



## MEMORANDUM

July 1, 2013

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**TO:** BOARD OF DIRECTORS, CRWCD

**FROM:** ERIC KUHN

**SUBJECT:** *COLORADO RIVER UPDATE*

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### 1. Colorado River Basin Hydrology

2013 is shaping up to be one of the four or five driest years for inflow into Lake Powell. April to July inflow is forecast to be about 37% of normal. Under the 2007 Interim Operating Guidelines, if the August 24-month study shows December 31 Lake Powell elevation below 3,575' (full is 3,700') and Lake Mead is above 1,025' then releases from Lake Powell for Water Year 2014 will be reduced to 7.48 million af (from a normal of 8.23 million af).

The June 24-month study showed Lake Powell at 3,577' (2 feet over the trigger) and Lake Mead >1,100' (75 feet over the 1,025' level). However, since the June forecast we've lost over 300K of projected inflow plus it is likely that the CRBFC model will show drier conditions in August through November. Thus, I believe the July and August 24-month studies will show Lake Powell well below the 3,575' elevation.

One of the purposes of the 3,575' trigger is to reduce the chances of Lake Powell dropping below the minimum power head. The power plant conduits take water at an elevation of 3,485'. However, Reclamation is going to get very nervous about air entrainment (which will result in cavitation damage to the turbine blades) caused by a vortex well above 3,485', perhaps in the 3,510' to 3,520' range. Remember, at these reservoir levels, a small change in storage results in a large change in elevation. I expect that Lake Powell levels in February/March of 2014 could be below 3550' (even with reduced deliveries).

The bottom line is that we're a moderately dry year away from the possibility of taking Lake Powell below minimum power head (winter of 2015). The financial impacts could be substantial. Glen Canyon normally generates >80% of total hydroelectric power. CRSP revenues are used to repay the Treasury (normally with interest) for the appropriations that funded the construction of projects. They fund environmental programs such as the Upper Basin and San Juan Endangered Fishes Recovery Programs, salinity control and the Grand Canyon research programs. Most importantly, CRSP revenues fund the operation and maintenance of the projects and the electric grid system that distributes project power. Total CRSP-generated revenues exceed \$200 million per year.

Payments to the Treasury can be deferred. The environmental programs are relatively small, can be temporarily cut back and the beneficiaries of the programs can be asked to contribute more. (Many in Congress might cheer these actions). However, covering the project operations and maintenance is critical. Is asking a dysfunctional Congress for appropriations or borrowing authority an option? If Reclamation was allowed to borrow against future power revenues, what would be the impact on power rates?

From the Lower Basin perspective, a 7.48 maf release is something they agreed to in 2007, but probably never thought it would happen. A 7.48 maf release from Powell in 2014 makes a tier I shortage in 2015 or 2016 almost certain. The tier I shortage (<1,075') results in a 333K shortage to Nevada and Arizona (CAP takes most of it) and 55K shortage to Mexico. A one year shortage is probably not a big deal. Due to conservation and the big housing recession, Nevada has been below its 300K normal apportionment in recent years. Arizona has been banking (or dumping depending on one's perspective) 200K to 300K into the ground for a number of years. Under a tier I shortage, the CAP will be limited to diverting about what it really needs. I've attached a discussion paper from CAP on a shortage.

The scary scenario for the Lower Basin is a multi-year shortage (two or more consecutive 7.48 maf years or a 7.48 year follows by several 8.23 years). In this situation, Lake Mead screams through a tier I into a tier II shortage (1,050'). Shortages to Nevada and Arizona are increased to 400K, but Lake Mead drops below the Southern Nevada Water Authority upper level intake (1,050'). If its bottom tap has been completed, it's probably okay.

Hoover Dam power production is dramatically reduced impacting Metropolitan Water District which uses inexpensive Hoover power to pump Colorado River water to the coast. Recreation on Lake Mead becomes marginal. Finally, if Lake Mead gets dangerously close or drops below 1,025', the tier III shortage (or panic level) occurs. If Lake Mead is below 1,025' and Powell is below 3,575', the criteria will change. Reclamation balances the active storage in each reservoir within a release range of 7 to 9 million af and the seven states go into a "reconsultation" mode. Shortages to the CAP and Nevada will be at least 500K and could have significant impacts.

I'm also highlighting the current status of Lake Powell because it's a great example of an Upper Colorado River Basin future with a "demand management" system in place where various actions are triggered by the storage levels in Lake Powell.

For example, in the future (I'm being optimistic and assuming Lake Powell will someday recover to an elevation well above 3,575'), the 3,575' level could be an elevation that would trigger Upper Basin-wide conservation efforts by major post-compact water rights holders. Would Denver Water consider initiating a Stage 3 drought plan if Lake Powell is below 3,575' but its local reservoirs are in good shape (this year is a great example!)? Would Northern Water consider restricting its quota when Lake Powell is below 3,575'? Would major users in other states such as Albuquerque which uses San Juan-Chama water or the Wastach Front Range cities which use Central Utah Project water participate? From Utah's perspective, this is not a simple question. Based on the data presented in the Basin Study, Colorado is currently using about 56-

58% of the Upper Basin's total consumptive use. Colorado's apportionment is 51.75%. Utah's apportionment is 23%, but its current use is only about 18-20%. If the Upper Basin adopts a demand management system, should post-compact users in state(s) using greater than its/their apportionment cut back first? NOTE, based on study being prepared by URS, the Basin Study consumptive use data are not that accurate. However, more accurate information probably compounds Colorado's problem.

For a demand management post-compact trigger, how would smaller in-basin users participate? Even the West Slope largest municipal providers, Ute Water and the Eagle River Water & Sanitation District have very small impacts on the flow at Lee Ferry (<5,000 af). Ute Water serves very little lawn water. Its customers primarily water their lawns from ditches with pre-compact water rights. Eagle River serves lawns, but summer precipitation is more abundant and its board has a policy that water for flows in Gore Creek is more important than lawns, thus it limits lawn watering to three days a week in all years, with further restrictions in drought years.

In any event, I would expect that a demand management trigger or post-compact rights would have to be "voluntary," but with state incentives. A second storage trigger could be used to initiate water banking where post-compact users/states would pay irrigators to deficit irrigate or fallow to reduce Upper Basin consumptive use. This trigger could be the same as, lower than, or higher than a post-compact trigger. Let's assume it's lower, at an elevation of 3,550'. Since it would take time to implement a deficit irrigation/fallowing program, I assume the decision would be based on something similar to the 24-month study (a projection).

If the January or February 24-month study showed that the September Lake Powell level was projected to be below the 3,550' trigger, then participating irrigators would begin fallowing or deficit irrigation in April. I'm assuming the irrigation districts would need 6-10 weeks of advance warning. If conditions turned wetter, could deficit/fallowing be turned off (deficit maybe, fallowing probably not). If the January/February forecasts were above the trigger, but conditions turned very dry in the spring (2004, 2012), could we trigger deficit irrigation in June?

If water banking/demand management is a future option, we're going to have to explore these questions and many more in great detail.

## **2. Colorado River Basin Study Follow-Up**

I've attached a short paper prepared by Reclamation titled "Moving Forward to Address the Challenges Identified in the Colorado River Basin Water Supply and Demand Study." There are three basic categories of follow-up actions:

- State-led activities: Water banking, water supply augmentation (pipelines to distant places) and watershed management.
- Workgroups (with state, federal, NGO and provider representation: M&I conservation/reuse workgroup, agricultural conservation/transfers workgroup and

healthy flow workgroup. NOTE, Dave Kanzer is participating on the agricultural workgroup and Peter Fleming is on the healthy flows workgroup.

- Reclamation-led activities: Continuing climate science research, data and tool development (CRSS improvements) and tribal study and follow-up.

Everyone recognizes that the federal agencies could have a major role in the state-led activities and states will have a role in the federal-led activities.

REK/ldp  
Attachments



**CAP**  
CENTRAL ARIZONA PROJECT

**Issue Brief**  
Business Planning and Governmental Relations

## COLORADO RIVER SHORTAGE

If there is an official declaration of shortage in the Colorado River water supply, the Central Arizona Project (CAP) will be subject to reductions in Colorado River water because CAP holds a "junior" priority<sup>1</sup> water entitlement to Colorado River water among the Lower Basin states (Arizona, California, and Nevada). Other low priority Colorado River contractors in



Arizona, such as the Mohave County Water Authority, also will be subject to reductions during times of shortage. To prepare for possible shortages and to guide Colorado River operations during low reservoir conditions, the seven Colorado River Basin states and the Bureau of Reclamation (BOR) completed an agreement in 2007 ("Shortage Sharing Guidelines") identifying steps to be taken should a water shortage situation arise. In addition, CAP has worked with the Arizona Water Banking Authority to store excess CAP

water underground that will be made available to protect municipal and industrial users from suffering reduced supplies during shortages and to meet Arizona's obligations pursuant to Indian Water Rights Settlements.

### What is Shortage?

Each year, the Secretary of the Interior determines the Colorado River water supply availability conditions for the Lower Basin States in terms of Normal, Surplus, or Shortage. A Shortage condition is defined as "...insufficient mainstream water is available to satisfy 7.5 million acre-feet<sup>2</sup> (maf) of annual consumptive use in the Lower Division states." The Shortage Sharing Guidelines outline how and when the Secretary makes the annual water supply determination. The key factor for water supply determination is the amount of storage (as measured by water elevation) in Lake Mead. To date, a Shortage has never been declared. There are a series of conditions and steps that must occur before a Shortage declaration would be made.

### Lake Powell and Lake Mead

Lake Mead releases water to meet water deliveries in Arizona, California, Nevada, and Mexico, while Lake Powell is operated to help the Upper Basin meet its obligations to deliver water to the Lower Basin. As part of the Shortage Sharing Guidelines, water levels in these two reservoirs are now coordinated to allow better management of the Colorado River supply. Three factors impact the water levels in Lakes Powell and Mead:

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<sup>1</sup> The "Law of the River", interlocking Federal and State laws, inter-State compacts, court decrees, contracts, and international treaties, defined Arizona and CAP water priority. Arizona's total entitlement to Colorado River water is 2.8 million acre-foot (maf); CAP's 1.5 maf share of the total has junior priority status.

<sup>2</sup> An acre-foot is the amount of water it takes to cover an acre of land with one foot of water, about 326,000 gallons.



1. The uses in the Upper Basin States<sup>3</sup> - currently, these four states use about 60% of their entitlement to Colorado River water. The unused water flows to Lake Powell.
2. The hydrology of the Colorado River, such as the amount of precipitation that falls within the basin and the resulting runoff that flows into the river and reaches the reservoirs.
3. Colorado River reservoir operations.

One goal of the 2007 agreement is to balance storage between Lakes Mead and Powell. The idea is for the reservoirs to rise and, in the case of drought, fall together. This approach shares the water supply opportunities and risks among the Upper and Lower Basin States. The agreement creates a formula in which additional water in Lake Powell must be transferred to Lake Mead when Mead levels run low. When storage is roughly equal, the minimum required amount is released from Powell to Mead. When Powell has more storage than Mead, some additional water above the minimum requirement is transferred from Powell to Mead.

### **How would Arizonans be impacted if a Shortage were declared?**

If a Shortage is declared by the Secretary of the Interior, most Arizonans will not notice any impact to their daily lives. Arizona has an entitlement to 2.8 maf of Colorado River water - including both water ordered by CAP contract holders and "excess" water delivered to other users and for recharge<sup>4</sup>. CAP uses about 1.6 maf of Arizona's entitlement every year. The senior water right users who are mostly located along the Colorado River would not have their supply reduced. While CAP holds a junior priority within Arizona and will be subject to shortages, CAP would manage Shortage by first reducing the excess water deliveries and ceasing portions of its recharge operations. If additional reductions were warranted, CAP would limit its water delivery to agricultural customers, who have limited rights to CAP water and could turn to pumping groundwater or other sources. If reductions were to be required beyond this level, then CAP would begin to recover the excess water stored underground to protect existing municipal and industrial CAP customers from experiencing reductions in deliveries of CAP water and to recover water stored to meet Arizona's obligations pursuant to Indian Water Rights Settlements.



<sup>3</sup> The Upper Basin States are Colorado, New Mexico, Utah, and Wyoming.

<sup>4</sup> Excess CAP water is CAP water that is not ordered by long-term CAP contractors and any unused portion of Arizona's Colorado River entitlement delivered through the CAP system. Almost half of CAP deliveries in recent years (about 800,000 af) is considered excess water, with about 400,000 af delivered for recharge.

## Other Shortage Solutions

Water professionals throughout Arizona and the seven Basin states have spent many years managing this issue. In addition to the triggers and protections mentioned above, the Central Arizona Project is taking part in other programs that work toward making our water supply system more resilient to changes in climate and variable water levels. Some examples are:

- CAP is working on making efficiency improvements to the Colorado River delivery system.
- CAP, in partnership with Lower Basin water agencies, funded the construction of a new off-stream reservoir<sup>5</sup> to reduce losses.
- CAP is working on increasing runoff by participating in cloud seeding in Colorado, Wyoming, and Utah, and improving vegetation management along the River.
- CAP is finding ways to reuse water and increase our available supplies.
- CAP is a partner with the BOR and Lower Basin water agencies in the Yuma Desalting Plant. The Plant is treating agricultural drainage water so it can be reused to replace Colorado River deliveries.
- CAP along with BOR and the Basin States reached an agreement with Mexico to allow Mexico to store up to 260,000 af in Lake Mead until the earthquake damage can be repaired and Mexican agricultural users can effectively use their full entitlement. The additional storage could reduce the likelihood of a shortage declaration in the near term.



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<sup>5</sup> The Warren H. Brock (formerly Drop 2) Reservoir was completed in October 2010 and will be operational in 2011. The reservoir is located in California, along the All American Canal, near El Centro.



## Colorado River Shortage Process:

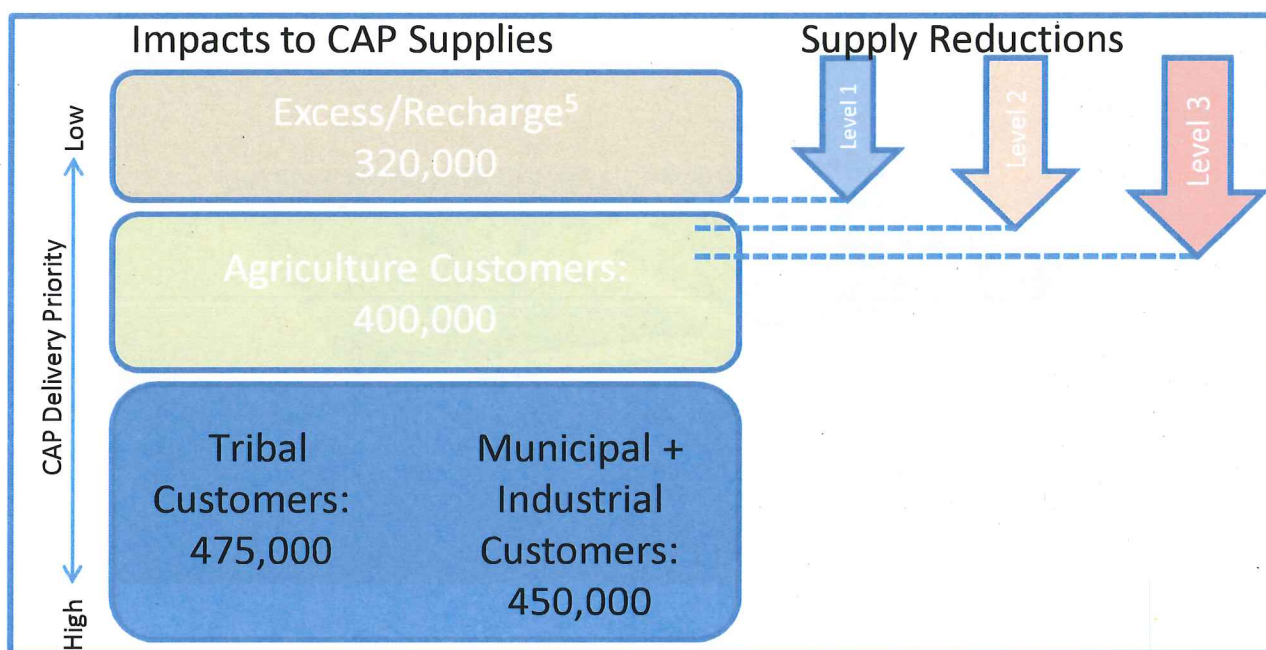
1. Shortage Notice: Water users will receive at least 12 months advanced notice of a shortage<sup>1</sup>.



2. Shortage Sharing: There are 3 levels of shortage reductions. Arizona bears the brunt of the reductions; with CAP taking most of the reductions.

Entity	Level 1 (1,075')	Level 2 (1,050')	Level 3 (1,025')
CAP <sup>2</sup>	Up to 320,000	Up to 400,000	Up to 480,000
Other Arizona <sup>3</sup>	0 to 32,000	0 to 40,000	0 to 48,000
Nevada	13,000	17,000	20,000
Mexico <sup>4</sup>	67,000	83,000	100,000

3. Impact to CAP Supplies:



- Notes:
1. USBR provides 24-month water forecasts, updated monthly.
  2. CAP's portion of shortage is related to water uses by other Arizona "on-river" users, which varies annually.
  3. Other Arizona water users's portion of shortage is based on their annual water usage.
  4. Mexico's share of shortage is subject to on-going negotiations.
  5. CAP Excess/Recharge priority includes ~ 35,000 af of turf, nursery, and other M&I type uses that lack a long-term contract.

For more information, please contact the Central Arizona Project Business Planning and Governmental Programs Office at 623-869-2150.



## Moving Forward to Address the Challenges Identified in the Colorado River Basin Water Supply and Demand Study

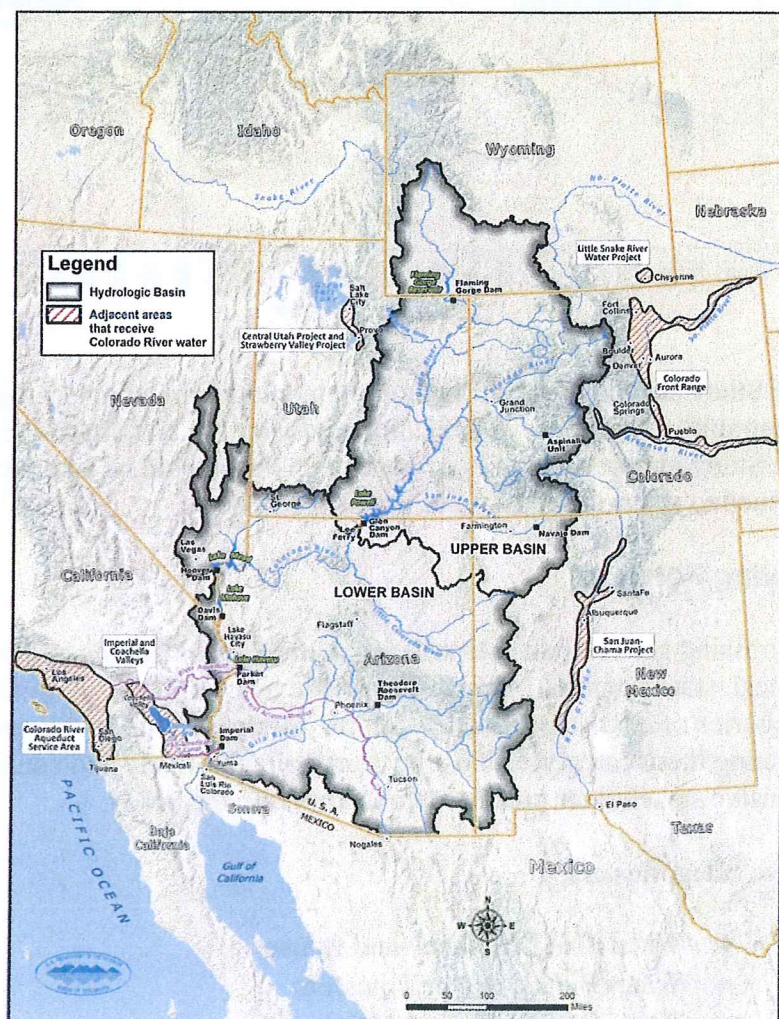
In 2012 the Bureau of Reclamation, in partnership with the seven Colorado River Basin States (Basin States), published the most comprehensive study of future supplies and demands on the Colorado River ever undertaken. The Colorado River Basin Water Supply and Demand Study (Study) confirmed what most experts knew: there are likely to be significant shortfalls between projected water supplies and demands in the Colorado River Basin (Basin) in coming decades.

Those that rely on the Colorado River and its tributaries are committed to approaching these future challenges with the same steadfastness that they have approached and overcome past challenges. Beginning today following the call to action of the Study and as a first step in that commitment, all that rely on the Colorado are taking initial steps — *working together* — to identify positive solutions that can be implemented to meet the challenges ahead.

### Phase 1: Stakeholder Teams Working Together — Verifying Potential Strategies for Water Conservation, Reuse, Transfers, and Healthy River Flows

Groups representing Federal, State, Tribal, agricultural, municipal, hydropower, environmental, and recreational interests are all engaged in a coordinated way to examine in more detail both the challenges we face together and the potential solutions that will work in the Basin. This effort will require innovative thinking, integration of many viewpoints, and a commitment to work in a positive and collaborative spirit. By working together, we will improve public understanding of the challenges faced in the Basin and identify the potential solutions that can help reduce future uncertainties and meet the significant challenges ahead.

This document sets out the framework for the first phase of action following publication of the Study and is intended to complement other State and Tribal efforts that will be undertaken in parallel processes.

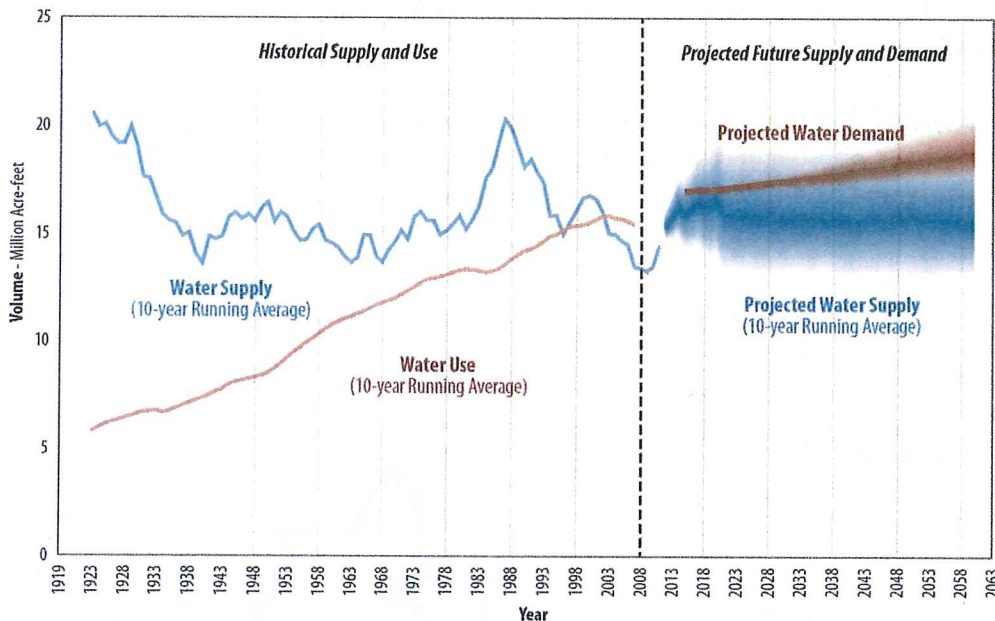




## Background

The Colorado River Basin Water Supply and Demand Study, conducted over the three-year period from January 2010 through December 2012, was an unprecedented joint effort by the Bureau of Reclamation (Reclamation) and the seven Colorado River Basin States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and is the most comprehensive basin-wide analysis ever undertaken within the Department of the Interior. Conducted in collaboration with a diverse range of stakeholders, the purpose of the Study is to define future imbalances in water supply and demand in the Basin through the year 2060, and to develop and analyze options and strategies to resolve those imbalances. The Study, a compilation of seven technical reports and two overview documents, is available in its entirety at

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



The Study confirms that without future actions, the Basin faces a range of potential future imbalances between supply and demand. A wide range of future imbalances is plausible and each of those imbalances results in the decline in the performance of Basin resources including water deliveries, hydropower, water quality, ecological, and recreational resources.

The Study also demonstrates the implementation of a broad range of options that can reduce Basin resource vulnerability and improve the Colorado River system's resiliency to low and variable hydrologic conditions. The Study identifies a series of next steps that should be taken to begin to discuss what actions should be pursued to ensure the sustainability of the system.

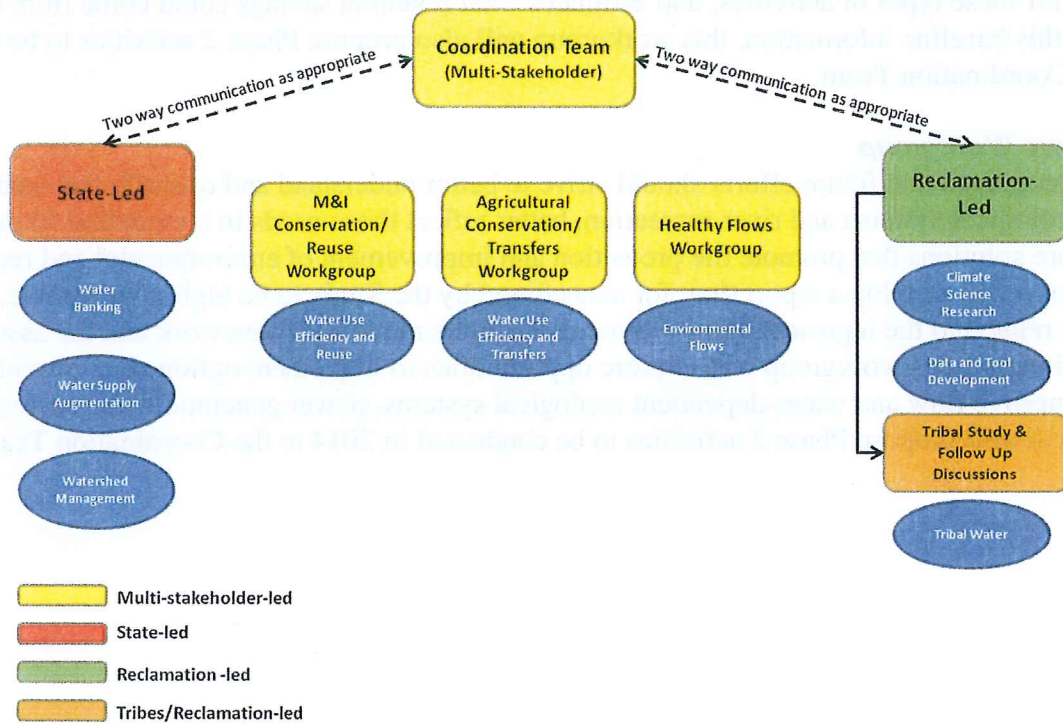
## Moving Forward

Addressing such imbalances will require diligent planning and collaboration that applies a wide variety of ideas at local, state, regional, and Basin-wide levels. With this in mind, a process has been designed to pursue the categories of next steps identified in the Study. Central to this process are partnerships and the recognition that pursuing these categories must be done collaboratively and continue to facilitate and build upon the broad, inclusive stakeholder process demonstrated in the Study.

These categories are:

- Water Use Efficiency and Reuse
- Water Banks, Water Transfers
- Water Supply Augmentation
- Watershed Management
- Tribal Water
- Environmental Flows
- Data and Tool Development
- Climate Science Research

Phase 1 of this process builds on findings for critical next investigations described in the Study and consists of the formation of three multi-stakeholder workgroups to investigate: 1) Municipal and Industrial (M&I) Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Healthy Flows to support ecological and recreational resources. Additionally, State or Reclamation-led activities will simultaneously pursue the other next step categories. For example, jointly with the Ten Tribes Partnership, Reclamation is pursuing a study related to tribal water use. This process is described in the following graphic. Categories named in the blue circles correspond with the categories described in the Study where next steps should be taken.



It is anticipated that Phase 1 will be completed within 2013, after which Phase 1 efforts will be reviewed, additional phases will be identified, and the process will be reassessed and modified as needed to facilitate anticipated further phases of work.

## Workgroups

Each workgroup consists of members with subject-matter expertise from various entities in an effort to bring important and different perspectives to the workgroup. Workgroup membership includes federal and state agencies, local municipalities, agricultural organizations and irrigation districts, Native American tribes and communities, non-governmental organizations, consultants, and other interested stakeholders. Each workgroup will be led by three co-chairs. A multi-stakeholder team (Coordination Team) will direct and review the efforts of the three workgroups. General descriptions of these groups' major activities within Phase 1 are provided below.

### M&I Conservation and Water Reuse Workgroup

M&I conservation and water reuse were common options in the strategies explored in the Study in providing a cost-effective solution for resolving imbalances in the near-term. This workgroup will collect information from municipalities relying on Colorado River water and prepare a report that quantifies each municipality's conservation and reuse savings from the initiation of conservation and reuse programs to date, documents



programs that have been successful to date, quantifies the amount of additional water savings each program estimates will be achieved by 2060, and estimates the anticipated impacts on Colorado River demands. From this baseline information, this workgroup will also propose Phase 2 activities to be conducted in 2014 to the Coordination Team.

#### ***Agricultural Conservation and Water Transfers Workgroup***

Agricultural conservation and voluntary water transfers can have many benefits and in particular promote flexibility in adapting to uncertain future conditions. This workgroup will collect information and prepare a report that quantifies agricultural conservation and transfers of Colorado River water (both in and outside of the Basin) that have occurred to date, documents programs that have been successful to date, lists any existing future plans for these types of activities, and estimates what potential savings could come from these existing plans. From this baseline information, this workgroup will also propose Phase 2 activities to be conducted in 2014 to the Coordination Team.

#### ***Healthy Flows Workgroup***

The Study recognized that future efforts should strive to better understand and quantify the needs of flow-dependent ecological systems and river recreation, better reflect those needs in a modeling framework, and further explore solutions that promote the protection and improvement of environmental and recreational flows. This workgroup will develop a report that, for areas found by the Study to be highly vulnerable, describes any uncertainties related to the representation of those areas in the modeling framework and the assumed flow needs. Additionally, this workgroup will explore opportunities to implement options that provide multiple benefits to improve flow and water-dependent ecological systems, power generation, and recreation. This workgroup will also propose Phase 2 activities to be conducted in 2014 to the Coordination Team.