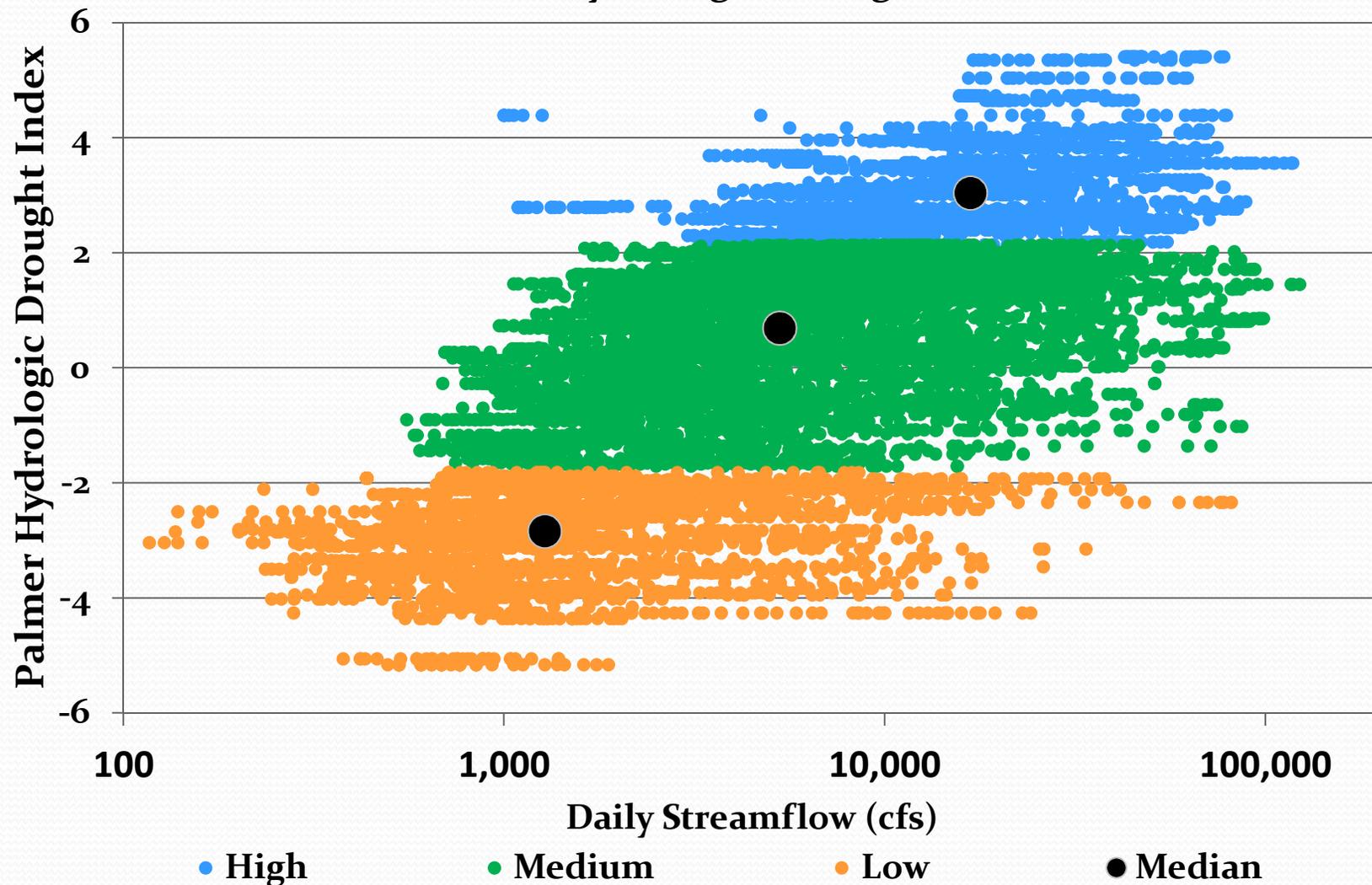
Questions?

Climatic Divisions for the Brazos and San Bernard River Basins

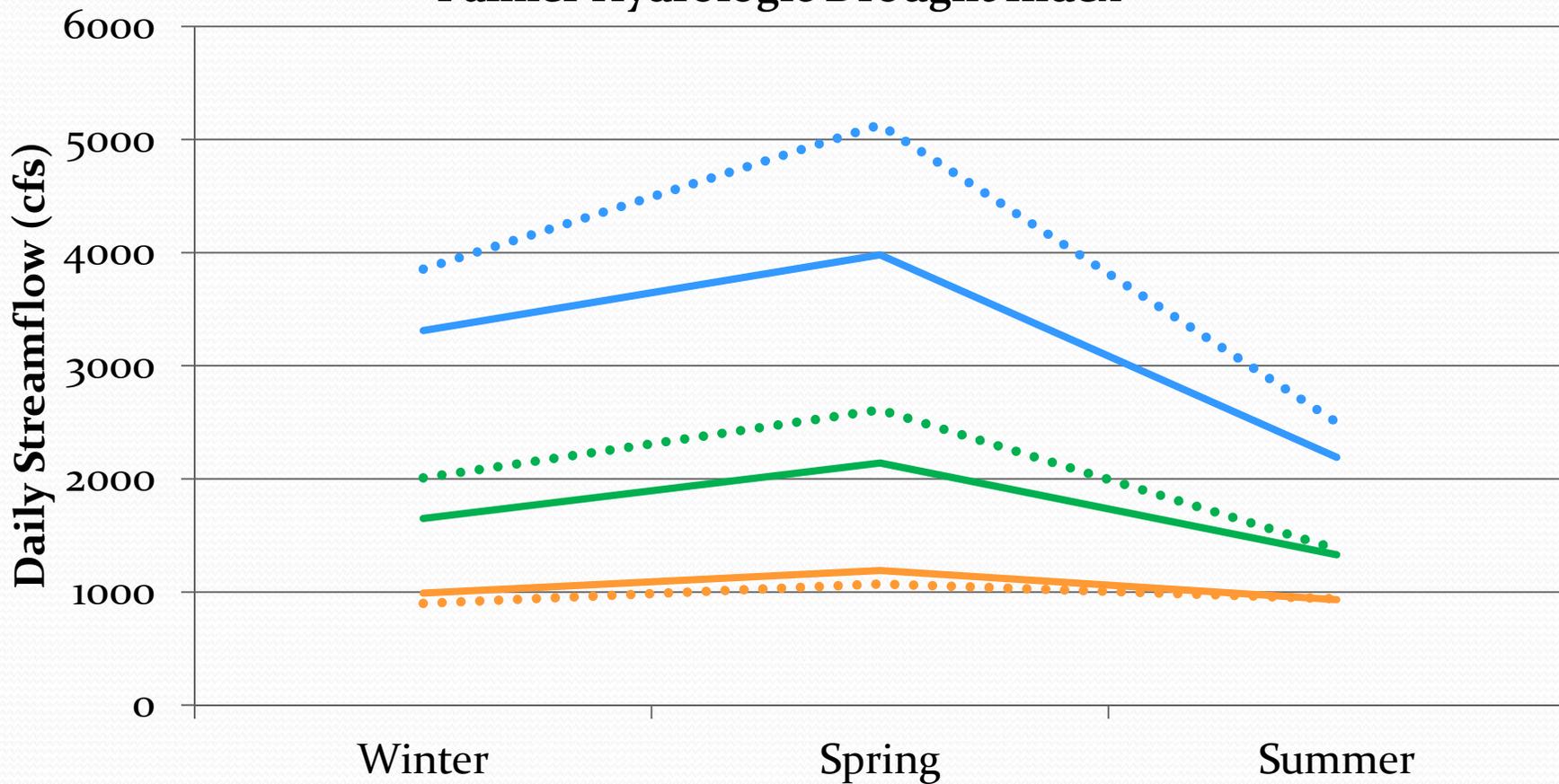


-  Climate Divisions
-  Watershed Boundaries
-  Stream Gages or Confluence

Spring Season (March – June) - Brazos River at Richmond Palmer Hydrologic Drought Index



Brazos River at Richmond Palmer Hydrologic Drought Index



— Low 25th Percentile

— Medium Median

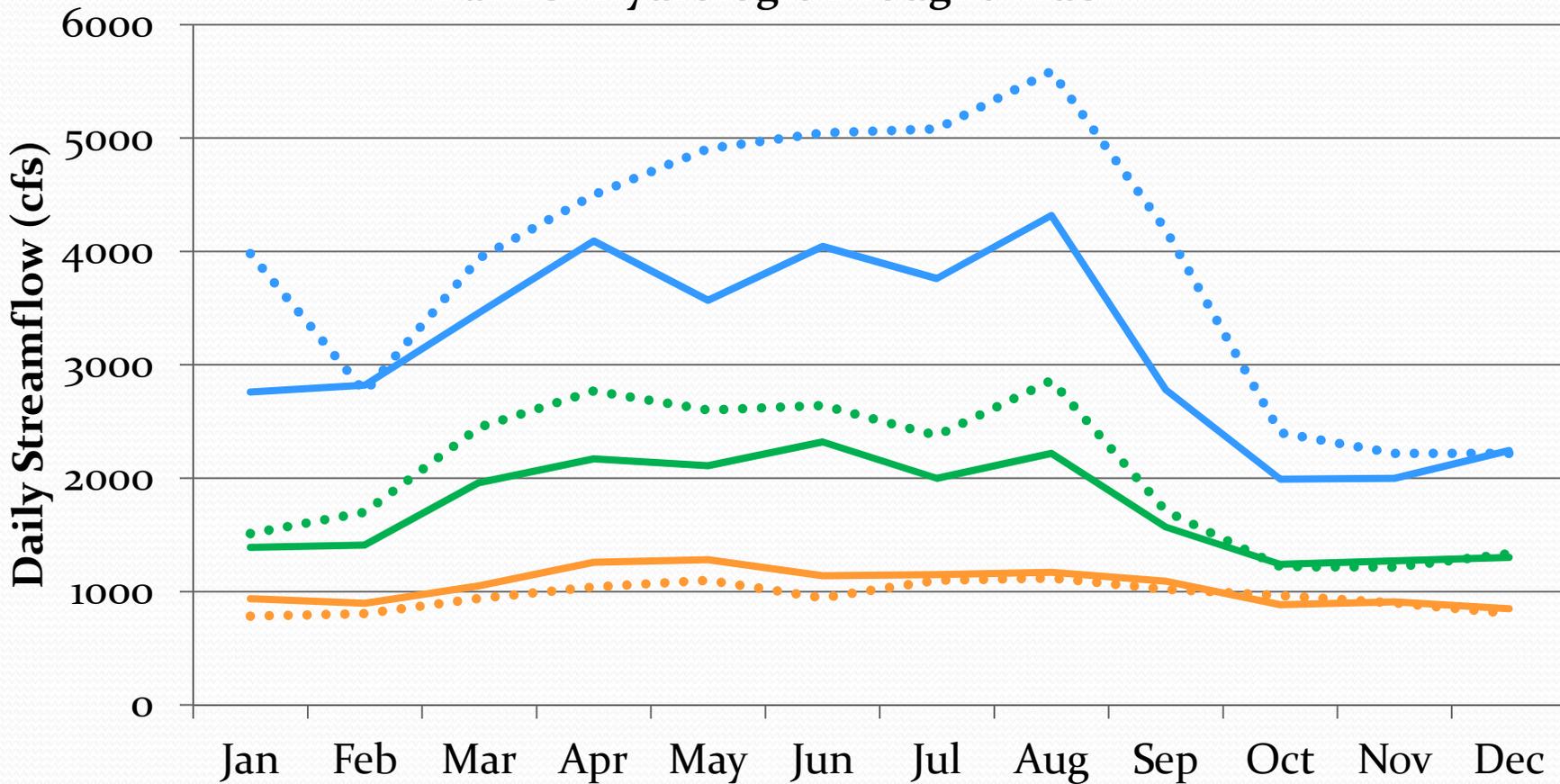
— High 75th Percentile

•••• Palmer Low Median

•••• Palmer Medium Median

•••• Palmer High Median

Brazos River at Richmond Palmer Hydrologic Drought Index



— Low 25th Percentile

— Medium Median

— High 75th Percentile

..... Palmer Low Median

..... Palmer Medium Median

..... Palmer High Median

Double Mountain Fork Brazos River near Aspermont

High Flow Pulses	Qp: 16,300 cfs with Average Frequency 1 per 5 years Regressed Volume is 77,100 Duration Bound is 31											
	Qp: 9,490 cfs with Average Frequency 1 per 2 years Regressed Volume is 44,900 Duration Bound is 27											
	Qp: 5,130 cfs with Average Frequency 1 per year Regressed Volume is 24,300 Duration Bound is 23											
	Qp: 92 cfs with Average Frequency 1 per season Regressed Volume is 610 Duration Bound is 12			Qp: 2,730 cfs with Average Frequency 1 per season Regressed Volume is 12,500 Duration Bound is 17				Qp: 2,540 cfs with Average Frequency 1 per season Regressed Volume is 11,900 Duration Bound is 19				
	Qp: 30 cfs with Average Frequency 2 per season Regressed Volume is 180 Duration Bound is 8			Qp: 1,120 cfs with Average Frequency 2 per season Regressed Volume is 5,120 Duration Bound is 14				Qp: 1,040 cfs with Average Frequency 2 per season Regressed Volume is 4,750 Duration Bound is 14				
				Qp: 570 cfs with Average Frequency 3 per season Regressed Volume is 2,600 Duration Bound is 12				Qp: 480 cfs with Average Frequency 3 per season Regressed Volume is 2,160 Duration Bound is 12				
				Qp: 280 cfs with Average Frequency 4 per season Regressed Volume is 1,270 Duration Bound is 10				Qp: 230 cfs with Average Frequency 4 per season Regressed Volume is 990 Duration Bound is 9				
Base Flows (cfs)	15			8				7				
	4			3				2				
	1			1				1				
Subsistence Flows (cfs)	1			1				1				
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	Winter				Spring				Summer			

Base Flow Levels	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)

Pulse volumes are in units of acre-feet and durations are in days.

Period of record used : 1/1/1940 to 12/31/2010.

Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 8cfs, or when the flow is below 45 cfs and the flow drops from one day to the next by less than 5%.



Designation of Flow Regime

- Used HEFR tool
- Based on statistical analysis of separated flows
- Flow recommendations examples on following Slides



Flow Separation

- Used HEFR Tool
- Based on Parameters, Divides Historical Flows:
 - **Subsistence**
 - **Base Flow**
 - **Pulse Flow**
 - **Overbank**