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Colorado River Inter-basin Coordination

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OVERVIEW

- Background on the Colorado River
- Background on the Law of the River
- Recent Hydrology
- Challenges

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

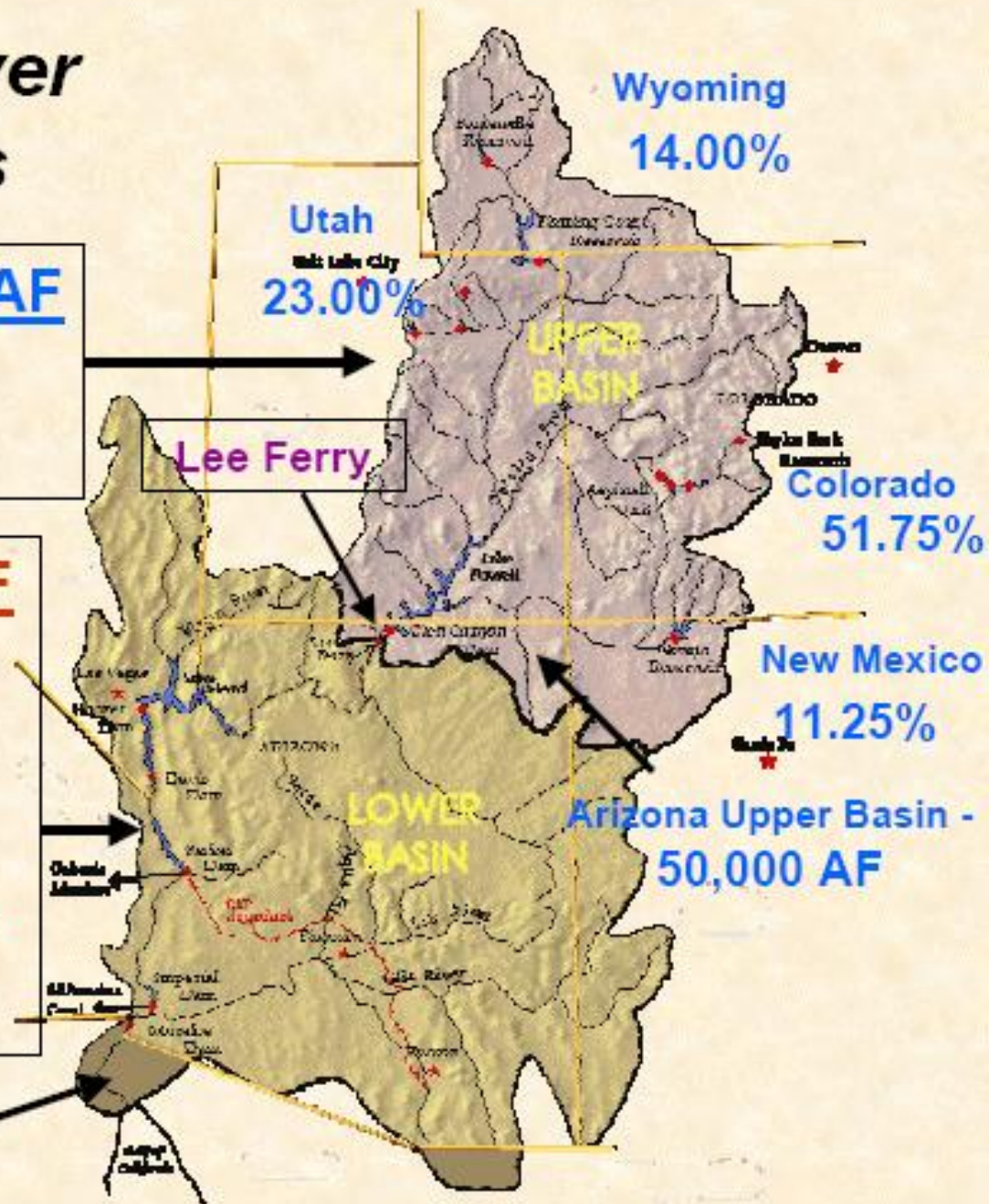
Arizona – 2.8 MAF

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



Colorado River Overview

- Up to 17.5 million acre-feet (MAF) allocated annually – 7.5 MAF to Upper Basin and 7.5 MAF plus an additional 1 MAF to Lower Basin and 1.5 MAF under the 1944 Treaty to Mexico.
- >15 MAF of consumptive use can occur annually within the U.S. (16.5 MAF including Mexico).
- 60 MAF of storage
- Approximately 15 MAF average annual “natural” runoff over past 100 years
- U.S. Bureau of Reclamation serves as “water master” for the Lower Basin.



Colorado River Compact of 1922



Delph Carpenter- “father of interstate compacts”



Interstate Compacts

- Could serve Colorado better than “equitable apportionment.”
- Allowed States to draft the terms rather than turning the decisions over to the Supreme Court and special masters.
- Less time.
- Less costly.
- Provided certainty.

Article III

- (a) There is hereby apportioned from the Colorado River System in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.
- (b) In addition to the apportionment in paragraph (a), the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by one million acre-feet per annum.

Article III

- (c) Any treaty obligation will first be met with Colorado River **system waters which are surplus** over and above the aggregate of the quantities specified in paragraphs (a) and (b). If not enough surplus exists, then **the deficiency** shall be equally borne by the Upper Basin and the Lower Basin, and **whenever necessary** the States of the Upper Division shall deliver at Lee Ferry water to supply one half of the deficiency so recognized in addition to that provided in paragraph (d).

Article III

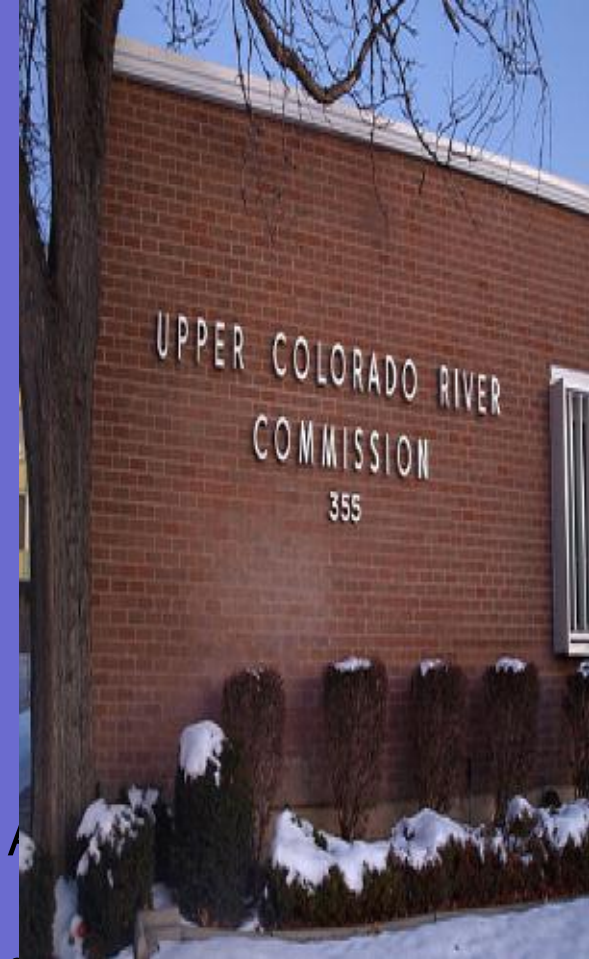
(d) ““The States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre aggregate acre-feet for any period of 10 consecutive years...””

THIS IS NOT A DELIVERY OBLIGATION!

(e) The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot be reasonably applied to domestic and agricultural use.

Upper Colorado River Basin Compact of 1948

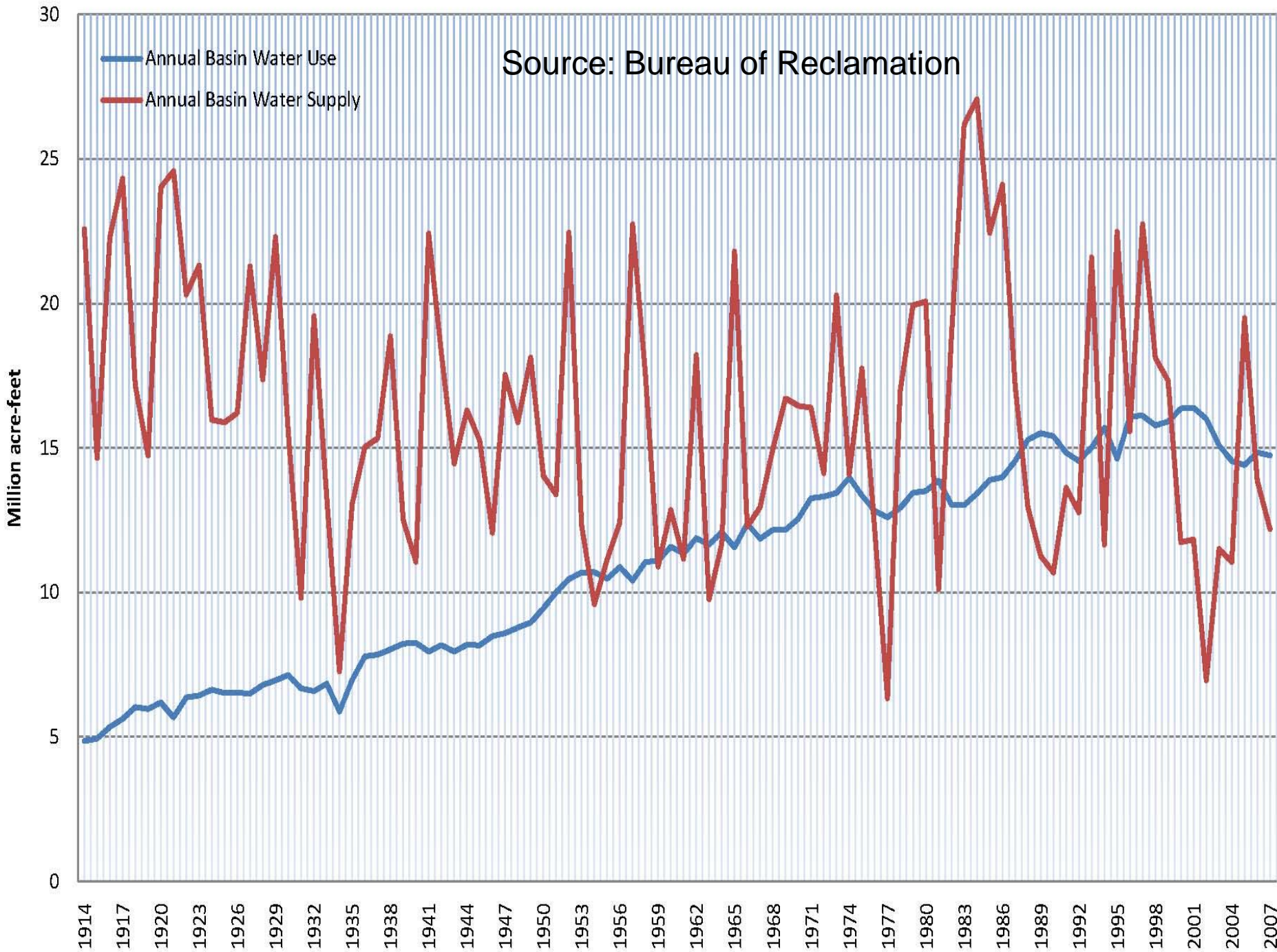
- Article IV-
- If the Upper Division States have to curtail use to keep the flow of the river at Lee Ferry from being depleted below 75 maf/10 yrs, the Upper Colorado River Commission will determine the quantity each state owes and the timing based on three principles:
 - (a) Curtailment must assure full compliance with the 1922 Compact;
 - (b) Overusing states must payback the amount of their overuse in the last ten years first;
 - (c) If overuse payback is insufficient to meet the flow target, then the states must deliver at Lee Ferry an amount of water that is proportionate to their use in the year immediately preceding the curtailment year.
- Note that present perfected rights are excluded from curtailment



MEXICAN TREATY

- “In the event of extraordinary drought or serious accident to the irrigation system in the United States, thereby making it difficult for the United States to deliver the guaranteed quantity of 1,500,000 acre-feet (1,850,234,000 cubic meters) a year, the water allotted to Mexico under subparagraph (a) of this Article [10] will be reduced in the same proportion as consumptive uses in the United States are reduced.”
- Mexican Water Treaty, Treaty Series 994, 59 Stat. 1249, November 14, 1944., Article 10 (b).

Source: Bureau of Reclamation



State of the System 1999-2011.

Source: Bureau of Reclamation

Water Year	Unregulated Inflow to Powell (% of avg)	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	27.24	54
2006	71	25.80	51
2007	70	24.43	49
2008	102	26.52	53
2009	88	26.40	53
2010	73	25.36	51
2011	?	?	?

LOW LEVELS AT POWELL



RECENT HYDROLOGY

- **2000-2010 has been the driest 11-year period in the 100-year historical record.**
- **Tree-ring reconstructions show more severe droughts have occurred over the past 1200 years (e.g., drought in the mid 1100's).**
- **Last year, Lake Mead dropped to elevation 1082 feet. At Elevation 1075 shortages in the lower basin begin.**

LOW LEVELS AT LAKE MEAD



How do you explain the last 11 years?

- A prolonged drought due to natural variability?
- Climate Change?
- Increased use in the lower basin in the context of natural variability?

Challenges are many, and include:

- Natural variability.
- Climate Change.
- Population growth.
- Increased focus on environmental and recreational instream flows.

Clark County population Approaches 2 million people

Year	Clark County Population
1970	277,230
1980	463,087
1990	770,280
2000	1,394,440
2007	1,954,319

Data Source: Nevada State Demographer.

Southwestern States Growth

- Los Angeles, San Diego, Phoenix, top 10 most populous cities in the United States.
- Denver, Las Vegas, Albuquerque.
- 2010 census, Colorado, Arizona, Nevada, Utah all within the top 10 fastest growing states.

State of Colorado Population

- By 2050, Colorado's population is expected to double to approximately 8.6 to 10 million people.
- By 2050, Colorado may face a Municipal and Industrial shortage or gap (depending on the success rate of certain identified water projects and processes) of between 190,000 acre-feet and 630,000 acre-feet.

Water Availability Study

- Historical Hydrology
- Alternative Hydrology (tree rings, etc.)
- Climate Change/Forest changes

Colorado River Water Availability Study

- 0 to 1,000,000 acre-feet available from the Colorado River for water development within Colorado.
- Over-development could result in more significant and more frequent curtailment under the “law of the river”
- Under-development would likely result in more dry-up of agriculture, and to the benefit of other states to the detriment of Colorado.

Compact Curtailment Has Steps

- 1- Litigation to enforce a compact curtailment may be possible, probable, or down right inevitable.
 - 1922 Compact legal issues.
- 2- Upper Colorado River Compact Commission's Role.
 - Role of litigation.
- 3- The State of Colorado's role.
 - Role of litigation.

Upper Colorado River Compact Commission

- Currently exploring at the work group level how to implement a curtailment between the upper basin states.
- Commitment in December 2010 to explore these issues and strive to achieve some resolution among the Upper Division States by December 31, 2013.

Colorado's role

- Colorado, and the other upper basin states, then are charged with administering the compact call.
- Administration.
 - Calls could be administered by priority across the basins?
 - Basin by basin administration.
 - Type of Use?
- Storage issues.
 - Do the Colorado River sub-basins have to be administered based on a 10 year rolling average?
- Pre-1922 rights.
- How does Colorado appropriately deal with and allocate risk?

Colorado's Compact Curtailment Study

- \$500,000 appropriated to undertake a study to identify issues associated with administration of water rights in the Colorado River basin in accordance with the law of the river and to evaluate options to avoid curtailment of use, and explore options for curtailing use in an equitable manner.
- State Engineer rules to avoid curtailment and administer curtailment, if necessary.

Colorado's Compact Curtailment Study

- Implemented in 2 phases. Phase 1 – Initiated.
- Data collection
 - Pre-1922 rights
 - Appropriated
 - Changed
 - Abandoned
 - Critical water supply needs.
- Explore alternatives to minimize, avoid, or delay curtailment.

Other Colorado internal Studies

- Water Bank-
 - Colorado River Water Conservation District; Southwest Water Conservation District; Trout Unlimited; Front Range Water Council; State of Colorado
 - \$300,000 to explore feasibility
- Aspinall Unit Roundtable study

The Colorado River Basin States Have a Long History of Collaboration

- Interim Shortage and Coordinated Reservoir Operation Guidelines
- Vegetative management (tamarisk removal)
- Augmentation Study (desalinization, importation, other options)
- Weather Modification (cloudseeding)
- U.S. Mexico bilateral negotiations

Basin Study

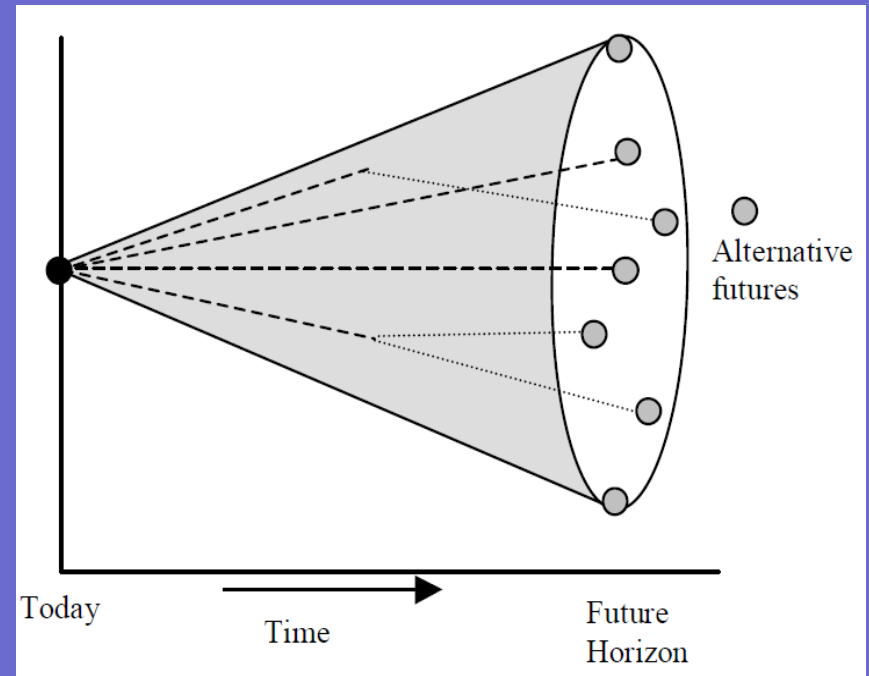
- “Plan of Study” provides the purpose and objectives of the Study
 - Evaluate future water supplies
 - Evaluate future water demands
 - Assess imbalances
 - Assess risks to Basin resources (system reliability)
 - Develop and evaluate options and strategies to resolve imbalances and mitigate risks

Water Supply (Phase I)

- **Objective** - Identify the quantity and location of current and future water supplies in the basin considering potential effects of climate variability and change.
- Water Supply Indicators
 - Streamflow (observed, paleo, paleo conditioned, future).
 - Historical and future gridded climate datasets.
 - Meteorological model input for hydrologic model (observed / future).
 - Hydrologic model results (streamflow, snowpack, ET, soil moisture).
 - Climate models.

Water Demand (Phase II)

- Objective - Assess the quantity and location of existing and future water demands, including the potential effects of climate variability and climate change.
- Scenario based planning
 - Current trends
 - Economic Slowdown
 - Expansive Growth
 - Enhanced Environment and Healthy Economy



Categorization and Selected Driving Forces for Storyline Development

General Driving Force Category	Key CRBS Driving Forces Identified in Survey
Natural Systems (Hydroclimate)	<ul style="list-style-type: none"> • Changes in streamflow variability and trends [1] • Changes in climate variability and trends (e.g. temperature, precipitation, etc.) [2]
Demographics & Land Use	<ul style="list-style-type: none"> • Changes in population and distribution [4] • Changes in agricultural land use (e.g. irrigated agricultural areas, crop mixes, etc.) [5]
Technology & Economics	<ul style="list-style-type: none"> • Changes in agricultural water use efficiency [8] • Changes in municipal and industrial water use efficiency [9] • Changes in water needs for energy generation (e.g. solar, oil shale, thermal, nuclear, etc.) [12]
Social & Governance	<ul style="list-style-type: none"> • Changes in institutional and regulatory conditions (e.g. laws, regulations, etc.) [10] • Changes in flow-dependent ecosystem needs for ESA-listed species [13] • Changes in other flow-dependent ecosystem needs [14] • Changes in social values affecting water use [15] • Changes in water availability due to tribal water use and settlement of tribal water rights claims [17]

System Reliability Metrics (Phase III)

- Objective - Develop a metric system to characterize water supply and demand imbalances and measure the effectiveness of strategies to remedy those imbalances.
- Metric Categories:
 - Water Allocations & Deliveries
 - Electrical Power Resources
 - Water Quality
 - Recreation
 - Ecological Values
 - Operational Resources

Evaluation of Opportunities (Phase IV)

- Options will include structural and non-structural opportunities.
- Options will be identified, developed analyzed.
- Options will be evaluated and refined:
 - Feasibility
 - Cost comparisons
 - Environmental Impacts/Permitting
 - Economic and Socioeconomic impacts
 - Legal and Policy Considerations
 - Risk and uncertainty
 - Assessment of effectiveness
 - Potential yield

U.S. Mexico bi-national negotiations

- 3 Minutes signed in 2010.
- Negotiations are continuing.
- Many implications for the States' legal positions and the States' ability to meet future water demands.
- Many difficulties to overcome.

Environmental and Power Issues

- Adaptive Management Work Group (AMWG).
- ESA issues. Upper Colorado Endangered Fish Recovery Implementation Program; San Juan River Basin Recovery Implementation Program. PBOs.
- Grand Canyon Trust litigation.
- Mexican environmental issues.

Negotiations today over litigation today:

- Could serve Colorado better than “equitable apportionment.”
- Allowed States to draft the terms rather than turning the decisions over to the Supreme Court and special masters.
- Could be completed more quickly than interstate litigation.
- Less costly.
- Provide certainty.

For more information

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