Chapter 2
The *Moving Forward* Effort

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[2] Co-Chair of the Environmental and Recreational Flows Workgroup
[3] Co-Chair of the Agricultural Water Conservation, Productivity, and Transfers Workgroup

2 The *Moving Forward* Effort

The Colorado River Basin Water Supply and Demand Study (Basin Study) demonstrated that the implementation of a broad range of options can improve the Colorado River Basin's (Basin) resiliency to dry and variable hydrologic conditions and help lead to long-term sustainability (Bureau of Reclamation [Reclamation], 2012). Implementing such options requires diligent planning and collaboration that applies a wide variety of water management ideas throughout the Basin. With this in mind, the *Moving Forward* effort was designed to pursue several areas of the "next steps" identified in the Basin Study. Other areas are being advanced through separate Reclamation or State-led activities. Central to the *Moving Forward* effort is the recognition that pursuing these areas must be done collaboratively and with a broad, inclusive stakeholder process as demonstrated in the Basin Study.

Reclamation and the seven Colorado River Basin States[1] (Basin States), in collaboration with the Ten Tribes Partnership[2] and conservation organizations, initiated in May 2013 the *Moving Forward* effort, which includes participation by federal, State, tribal, and conservation organization representatives as well as other Basin stakeholders. The first phase of the *Moving Forward* effort, Phase 1, was funded by Reclamation and the Basin States and was completed in December 2014. This Report documents the outcomes of Phase 1 with contributed chapters from each of the multi-stakeholder workgroups formed as part of the effort. After the completion of Phase 1, Phase 2 will commence and build on the Phase 1 activities and outcomes. The structure of the effort will be reassessed and modified as needed to facilitate Phase 2 activities.

Figure 2-1 shows the areas of the "next steps" recommended in the Basin Study and whether they are being undertaken through the *Moving Forward* effort or by other State or Reclamation-led efforts. The Coordination Team, whose members are listed at the start of this chapter, guides and reviews the activities of the *Moving Forward* workgroups and receives periodic updates on the status of activities in these other areas in an ongoing effort to coordinate the activities of the workgroups.

2.1 Phase 1 Workgroups

A Coordination Team was formed in Phase 1 of the *Moving Forward* effort to guide and review the activities of the three workgroups, also formed as part of the effort. These workgroups are listed below:

- Municipal and Industrial (M&I) Water Conservation and Reuse Workgroup
- Agricultural Water Conservation, Productivity, and Transfers Workgroup
- Environmental and Recreational Flows Workgroup

The Basin Study found that, relative to the other options explored, water use efficiency in the M&I and agricultural sectors as well as water reuse were cost-effective solutions that could be implemented in the near-term. As such, it was recommended that workgroups in these areas be formed. The Basin Study was limited in its inclusion of options which specifically included objectives towards improving ecological and recreational resources, and a workgroup in this area was formed to further explore such options.

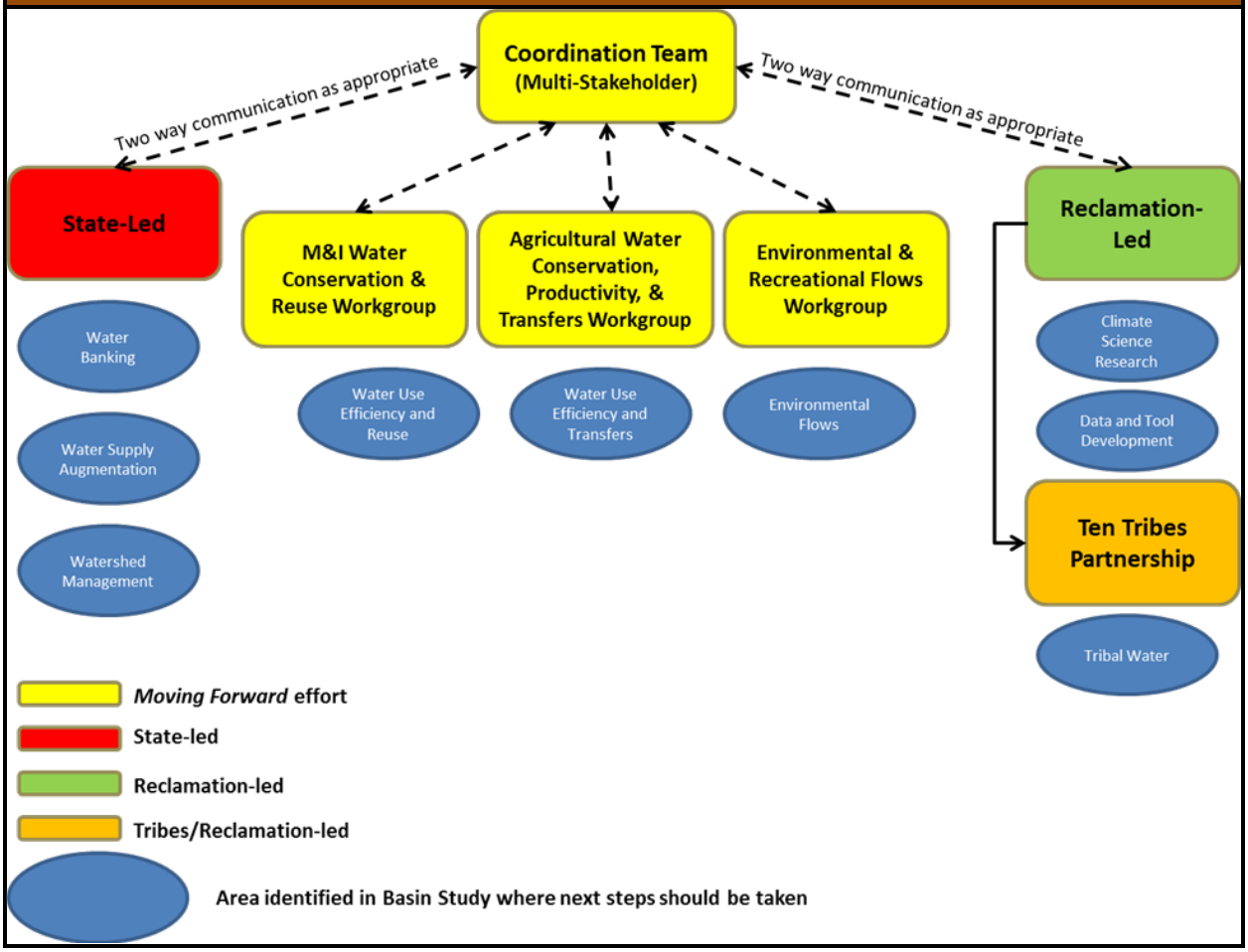
The overall purpose of these workgroups during Phase 1 was to further investigate these areas by documenting past and projected future trends and exploring the opportunities and challenges of various water management actions. Each workgroup identified potential future actions to address critical challenges related to projected water imbalances that provide a wide-range of benefits and have broad-based support.

Each workgroup is led by three co-chairs and consists of members with subject-matter expertise from various stakeholder entities in an effort to bring important and different perspectives to the workgroups.

[1] Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming

[2] Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Jicarilla Apache Nation, Navajo Nation, Quechan Indian Tribe, Southern Ute Indian Tribe, Ute Indian Tribe of the Unitah and Ouray Reservation, Ute Mountain Ute Indian Tribe

FIGURE 2-1
Organization of "Next Steps" Activities



Workgroup membership, listed at the beginning of each workgroup's chapter of this Report, includes federal and state agencies, local municipalities, agricultural organizations water districts, federally recognized tribes, non-governmental organizations, consultants, and other interested stakeholders. The Coordination Team is led by representatives from Reclamation and the Basin States. In September 2013, Reclamation entered into a contract with CH2M Hill to provide technical and administrative support for the *Moving Forward* effort.

The Coordination Team and workgroups used a collaborative problem-solving approach to complete their tasks and assist in the preparation of the Phase 1 Report. Chapters 3, 4, and 5 of this Report were contributed by each respective workgroup and reviewed by the Coordination Team. The workgroups met frequently, both in person and via webinar, during the approximately 18-month period needed to complete their Phase 1 activities, including preparing their chapters. The Coordination Team met, also in person and via webinar, to review the workgroup's completed tasks and the overall workgroup progress. The Coordination Team strove to coordinate the efforts of the workgroups with the recognition that some differences in their approaches remain.

The Phase 1 Report is intended to identify opportunities and potential actions that convey the perspectives of the workgroups regarding the role of their respective sector in being a part of the solution set needed to address the challenges identified in the Basin Study. This report is neither intended to make value judgments nor develop recommendations related to municipal and agricultural water conservation, reuse, transfers, or environmental and recreational flows.

2.2 Separate Efforts Led by the Basin States and the Bureau of Reclamation

Separate from the *Moving Forward* effort, Reclamation and the Basin States are simultaneously pursuing other areas of future considerations and next steps identified in the Basin Study. These efforts and the status of each are briefly described below.

2.2.1 Water Banking

Building on the Basin Study work related to Upper Basin water banking, the Upper Basin States of Colorado, New Mexico, Utah and Wyoming continue to explore the potential for water banking as a drought mitigation tool. The Upper Basin States have explored a wide variety of possible hydrology scenarios to understand possible durations and volumes of future water bank operations. To that end, the Upper Basin States have also analyzed reservoir capacities and operations and general feasibility questions regarding water conservation and banking. Moreover, in Colorado, the Colorado Water Conservation Board (CWCB) and a number of stakeholders are conducting a more detailed investigation of potential water bank participation, considering the differences based on type, size and management structures of ditch systems, irrigation methods, crop types and elevation. This Water Bank Working Group (consisting of the CWCB, the Colorado River Water Conservation District, the Southwestern Water Conservation District, The Nature Conservancy, and the Front Range Water Council) are conducting pilot studies and intensive field investigations to determine the benefits, impacts and possible water savings related to deficit irrigation of alfalfa and grass hay.

The Wyoming State Engineer's Office is also evaluating the feasibility of a "demand management" program within the Basin in Wyoming. The study is focusing on the development of voluntary water demand management strategies, including options and alternatives for a water bank program that can provide positive outcomes on a strategy for avoiding curtailment. This study will outline any information gaps, and the necessary technical, legal and policy questions and issues that will require future evaluation and actions by the State, whether through the State Engineers Office, Governor, or State Legislature working in concert with all of the stakeholders in the Basin.

2.2.2 Water Supply Augmentation

The possibility of future water supply and demand imbalances has been identified since the 1960's. Almost 40 years ago the study, "The Westside Study Report on Critical Water Problems Facing the Eleven Western States" (Reclamation, 1975), concluded that in spite of conservation, the Basin faces future water shortages unless its natural flows are augmented by more than 2.5 million acre-feet per year, or water-dependent Basin development is limited. In response to the promulgation of the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (Reclamation, 2007) in 2007 and the ongoing drought, the Basin States finalized the "Study of Long –Term Augmentation Options for the Water Supply of the Colorado River System" (Colorado River Water Consultants, 2008). Twelve potential long-term options for augmenting the Colorado River were evaluated against parameters related to water quality, technical implementation, environmental considerations, permitting, relative costs and projected water yield.

In March 2013 the Basin States Augmentation Workgroup began the development of a long-range augmentation plan. To aid in this effort the Central Arizona Water Conservation District (CAWCD) funded a study to evaluate new water supplies (above and beyond those already included in a supply portfolio) to augment the Colorado River that have a reasonable chance of being permitted/implemented, produce a reliable quantity of new water, and can be developed for a reasonable cost. This report will be used as one source of information for the Basins States Augmentation Workgroup to continue efforts to develop a long-range plan for augmentation of the Colorado River. The Arizona Department of Water Resources and the Upper Colorado River Commission co-chair this workgroup.

2.2.3 Watershed Management

Upper Basin Cloud Seeding

Orographic cloud seeding is a technology designed to enhance precipitation in winter storms with an inefficient precipitation process due to a lack of natural ice nuclei. The Wyoming Weather Modification Pilot Program (WWMPP) was conducted to assess the feasibility of increasing Wyoming water supplies through winter orographic cloud seeding. In the spring

of 2015, the Wyoming Water Development Commission (WWDC) will publish the final report on their multi-year WWMPP. This program has been unique among other state and federally-sponsored programs in that it has included a substantial component to evaluate the feasibility and effectiveness of cloud-seeding in three mountain ranges in Wyoming. Results released to date from statistical, modeling, and physical studies suggest a positive orographic seeding effect, over a winter season, on the order of 5 to 15 percent for seedable cases (WWDC, 2014). Due to these positive results, Wyoming will likely seek to continue and expand their weather modification program in the Basin as well as across the state. Throughout the course of the pilot program, numerous Basin entities have contributed funds to support and enhance the programs operation. To date, Wyoming has spent over $14 million statewide on the WWMPP. A 2006 study commissioned by the Upper Colorado River Commission found that optimizing existing seeding operations and starting new operations where optimal conditions exist, has the potential to increase Colorado River runoff (North American Weather Consultants, 2006).

Since 2007 the CAWCD, the Six Agency Committee of California, and the Southern Nevada Water Authority have been contributing funds to the States of Colorado, Utah and Wyoming for cloud seeding projects. The goal is to increase snowfall from winter storms generating more runoff. The additional water generated is for the good of the system not any individual entity. Since 2007, over $1 million has been distributed to Colorado, and over $800,000 each has been distributed to Utah and Wyoming for these projects.

In 2015 the three agencies plan for an additional $192,500 to be distributed to Colorado, an additional $136,500 to be distributed to Utah, and an additional $369,000 to Wyoming. In addition to the contributions of the three agencies, various other State and Federal agencies are contributing $543,000 to Wyoming. The total Wyoming funds of $912,000 will support continuation of activities as well as a transition of the existing program in the Wind River Range from a research based program to an operational program.

Hydrologic Effects of Mountain Pine Beetle

Unhealthy forests can result in many threats to a watershed including increased erosion and higher sediment loadings, decreased water quality, decreased reservoir capacity, and negative impacts to environmental and recreational resources. Forest health depends on a variety of factors, such as drought, and unhealthy forests are more at risk to disturbances such as fire, insects and disease. Coniferous forests in much of the Upper Basin are experiencing a profound and intense invasion by the mountain pine beetle. Though beetles are part of natural forest succession, this ecological disturbance is altering the view and function of many mountains, hills and valleys by infesting and killing much of the forest. Many questions have emerged about the overall hydrologic impacts associated with runoff timing, peaks and volume; snow collection, retention and scouring; and the overall hydrology and magnitude of change caused by the mountain pine beetle. The present knowledge of hydrologic changes resulting from vast pine beetle disturbances is based primarily on experiments conducted either at stand level or on smaller watersheds. Only anecdotal information exists on the impacts of large watershed and forest-wide disturbances, and concern is often expressed in extrapolating the experimental findings of smaller to larger scales. Much remains unknown about the site-specific influences the mountain pine beetle will have on the water yield to watersheds.

Tamarisk and Russian Olive Efforts

In May 2008 the Basin States entered into a Memorandum of Understanding with the Tamarisk Coalition to prepare an assessment of Tamarisk and Russian Olive control options and evaluate potential water savings related to each control option. The final Colorado River Basin Tamarisk and Russian Olive Assessment was released by the Tamarisk Coalition in December 2009 and contained eleven specific findings, identified a set of research questions, and listed potential demonstration projects in the Upper and Lower Basins.

In addition, studies are ongoing that explore the value of reducing consumptive losses of Colorado River water through the management of tamarisk. Recently completed research at the Cibola National Wildlife Refuge, through collaborative funding from the Basin States, shows that groundwater levels near the main-stem of the Colorado River are affected by tamarisk water consumption and that estimates of evapotranspiration by energy balance methods correlate well to groundwater level fluctuations.

2.2.4 Climate Science Research

Reclamation's Research and Development Office recently released new hydrologic projections that will help local water managers answer questions about future climate, stream flow, and water resources. The hydrologic projections were derived from new downscaled climate projections using the Coupled Model Inter-comparison Project (CMIP) Phase 5 data from the World Climate Research Program (Reclamation, 2014). The World Climate Research Program develops global climate projections through its CMIP roughly every 5 to 7 years. Results from CMIP Phase 3 were released in 2007 and were used in the Basin Study. Reclamation is currently evaluating the new projections to better understand how they are projected to impact the Basin and how they compare with the projections used in the Basin Study.

2.2.5 Data and Tool Development

Reclamation continually works to enhance its suite of modeling tools, including the Colorado River Simulation System (CRSS), and data to support such tools. As a follow-up to the Basin Study, The Nature Conservancy completed a project, funded by the Southern Rockies Landscape Conservation Cooperative, which explored modeling improvements to more accurately consider environmental and recreational flow needs in CRSS (Alexander et al., 2013). As future, specific project needs arise, the recommendations from this project will be considered if model enhancements are necessary to meet a proposed project's needs.

During the Basin Study, Reclamation and the Basin States committed to work together to (1) develop natural flows for the Little Colorado, Virgin, and Bill Williams Rivers, (2) modify CRSS to use these flows, and (3) explore the feasibility and usefulness of computing natural flows for the Gila River Basin and the feasibility and usefulness of incorporating the Gila River Basin into CRSS. The development of natural flows for the Lower Basin tributaries requires several steps including the recalculation of the consumptive uses and losses from 1971 to the present and the extension of the consumptive uses and losses from 1970 to 1906. Reclamation, in coordination with the Basin States, is currently working to recalculate the consumptive uses and losses for the Little Colorado, Virgin, and Bill Williams Rivers. It is anticipated that the recalculation of consumptive uses and losses for 1971 to the present and the extension back through 1906 will be completed by the end of 2016.

Though not specifically a Reclamation-led effort or a next step identified in the Basin Study, several related efforts are underway to understand consumptive use calculation methods in the Basin. The Upper Basin States and Reclamation are working to understand different consumptive use calculation methods available, or currently being used, in the Upper Basin. Additionally, the U.S. Geological Survey (USGS) is working closely with Reclamation on a publication, anticipated for release in 2015, to (1) compare and contrast USGS and Reclamation terminology and methods as they relate to the calculation of water use and (2) identify opportunities for increased collaboration and efficiency in the future.

2.2.6 Colorado River Basin Ten Tribes Partnership Tribal Water Study

Begun in late 2013, this study is a partnership with the Ten Tribes Partnership, whose members hold a significant amount of quantified and unquantified federal reserved water rights to the Colorado River and its tributaries. The study builds on the technical foundation of the Basin Study by further assessing water supplies and demands for these tribes and identifies tribal opportunities and challenges associated with the development of tribal water. This study is anticipated to be completed in 2016.

2.3 References

Alexander, C.A.D., E. Olson, J. Carron. 2013. Integrated Water Management in the Colorado River Basin: Evaluation of Decision Support Platforms and Tools. Final Report. Prepared by ESSA Technologies Ltd. and Hydros Consulting for the Colorado River Program of The Nature Conservancy. Boulder, Colorado.

Bureau of Reclamation (Reclamation), 1975. *The Westside Study Report on Critical Water Problems Facing the Eleven Western States.*

_____, 2007. *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead Final Environmental Impact Statement.*

_____, 2012. *Colorado River Basin Water Supply and Demand Study, Study Report.* December.

Bureau of Reclamation (Reclamation) and the National Center for Atmospheric Research, 2014. *Downscaled CMIP3 and CMIP5 Hydrology Projections.* Release of Hydrology Projections, Comparison with Preceding Information and Summary of User Needs.

Colorado River Water Consultants, 2008. *Study of Long –Term Augmentation Options for the Water Supply of the Colorado River System.*

North American Weather Consultants, Inc, 2006. *The Potential of Winter Cloud Seeding Programs to Augment the Flow of the Colorado River.* March.

Wyoming Water Development Commission (WWDC), 2014. *The Wyoming Weather Modification Pilot Program Level II Study.* Draft Executive Summary. December.