

Colorado River Risk Management

**Roundtable Summit
March 1, 2012**

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Director, Colorado Water Conservation Board**

Colorado River Allocations

UPPER BASIN - 7.5 MAF

Upper Basin Allocations
Established by Upper Colorado
Basin Compact - 1948

LOWER BASIN - 7.5 MAF

California – 4.4 MAF

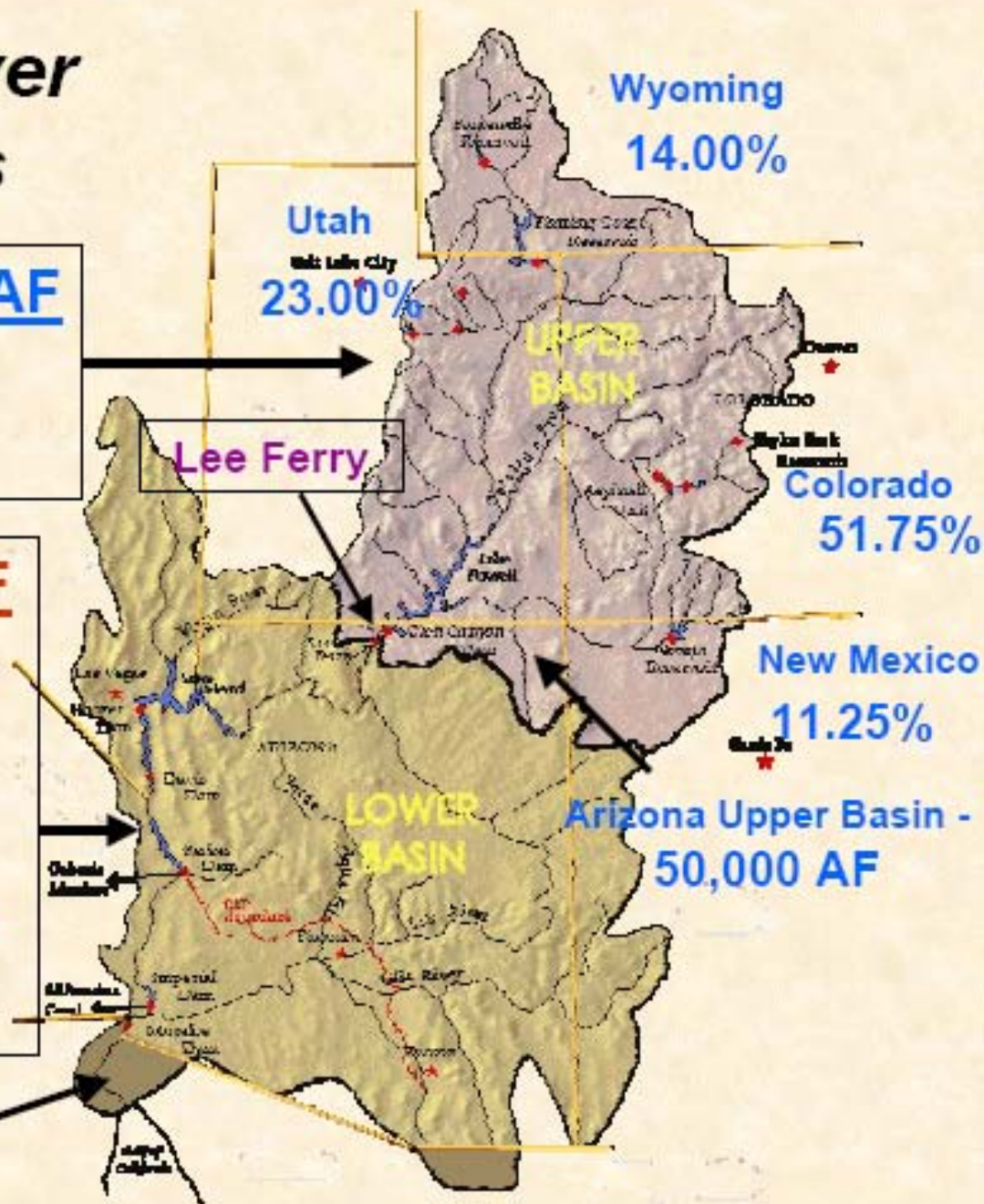
Arizona – 2.8 MAF

Nevada – 0.3 MAF

Lower Basin Allocations Established
by the Boulder Canyon Project Act -
1928

Mexico - 1.5 MAF

Established by Treaty
with Mexico -1944



2007 Interim Guidelines

- Adopted by Interior in 2007, and effective until 2026.
- Established “shortages” that will be imposed when Lake Mead elevations occur.
- Established guidelines for releases from Lake Powell based on Lake Powell elevation, Lake Mead elevation, and other specific criteria.
- Allows the Lower Basin states to create “Intentionally Created Surplus” (ICS) and use that water under the terms of certain agreements and the guidelines.

Lake Powell & Lake Mead

Operational Guidelines for Projected Conditions

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹
3,700	Equalization Tier Equalize, avoid spills or release 8.23 maf	24.3	1,220	Flood Control Surplus or Quantified Surplus Condition Deliver > 7.5 maf	25.9
3,646.26		16.75	1,200 (approx.) ²		22.9 (approx.) ²
1/1/12 Projection	Upper Elevation Balancing Tier³ Release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	1/1/12 Projection	1,145	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	15.9
			1,134.12		14.78
3,575	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1/1/12 Projection	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	1/1/12 Projection
			1,075		9.4
3,525	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,050	Shortage Condition Deliver 7.167 ⁴ maf	7.5
			1,025		5.8
3,490		4.0	1,000	Shortage Condition Deliver 7.0 ⁵ maf Further measures may be undertaken ⁷	4.3
3,370		0	895		0

Diagram not to scale

¹ Acronym for million acre-feet

² This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

³ Subject to April adjustments which may result in a release according to the Equalization Tier

⁴ Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

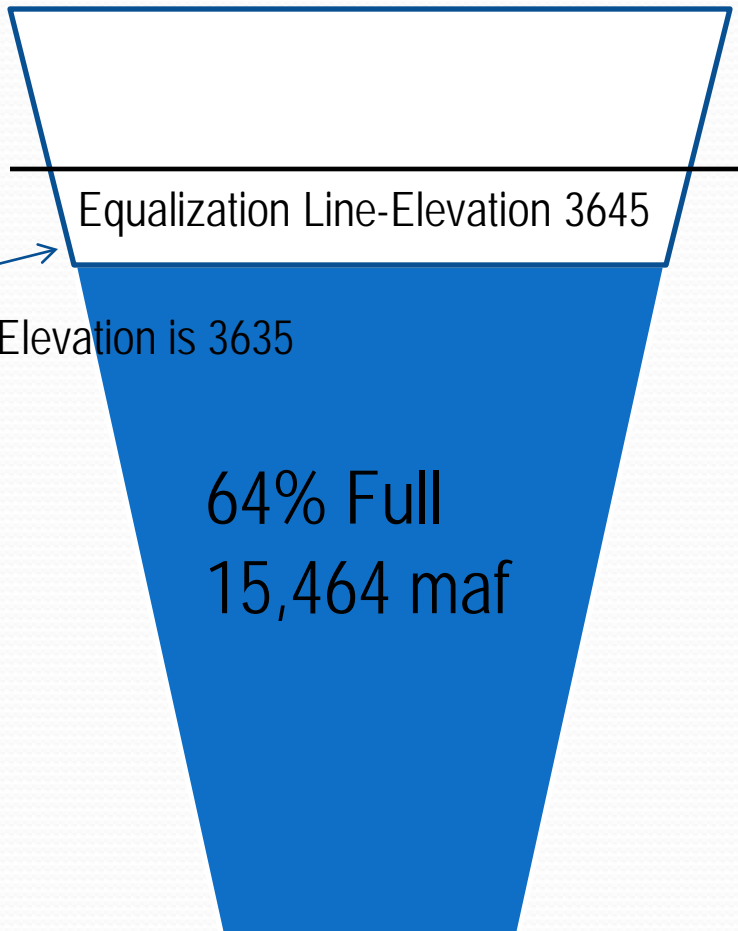
⁵ Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

⁶ Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

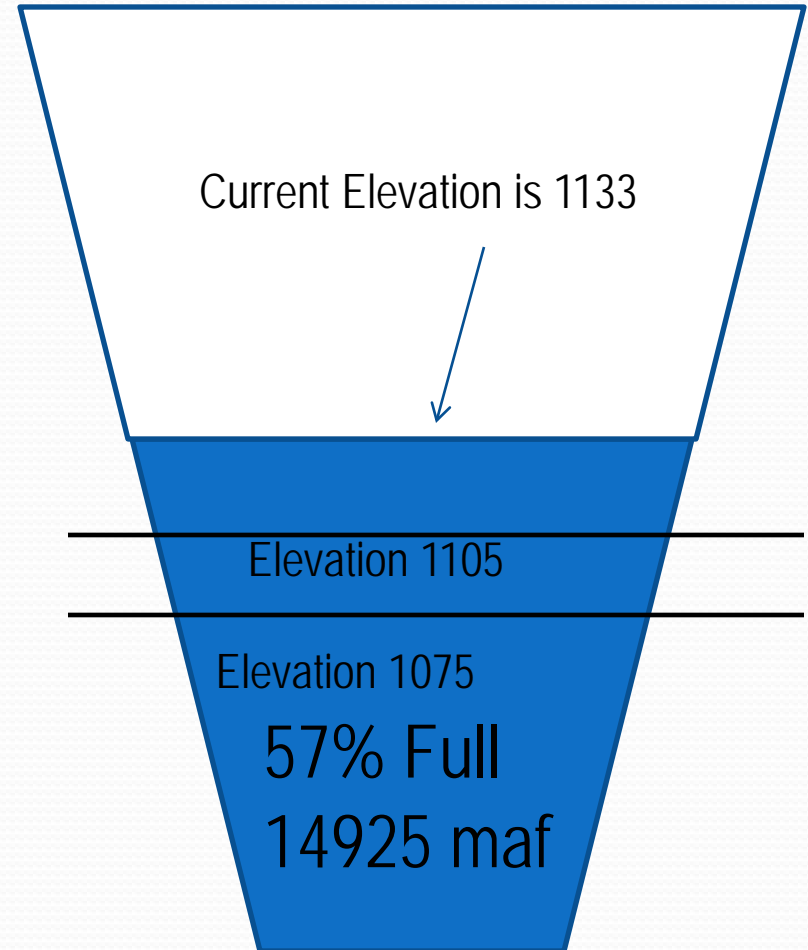
⁷ Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

Current Storage

24.3 MAF Lake Powell



25.8 MAF Lake Mead



Coordinated Operations

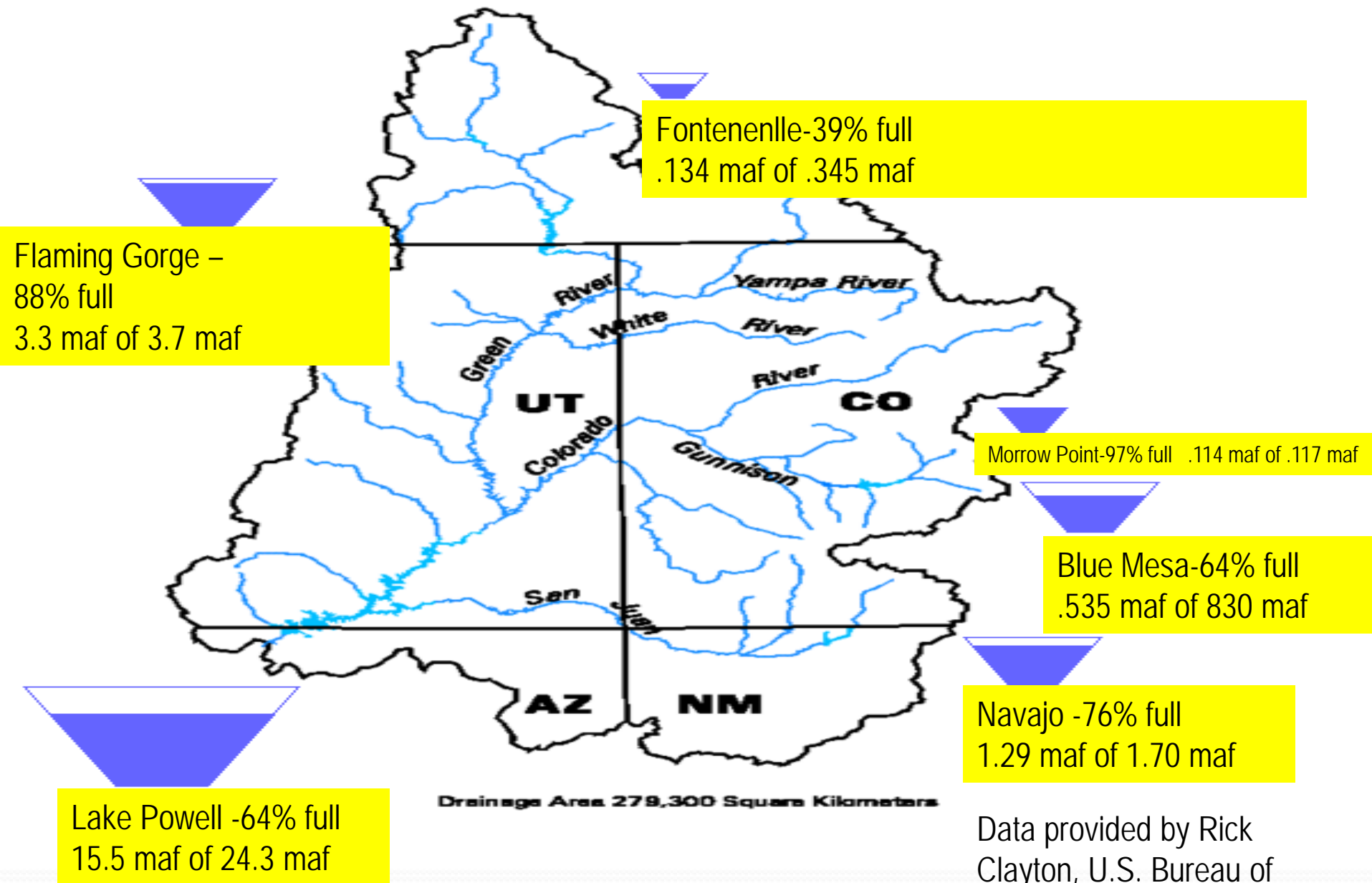
Powell Elevation	Powell Operation
3,700 ft.	Equalize or 8.23 maf
3,636 - 3,664 ft. (see Equalization Table)	8.23 maf; If Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf
3,575 feet	7.48 maf
3,525 feet	8.23 maf if Mead < 1,025
3,370 feet	Balance contents with a min/max release of 7.0 and 9.5 maf

The Lee's Ferry
annual flow, and
10 year flow
rolling average.

The 10 year
provision gives
the Upper
Division States
some time to
know that a crisis
is coming.

YEAR	Annual Release (AF)	10 year average (AF)
• 2000	9,530	101,754
• 2001	8,361	101,983
• 2002	8,348	102,308
• 2003	8,372	102,543
• 2004	8,348	102,585
• 2005	8,395	101,738
• 2006	8,508	98,716
• 2007	8,422	93,265
• 2008	9,180	89,004
• 2009	8,406	85,870
• 2010	8,436	84,777
• 2011	12,754	89,169
• 2012	>9,514	>90,335

Upper Colorado River Drainage Basin



Data provided by Rick Clayton, U.S. Bureau of Reclamation

Historic Colorado River Water Supply & Use (Annual)

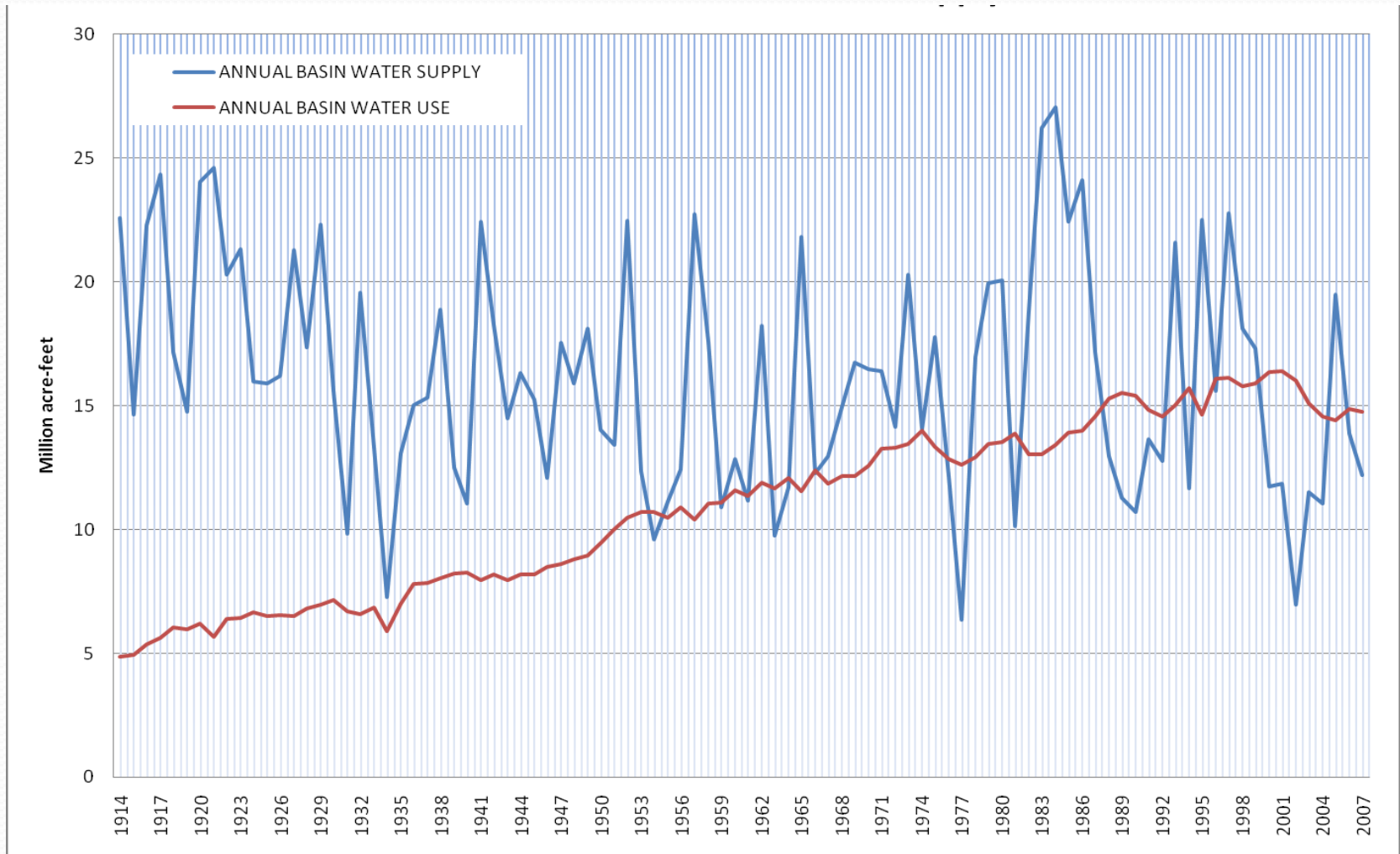
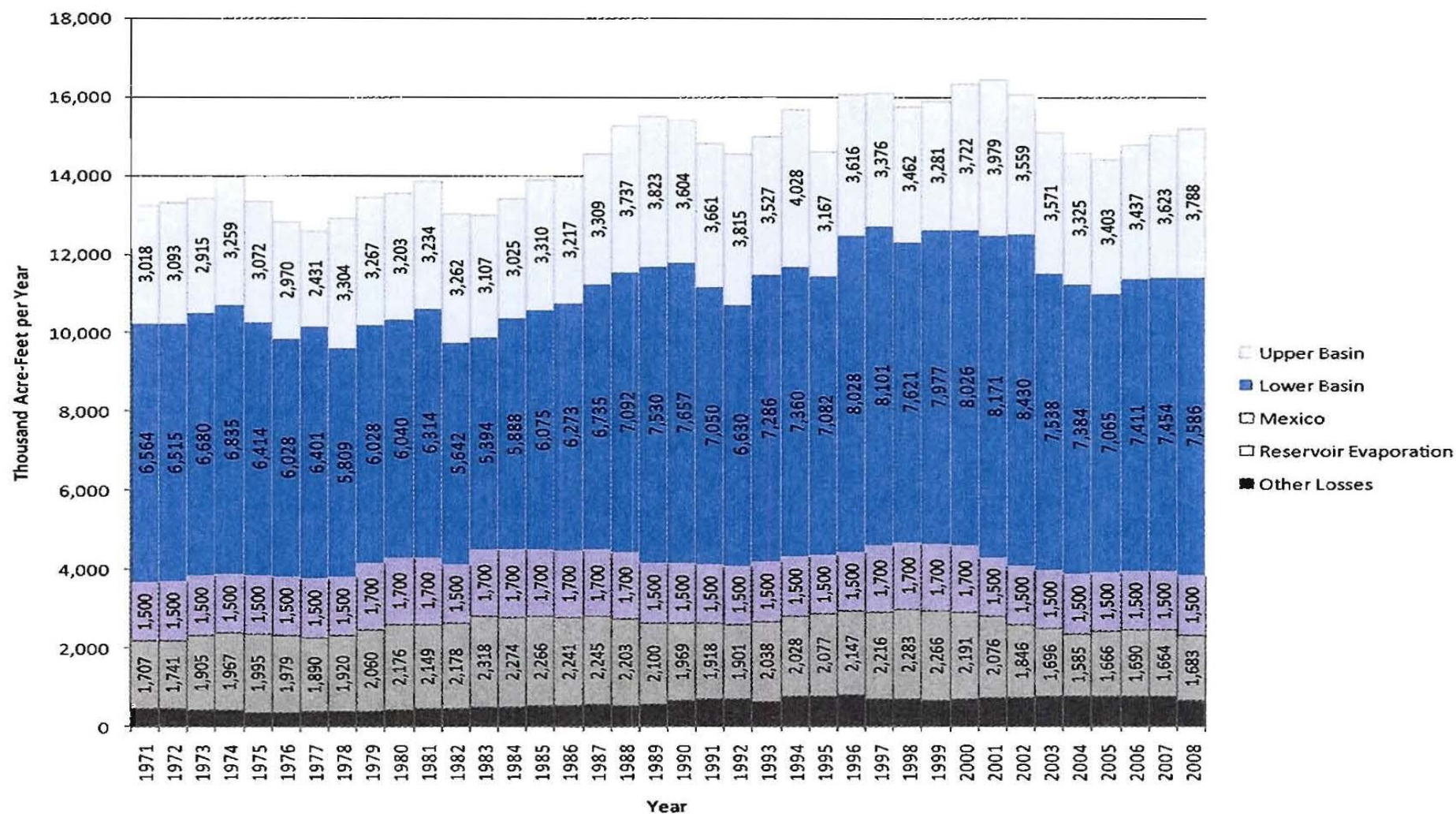


FIGURE C-6

Historical Colorado River Water Consumptive Use¹ by Basin², Delivery to Mexico, Reservoir Evaporation, and Other Losses³, 1971-2008



1.Excluding consumptive use in the lower basin tributaries. 2. Lower Basin Use great than 7.5 maf is due to surplus water supply conditions in the Lower Division States. 3. Phreatophyte and operational inefficiency losses.

Risk Management Strategies

- Studies
 - Colorado River Basin Study (basin-wide strategies)
 - Colorado River Compact Compliance Study (Colorado only legal and technical analysis)
 - Colorado River Water Availability Study (technical work)

Risk Management Strategies

- Discussions with other Upper Basin States
- Portfolio development
- Alternatives to Agricultural Transfers

Risk Management Strategies

- Water Banking Work Group
- Aspinall Unit Arkansas and Gunnison Roundtable Work
- State acquisition of water for compact purposes

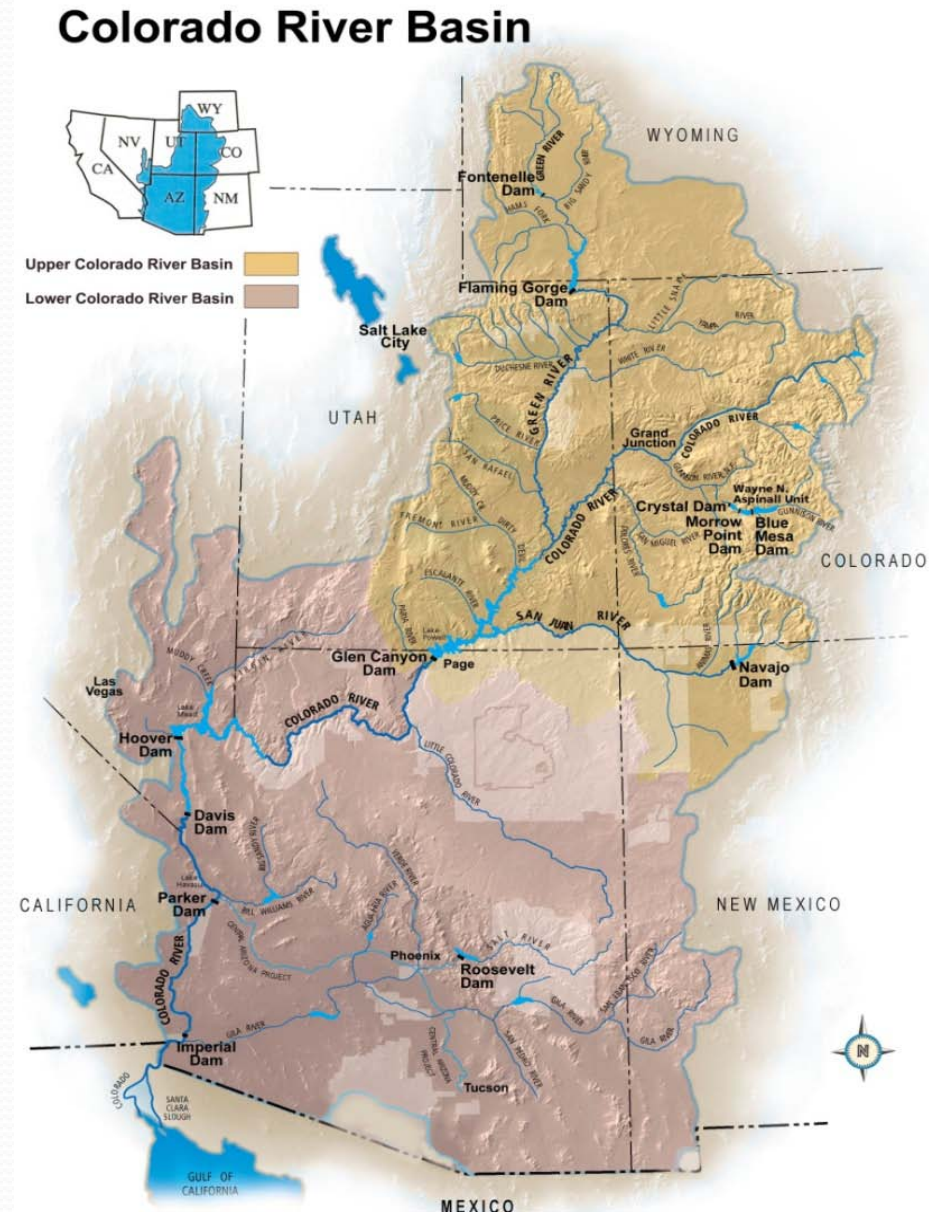


Risk Management Strategies

What else?

Colorado River Basin Water Supply and Demand Study

- Study Overview
 - Water Supplies
 - Water Demands
 - Metrics
 - Options and Strategies



Historic Colorado River Water Supply & Use (10-year Running Average)

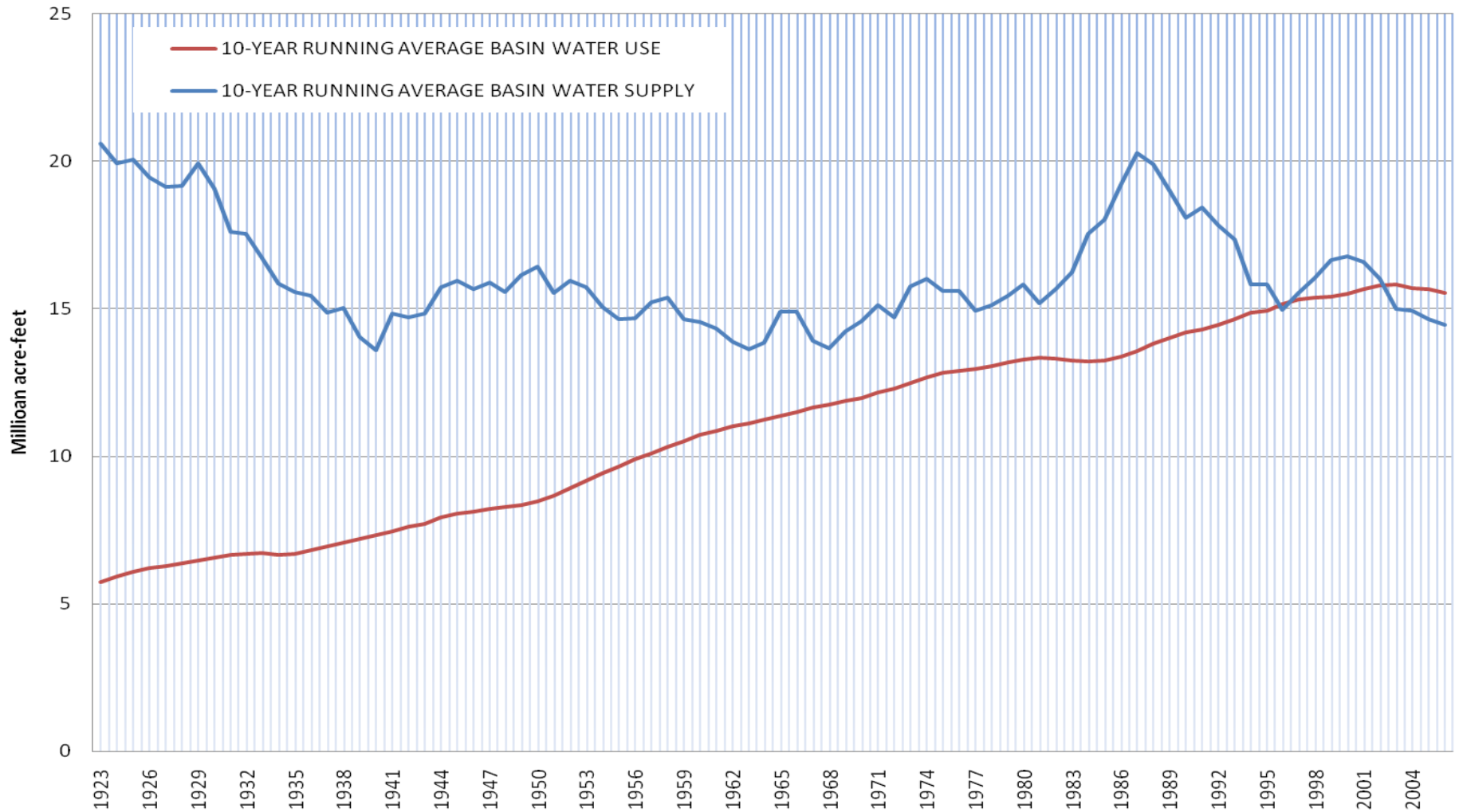
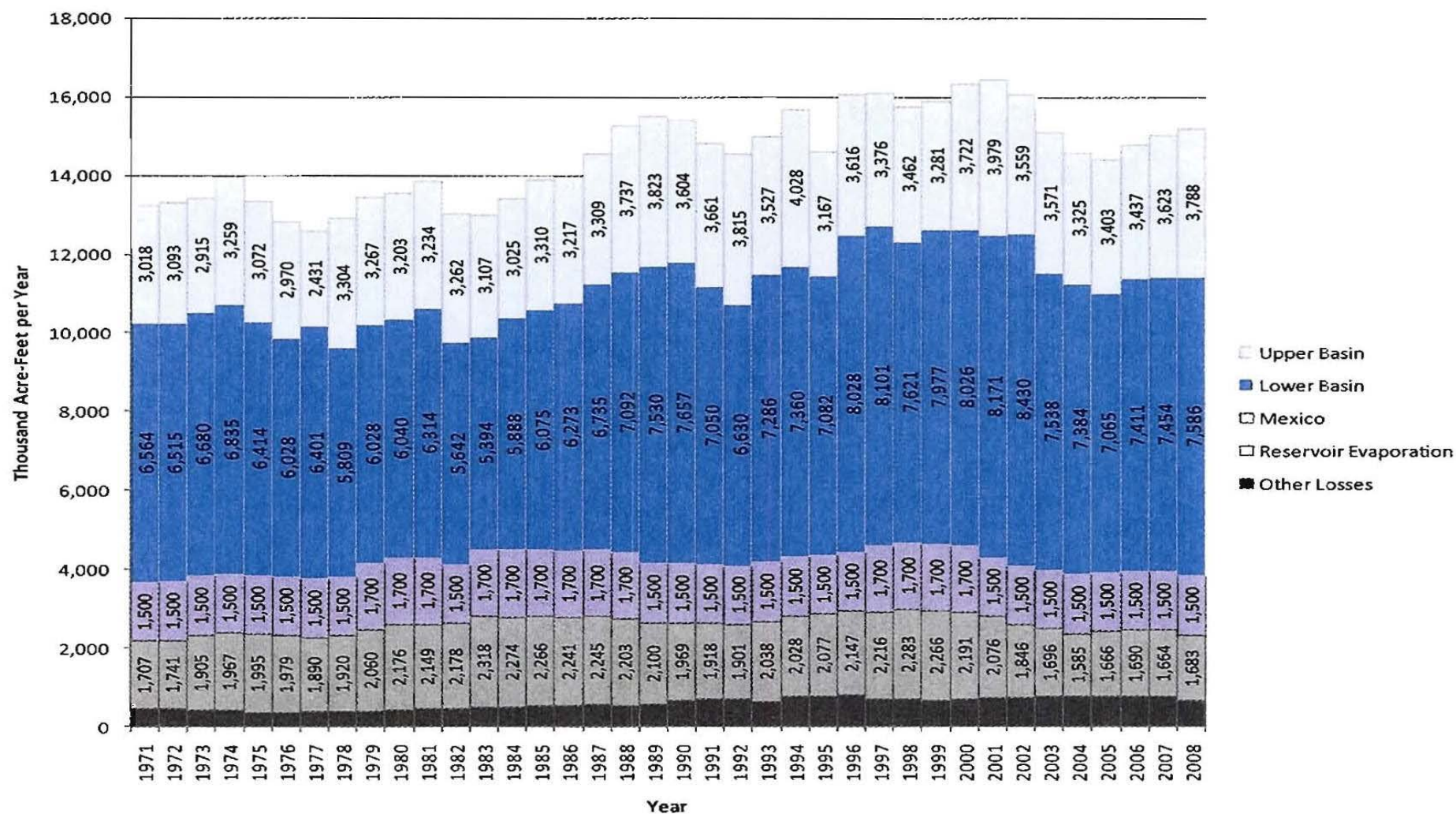


FIGURE C-6

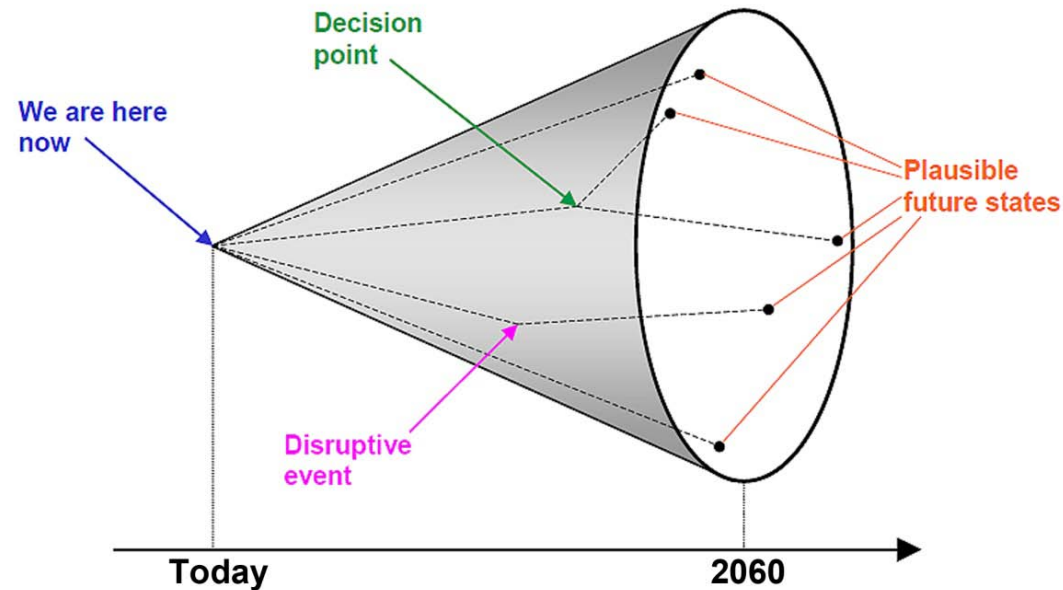
Historical Colorado River Water Consumptive Use¹ by Basin², Delivery to Mexico, Reservoir Evaporation, and Other Losses³, 1971-2008



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Addressing an Uncertain Future

- The path of major influences on the Colorado River system is uncertain and can not be represented by a single view.
- An infinite number of plausible futures exist
- A manageable and informative number of scenarios are being developed to explore the broad range of futures



Water Supply Scenarios

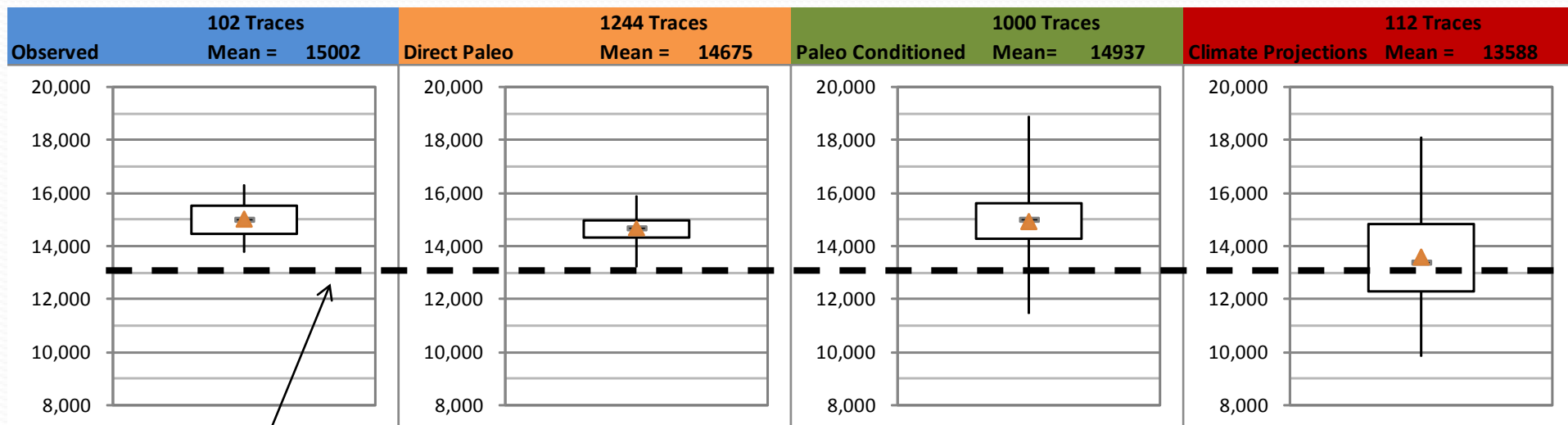
- Observed Resampled: hydroclimatic trends and variability are similar to the past 100 years
- Paleo Resampled: future hydroclimatic trends and variability are represented by reconstructions of streamflow for a much longer period in the past (nearly 1250 years) that show expanded variability

Water Supply Scenarios

- Paleo-Conditioned: future hydrologic trends and variability are represented by a blend of the wet-dry states of the longer paleo-reconstructed period (nearly 1250 years).
- Downscaled GCM Projected: future climate will continue to warm with regional precipitation and temperature trends represented through an ensemble of future downscaled GCM projections

Projections of Natural Flow at Lees Ferry

2011 – 2040 Period Mean Annual Flows



1988 – 2007 period mean

Water Demand Scenarios

- Current Trends: growth, development patterns, and institutions continue along recent trends
- Economic Slowdown: low growth with emphasis on economic efficiency

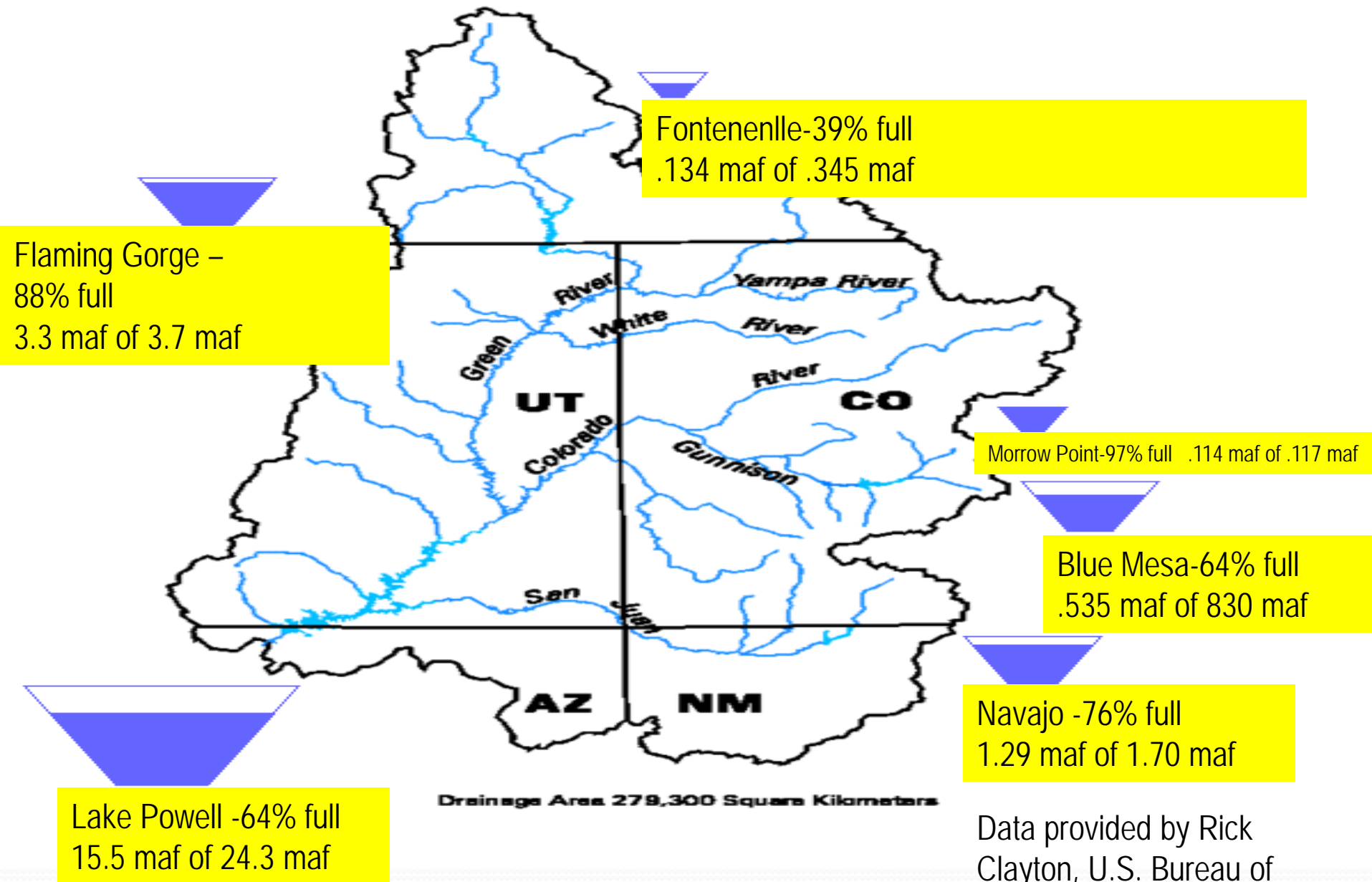
Water Demand Scenarios

- Expansive Growth: economic resurgence (population and energy) and current preferences toward human and environmental values
- Enhanced Environment and Healthy Economy: expanded environmental awareness and stewardship with growing economy

Upper Colorado River Commission Issues

- 2010 Resolution regarding Compact issues
- UCRC is authorized to make specific findings
- Benefits associated with Basin-wide water management strategies

Upper Colorado River Drainage Basin



Data provided by Rick Clayton, U.S. Bureau of Reclamation

Colorado Compact Compliance Study

- The Colorado General Assembly directed the CWCB to identify issues associated with administration of state water rights with respect to the Colorado River compacts.
- The study is to look at options to avoid or delay the curtailment of water uses, if possible, and evaluate options for administering a potential curtailment.



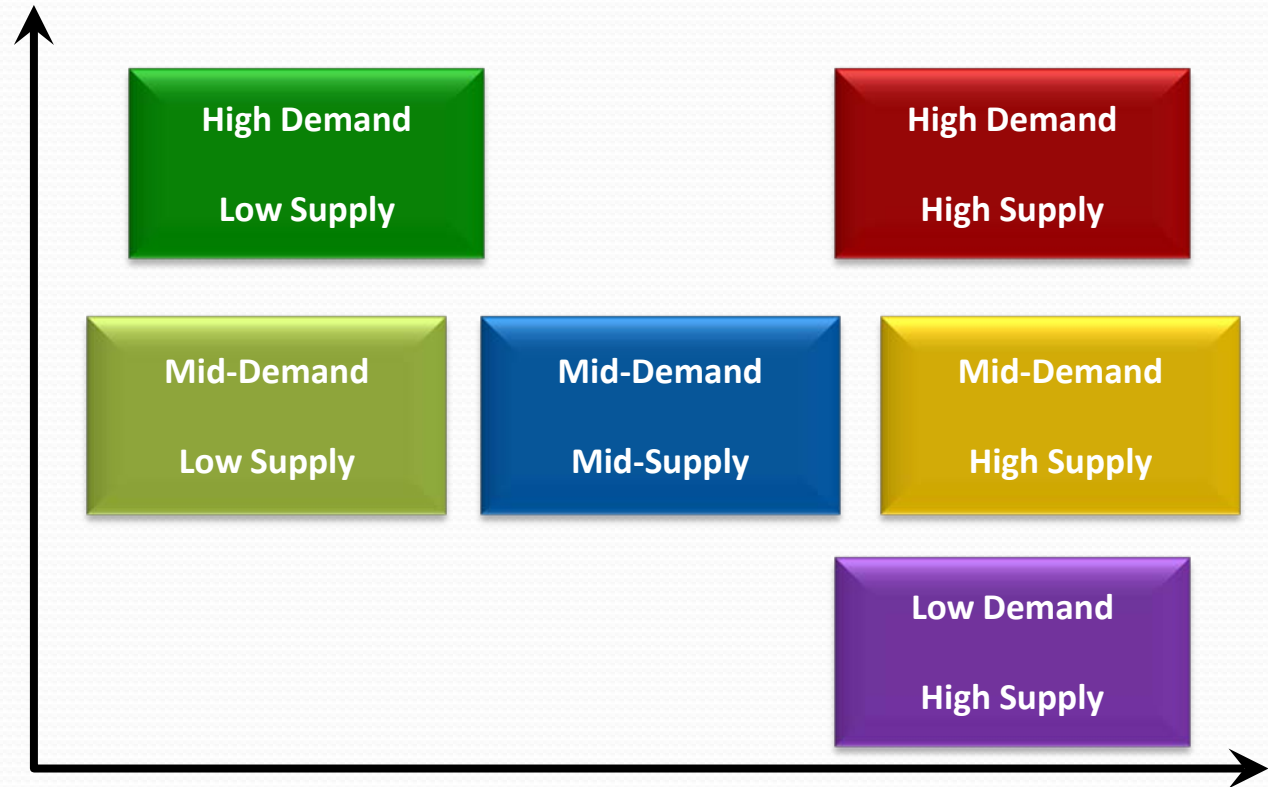
Colorado Compact Compliance Study

- Largely being conducted in a confidential and privileged manner.
- Currently in Phase I: a technical evaluation of water rights and consumptive use on the Colorado River and tributaries.
- Also, a preliminary analysis of options and strategies that could help avoid, delay, or minimize impacts to water users while maintaining compact compliance.
- Phase II: further investigation of the most promising options and strategies.

Portfolio Work

Demand Factors:

- M&I growth
- Energy demands
- GW Replacement



CO River Supply Factors:

- Colorado River hydrologic variability
- Climate change
- Compact considerations

Water Banking Working Group

- Currently, a water banking pilot project is underway. This is a feasibility analysis, exploring whether a water bank concept could help delay or prevent a compact curtailment, and its effects on water users.
- Partners:
 - Colorado River Water Conservancy District
 - Southwestern Water Conservation District
 - The Nature Conservancy
 - Front Range Water Council
 - CWCB

Water Banking

- In part, seeks to provide a means for pre-compact water rights to be used to allow critical post-compact water uses to continue, in the case of a curtailment call.
- Lands irrigated by pre-compact rights could be fallowed temporarily, and these rights could be used to offset depletions in critical post-compact uses.



Colorado River Water Availability Study

- Technical basis for the other work occurring.
- Phase I is nearly complete.
- The CWCB has recommended that the General Assembly fund Phase II of the CRWAS, starting first with risk management.

Risk Management

- Other Options/Tools/Strategies?
- How consider these in portfolios or within basin roundtable planning?