



Colorado River Risk Study Phase III

SOUTHWESTERN WATER CONSERVATION DISTRICT

37TH ANNUAL WATER SEMINAR

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With Credit to Hydros Consulting, Inc.

Disclaimer Part 1:

The findings presented herein are for discussion purposes only, and do not represent the official position of any entity with respect to factual or legal matters concerning the Colorado River.

Disclaimer Part 2:

All Models are Wrong, some are Useful – George Box

All Results Presented herein are Preliminary and Subject to Change

Colorado River Risk Study - Background

- Originated in 2014 from joint West Slope BRT discussions
- Phase I completed Fall 2016; Phase II completed Fall 2018
- Takeaways thus far:
 1. Under current conditions and operating policies, the likelihood of reaching critical elevations or a compact deficit is low, but impacts could be significant
 2. Hydrology and amount of future growth in the Upper Basin are key drivers of risk
 3. It is not just a Lower Basin / Structural Deficit problem (hence the UB DCP plan)

Risk Study Phase III

1. Continue to answer Lake Powell Risk Questions using “Stress Test” period hydrology and assuming:
 1. Existing level of U.B. Depletions
 2. Future Level of U.B. Depletions
2. Evaluate hypothetical Post-Compact water right curtailment scenarios

Risk Drivers:

- Hydrology
- Consumptive Use
- Low Reservoir Storage Conditions

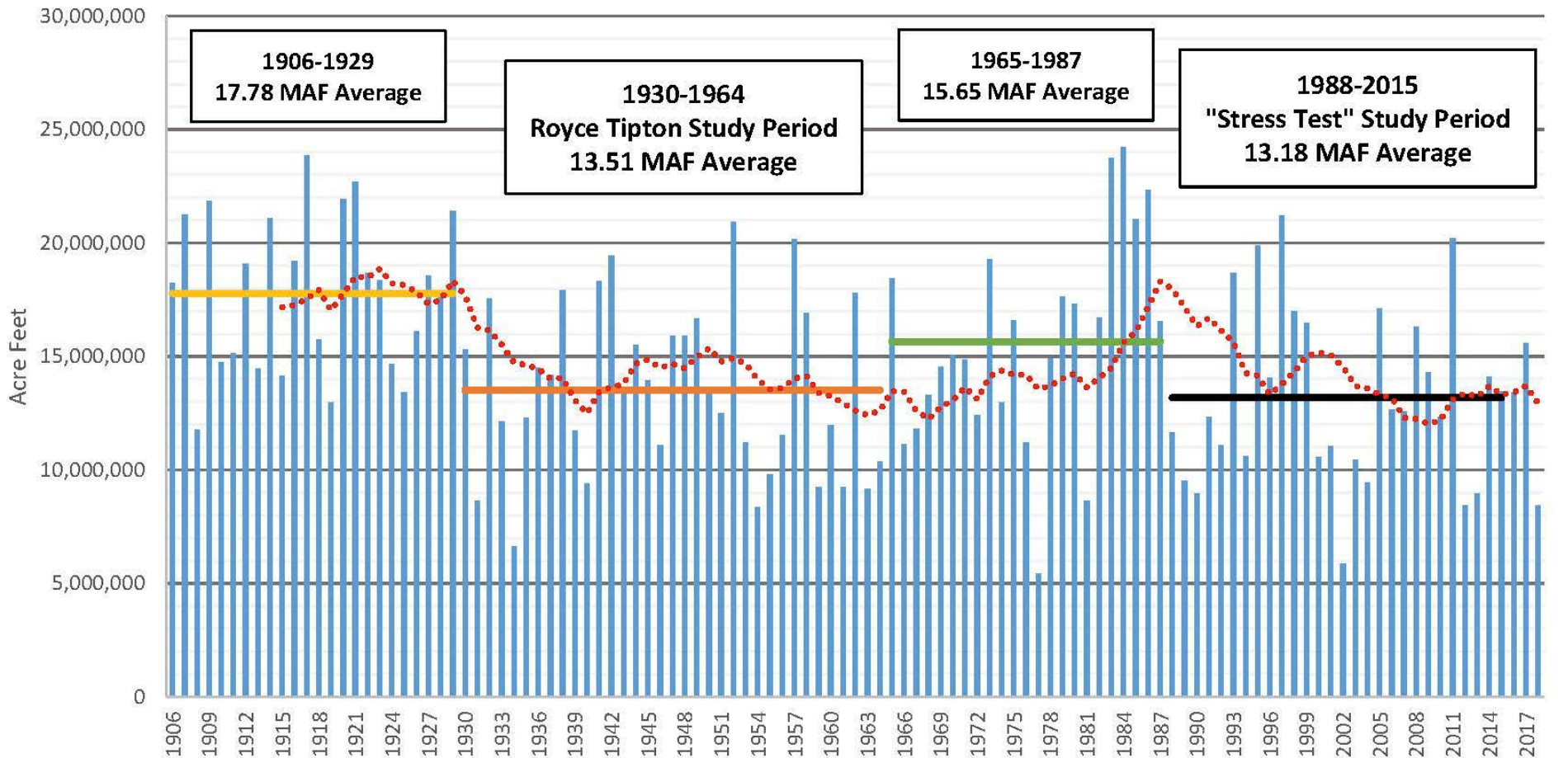


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Lake Powell Storage



COLORADO RIVER NATURAL FLOW AT LEE FERRY



What does Modeling tell us about Risk?

Model analysis from Phase III of the Risk Study using the 1988-2015 Stress Test Hydrology indicates:

1. The likelihood of Lake Powell Dropping below 3525' at some point in the next 25 years is ~ 39% (11 of 28 traces).
2. The likelihood of the 10-year running average Lee Ferry volume dropping below 82.5 Maf is ~ 46% (13 of 28 traces)
3. The likelihood of the 10-year running average Lee Ferry volume dropping below 75 Maf is ~ 0%* (0 of 28 traces)

An increase in annual Upper Basin Consumptive Use averaging 11.5% (approximately 500 Kaf)** roughly doubles the risk of #1 and #2.

***Note** that previous Risk Study simulations and Reclamation runs have shown likelihoods greater than zero at the 75 Maf threshold (Model assumptions matter!)

**The UCRC Demand Schedule anticipates reaching that level of use by ~2037.

Pre-Emptive Water Management Options

The recently approved Drought Contingency Plans (DCPs) provide a mechanism for protecting critical elevations at both Lake Powell and Lake Mead.

The Upper Basin DCP has three voluntary components intended to reduce or eliminate the risk of reaching critically low Lake Powell levels:

1. Cloud Seeding and Phreatophyte Control (Ongoing)
2. Drought Operations of CRSP storage facilities (Subject to consultation between UB States and Reclamation)
3. Exploration of voluntary and compensated Demand Management program, including use of 500,000 af storage account in one or more CRSP facilities

If these (and possibly other) pre-emptive actions are insufficient to protect Lake Powell levels, and if as a result Lake Powell was unable to release sufficient water past Lee Ferry, a Compact Deficit could result.

A Compact Deficit could result in Involuntary Curtailment

Questions:

- How much Colorado River water does the State of Colorado use?
- How much of Colorado's depletions are pre-compact?
 - How is this volume split up across the west slope basins (including TMDs)?
 - How much post-compact use could be called out?
 - Where are those post-compact uses?
- What are potential approaches to "Sharing the Pain"?

Colorado's Consumptive Use of Colorado River Water

<i>Basin</i>	Annual Depletions (acre-feet)		
	Minimum	Average	Maximum
Yampa	173,547	196,982	215,193
White	48,550	62,060	70,397
Colorado	1,117,487	1,220,386	1,345,192
<i>In-Basin</i>	650,887	669,397	692,333
<i>TMDs</i>	466,600	550,989	652,859
Gunnison	481,626	552,418	601,030
Southwest	335,365	500,717	556,627
Total	2,156,575	2,532,564	2,788,439

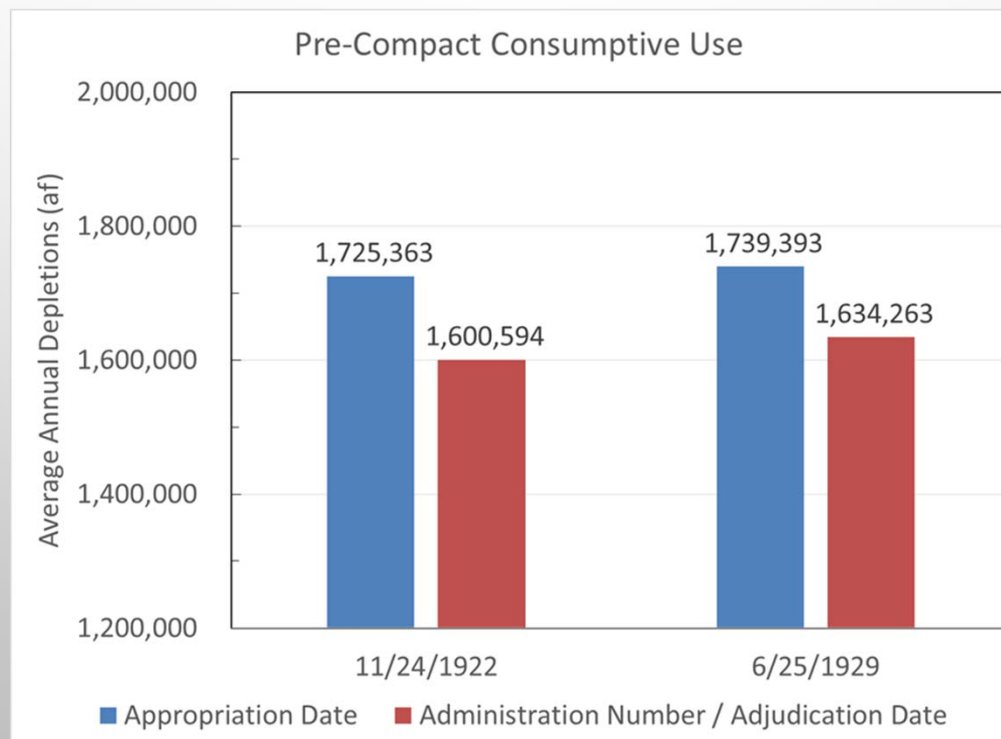
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Key Question: How Much Consumptive Use is Pre-Compact?

- Boulder Canyon Project Act (6/25/1929): U.S. Congress approves Colorado River Compact, which was signed by 6 of the 7 basin states on November 24, 1922.
 - Article VIII of the 1922 Compact: “Present perfected rights to the beneficial use of waters of the Colorado River System are unimpaired by this compact...”
- States of the upper basin would most likely attempt to maximize the amount of pre-compact consumptive use
- A point of contention regarding pre-compact rights is likely to be the quantification of “present perfected use” as of 1922.

Appropriation Dates vs. Administration Dates

- Administration of water rights in Colorado is generally based on adjudication dates (represented by admin numbers in StateMod)
- Modeling a Compact Call using appropriation dates yields more pre-compact consumptive use than using administration numbers/dates.



Primary and Subject to Change

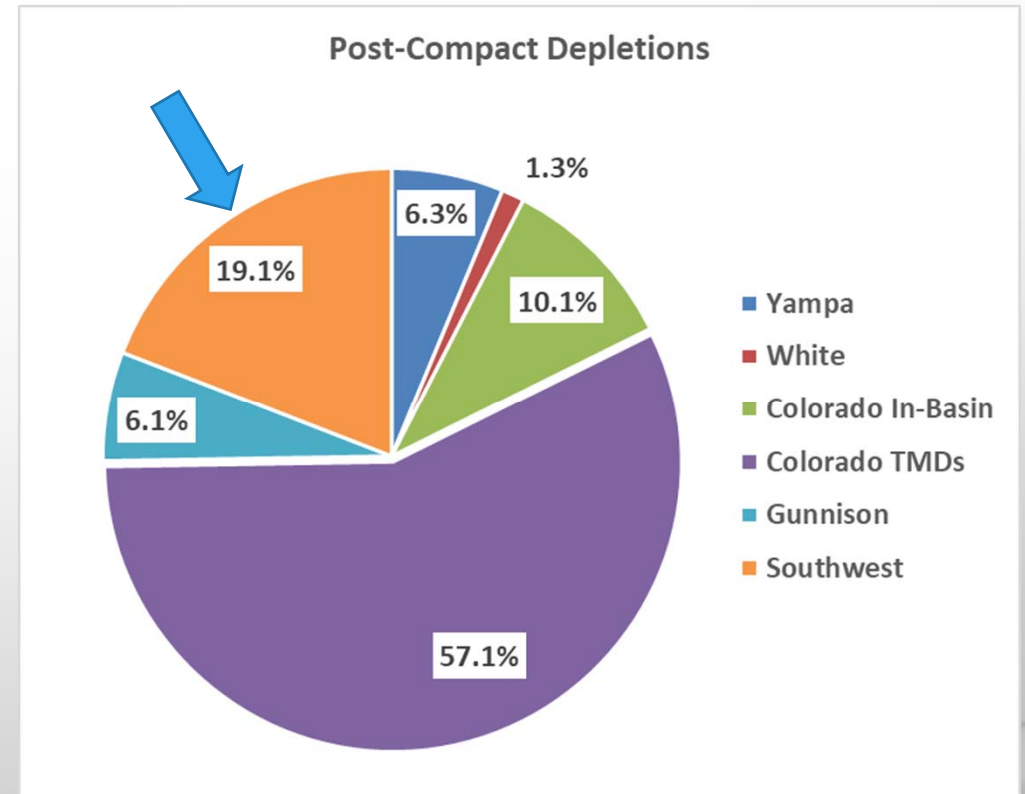
A Closer Look at Pre/Post Compact Depletions

<i>Basin</i>	Average Annual Depletions (acre-feet)		
	All Users	Pre-Compact	%Pre-Compact
Yampa	196,982	138,544	70%
White	62,060	50,173	81%
Colorado	1,220,386	594,169	49%
<i>In-Basin</i>	669,397	574,997	86%
<i>TMDs</i>	550,989	19,173	3%
Gunnison	552,418	495,147	90%
Southwest	500,717	322,561	64%
Total	2,532,564	1,600,594	63%

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Who is Impacted by Curtailment of all Post-Compact Rights?

<i>Basin</i>	Average Annual Depletions (af)	
	Post-Compact	% of Total
Yampa	58,438	6.3%
White	11,887	1.3%
Colorado	626,216	67.2%
<i>In-Basin</i>	94,400	10.1%
<i>TMDs</i>	531,816	57.1%
Gunnison	57,271	6.1%
Southwest	178,157	19.1%
Total	931,969	100.0%



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What if Curtailment of all Post-Compact Rights is not the only Option?

Q: How deep would administrative call be in order to yield a given volume?

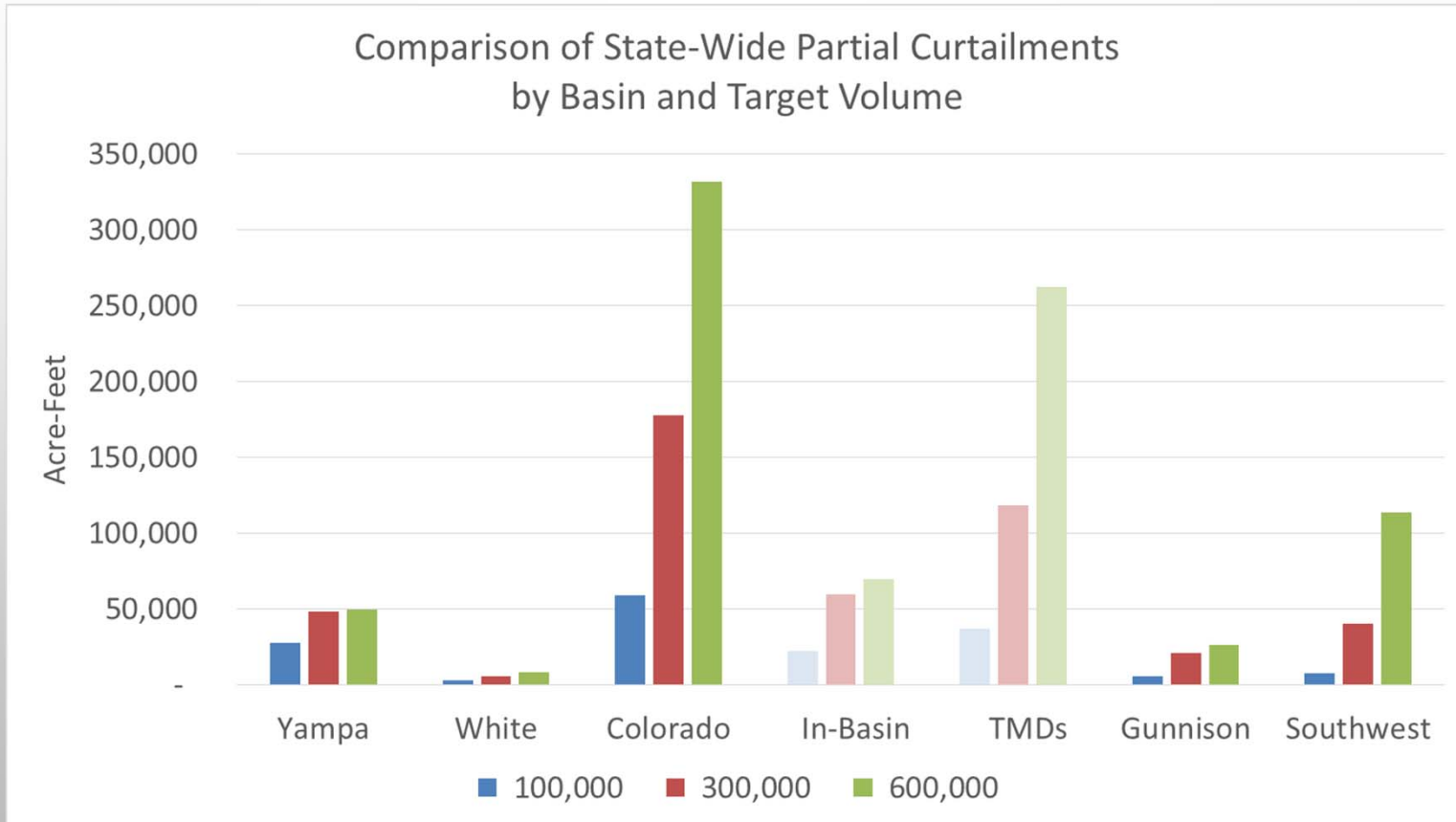
Assume different target volumes for reduced consumptive use:

- 100,000 af
- 300,000 af
- 600,000 af

Recall that a “full” compact call yields about 932,000 af on average

Target Volume (acre-feet/yr)	All Colorado River Rights
100,000	Jul 1957
300,000	Sep 1940
600,000	Aug 1935
932,000	Nov 1922

Impact of a Single State-Wide Partial Call on each Sub-Basin



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What if Curtailment According to a Single State-Wide Priority Date is not the only option?

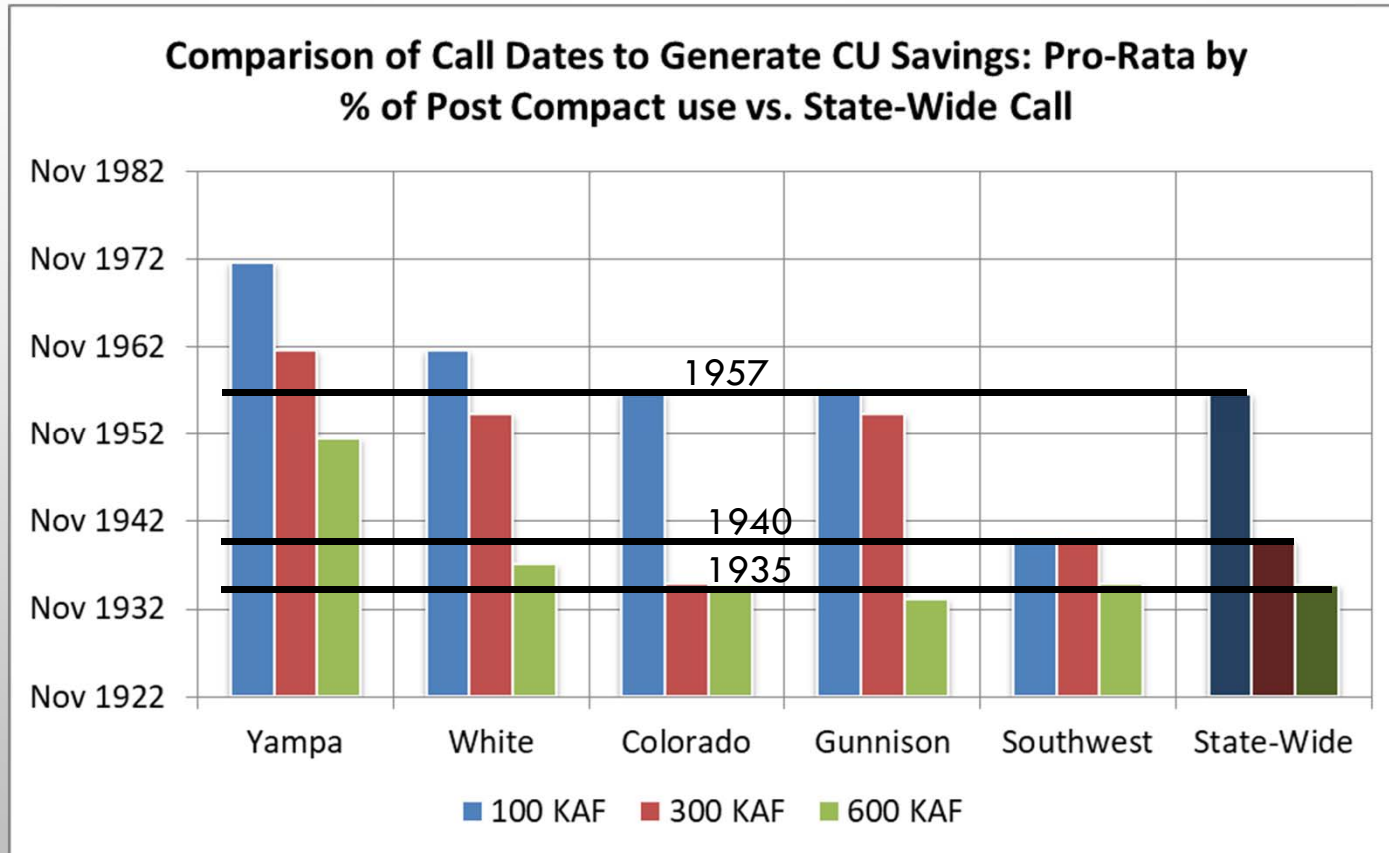
Purpose: Investigate different assumptions regarding the volume and distribution of mandatory curtailment actions *other than* total curtailment.

Examples: Agree to reduce consumptive use via a pro-rata basis. What if*:

1. We distribute the mandatory reductions based on each sub-basin's percentage of post-compact water use relative to the State as a whole?
2. We distribute the mandatory reductions between in-basin uses and TMDs based on each group's percentage of post-compact water relative to the State as a whole?

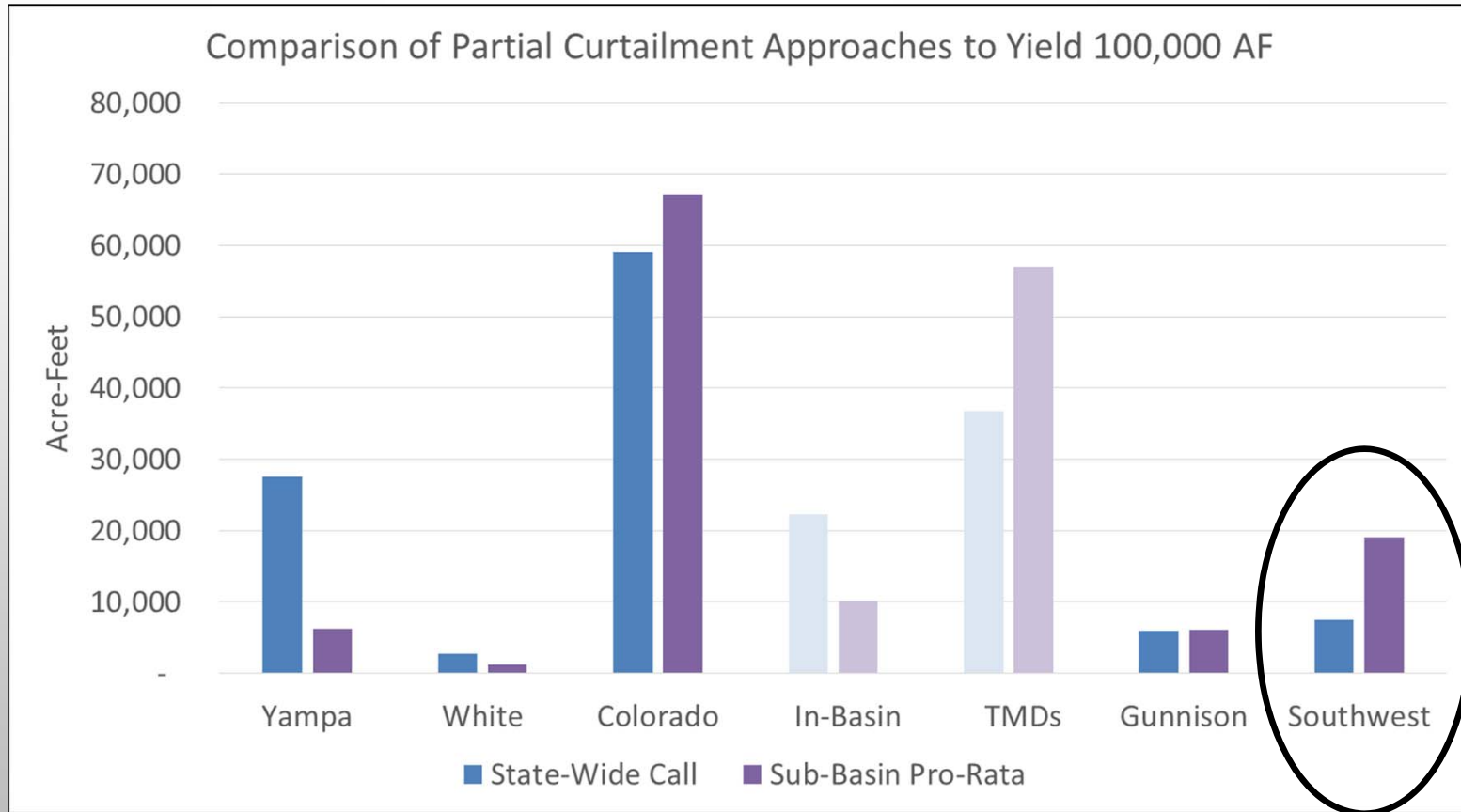
**These scenarios should NOT be construed as advocating for a particular approach to Compact administration. The intent is to quantify and better understand a variety of possible options.*

How would a Call vary across Sub-Basins (Pro-Rata) Compared to a State-Wide Call?



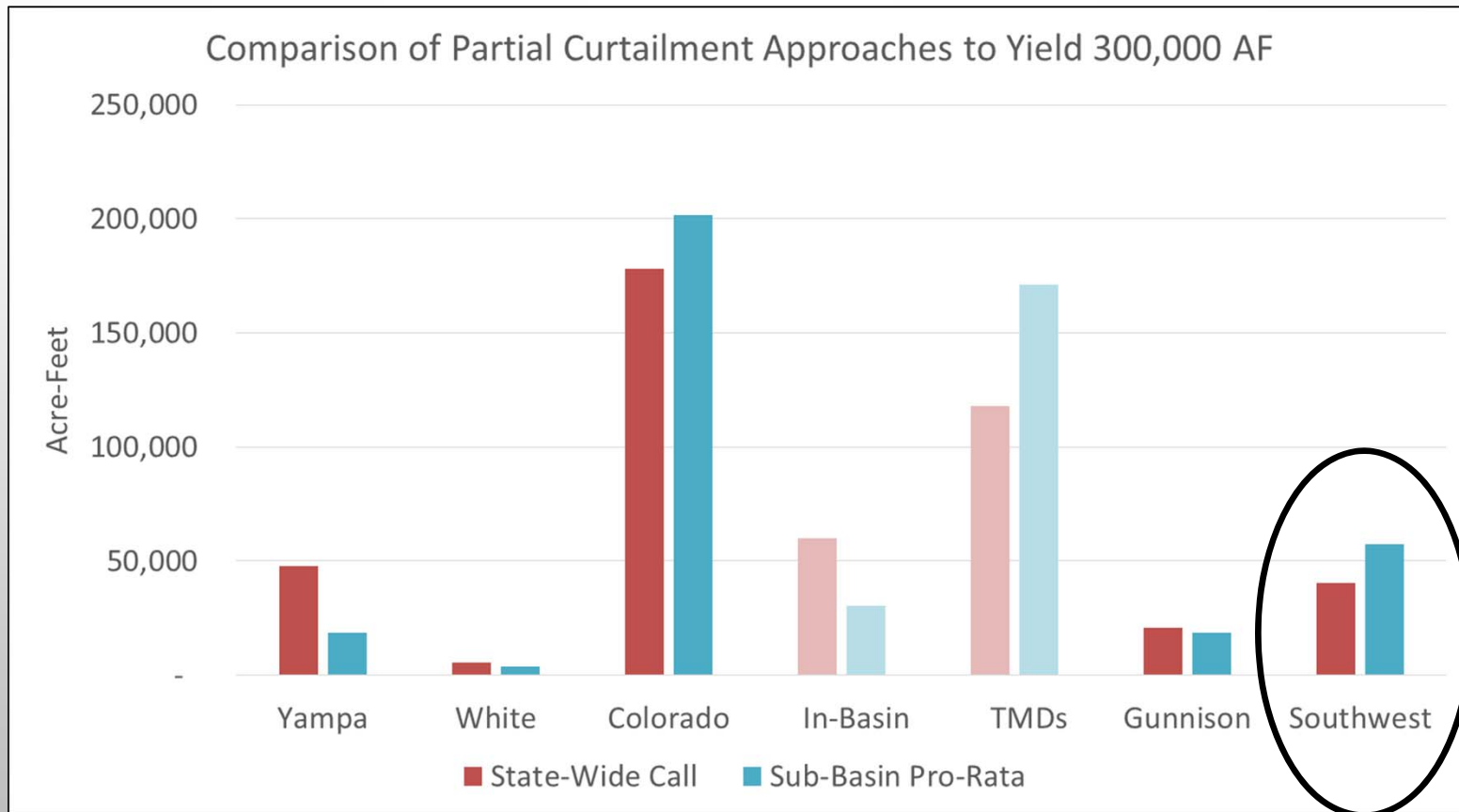
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Comparison of State-Wide vs Sub-Basin Approaches to Curtailment



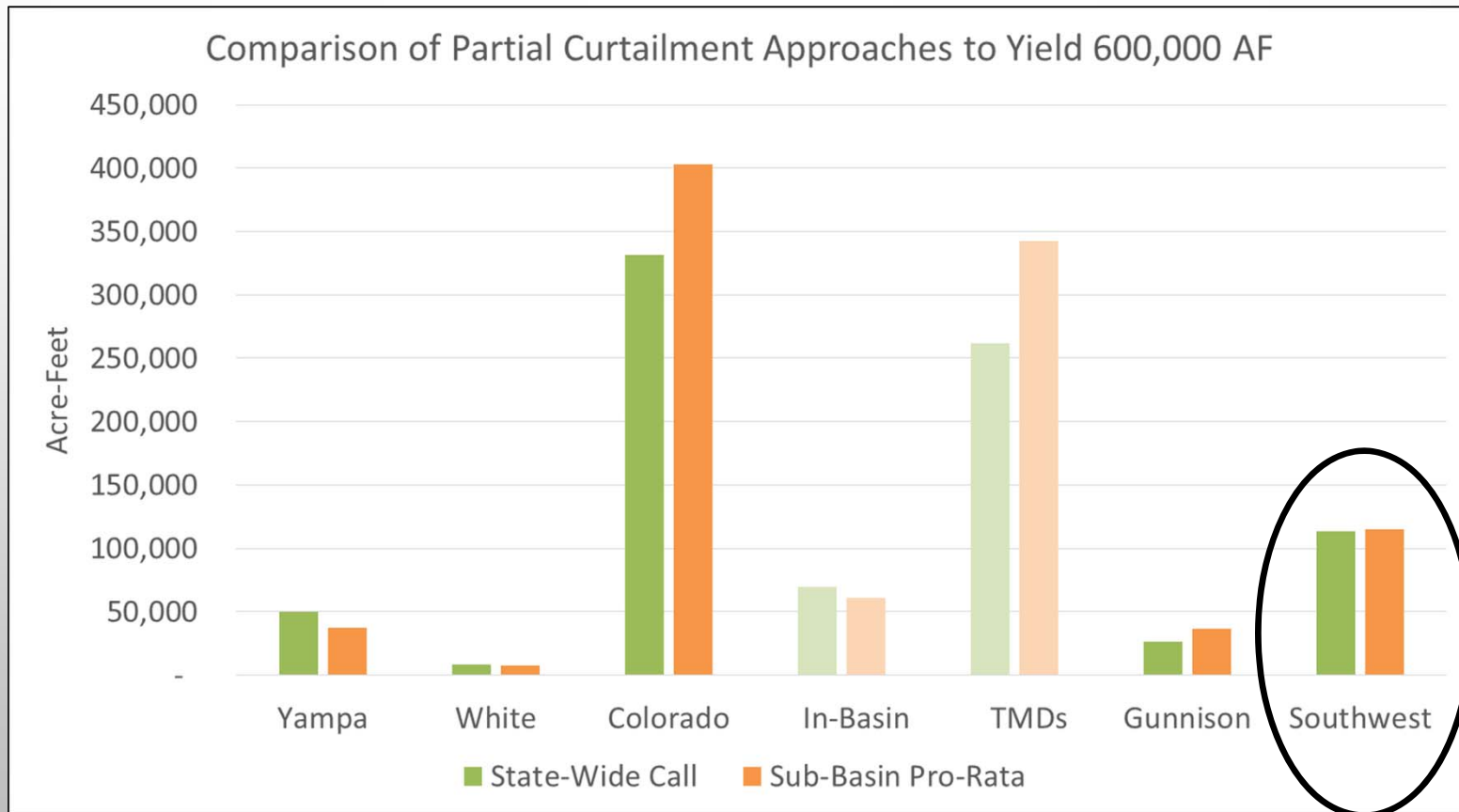
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Comparison of State-Wide vs Sub-Basin Approaches to Curtailment



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CLOSING OBSERVATIONS

1. Of Colorado's ~2.5 Maf of average annual consumptive use, approximately ~1.6 Maf is attributable to Pre-Compact rights, and ~900 Kaf is Post-Compact
2. TMDs constitute over half of the Post-Compact depletions (~56%)
3. Because of #2, the Colorado Mainstem users comprise 2/3 of all Post-Compact uses
4. Allocating deficit volumes pro-rata by sub-basin depletions results in substantially different administration dates (and volumes) for certain sub-basins when compared to a state-wide curtailment of all Colorado River water users.
5. SW water use is ~36% Post-Compact compared to ~15% for all other WS basins combined (excluding TMDs)
6. Excluding TMDs, SW accounts for ~44% of total WS Post-Compact use.