

RECLAMATION

Managing Water in the West

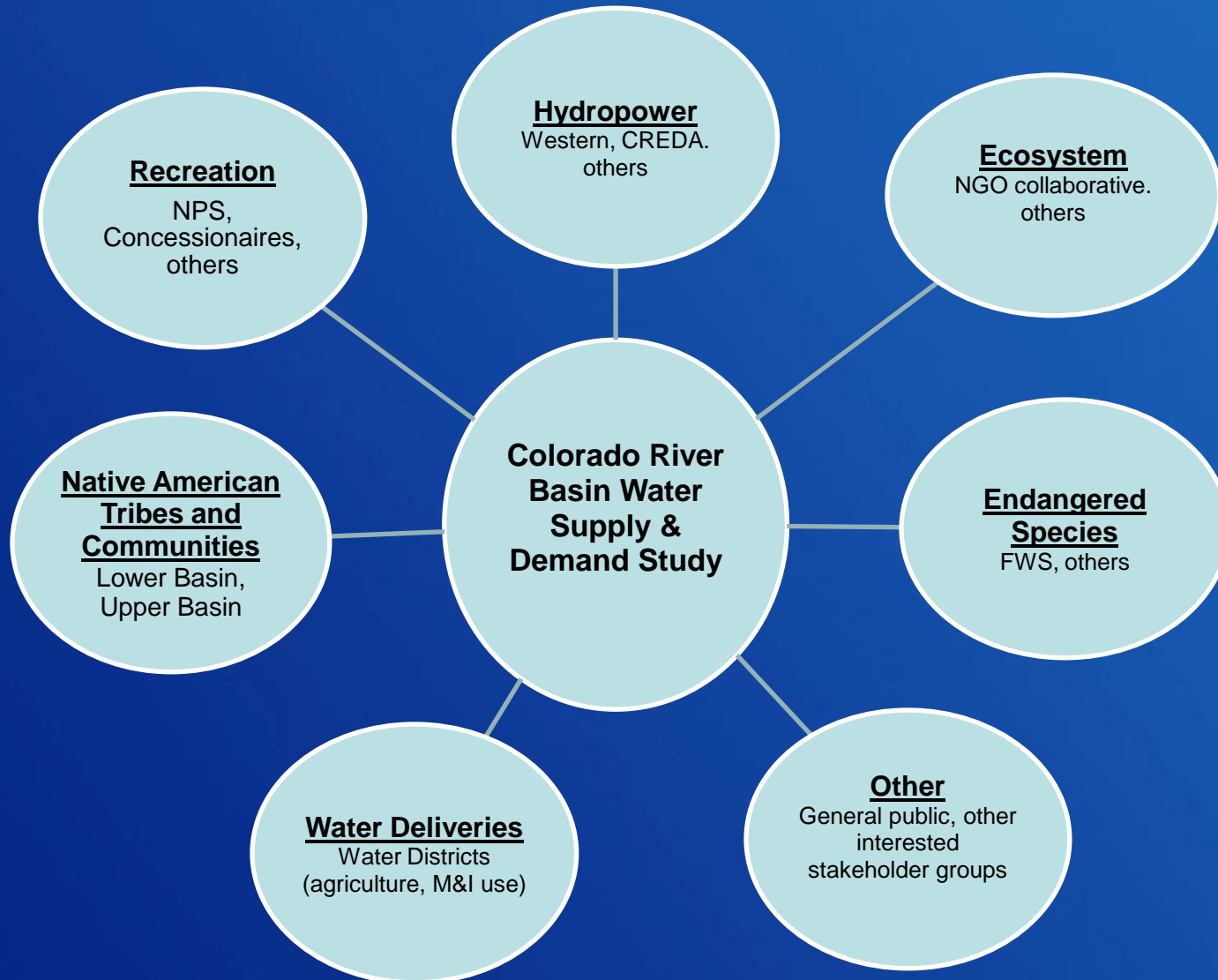
Colorado River Basin Water Supply and Demand Study

Navigating the Future of the Colorado River
Natural Resources Law Center
June 9, 2011

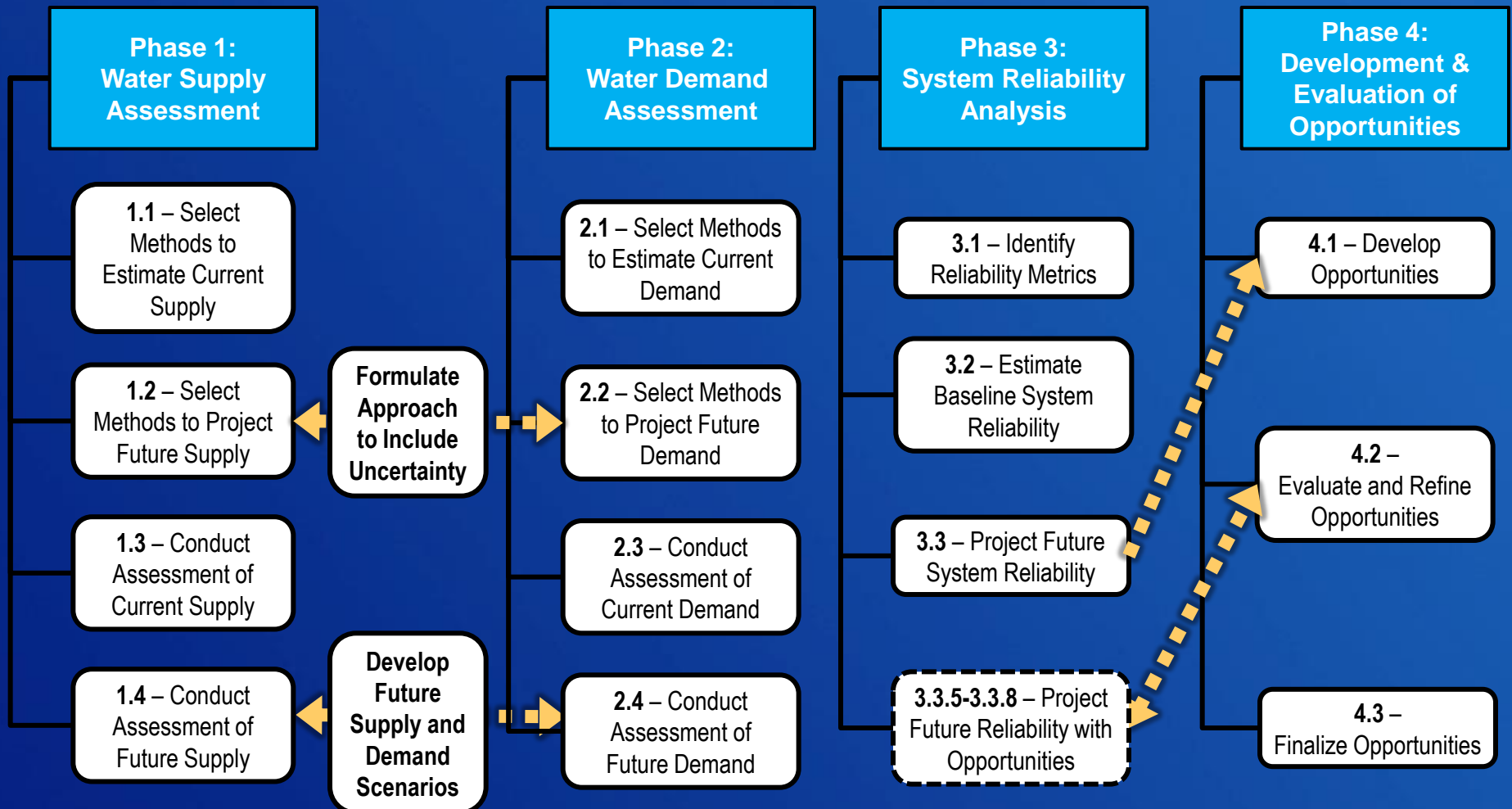


U.S. Department of the Interior
Bureau of Reclamation

Study Outreach



Study Phases and Tasks



Green denotes essentially complete

Interim Report No. 1

- Interim reports provide a comprehensive “snapshot” of the Study’s progress to date
- Approach facilitates the integration of continuous technical developments and the ongoing input of stakeholders
- Interim Report No. 1 is a “snapshot” as of January 31, 2011 and is available at:
<http://www.usbr.gov/lc/region/programs/crbstudy.html>
- Submit comments by July 8, 2011
- Further instructions available on website

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Interim Report No. 1

Colorado River Basin Water Supply and Demand Study



U.S. Department of the Interior
Bureau of Reclamation

June 2011

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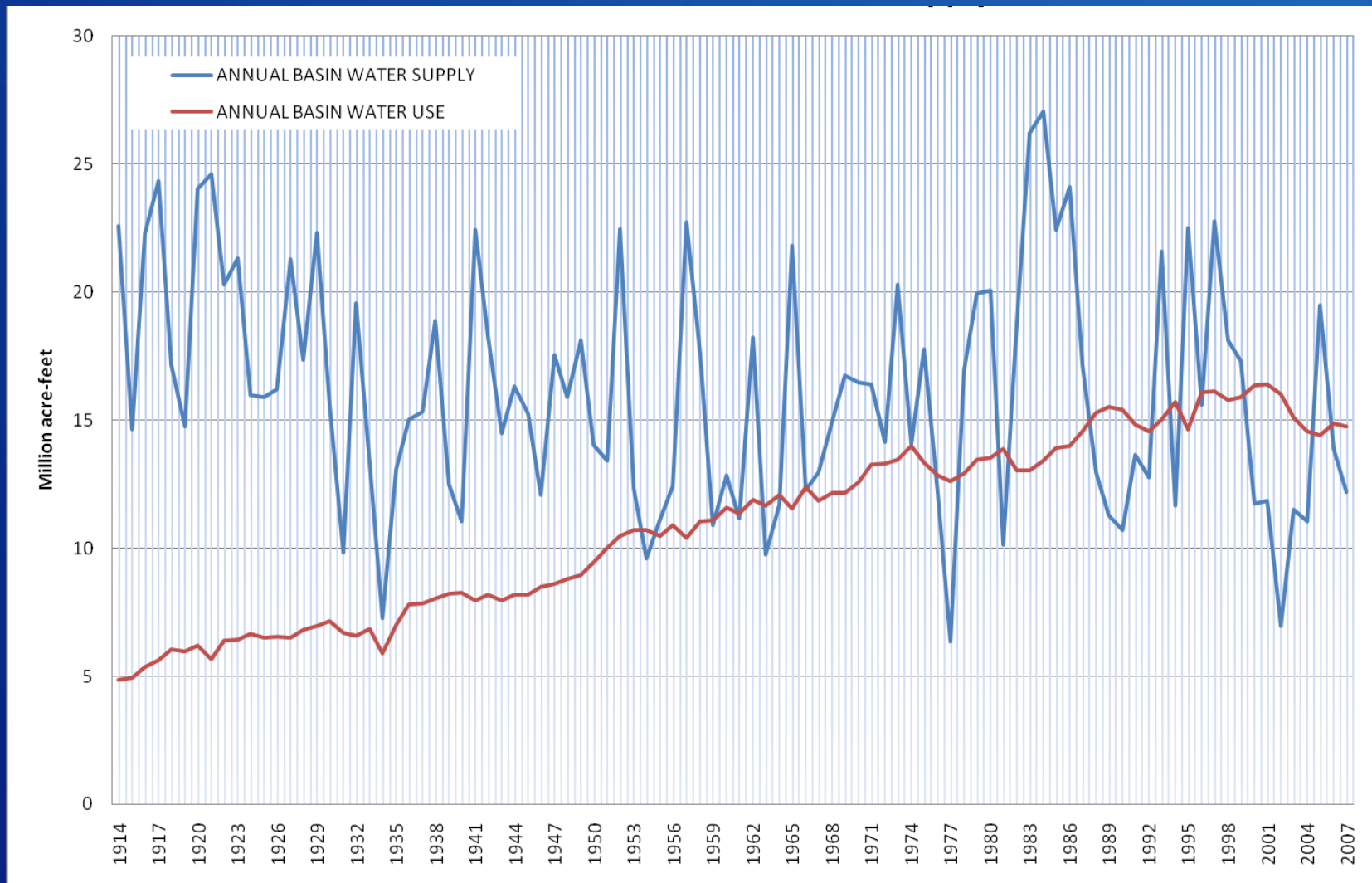
Options for Participation in the Study (not mutually exclusive)

- Project website, webinars, emails
- Review and comment on products
- Periodic updates (formal and/or informal)
- Establish points-of-contact with working groups (“Sub-Teams”)
- Participation in Sub-Teams
- Other

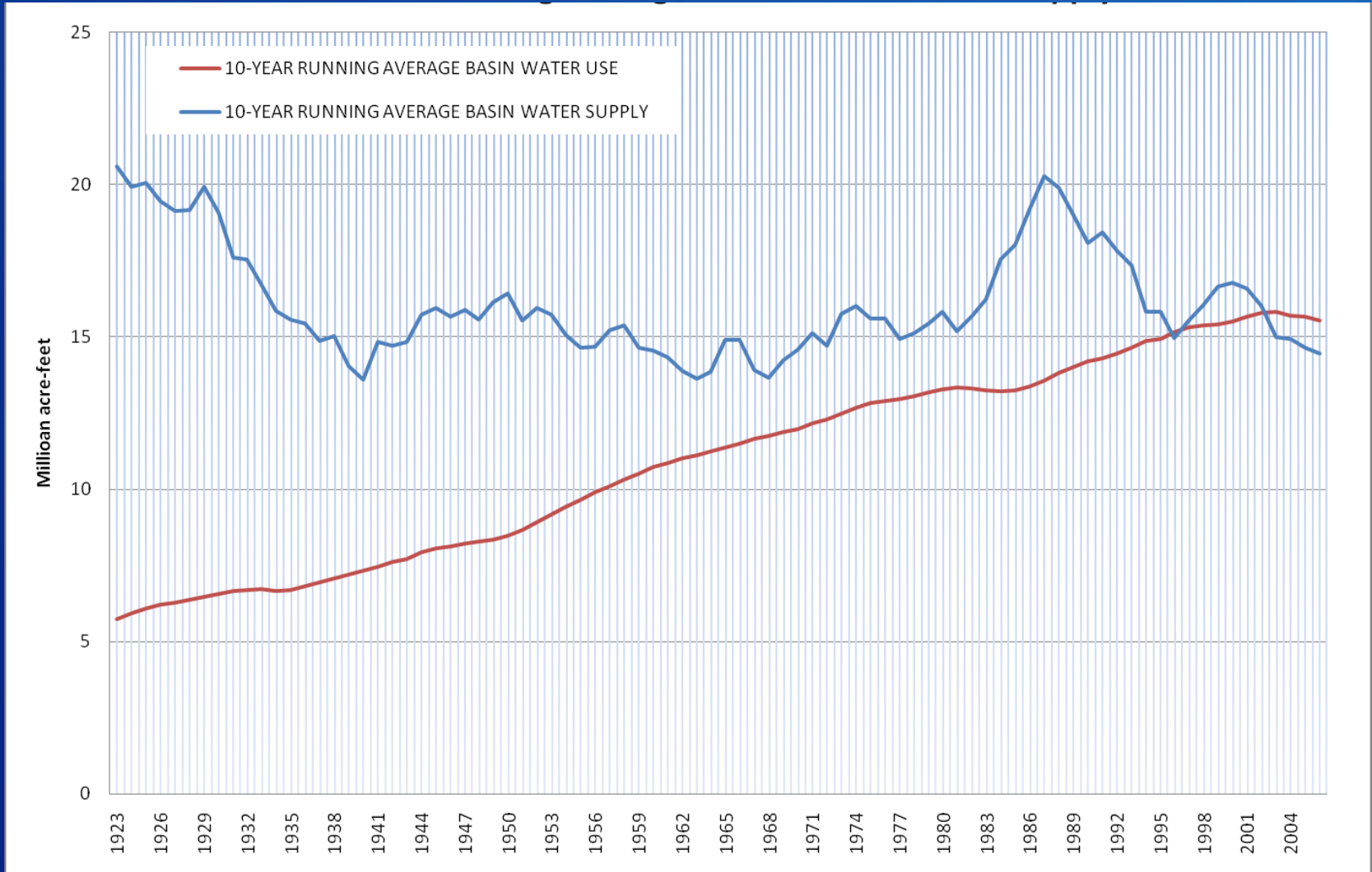
Milestones and Schedule for Remainder of Study

Feb – Aug 2011	Quantify Water Demand Scenarios
Jul – Sept 2011	Perform “Baseline” System Reliability Analysis
Sept – Dec 2011	Develop Options and Strategies
Oct 2011	Publish Interim Report No. 2
Nov 2011 – Feb 2012	Perform System Reliability Analysis with Options and Strategies
Mar 2012	Publish Interim Report No. 3
Apr – May 2012	Finalize and Evaluate Options and Strategies
June 2012	Publish Draft Final Study Report for Comment
July 2012	Publish Final Study Report

Historic Colorado River Water Supply & Use (Annual)



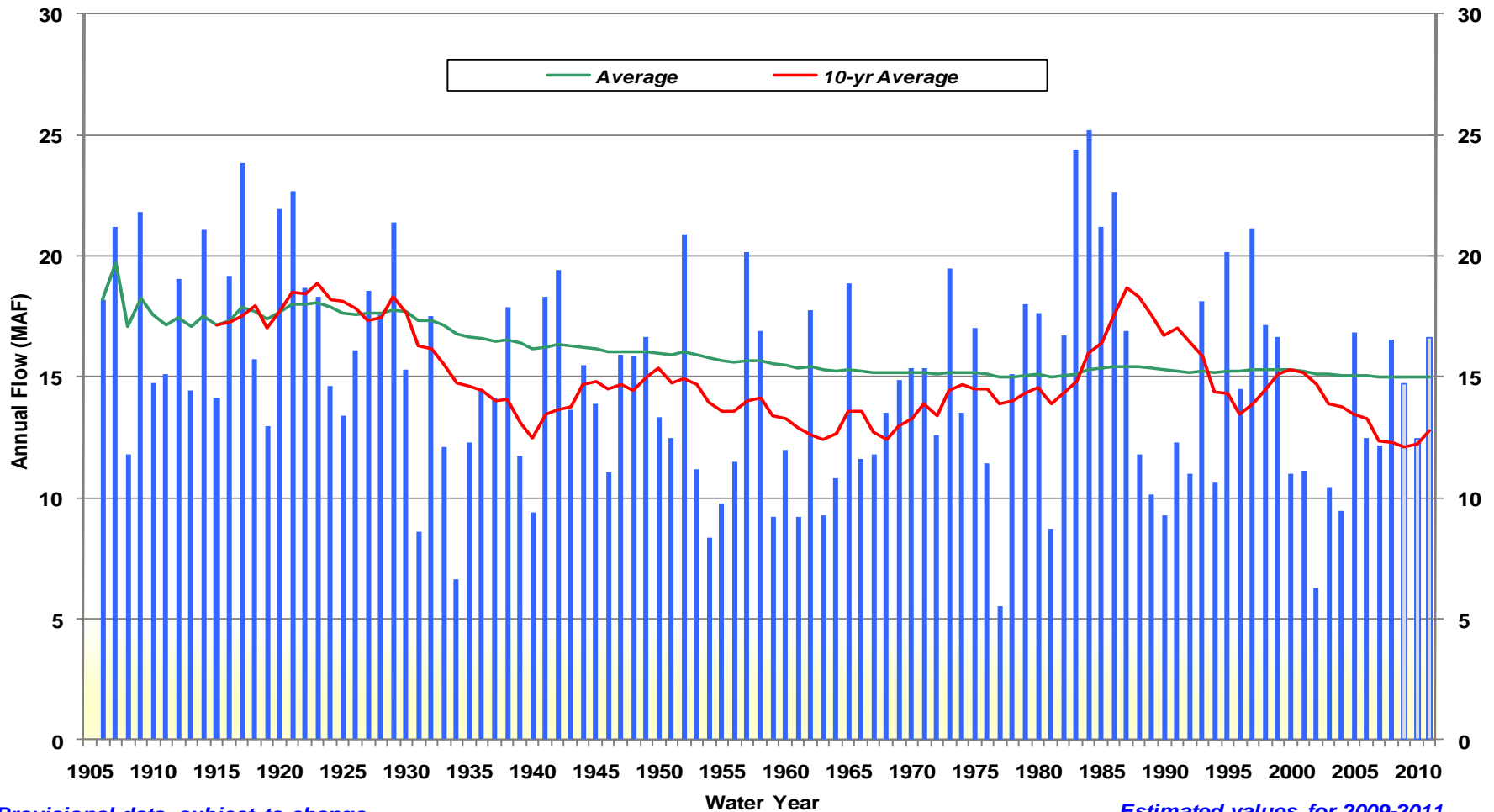
Historic Colorado River Water Supply & Use (10-year Running Average)



Natural Flow at Lees Ferry, Arizona

Water Year 1906 to 2011

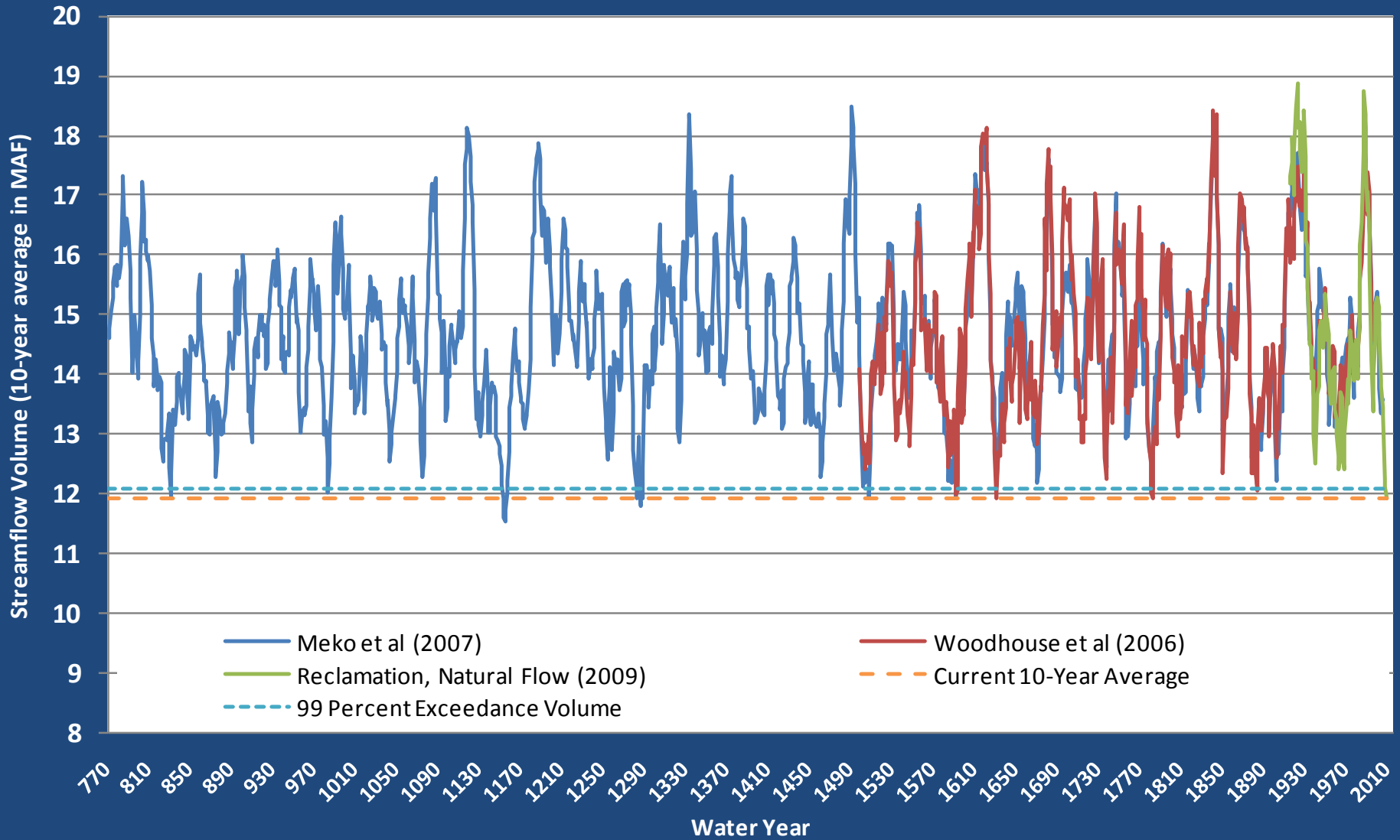
Colorado River at Lees Ferry, AZ - Natural Flow



Provisional data, subject to change

Estimated values for 2009-2011

Estimated Natural Streamflow Volumes at Lees Ferry Gage Running 10-Year Averages from 771 - 2009



Water Year Snowpack and Precipitation as of June 6, 2011

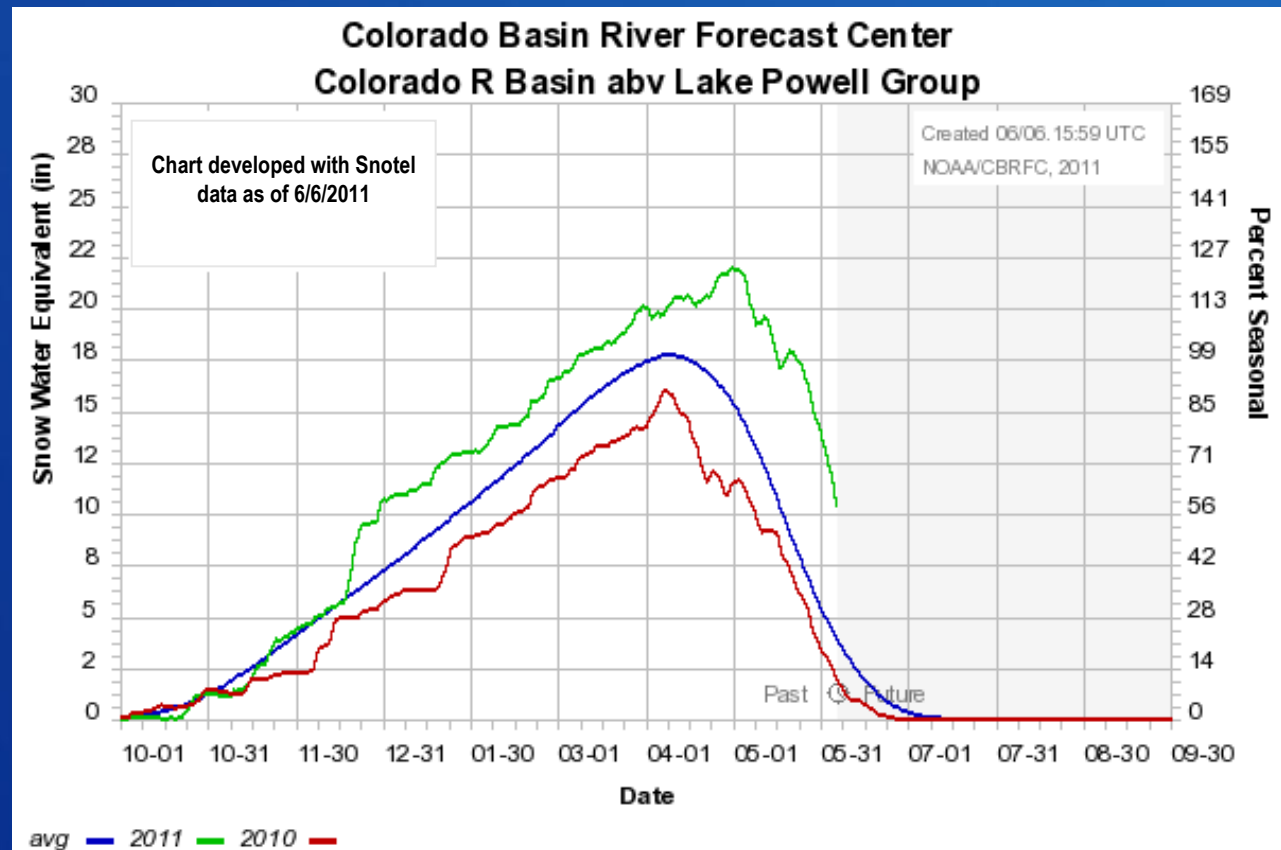
Colorado River Basin
above Lake Powell

Water Year
Precipitation
(year-to-date)

128%

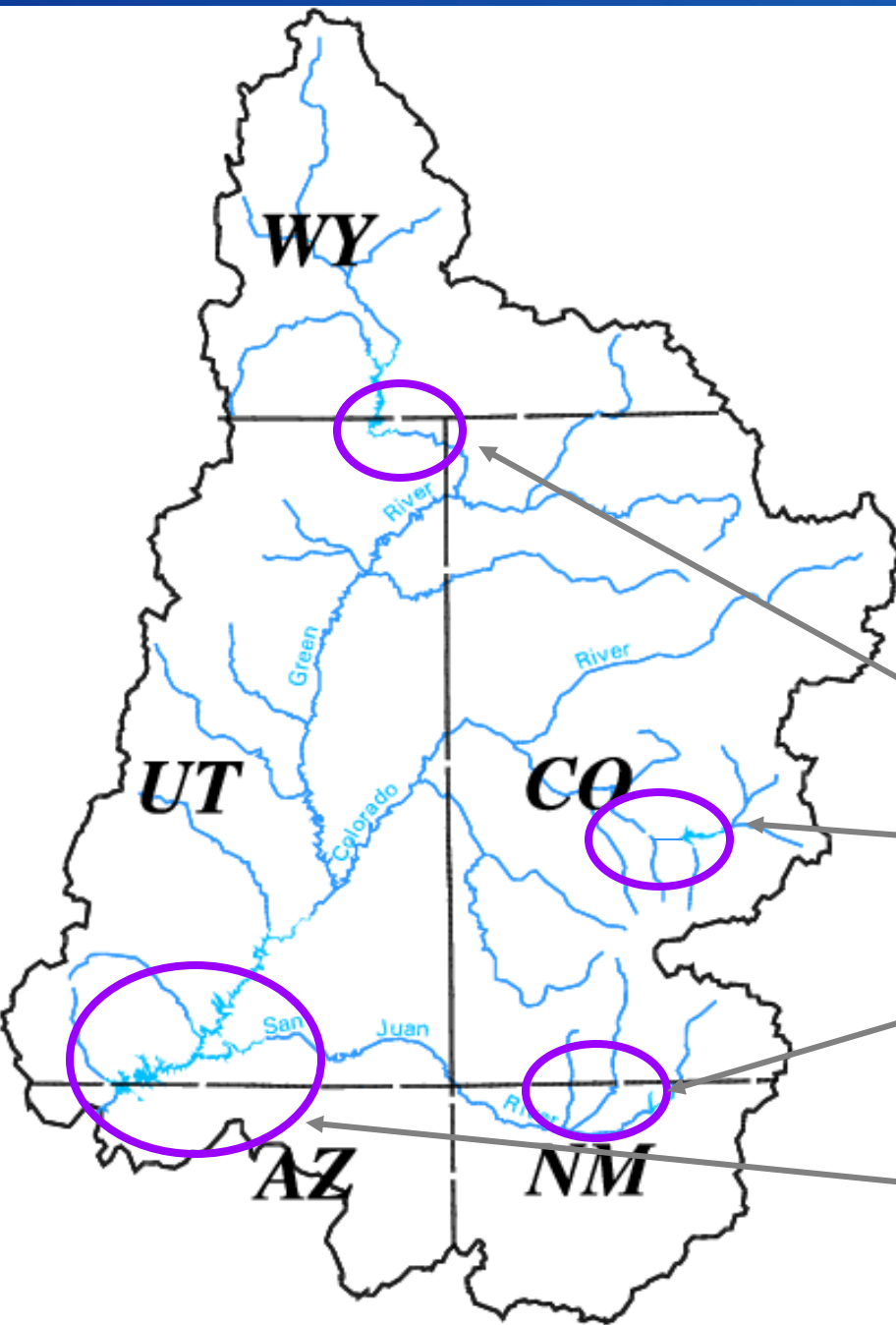
Current Snowpack

264%



Source: CBRFC

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2011 Upper Colorado Forecasted Apr–Jul Inflow as of June 3

Flaming Gorge – 159%

Blue Mesa – 124%

Navajo – 69%

Lake Powell – 159%

Lake Powell & Lake Mead

Operational Diagrams and Current 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
3,636 - 3,666 (2008-2026)		15.5 - 19.3 (2008-2026)	1,200 (approx.) ²		22.9 (approx.) ²
3,620	Upper Elevation Balancing Tier³ Release 8.23 maf;	13.76	1,145	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	15.9
5/25/11	if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	5/25/11	1,105 1,097	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	11.9 11.20
3,575		9.5	5/25/11 1,075		5/25/11 9.4
	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf		1,050	Shortage Condition Deliver 7.167 ⁴ maf	7.5
3,525		5.9	1,025	Shortage Condition Deliver 7.083 ⁵ maf	5.8
	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	4.0	1,000	Shortage Condition Deliver 7.0 ⁶ maf Further measures may be undertaken ⁷	4.3
3,490		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.

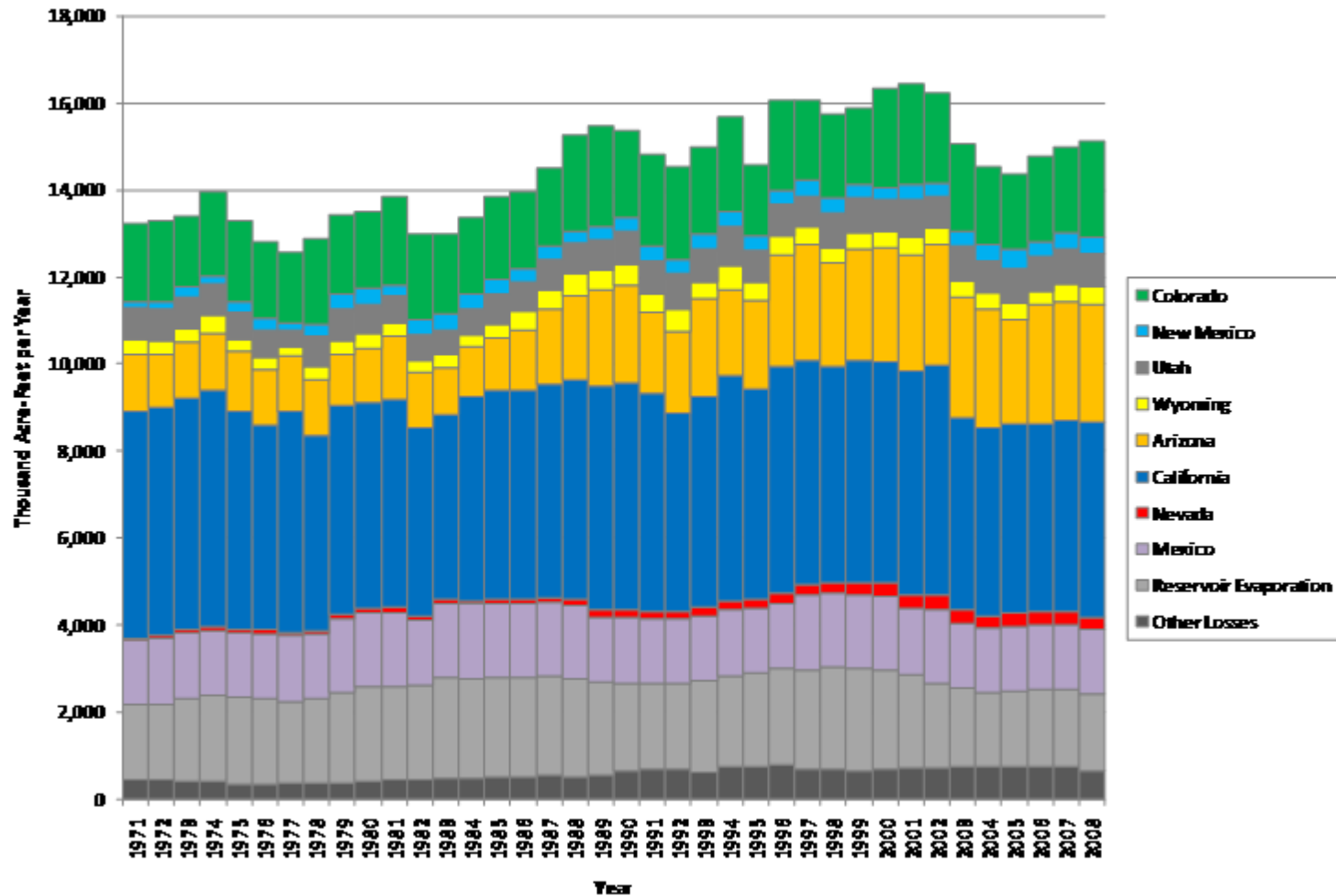
Intentionally Created Surplus (ICS)



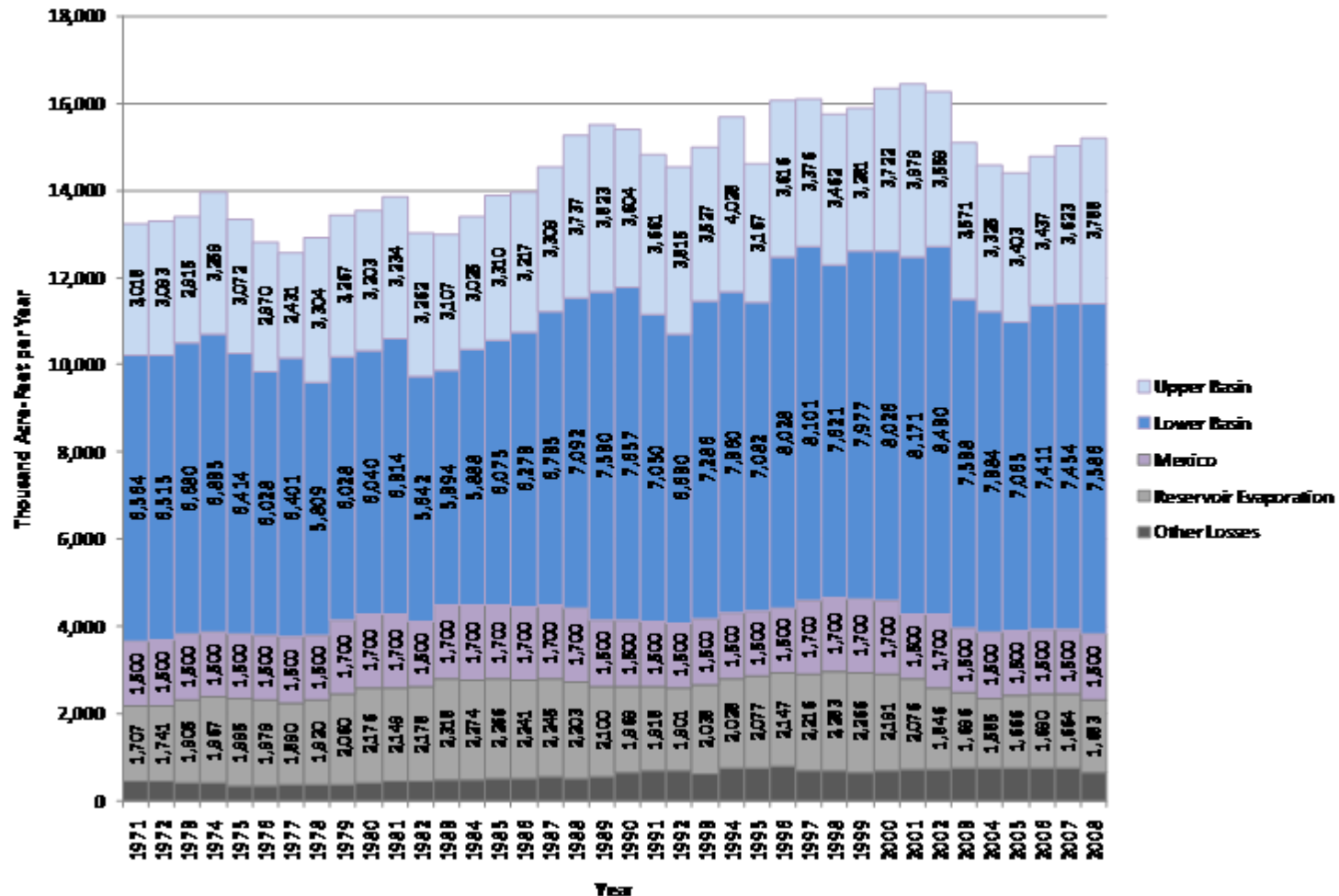
Warren H. Brock Storage Reservoir

- ICS may be created through “extraordinary conservation” measures including:
 - land fallowing, canal lining, desalination, importation, system efficiency
- There is a 5% “system assessment” when ICS is created (except for system efficiency projects)
- Delivery of ICS may occur in years after creation

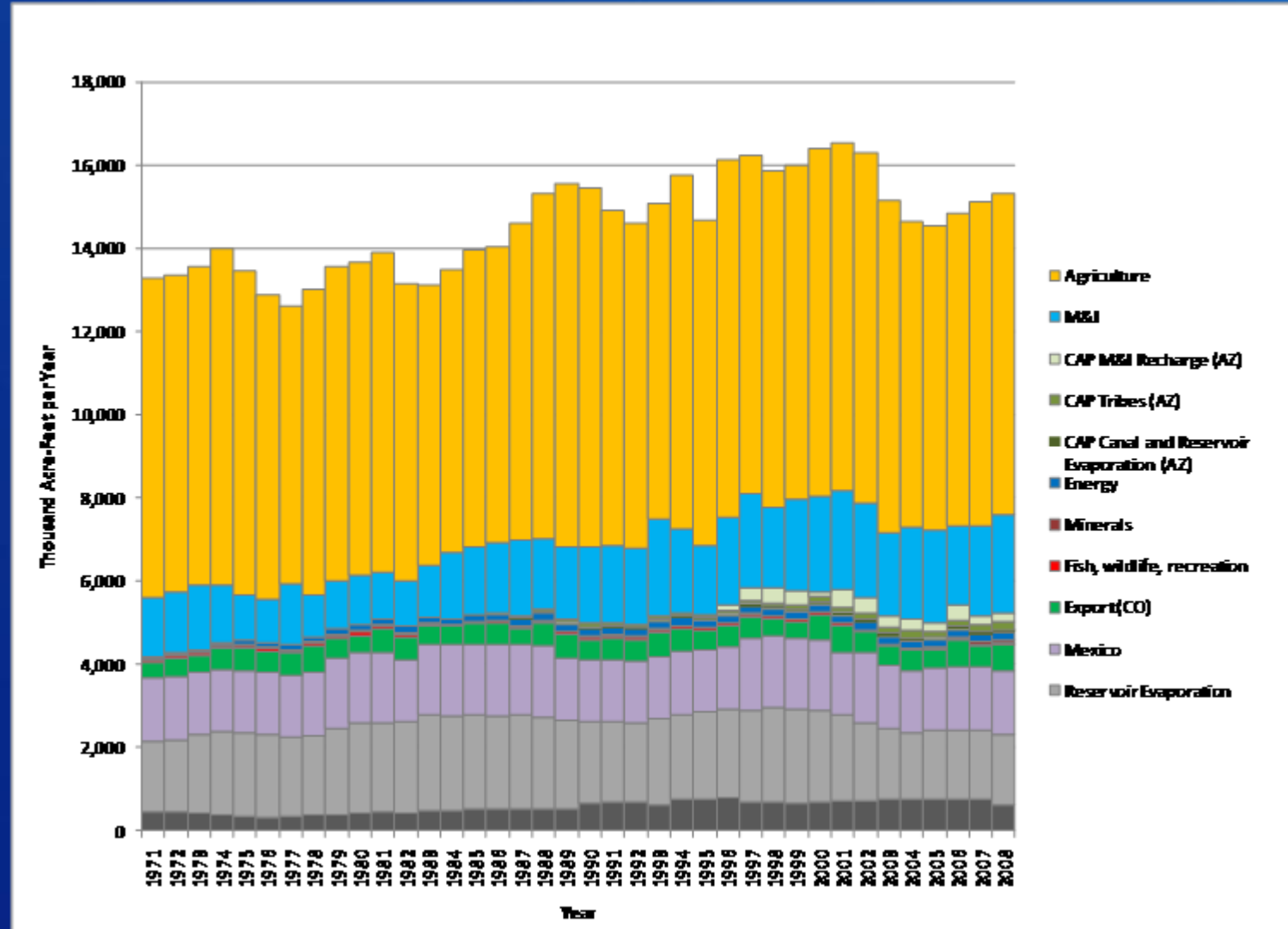
Historical Consumptive Use and Loss 1971-2008



Historical Consumptive Use and Loss 1971-2008

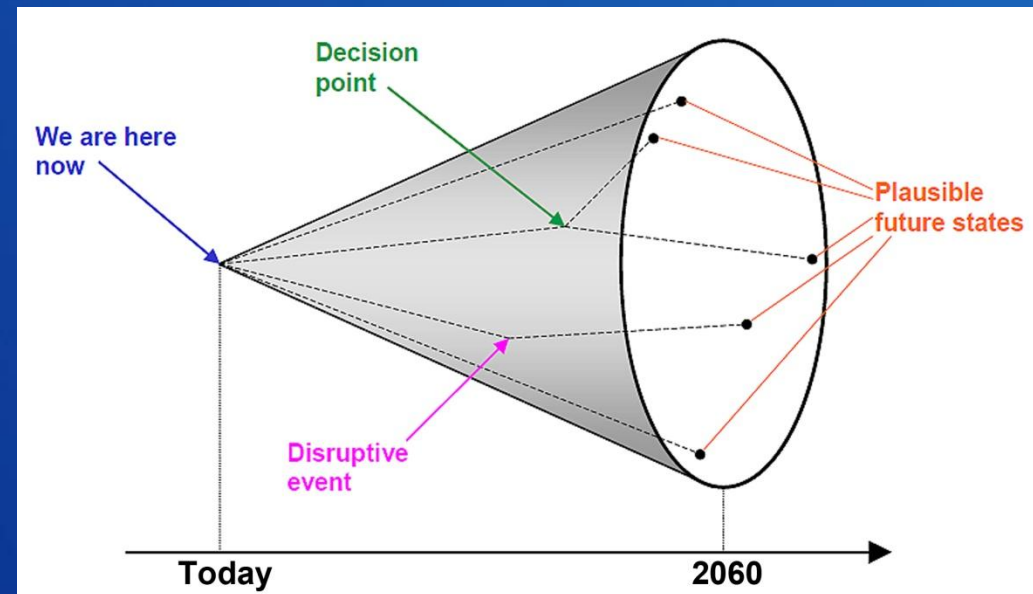


Historical Consumptive Use and Loss 1971-2008



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



(adapted from Timpe and Scheepers, 2003)

Water Supply Scenarios *

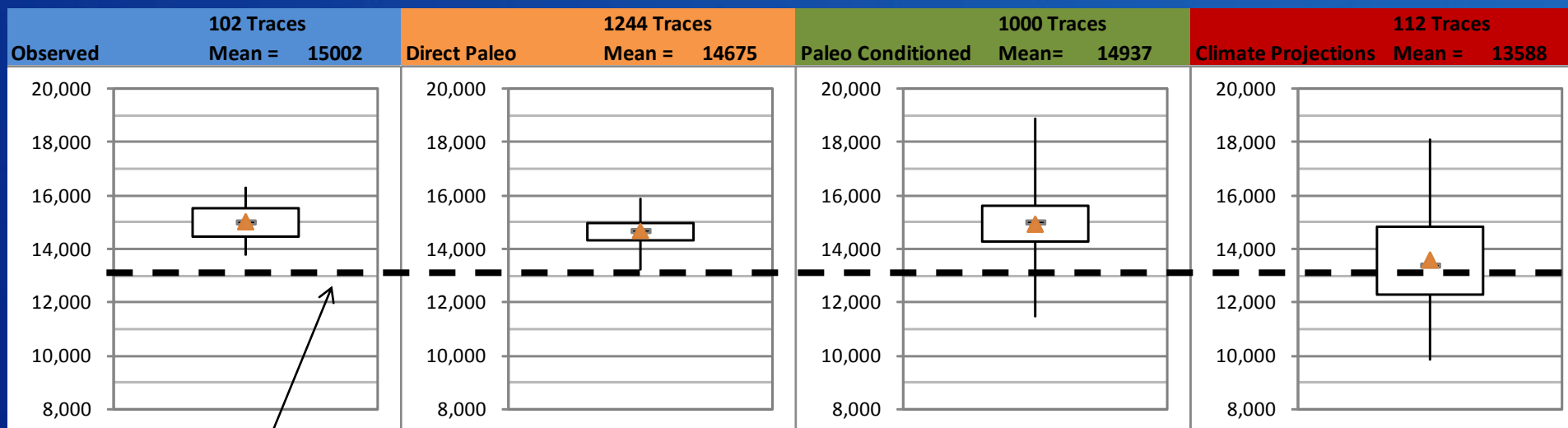
- **Observed Resampled:** hydroclimatic trends and variability are similar to the past 100 years
- **Paleo Resampled:** future hydroclimatic trends and variability are represented by reconstructions of streamflow for a much longer period in the past (nearly 1250 years) that show expanded variability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

* Preliminary – Subject to change

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Projections of Natural Flow at Lees Ferry

2011 – 2060 Period Mean Annual Flows



1988 – 2007 period mean

Box represents 25th – 75th percentile, whiskers represent min and max, and triangle represents mean of all traces

Water Demand Scenarios *

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

* Preliminary – Subject to change

** Additional “branches” possible depending upon assumed trajectory of specific socio-economic factors

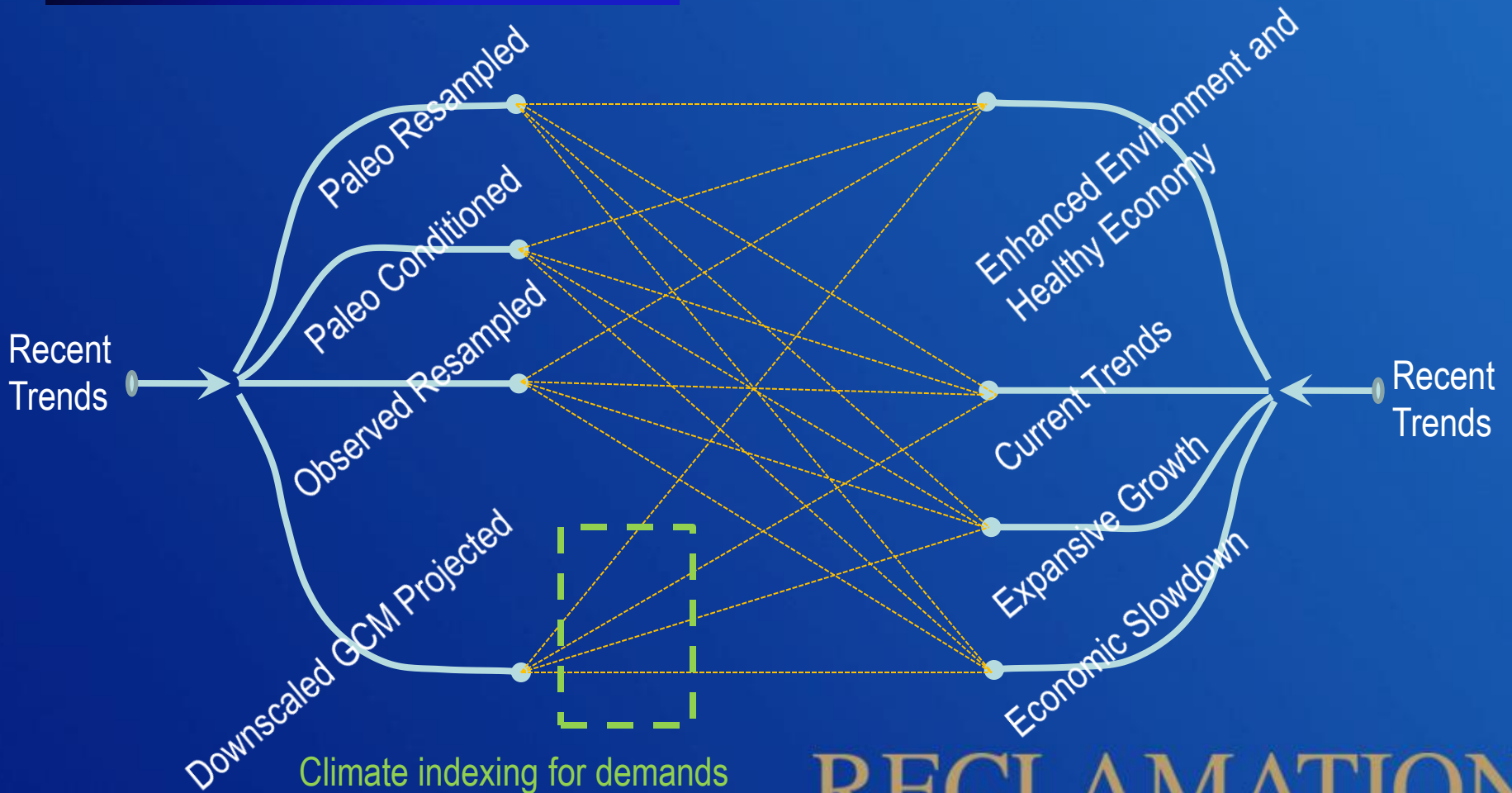
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Integration of Supply and Demand Scenarios

Water Supply Scenarios


(multiple realizations for each scenario)

Water Demand Scenarios



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Colorado River Basin Water Supply and Demand Study



Study Contact Information

- Website: <http://www.usbr.gov/lc/region/programs/crbstudy.html>
- Email: ColoradoRiverBasinStudy@usbr.gov
- Telephone: 702-293-8500; Fax: 702-293-8148

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