RECLAMATION

Managing Water in the West

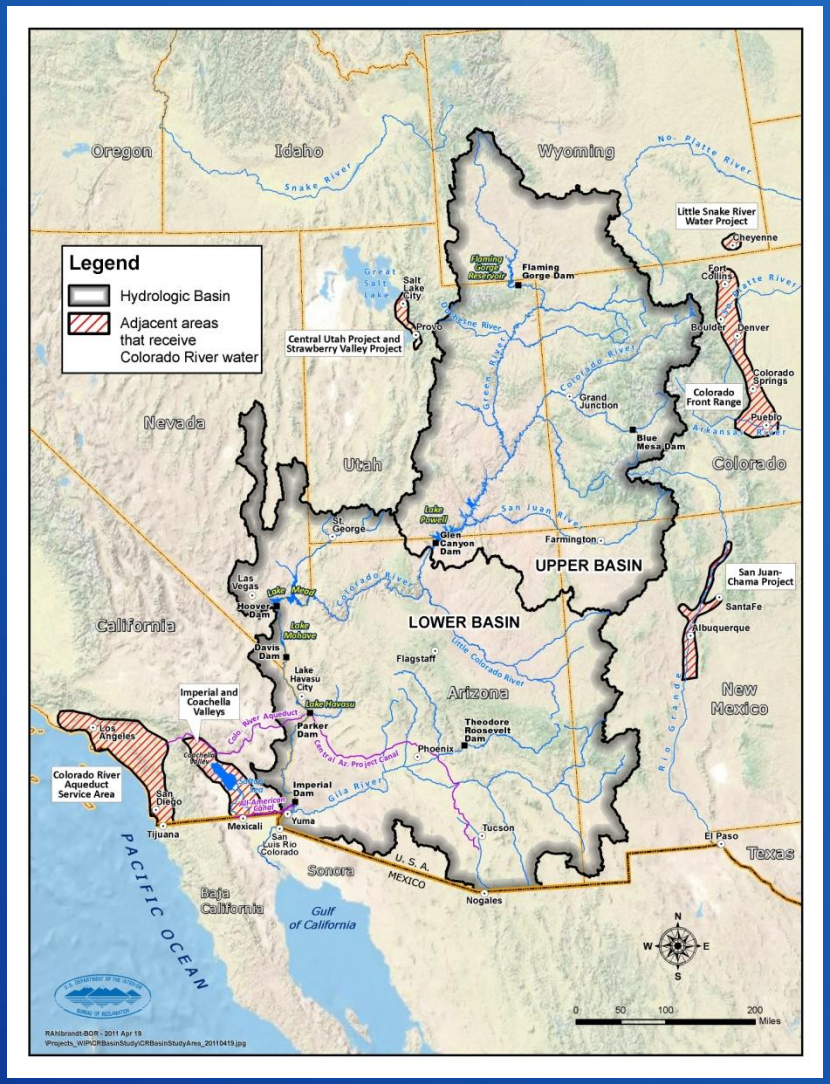
Overview of the Colorado River Basin Water Supply and Demand Study

May 2012

U.S. Department of the Interior
Bureau of Reclamation

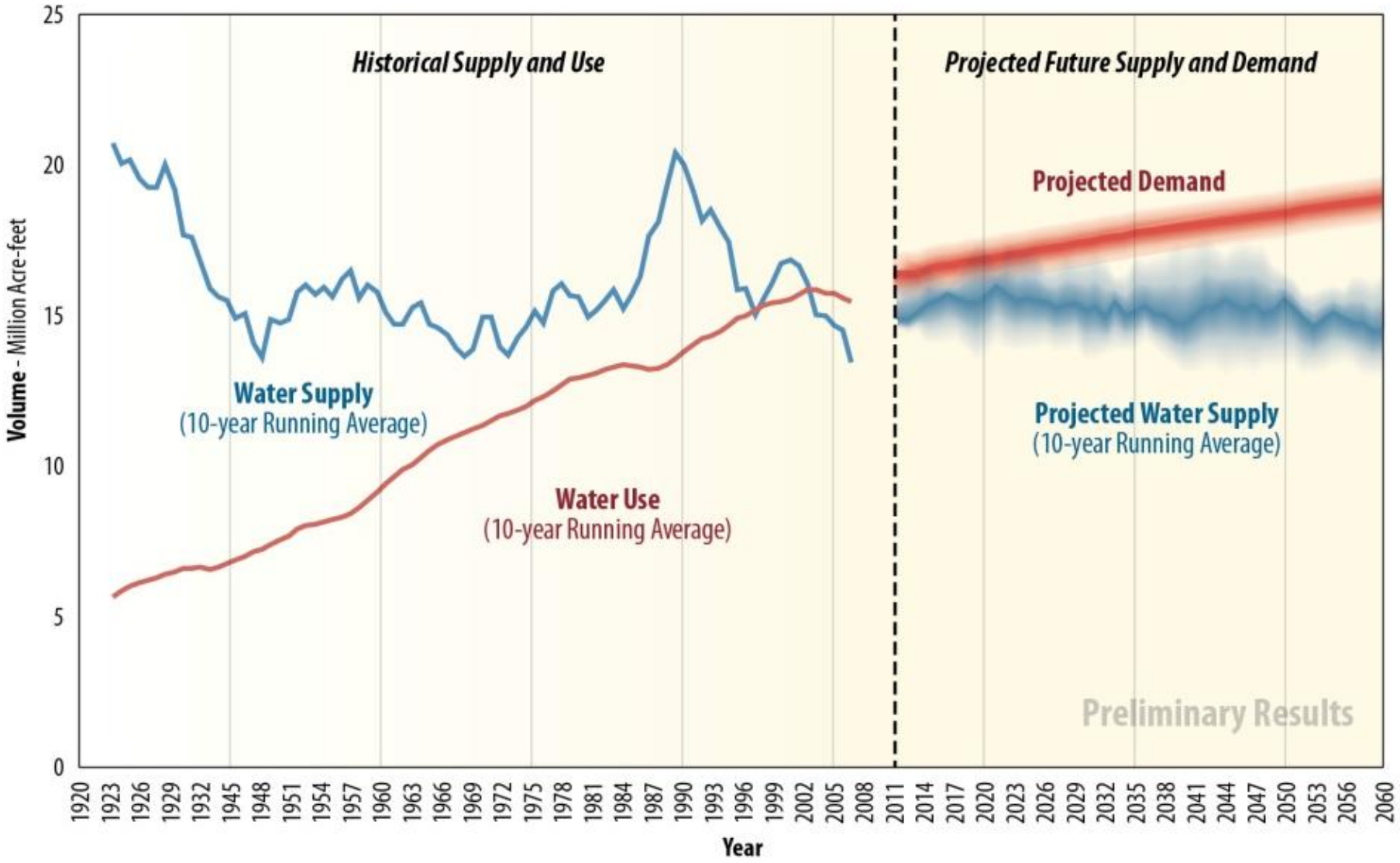
Colorado River Basin Water Supply and Demand Study

- Study Objectives:
  - Assess future water supply and demand imbalances over the next 50 years
  - Develop and evaluate opportunities for resolving imbalances
- Study being conducted by Reclamation and the Basin States, in collaboration with stakeholders throughout the Basin
- January 2010 - September 2012
- It will *not* result in any decisions, but will provide the technical foundation for future activities



RECLAMATION

Historic and Future Colorado River Water Supply & Use (10 year running averages)



50 Years of Colorado River Changes

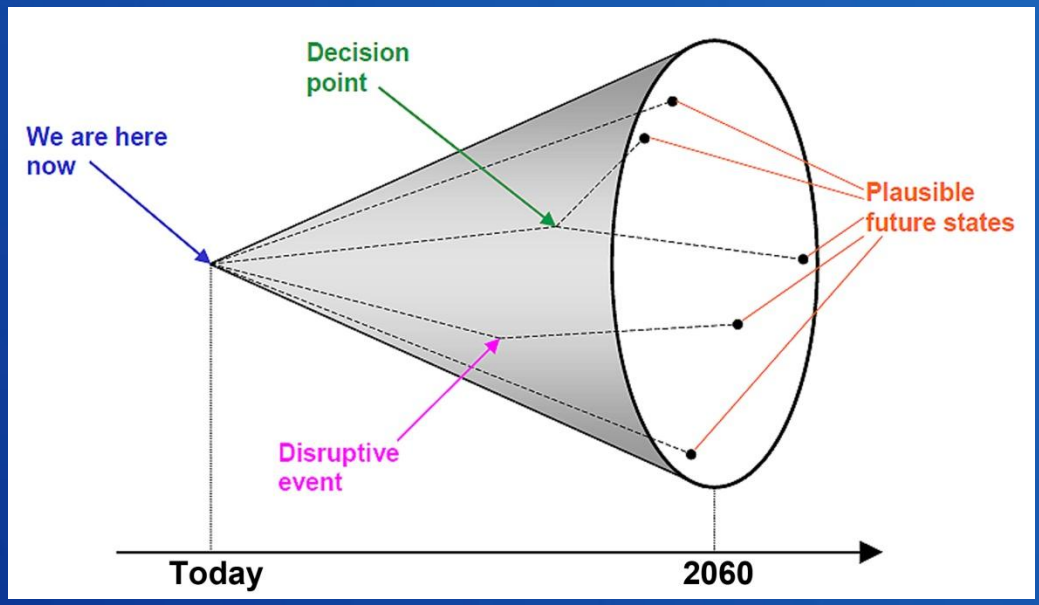
	1960	2010
Demographics / Land Use • Population served • Acres irrigated	12 million < 3 million	30 million 3 million
Physical System • Storage capacity • Hydropower generation capacity	30 maf 6,700 GW	67 maf 12,400 GW
Natural System • Annual mean natural flow at L.F. • Lowest 10-yr average flow at L.F.	15.1 maf (14.9) 12.5 maf (1931-1940)	15.0 maf 12.0 maf (2001-2010)
Institutions, Governance • Legislation, Policies, Agreements	• Colorado River Compact • Boulder Canyon Project Act • US-Mexico Water Treaty • UC River Basin Compact • CR Storage Project	• Decree in *AZ v. CA* • NEPA • ESA • QSA • 2007 Interim Guidelines

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

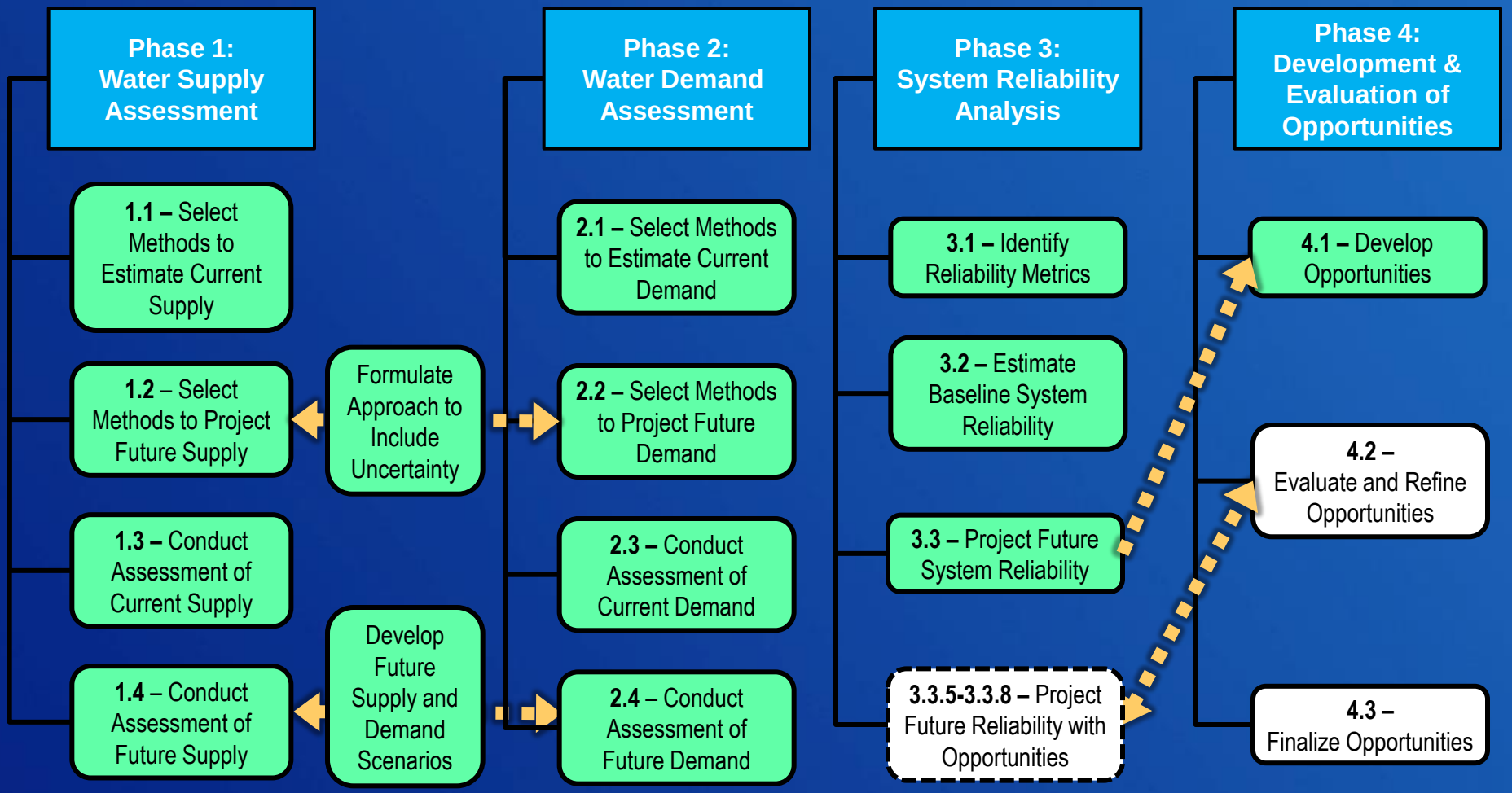
- A manageable and informative number of scenarios are being developed to explore the broad range of futures



(adapted from Timpe and Scheepers, 2003)

RECLAMATION

Study Phases and Tasks



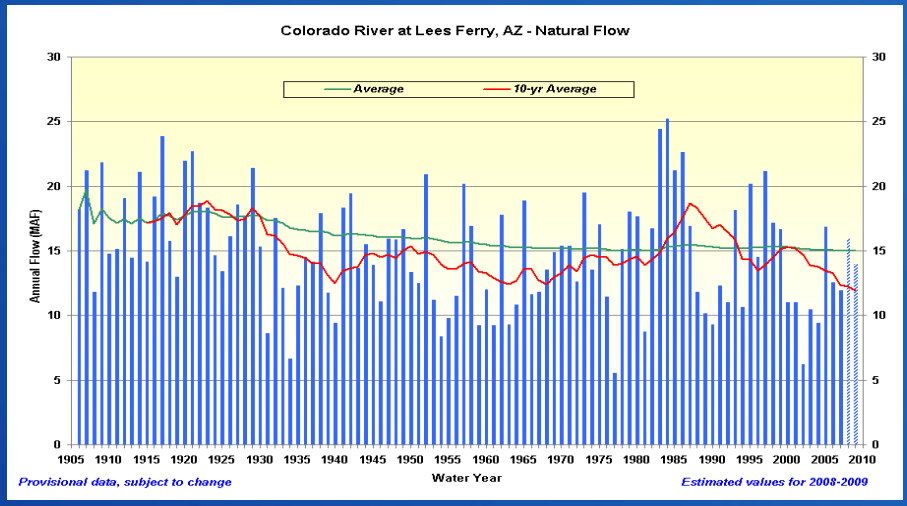
Green denotes essentially complete

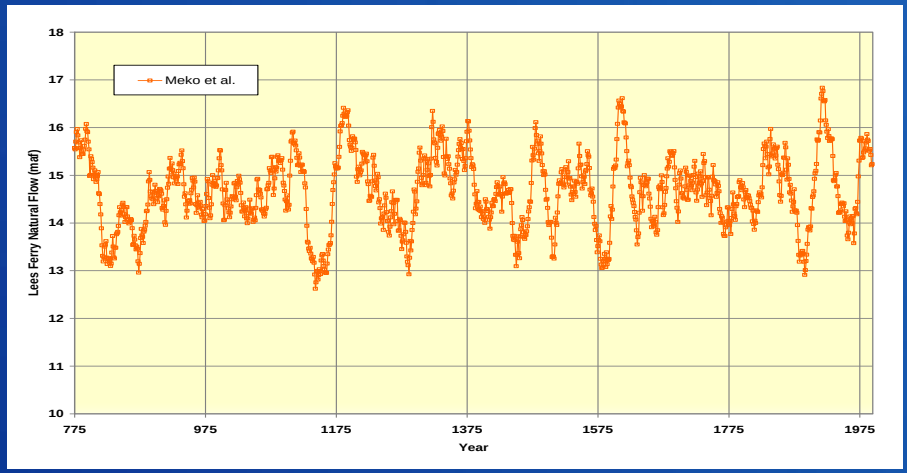
RECLAMATION

Phase 1: Water Supply Assessment

Scenarios *

- Observed Resampled
- Paleo Resampled
- Paleo Conditioned
- Downscaled GCM Projected



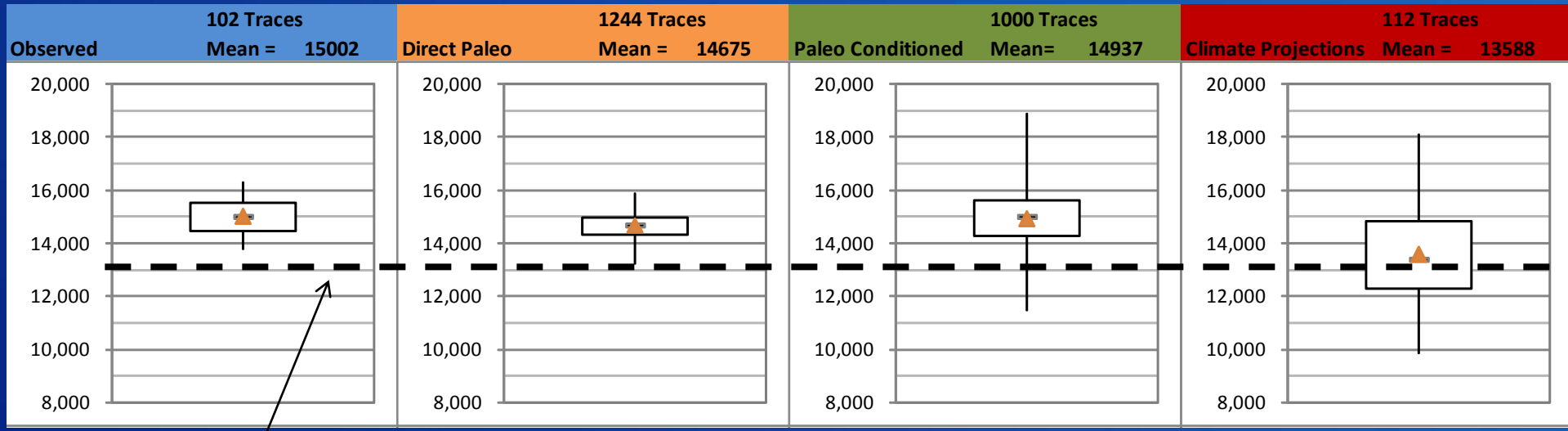


* Multiple realizations for each scenario

RECLAMATION

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

RECLAMATION

Phase 2: Water Demand Assessment

Six Scenarios:

- **Current Projected (A)**: growth, development patterns, and institutions continue along recent trends
- **Slow Growth (B):** low growth with emphasis on efficiency
- **Rapid Growth (C1 and C2):** economic resurgence (population and energy) and current preferences toward human and environmental values **
- **Enhanced Environment (D1 and D2):** expanded environmental awareness and stewardship with growing economy **

RECLAMATION

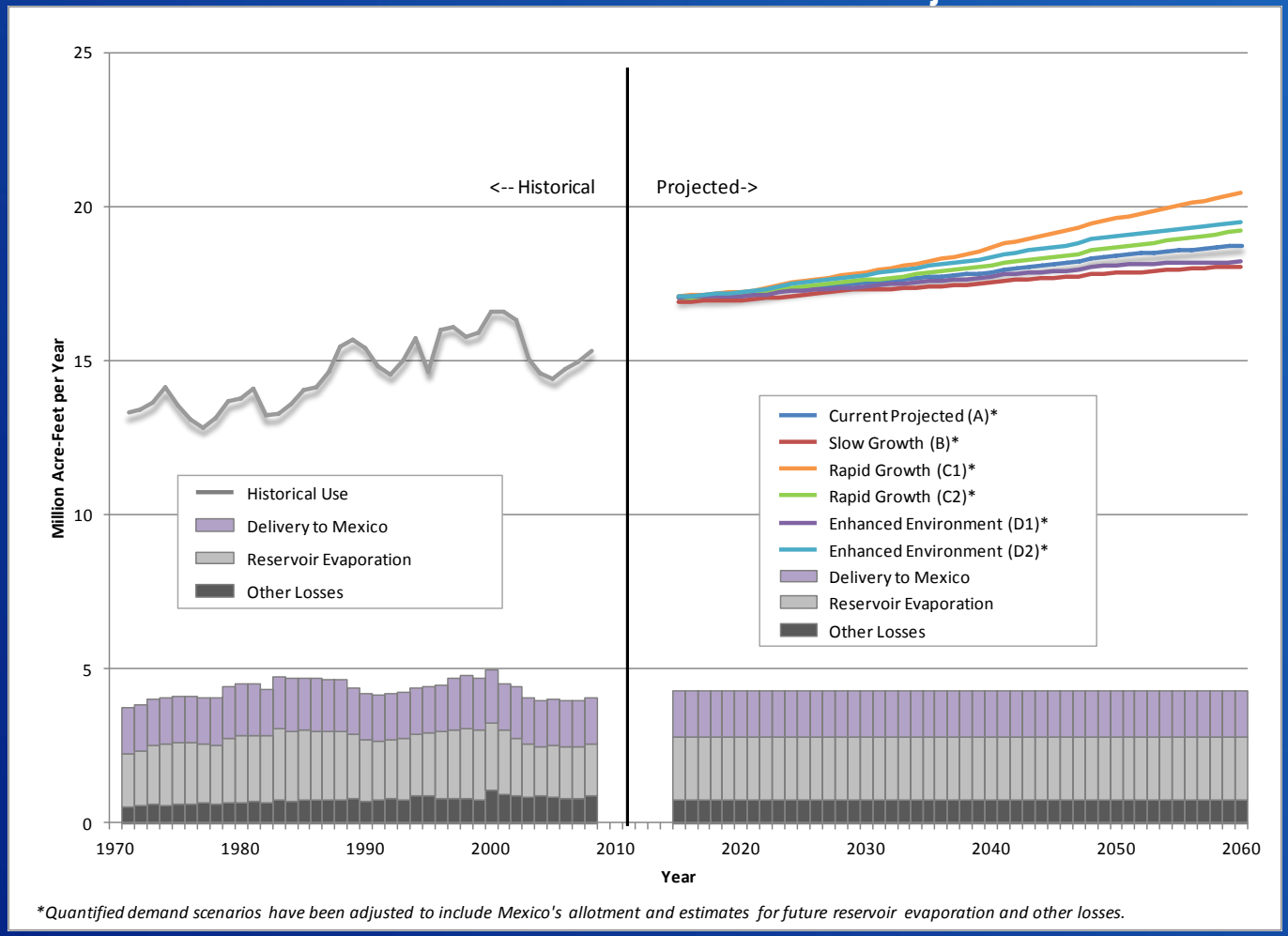
Technical Memorandum C – Quantification of Water Demand Scenarios

- Demand scenarios originally published in narrative or “storyline” format
- Demand scenarios now quantified
- Scenarios
  - Current Projected
  - Slow Growth
  - Rapid Growth – two tracks
  - Enhanced Environment – two tracks

RECLAMATION

Technical Memorandum C – Quantification of Water Demand Scenarios

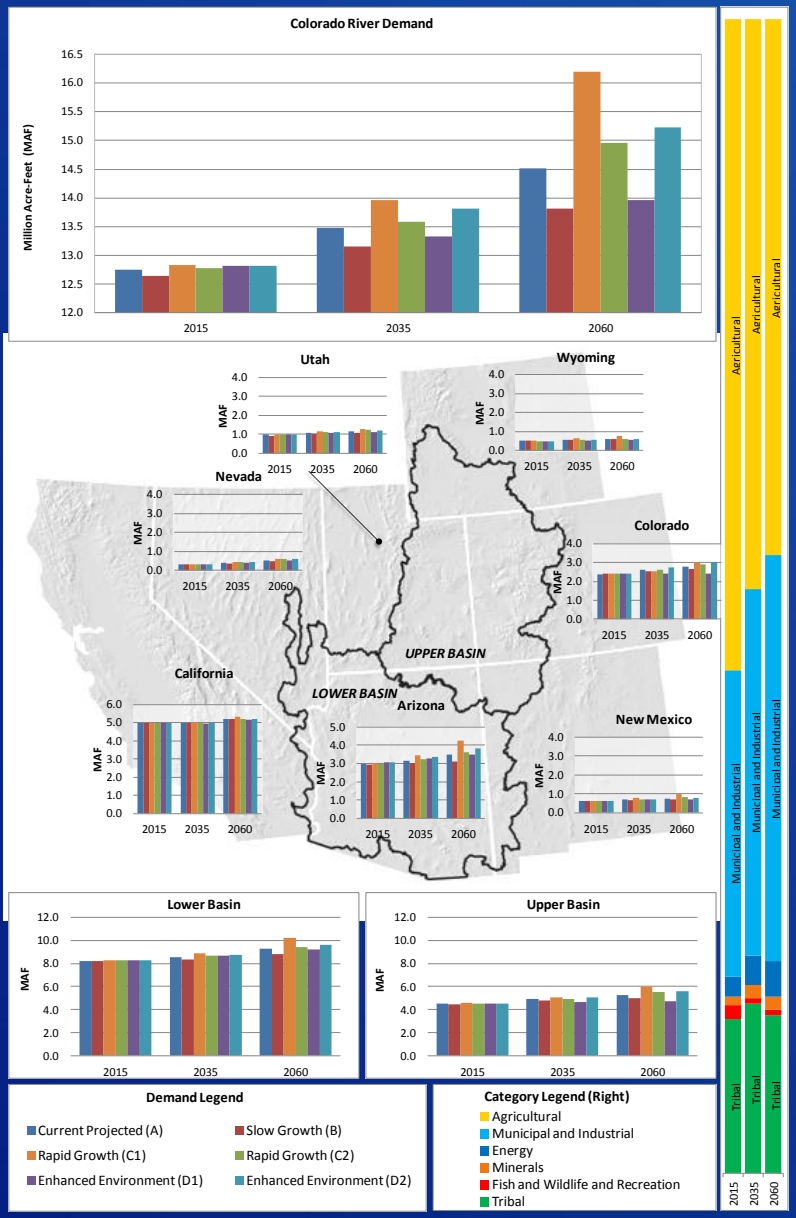
Colorado River Basin Historical Use and Future Projected Demand



*Quantified demand scenarios have been adjusted to include Mexico's allotment and estimates for future reservoir evaporation and other losses.

RECLAMATION

Quantification of Water Demand Scenarios

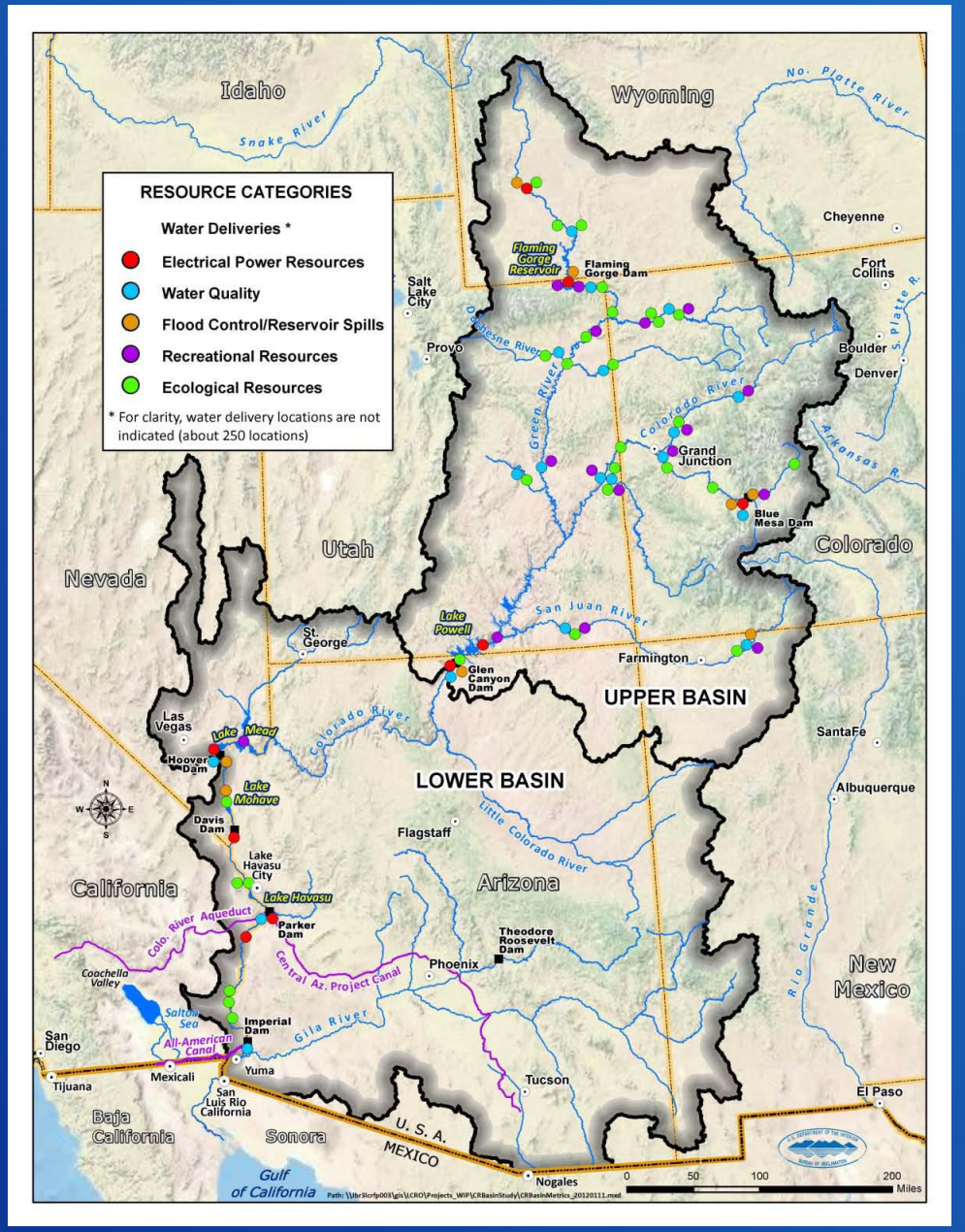


- Consumptive use demands range between 13.8 and 16.2 maf by 2060
- Including Mexico and losses = 18.1 and 20.4 maf by 2060
- Coupled with water supply scenarios, gaps of 3.8 to 6.2 maf are plausible
- Demands presented across category by state and planning area within a state
- Tribal demands developed in coordination with tribes through one-on-one outreach

RECLAMATION

Phase 3: System Reliability Analysis

- Simulate the state of the system on a monthly time step over the next 50 years for each scenario, with and without options and strategies
- Metrics will be used to quantify impacts to Basin resources
- **Resource Categories**
  - Water Deliveries
  - Electrical Power Resources
  - Water Quality
  - Flood Control
  - Recreational Resources
  - Ecological Resources

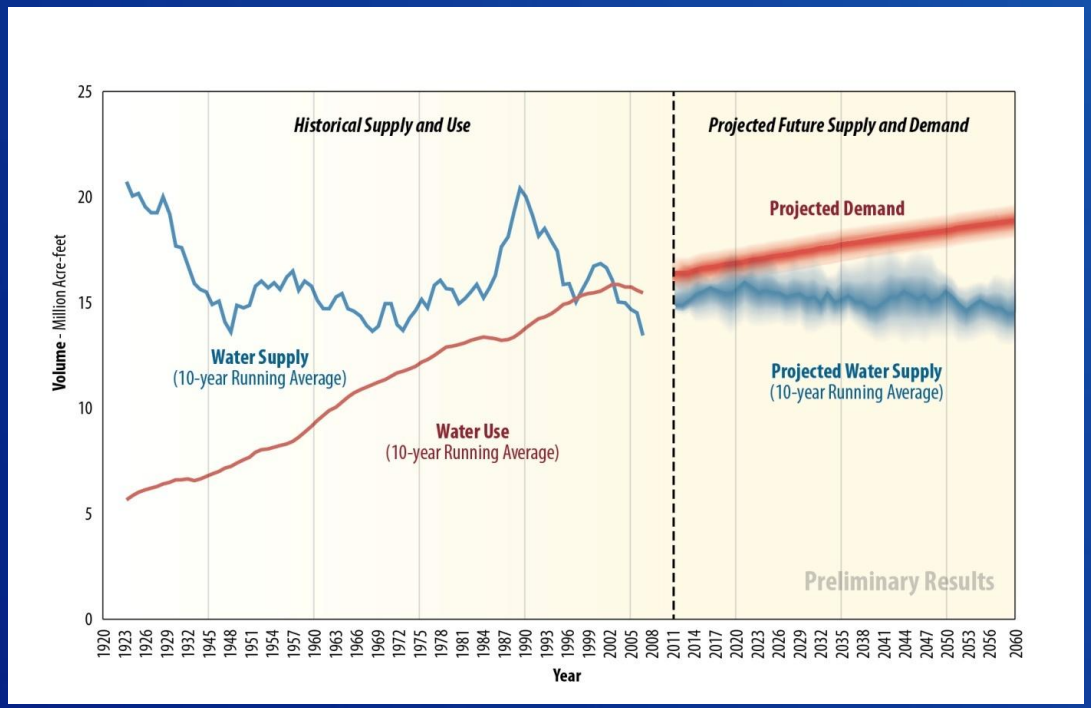


RECLAMATION

Phase 4: Development and Evaluation of Opportunities to Balance Supply & Demand

- Consider a wide range of options and strategies
- Will not result in selection or funding of a proposed project

Projected Future Colorado River Basin Supply & Demand

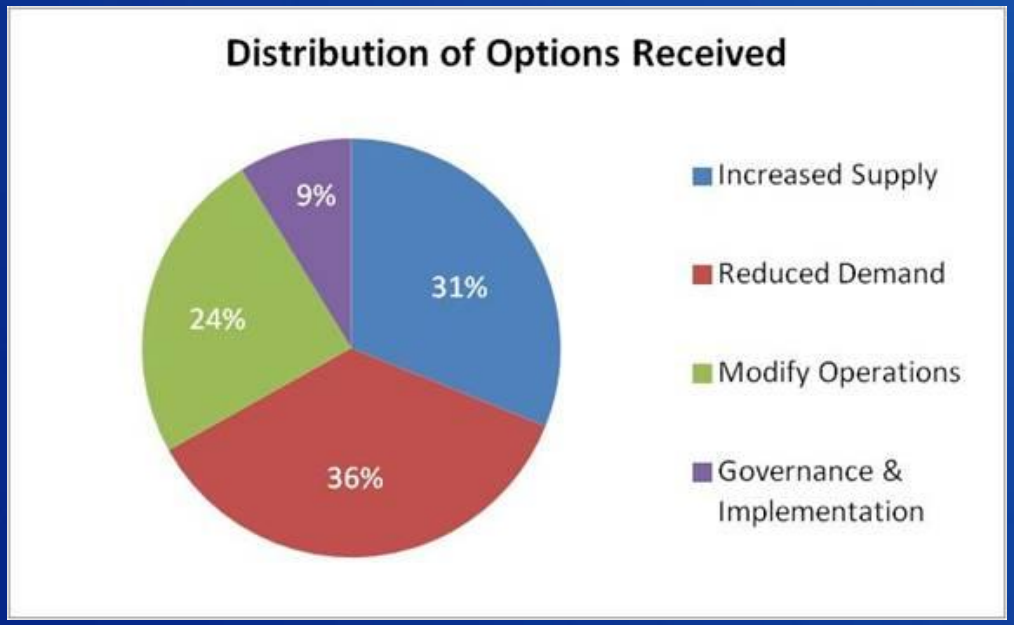


- Preliminary Assessment based on:
  - "Current Projected" demand scenario
  - supply scenario that considers a changing climate
- A broad range of imbalances will be considered when all supply and demand scenarios are combined

RECLAMATION

Summary of Options Submitted

- Over 140 options were submitted to the Study and have been posted to the Study website in their original form



Increased Supply – importation, reuse, desalination, etc.

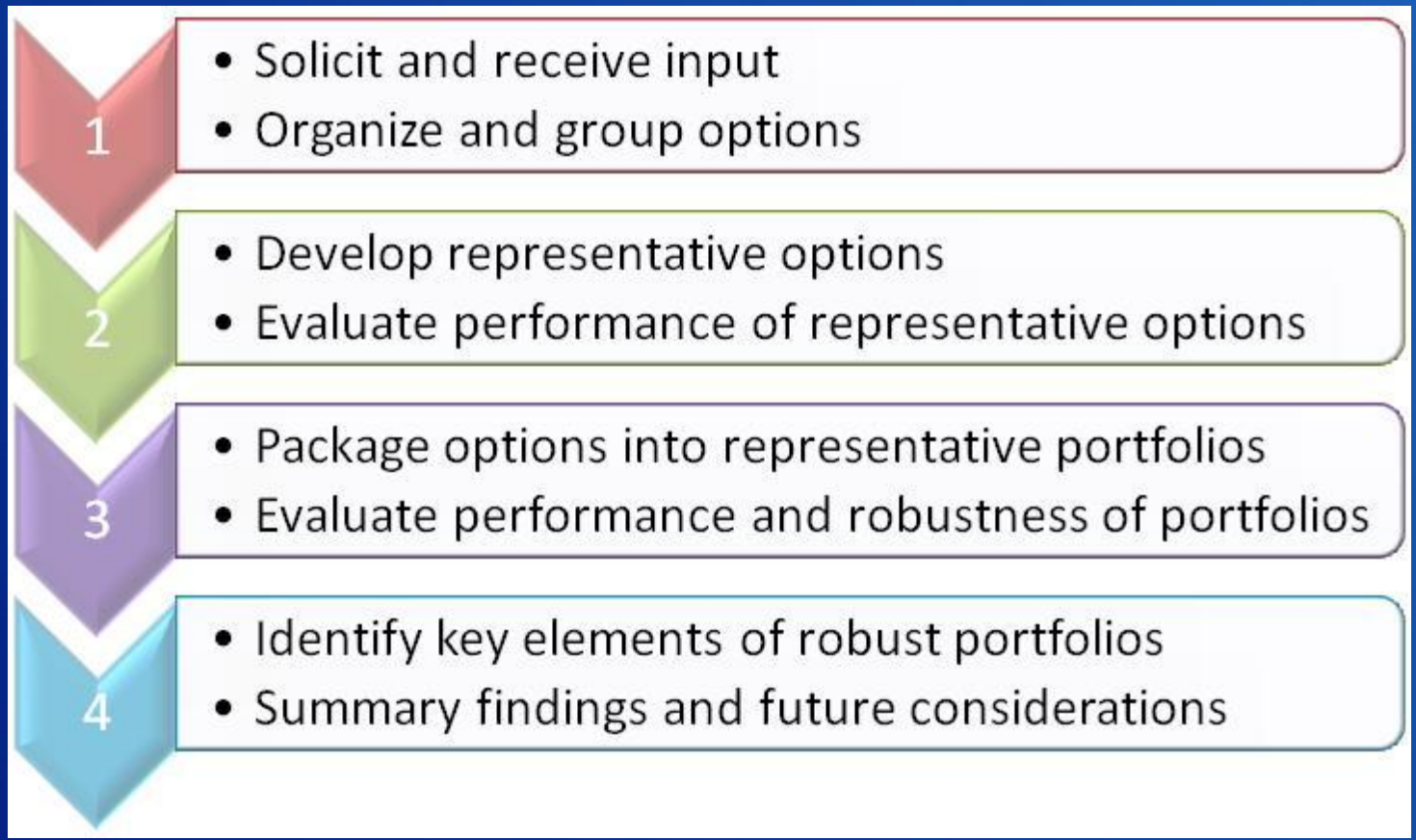
Reduced Demand – M&I and agricultural conservation, etc.

Modify Operations – transfers & exchanges, water banking, etc.

Governance & Implementation – stakeholder committees, population control, re-allocation, etc.

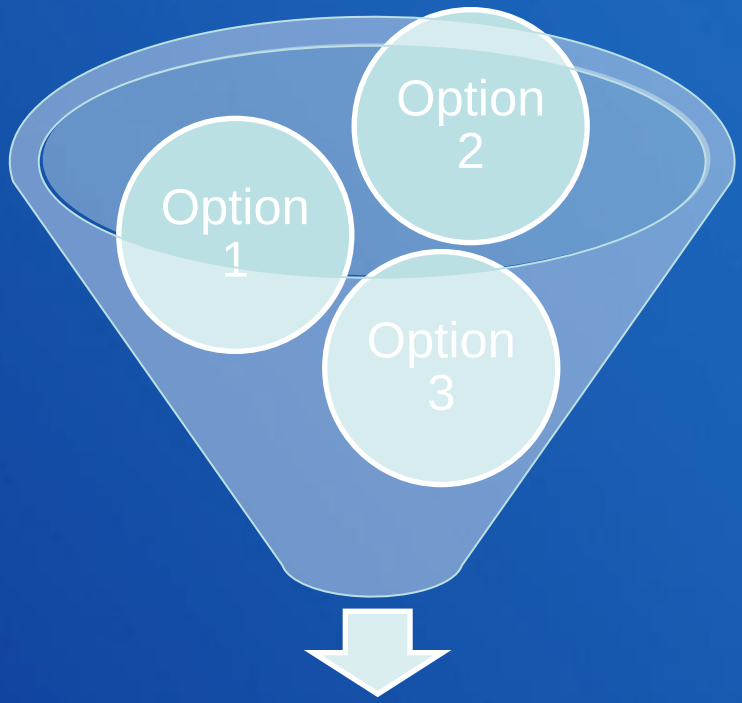
RECLAMATION

Approach for Developing & Evaluating Options & Strategies



Organizing and Characterizing Options

- Evaluation Criteria may include:
  - Potential yield
  - Timing of implementation
  - Technical feasibility
  - Cost
  - Environmental impacts/permitting requirements
  - Legal/public policy
  - Risk/uncertainty



Importation

Desal/Reuse

Banking/Exchange

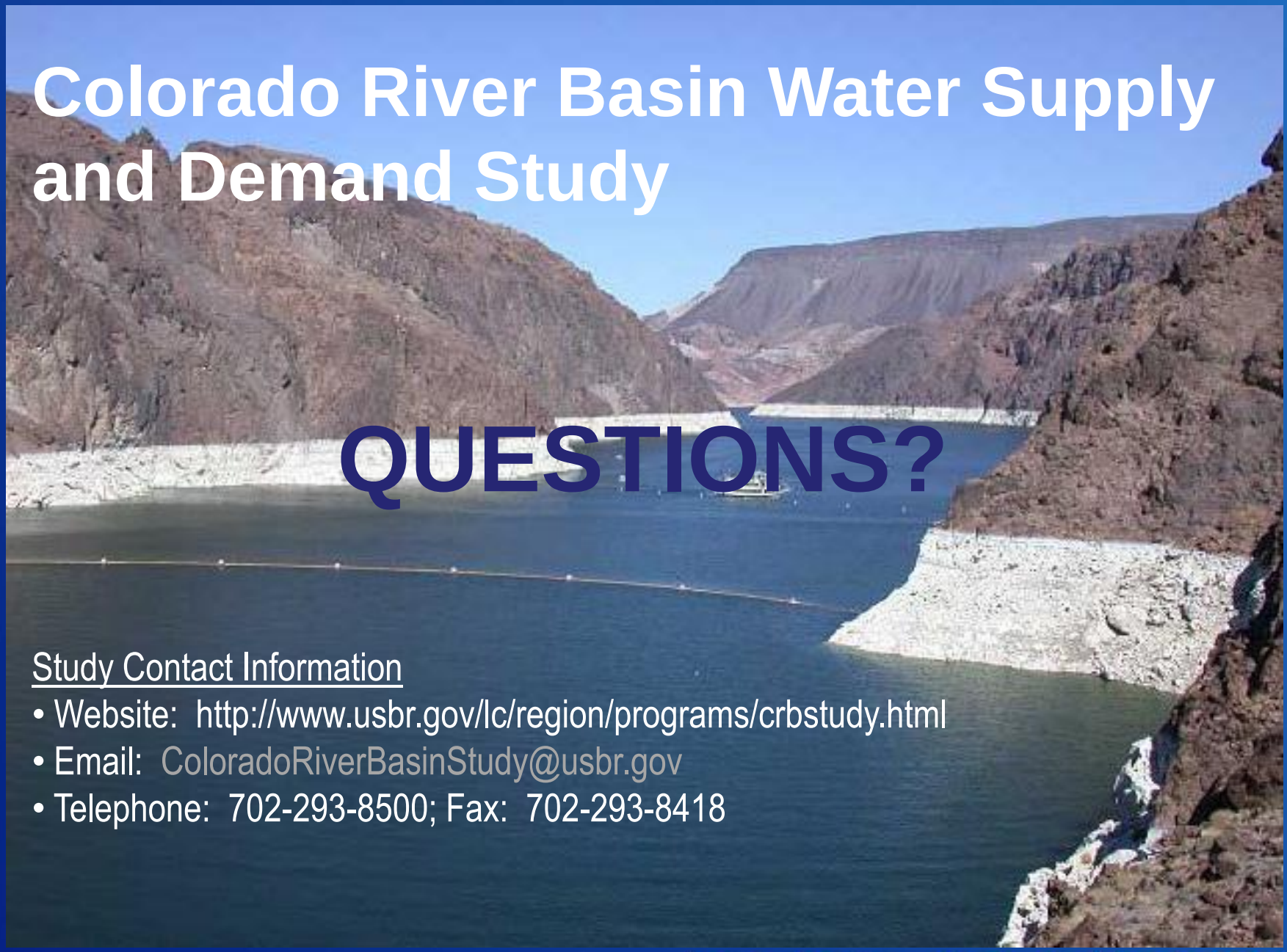
Demand Management

Watershed Management

Operational Efficiencies

RECLAMATION

Colorado River Basin Water Supply and Demand Study



QUESTIONS?

Study Contact Information

- Website: http://www.usbr.gov/lc/region/programs/crbstudy.html
- Email: ColoradoRiverBasinStudy@usbr.gov
- Telephone: 702-293-8500; Fax: 702-293-8418

RECLAMATION

Water Supply Scenarios

Observed Resampled:

- future hydrologic trends and variability will be similar to the past 100 years

Paleo Resampled:

- future hydrologic trends and variability are represented by the distant past (approximately 1250 years)

Paleo Conditioned:

- future hydrologic trends and variability are represented by a blend of the wet dry states of the paleo-climate record but magnitudes are more similar to the observed period

Downscaled Global Climate Model (GCM) Projected:

- future climate will continue to warm with regional precipitation trends represented through an ensemble of future GCM projections

Water Demand Scenarios

Current Projected:

- growth, development patterns, and institutions continue along recent trends

Slow Growth:

- low growth with emphasis on economic efficiency

Rapid Growth*:

- economic resurgence (population and energy) and current preferences toward human and environmental values *

Enhanced Environment*:

- expanded environmental awareness and stewardship with growing economy*

* Additional “branches” exist due to assumed trajectory of specific socio-economic factors.

RECLAMATION