

RECLAMATION

Managing Water in the West

Colorado River Studies

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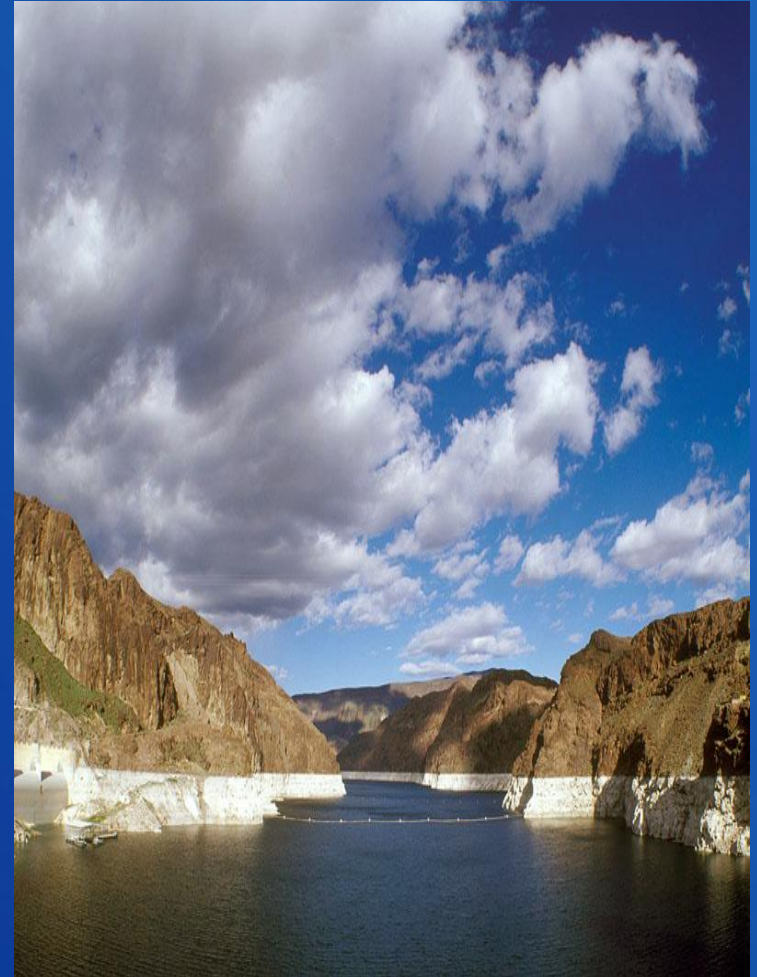
Western Coalition of Arid States Annual Conference
June 16, 2010



U.S. Department of the Interior
Bureau of Reclamation

Outline

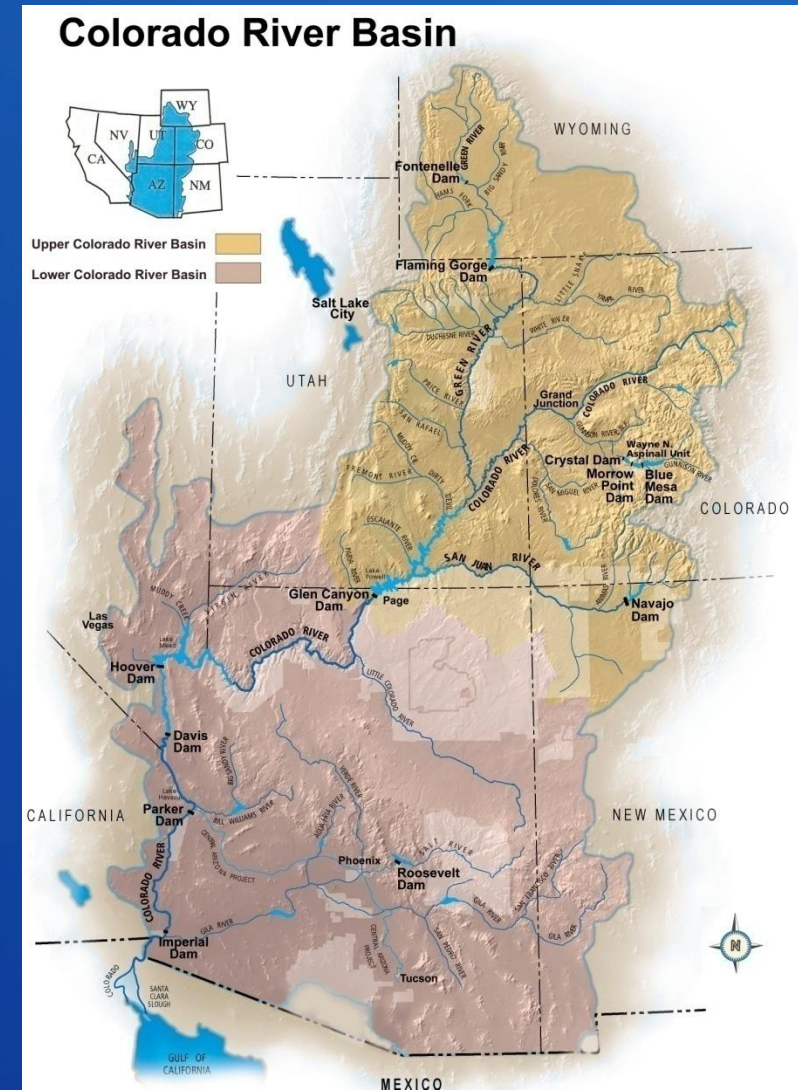
- Overview of the Colorado River Basin and the Operation of Lake Powell and Lake Mead
- Overview of the Colorado River Basin Water Supply and Demand Study



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Colorado River Basin

- Operation governed by the Law of the River including:
 - Colorado River Compact (1922)
 - Boulder Canyon Project Act (1928)
 - U.S. Mexican Water Treaty (1944)
 - Colorado River Storage Project (1956)
 - Supreme Court Consolidated Decree (1964 and following)
 - Colorado River Basin Project Act (1968)
- Variable hydrology
- 60 million acre-feet of storage capacity
- System operated on a tight margin



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Water Budget at Lake Mead

Given basic apportionments in the Lower Basin, the allotment to Mexico, and an 8.23 maf release from Lake Powell, Lake Mead storage declines

- Inflow = 9.0 maf
(release from Powell + side inflows)
- Outflow = - 9.6 maf
(AZ, CA, NV, and Mexico delivery
+ downstream regulation and gains/losses)
- Mead evaporation loss = - 0.6 maf
- Balance = - 1.2 maf

Data based on long-term averages

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State of the System (1999-2010)

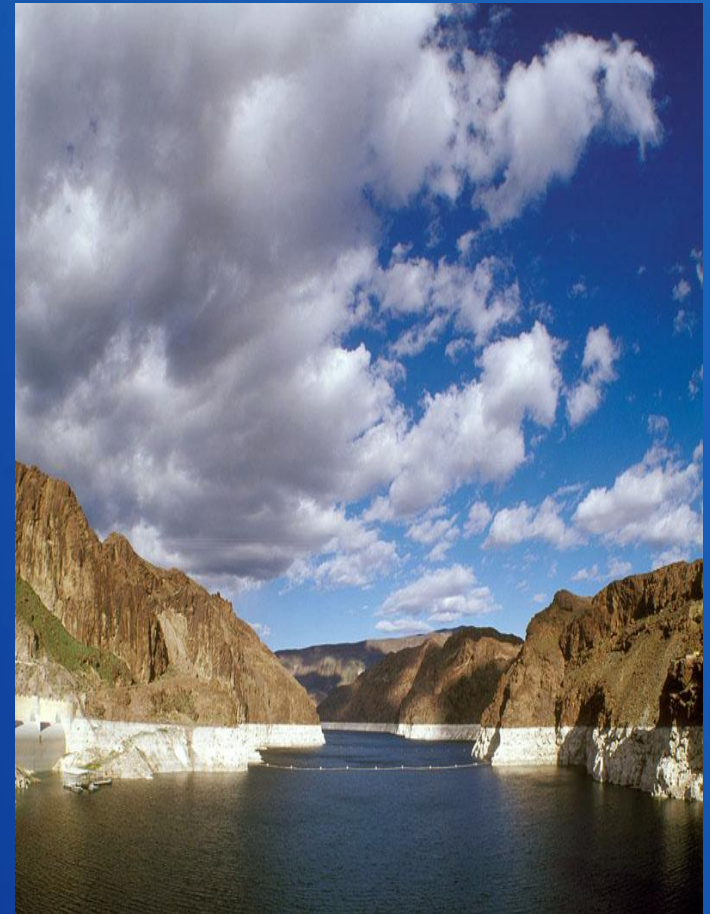
WY	Unregulated inflow into Powell % of Average	Powell and Mead Storage maf	Powell and Mead % Capacity
1999	109	47.59	95
2000	62	43.38	86
2001	59	39.01	78
2002	25	31.56	63
2003	52	27.73	55
2004	49	23.11	46
2005	104	27.16	54
2006	71	25.80	51
2007	70	24.43	49
2008	102	26.52	53
2009	88	26.40	53
2010*	68	24.78	49

•Inflow based on latest CBRFC forecast; storage and percent capacity based on April 2010 24-Month Study

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Impetus for the 2007 Interim Guidelines

- In 2004, after five years of unprecedented drought and declining reservoirs, tensions were high basin-wide
- Operations between Lake Powell and Lake Mead were coordinated only at the higher reservoir levels through “equalization”
- There were no guidelines for Lower Basin shortages
- “Mid-year review” of the 2005 AOP



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2007 Interim Guidelines

- Operations specified for full range of operation for Lake Powell and Lake Mead
- Strategy for shortages in the Lower Basin
- Mechanism in Lower Basin to encourage efficient and flexible use and management of Colorado River water (ICS)
- In place for an interim period (through 2026)



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2007 Interim Guidelines

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
3,619	Upper Elevation Balancing Tier³ Release 8.23 maf;	13.63		Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	
4/18/10	if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	4/18/10	1,145		15.9
3,575		9.5	1,105 1,099	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf	11.9 11.42
	Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf		4/18/10 1,075		4/18/10 9.4
3,525		5.9		Shortage Condition Deliver 7.167 ⁴ maf	7.5
	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf		1,050		
3,490		4.0		Shortage Condition Deliver 7.083 ⁵ maf	5.8
3,370		0	1,025		
			1,000	Shortage Condition Deliver 7.0 ⁶ maf Further measures may be undertaken ⁷	4.3
			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.

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Intentionally Created Surplus (ICS)



Drop 2 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

Colorado River Basin Storage

(as of June 13, 2010)

Current Storage	Percent Full	MAF	Elevation (Feet)
Lake Powell	63%	15.31	3,634
Lake Mead	42%	10.85	1,093
Total System Storage*	58%	34.21	NA

*Total system storage was 34.71 maf or 58% this time last year

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2010 Upper Colorado Projected Apr–Jul Inflow

as of June 4, 2010

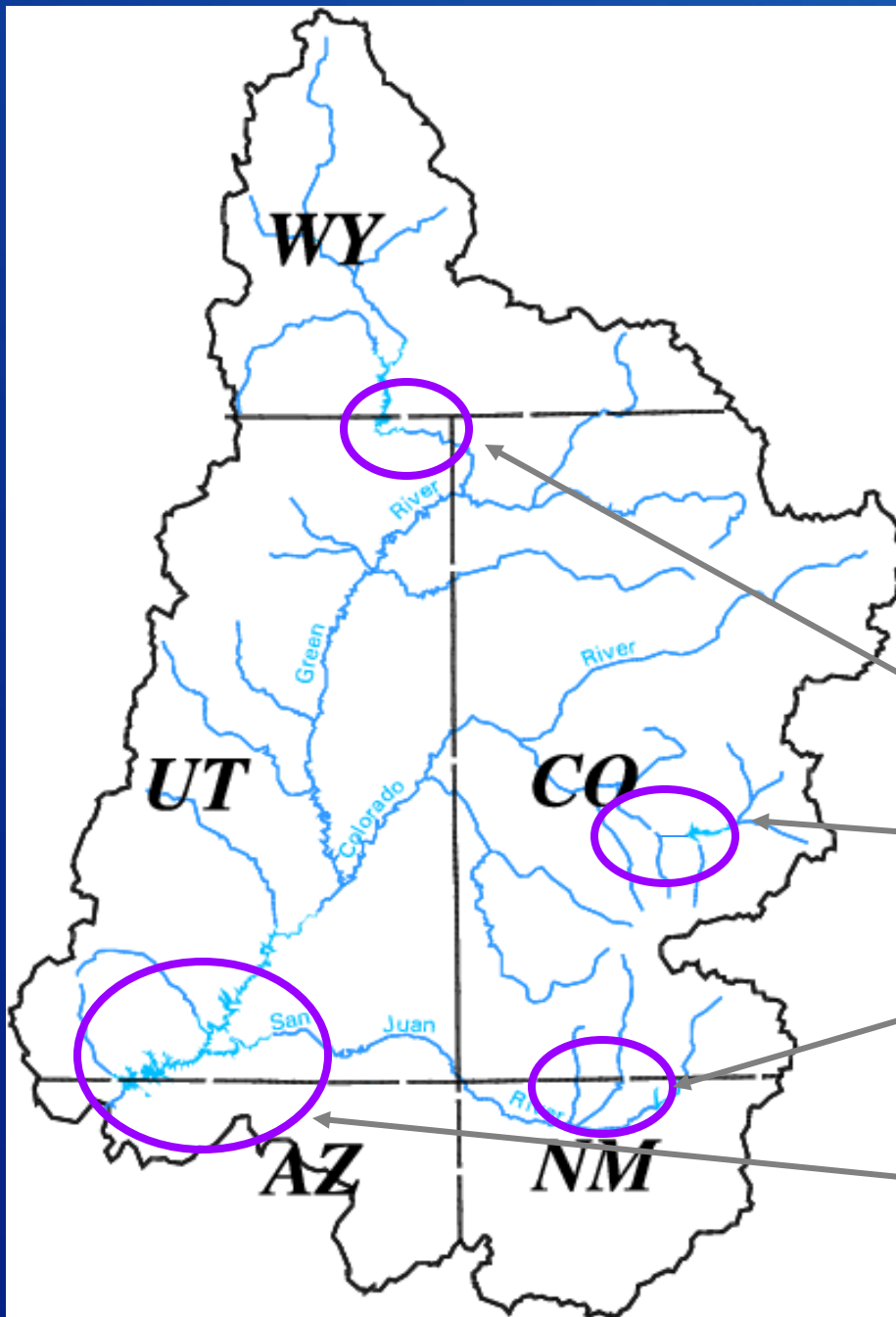
Flaming Gorge – 48%

Blue Mesa – 69%

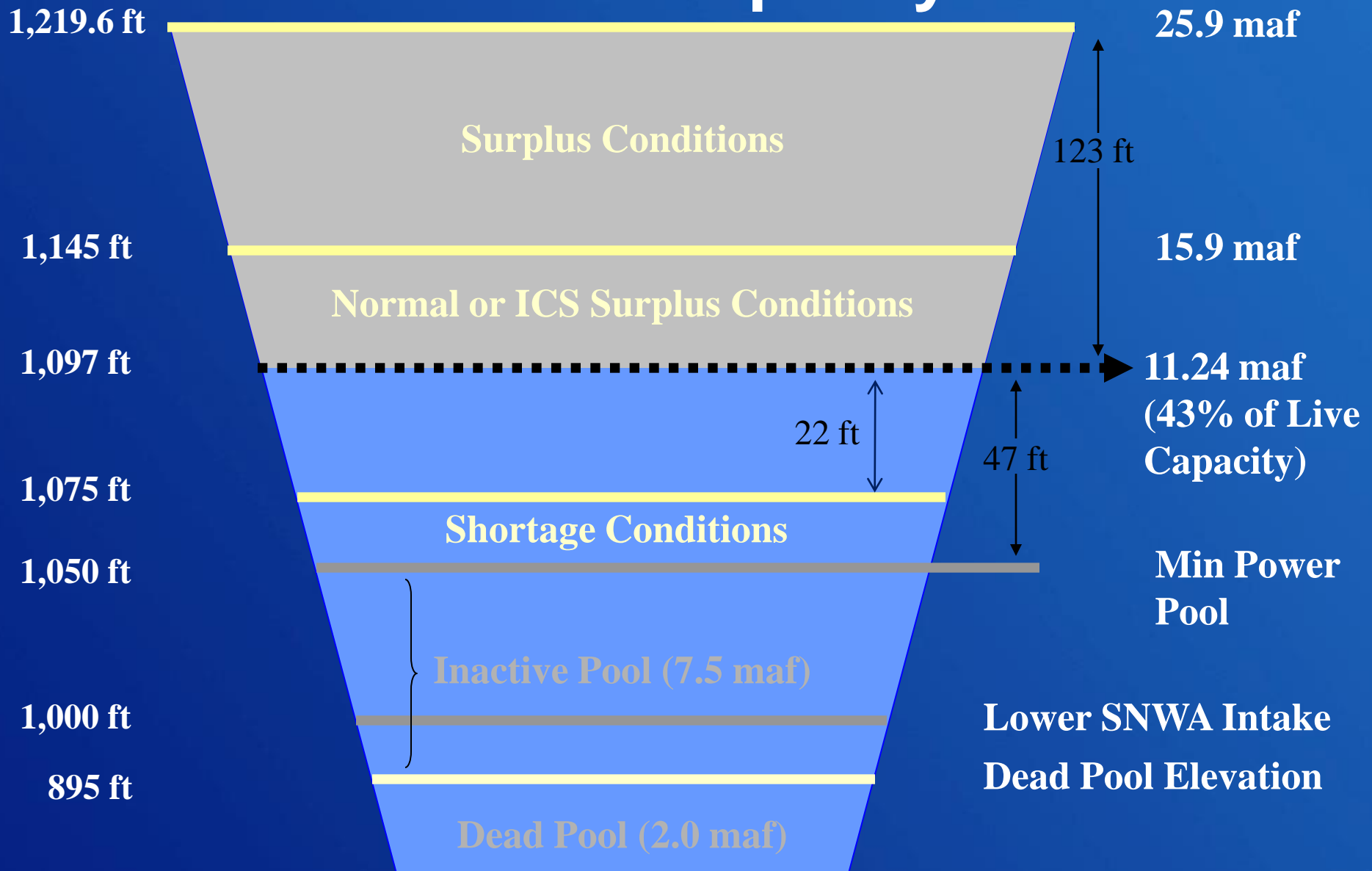
Navajo – 83%

Lake Powell – 65%

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Lake Mead Capacity



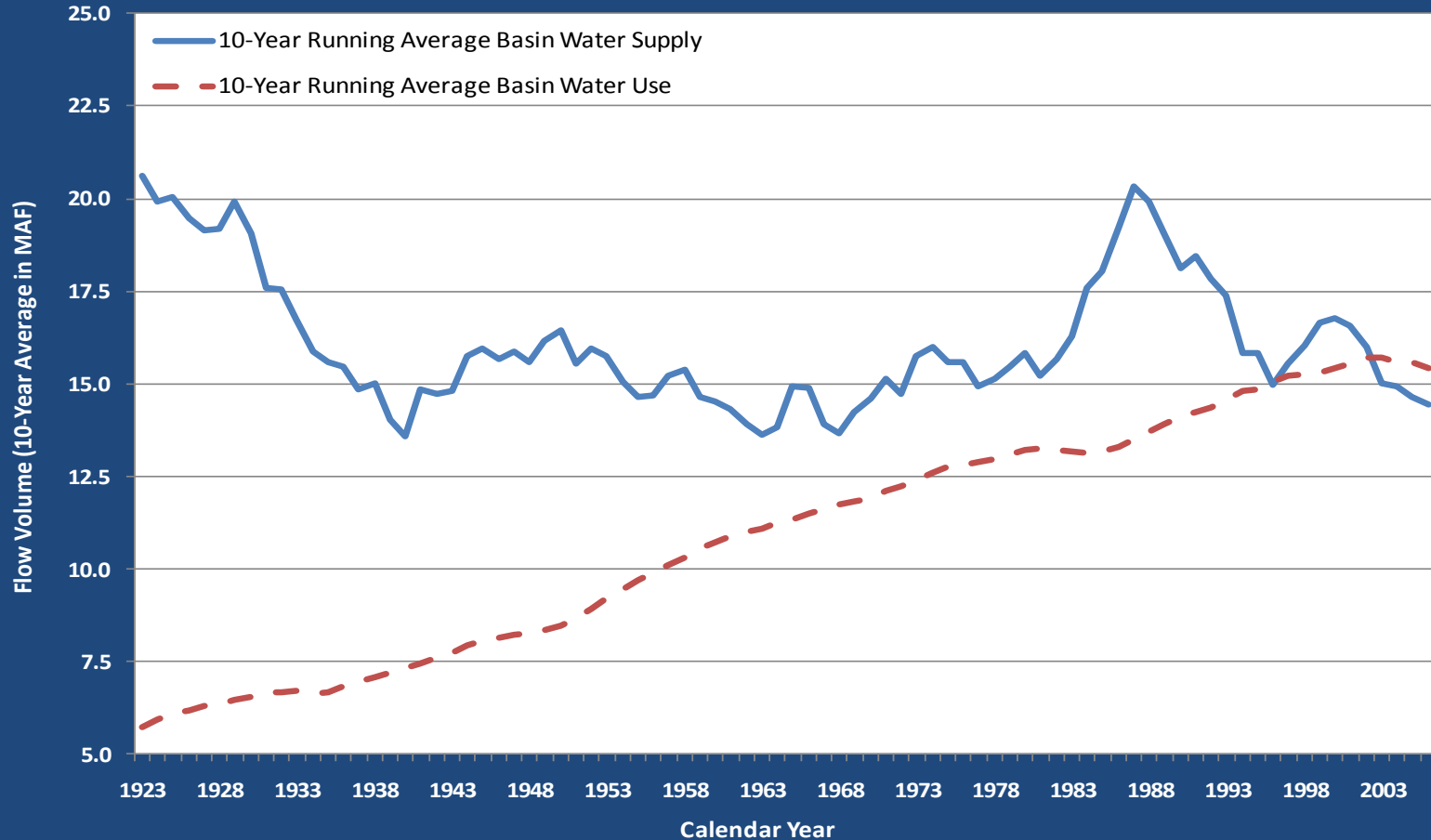
Not to scale

As of May 9, 2010

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Colorado River Water Supply & Use

Colorado River Basin Water Supply and Water Use
10-Year Averages from 1923 to 2006



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Colorado River Basin Water Supply and Demand Study

- Two-year, \$2 million study cost shared by Reclamation and the Basin States
 - Assess future water supply and demand imbalance
 - Assess risks to all basin resources
 - Investigate options and strategies to mitigate impacts
- A transparent, collaborative study with input from all stakeholders
- Email:

ColoradoRiverBasinStudy@usbr.gov

- Website:

<http://www.usbr.gov/lc/region/programs/crbstudy.html>

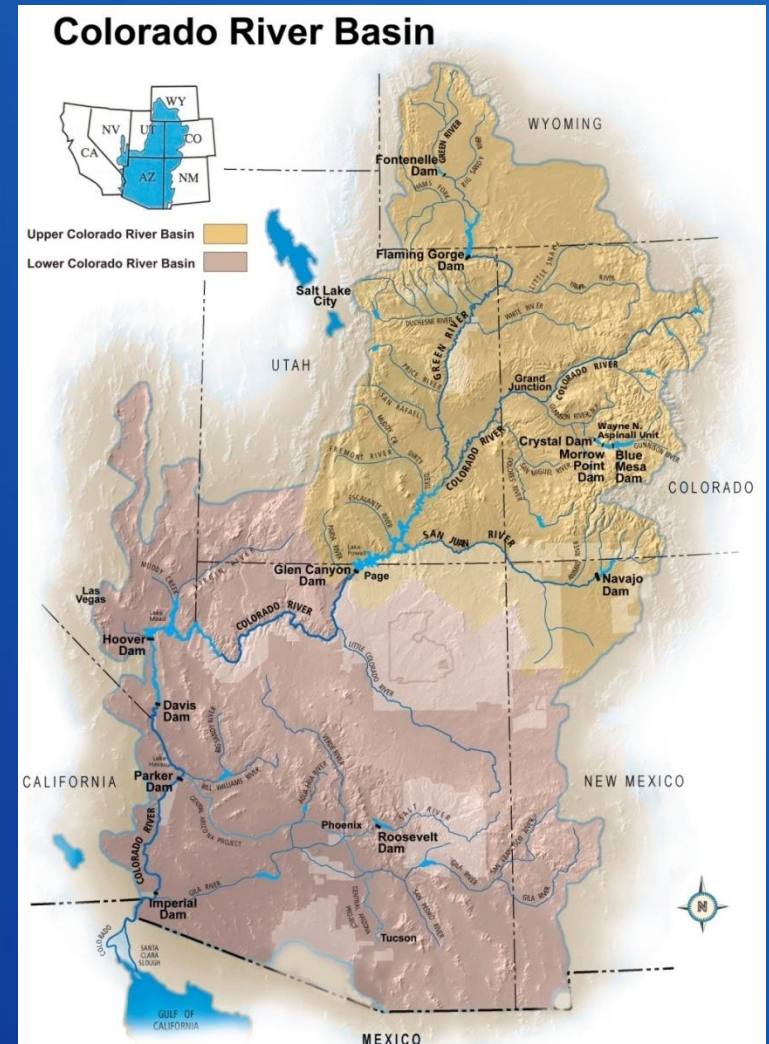


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Colorado River Basin Study

Cost-Share Partners

- Arizona Department of Water Resources
- (California) Six Agency Committee
- Colorado Water Conservation Board
- New Mexico Interstate Stream Commission
- Southern Nevada Water Authority
- Utah Division of Water Resources
- Wyoming State Engineer's Office
- Reclamation's Upper and Lower Colorado Regions



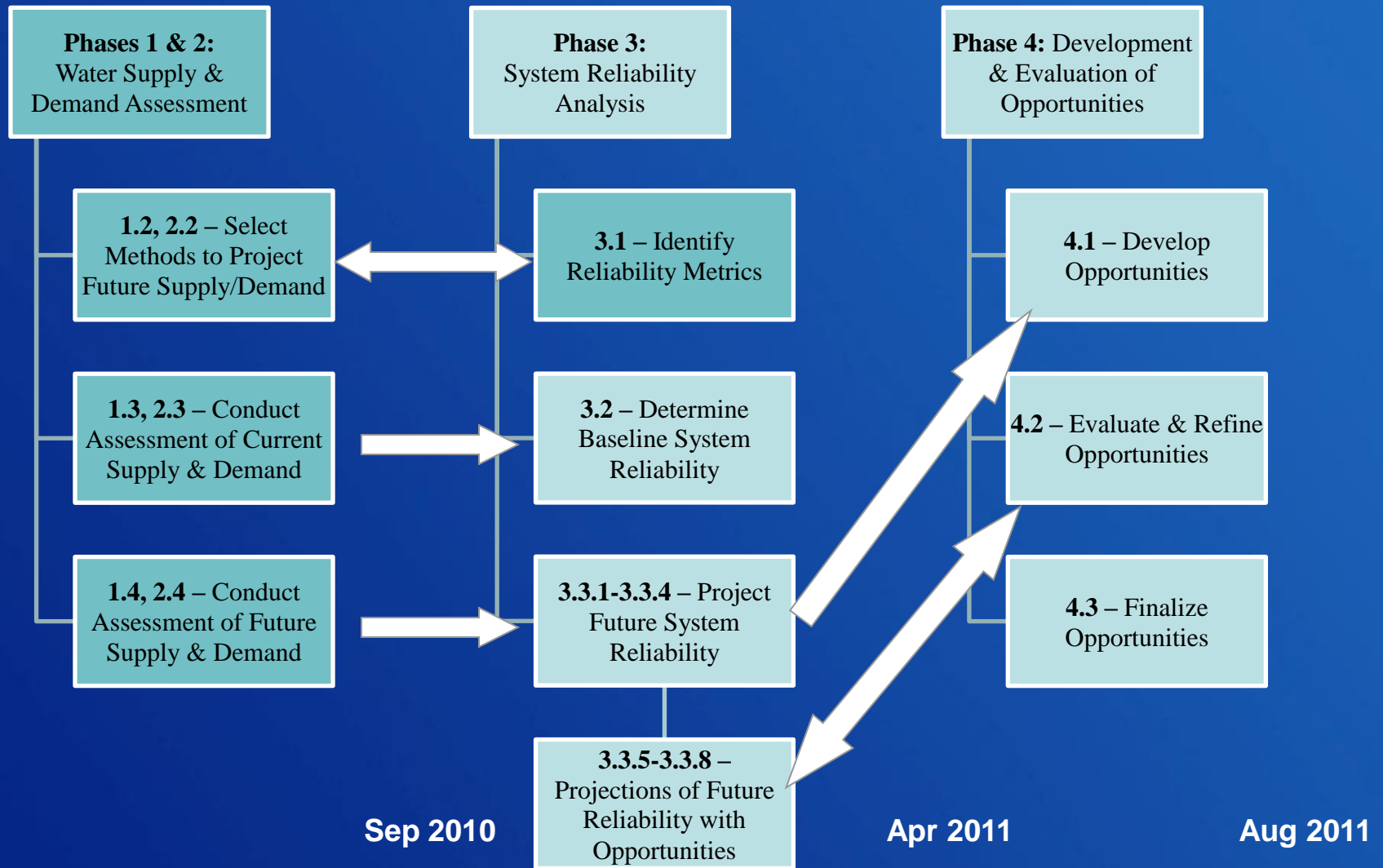
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Colorado River Basin Resources

- The Colorado River supports many important resources including:
 - water allocations and deliveries consistent with the apportionments under the Law of the River
 - hydroelectric power generation
 - recreation
 - fish, wildlife, and their habitats (including candidate, threatened, and endangered species)
 - water quality including salinity
 - flow and water dependent ecological systems
 - flood control
- The Study will look at system reliability with respect to all resources

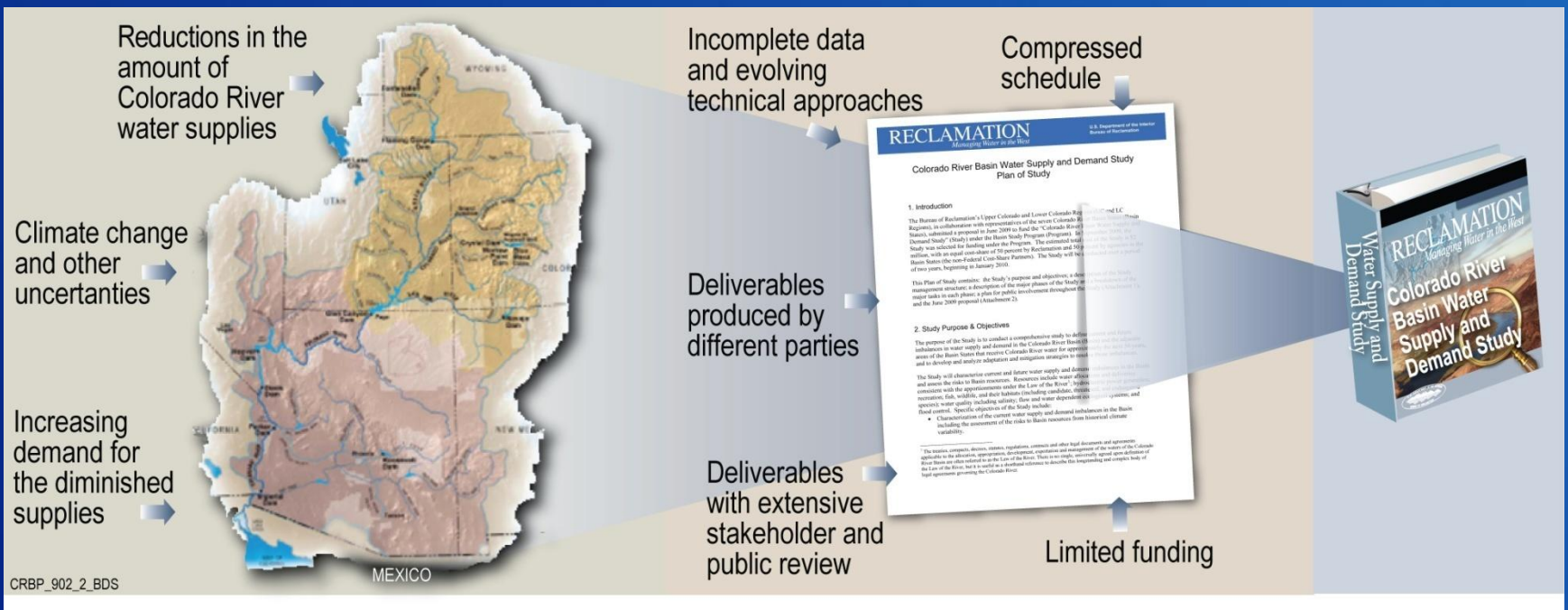
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Plan of Study: Study Phases



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Colorado River Basin Study Challenges



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Addressing an Uncertain Future

- Categorization of Uncertainty
 - Factors largely outside of the influence of management entities
 - Factors partially under influence by management entities
 - Factors mostly under influence by management entities
- Key Uncertainties to be Incorporated in this Phase
 - Hydroclimatic variability and change
 - Changes to magnitude and timing of water supply available to system
 - Changes to Basin water use and demands
- Uncertainty to be Addressed through a Scenario-based Approach

Scenario-Based Approach toward Addressing Uncertainties

Water Supply Scenarios

Hydroclimatic Variability & Change (Past, Present, and Future)

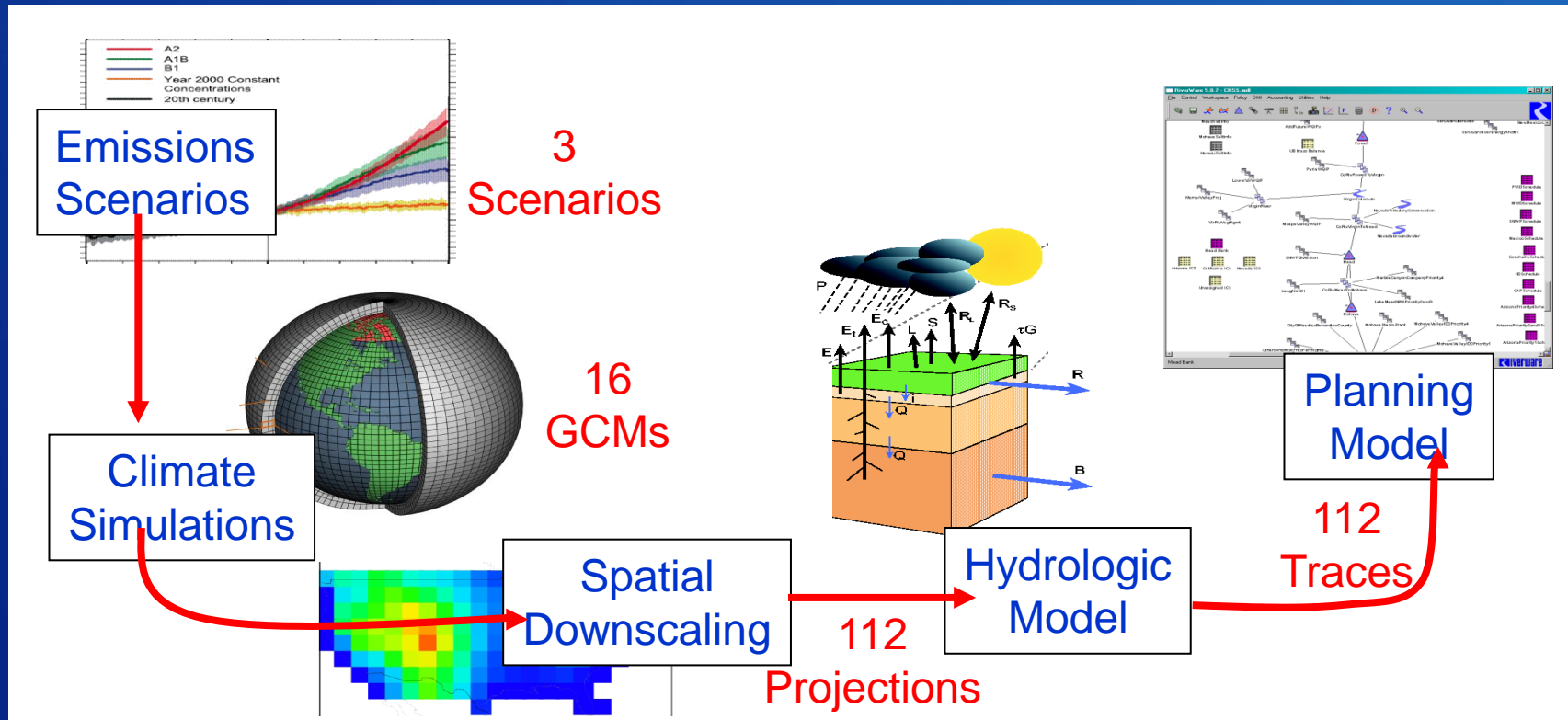
1. Observed Historic Record
2. Paleo-Conditioning
3. Paleo Record
4. Downscaled Climate Projections

Water Demand Scenarios

Storyline Approach to Plausible Future Demands

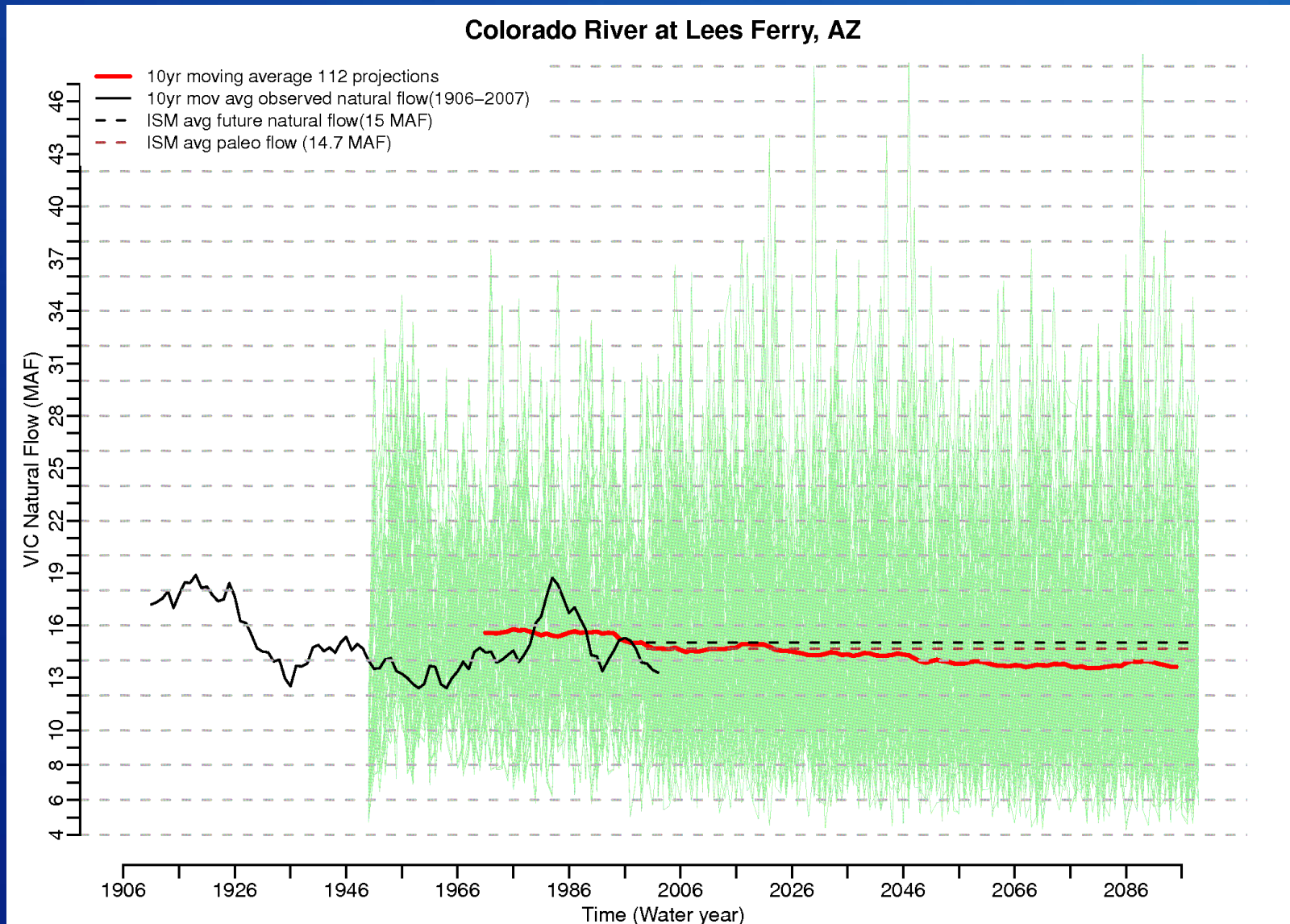
1. Baseline Demands
2. Alternative Futures by Storylines
 - More Intensive Demands
(higher population growth, less water use efficiency, lower technology use)
 - Less Intensive Demands
(stable population growth, more water use efficiency, rapid technology adoption)

Methodology to Incorporate Modeled Future Projections of Climate Change into Water Supply Projections



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Preliminary Results of 112 Inflow Projections



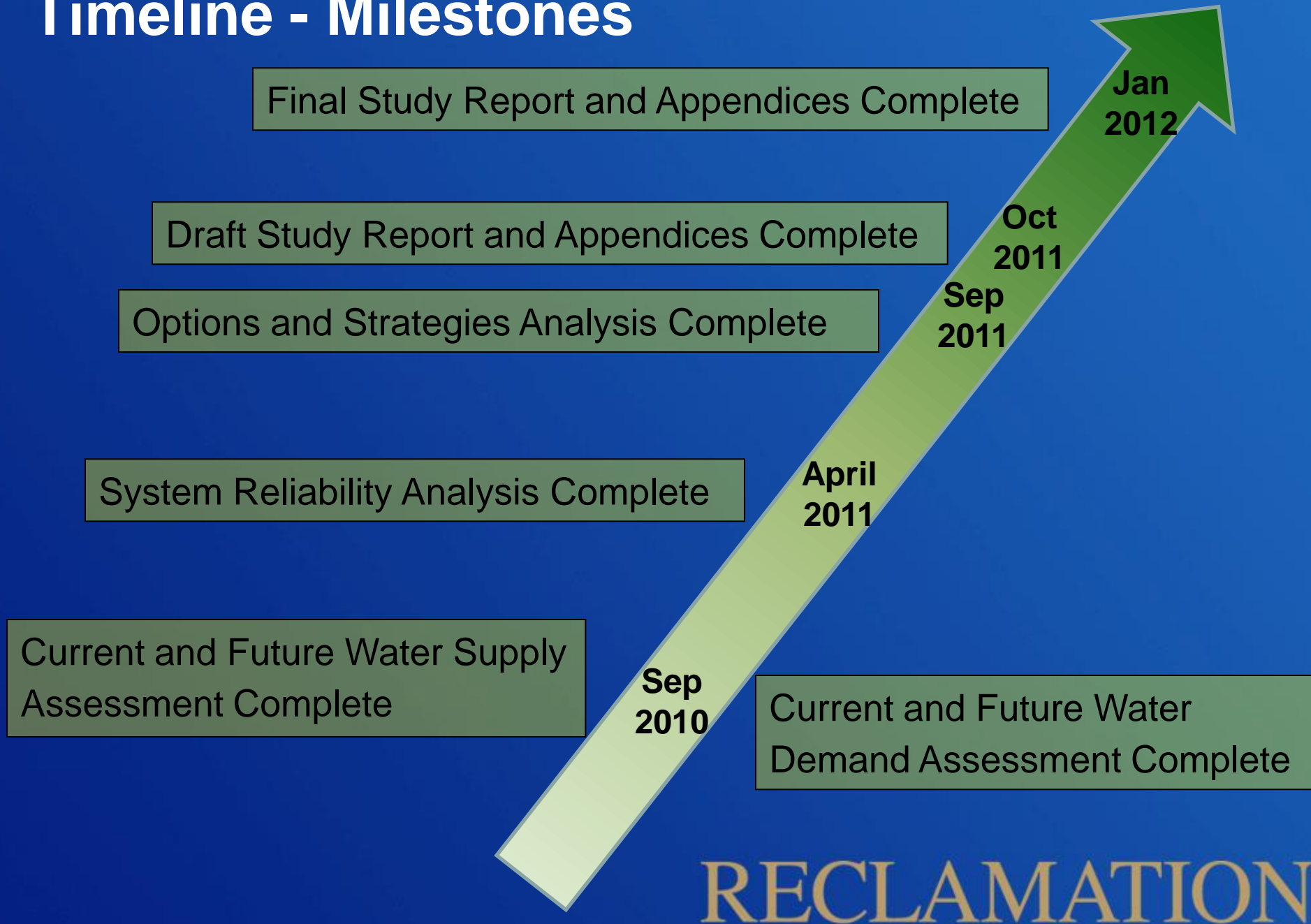
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Colorado River Basin Study Outreach



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Timeline - Milestones



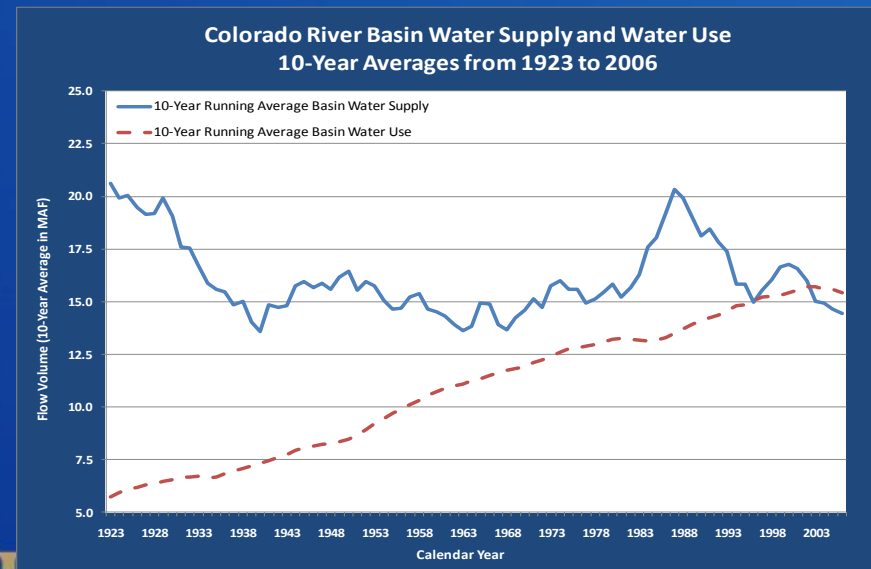
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