

Evaluation of
Brazos BBEST Recommendation on
Yield of Cedar Ridge Reservoir

PRELIMINARY – DRAFT

June 27, 2012

TCEQ Instream Environmental Flow Standards Summary

Basin	Status	Utilized Site Specific Studies ¹	Subsistence Flows	Base Flows		High Flow Pulse Tiers	Overbank	50% Rule ²	Pulse Exemption Requirement(s) ³
				Tiers	Hydrologic Condition(s)				
Sabine	Adopted	No	Yes	1	Dry ⁴	1	No	No	Diversion amount less than 10,000 acft/yr
Neches	Adopted	No	Yes	1	Dry ⁴	1	No	No	Diversion amount less than 10,000 acft/yr
Trinity	Adopted	No	Yes	1	Dry	1	No	No	Diversion amount less than 10,000 acft/yr
San Jacinto	Adopted	No	Yes	1	Dry ⁴	1	No	No	Diversion amount less than 10,000 acft/yr
Guadalupe	Proposed	Yes	Yes	1	Avg or Wet	1	No	Yes	Diversion rate less than 20% of the pulse peak
San Antonio	Proposed	Yes	Yes	3	Dry, Wet & Avg	2	No	Yes	Diversion rate less than 20% of the pulse peak
Lavaca	Proposed	No	Yes	3	Dry, Wet & Avg	3	No	No	None
Colorado	Proposed	Yes	Yes	3 or 2 ⁵	Dry & Avg	3 or 2 ⁵	No	No	Diversion rate less than 500cfs or impoundment less than 2,500 acft downstream of Lake Travis

¹Site specific studies were utilized in developing the proposed environmental flow regimes:

- San Antonio River below San Antonio (SB2 process);
- Colorado River below Lake Travis (detailed project studies); and
- Guadalupe River below New Braunfels (Pre-SB2 studies).

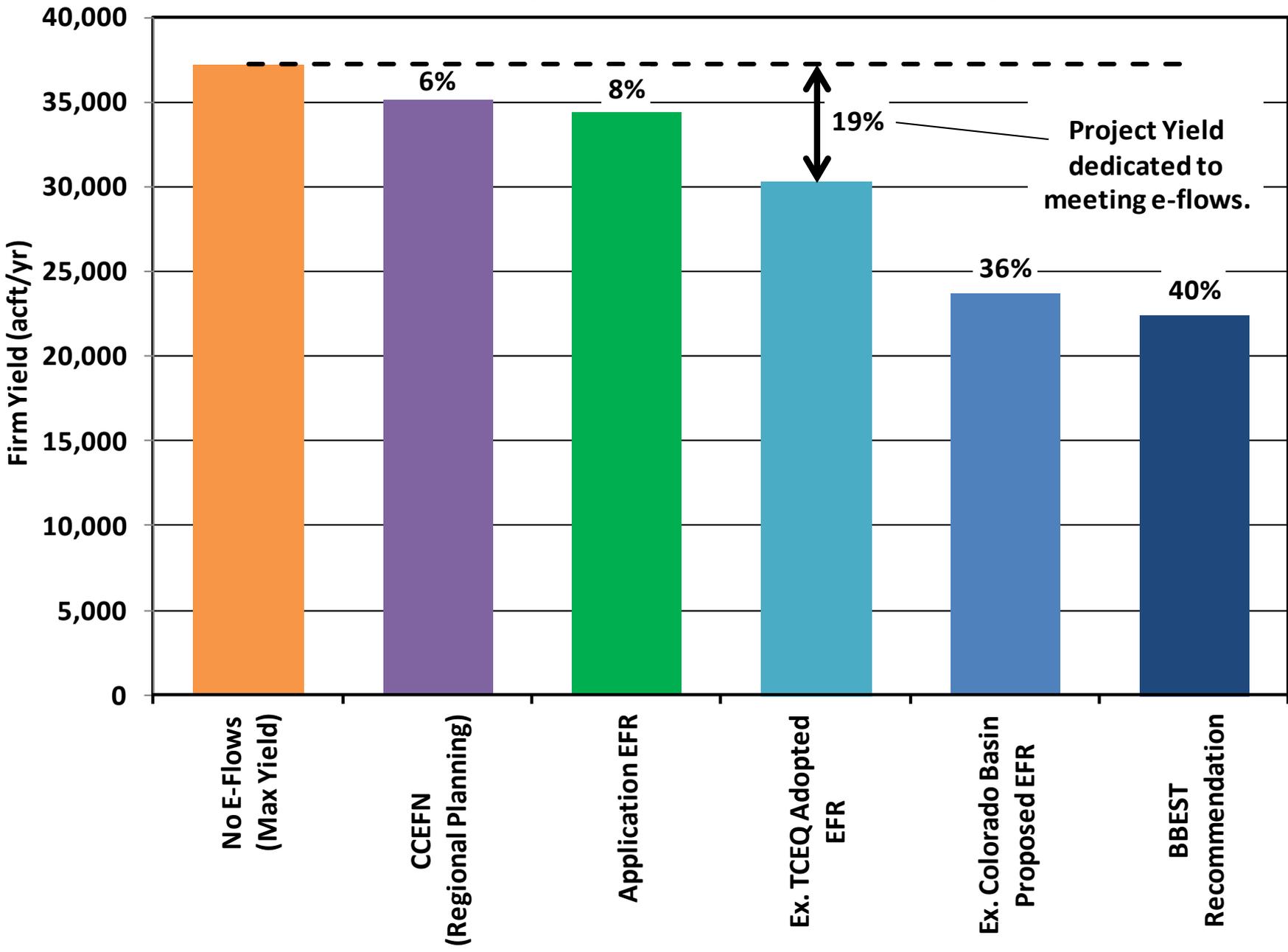
²When streamflow is less than the lowest or only tier of base flow, diversions may not exceed 50% of the difference between the streamflow and subsistence flow value.

³If a permit application meets one of the pulse exemption requirements, then that application would not be subject to some or all of the high flow pulse requirements.

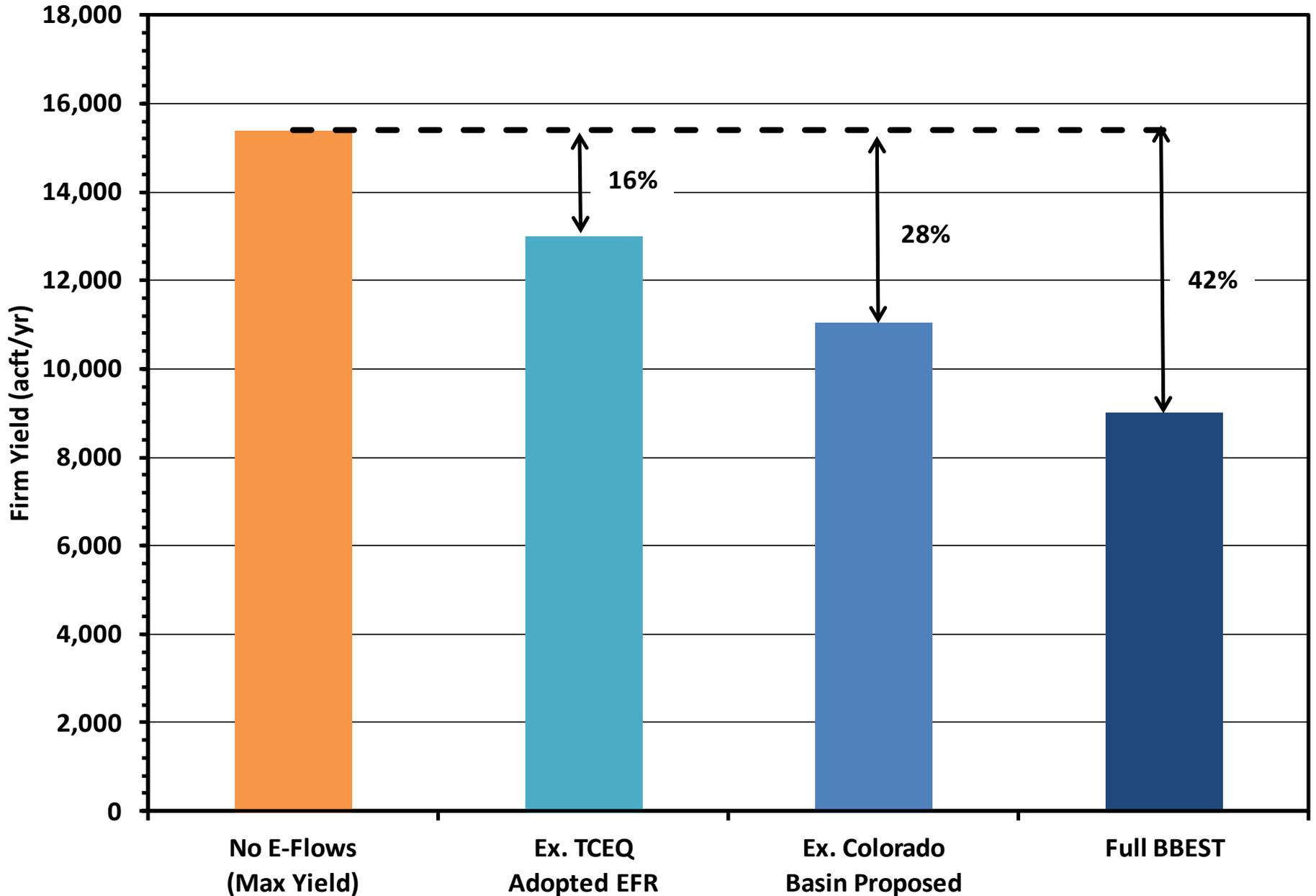
⁴The TCEQ adopted dry base flows were increased by 10% from the recommendation of the BBEST and BBASC.

⁵For the Colorado Basin, three tiers of base flows and pulses are proposed upstream of Lake Travis and two tiers of base flows and pulses are proposed downstream of Lake Travis.

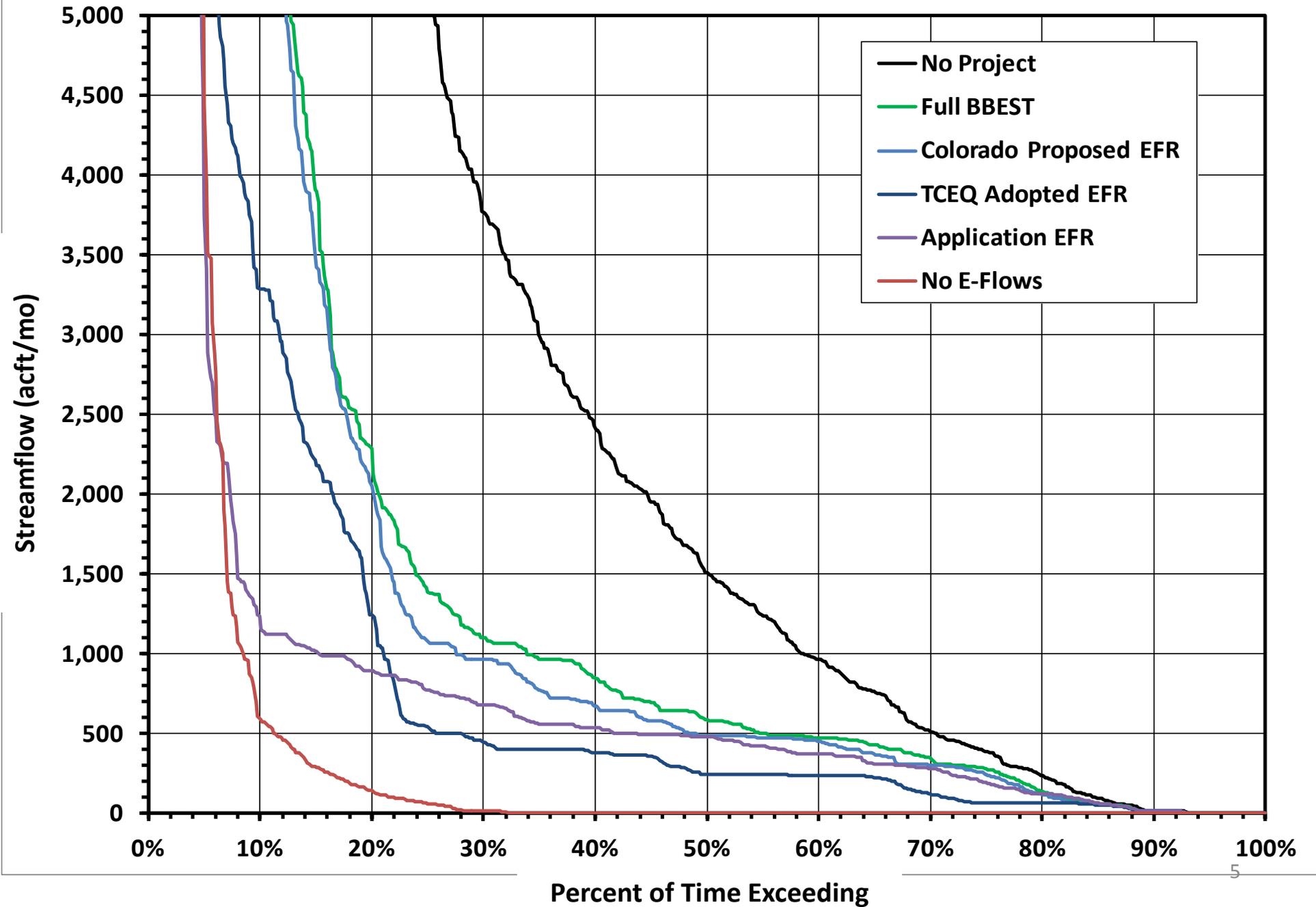
Cedar Ridge Reservoir Firm Yield Summary



Double Mtn Fork West Reservoir Yield Summary



Regulated Flow at Clear Fork Brazos River at CRR Dam



Questions



Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Full BBEST Recommendation (Drainage Area Ratio of Clear Fork Brazos River at Nugent to CRR)

Overbank Events		Qp: 10,260 cfs with Average Frequency 1 per 5 years Regressed Volume is 54,502 Duration Bound is 28											
High Flow Pulses	HFP 5	Qp: 5,829 cfs with Average Frequency 1 per year Regressed Volume is 30,584 Duration Bound is 24											
	HFP 4	Qp: 3,124 cfs with Average Frequency 1 per year Regressed Volume is 16,076 Duration Bound is 21											
	HFP 3	Qp: 144 cfs with Average Frequency 1 per season Regressed Volume is 928 Duration Bound is 15	Qp: 1,686 cfs with Average Frequency 1 per season Regressed Volume is 8,130 Duration Bound is 15										Qp: 1,281 cfs with Average Frequency 1 per season Regressed Volume is 6,509 Duration Bound is 16
	HFP 2	Qp: 34 cfs with Average Frequency 2 per season Regressed Volume is 209 Duration Bound is 9	Qp: 771 cfs with Average Frequency 2 per season Regressed Volume is 3,660 Duration Bound is 12										Qp: 510 cfs with Average Frequency 2 per season Regressed Volume is 1,890 Duration Bound is 12
	HFP 1			Qp: 239 cfs with Average Frequency 4 per season Regressed Volume is 1,124 Duration Bound is 9									
Base Flows (cfs)	Wet	17				16				12			
	Avg	11				8				5			
	Dry	7				4				1			
Subsistence Flows (cfs)		1.0				1.0				1.0			
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
		Winter				Spring				Summer			

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

Notes:

1. Period of Record used : 1/1/1925 to 12/31/2010.
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. CRR values were calculated by translating BBEST Nugent E-flow criteria downstream to CRR dam site using a drainage area ratio of 1.307.
5. CRR E-flow criteria calculated from DAR with BBEST Nugent E-flow criteria were set to not exceed BBEST Ft. Griffin E-flow criteria.

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Colorado Basin Proposed

	HFP 4	Qp: 3,124 cfs with Average Frequency 1 per year Regressed Volume is 16,076 Duration Bound is 21											
	HFP 3	Qp: 144 cfs with Average Frequency 1 per season Regressed Volume is 928 Duration Bound is 15				Qp: 1,686 cfs with Average Frequency 1 per season Regressed Volume is 8,130 Duration Bound is 15				Qp: 1,281 cfs with Average Frequency 1 per season Regressed Volume is 6,509 Duration Bound is 16			
	HFP 2	Qp: 34 cfs with Average Frequency 2 per season Regressed Volume is 209 Duration Bound is 9				Qp: 771 cfs with Average Frequency 2 per season Regressed Volume is 3,660 Duration Bound is 12				Qp: 510 cfs with Average Frequency 2 per season Regressed Volume is 1,890 Duration Bound is 12			
Base Flows (cfs)	Wet	17				16				12			
	Avg	11				8				5			
	Dry	7				4				1			
Subsistence Flows (cfs)	1.0				1.0				1.0				
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
		Winter				Spring				Summer			

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

Notes:

1. Period of Record used : 1/1/1925 to 12/31/2010.
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4. CRR values were calculated by translating BBEST Nugent E-flow criteria downstream to CRR dam site using a drainage area ratio of 1.307.
5. CRR E-flow criteria calculated from DAR with BBEST Nugent E-flow criteria were set to not exceed BBEST Ft. Griffin E-flow criteria.

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - TCEQ Adopted

High Flow Pulses	HFP 2	Qp: 34 cfs with Average Frequency 2 per season Regressed Volume is 209 Duration Bound is 9	Qp: 771 cfs with Average Frequency 2 per season Regressed Volume is 3,660 Duration Bound is 12	Qp: 510 cfs with Average Frequency 2 per season Regressed Volume is 1,890 Duration Bound is 12									
Base Flows (cfs)	Dry	7	4	1									
Subsistence Flows (cfs)		1	1	1									
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
		Winter				Spring				Summer			

Notes:

1. Period of Record used : 1/1/1925 to 12/31/2010.
2. Volumes are in acre-feet and durations are in days.
3. Episodic events are terminated when the volume or duration criteria are met, or when the flow drops below 6 cfs, or when the flow is below 29 cfs and the flow drops from one day to the next by less than 5%.
4. CRR values were calculated by translating BBEST Nugent E-flow criteria downstream to CRR dam site using a drainage area ratio of 1.307.
5. CRR E-flow criteria calculated from DAR with BBEST Nugent E-flow criteria were set to not exceed BBEST Ft. Griffin E-flow criteria.

Clear Fork Brazos River at Cedar Ridge Reservoir Dam - Application

Overbank Events		To be met from spill events from the reservoir, not controlled passes.											
High Flow Pulses	Wet¹	Qp: 50 cfs with Average Frequency 1 per season Regressed Volume is 314 Duration is 5 days			Qp: 384 cfs with Average Frequency 1 per season Regressed Volume is 2,224 Duration is 9 days			Qp: 421 cfs with Average Frequency 1 per season Regressed Volume is 2,157 Duration is 7 days			Qp: 184 cfs with Average Frequency 1 per season Regressed Volume is 843 Duration is 5 days		
	Avg¹	Not Recommended			Qp: 65 cfs with Average Frequency 2 per season Regressed Volume is 311 Duration is 4 days			Qp: 119 cfs with Average Frequency 2 per season Regressed Volume is 501 Duration is 4 days			Qp: 22 cfs with Average Frequency 2 per season Regressed Volume is 77 Duration is 2 days		
	Dry¹	Not Recommended			Qp: 65 cfs with Average Frequency 1 per season Regressed Volume is 311 Duration is 4 days			Qp: 119 cfs with Average Frequency 1 per season Regressed Volume is 501 Duration is 4 days			Qp: 22 cfs with Average Frequency 2 per season Regressed Volume is 77 Duration is 2 days		
Base Flows (cfs)	Wet¹	16			14			11			12		
	Avg¹	9			8			6			6		
	Dry¹	5			4			2			2		
Subsistence Flows (cfs)³		1.5			1.5			1.5			1.5		
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
		Winter				Spring			Summer			Fall	

Notes:

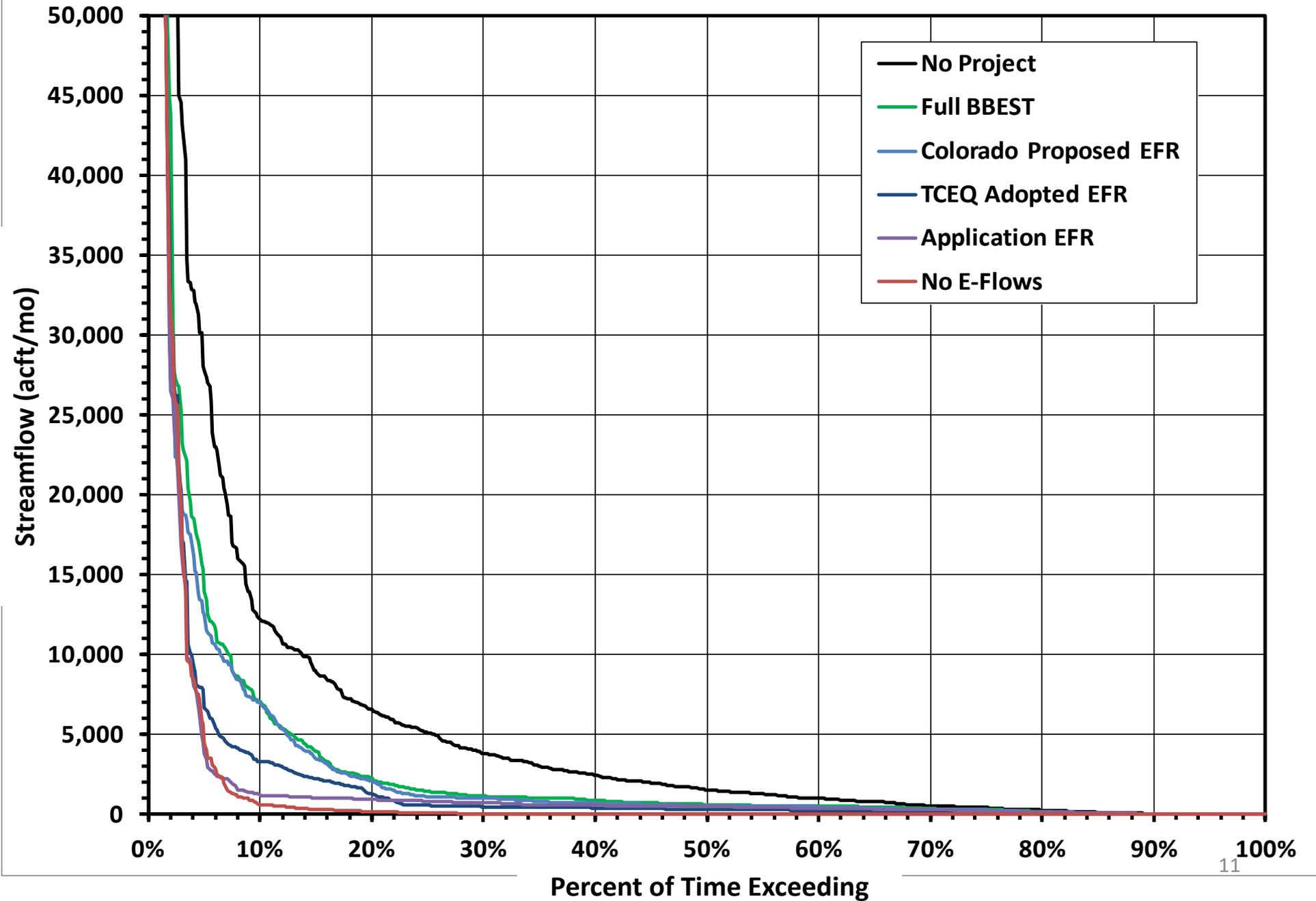
All values shown in cfs and are based on average daily flows and not instantaneous flows. Period of record used: 1/1/1939 to 12/31/2009.

¹Wet, average and dry hydrologic conditions are determined based on annual demand and reservoir storage on day 1 of each season.

²High flow pulses in August are limited to a peak flow of 184 cfs, a volume of 843 acft, and duration of 5 days for juvenile snake considerations (same as the Fall season).

³Subsistence flow is equal to the published 7Q2 value for the Clear Fork at Nugent Gage.

Regulated Flow at Clear Fork Brazos River at CRR Dam



Regulated Flow at Brazos River near Waco

