

The Role of Weather Modification in the Colorado River Basin States Process

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1. Background

In a May 2, 2005 letter to the Governors of the Seven Colorado River Basin States (Basin States, Parties) the Secretary of the Interior (Secretary) announced her intent to undertake a process to develop Lower Colorado River Basin (Arizona, California and Nevada) shortage guidelines and explore management options for the coordinated operation of lakes Powell and Mead. On June 19, 2005 the Bureau of Reclamation published a notice in the *Federal Register*, announcing its intent to implement the Secretary's direction.

On August 25, 2005 the Governors' Representatives for the Basin States wrote a letter to the Secretary expressing conceptual agreement in the development and implementation of three broad strategies for improved management and operations of the Colorado River: Coordinated Reservoir Management and Lower Basin Shortage Guidelines; System Efficiency and Management; and Augmentation of Supply. At the request of the Secretary, the Parties have continued their discussions relative to the areas of agreement.

The Parties have reached agreement to take additional actions for their mutual benefit, which are designed to augment the supply of water available for use in the Colorado River System and improve the water management in the Colorado River Basin. Augmentation concepts have been identified such as vegetation management, desalination, and Weather Modification (WxMod). States in the Upper Colorado River Basin (Colorado, New Mexico, Utah, and Wyoming) have a variety of operational and experimental WxMod programs in the Colorado River Basin. These programs are funded, operated, and regulated at the state and local level. The Parties have agreed to implement actions toward optimizing cloud seeding activities.

In an effort toward developing a long-term cooperative WxMod program in the Upper Basin, the seven Colorado River Basin States are working together under the following guiding principles:

- Appropriately designed winter season orographic WxMod programs can increase winter snowpack in the Colorado River Basin. Increases in snowpack can

increase the yield of the Colorado River by increasing runoff to the river, which augments the water supply in the entire Colorado River system.

- All Colorado River Basin States benefit from augmentation of the water supply in the Colorado River system. These benefits include: additional system storage to avoid or delay the onset of shortage conditions, increased power production, and increases in available water supply at local, regional, and basinwide scales.

- The science and operational data strongly suggest WxMod may be a cost-effective water supply augmentation strategy. However, further efforts to quantify the potential magnitude of increased snowpack and resulting increased runoff to the reservoir system from WxMod programs would be useful.

- Opportunities exist for the Basin States to augment Colorado River system runoff through a cooperative WxMod program. It is not the Parties intent to claim a right to any increase in water supply resulting from WxMod programs. Any water resulting from these programs would become water of the Colorado River System as defined by the "Law of the River" and state water laws would not be claimed as attributable to any one Party or Parties.

2. Water Year 2006 Trial Extension

The Southwestern Water Conservation District (SWCD) in the vicinity of Durango, Colorado has been performing WxMod through cloud seeding in its district on and off since the late 1970s. This program has historically been funded by the SWCD, and more recently with supplemental funds from the

Colorado Water Conservation Board (CWCB). In response to the drought in 2003 and 2004 New Mexican Water Users assisted Colorado's San Juan Mountains cloud seeding program with out-of-state funding. On January 31, 2006 the normal Water Year (WY) 2006 WxMod budget was exhausted for this program. An opportunity for water augmentation through cloud seeding in late winter existed as indicated by the area's snowfall climatology. The SWCD and CWCB welcomed additional funding to extend the program on a trial basis for one year. As part of Colorado River drought management activities, it was proposed that the Lower Basin States provide funding to extend operations in WY 2006. Although there are several WxMod projects in Colorado which were good candidates for a trial extension, the San Juan mountains were chosen because snowfall in the range was far below normal that year. NRCS Snow Survey graphs for the San Juan, Animas, Dolores, and San Miguel Basins in southwest Colorado were 54% of the 30-year average for the month of February 2006.

Colorado River contractors in the Lower Basin, comprised of the Six Agency Committee, the Southern Nevada Water Authority, and the Central Arizona Water Conservation District contributed \$15,000 each to this Trial Extension. Of the total, \$35,000 was spent for seeding and \$10,000 was spent for an evaluation component documented the success and runoff potentially made available by the late season trial extension. The SWCD contributed an additional \$7,000 for seeding. An agreement among those Lower Basin contractors and SWCD was executed in early March, 2006. The extension added 1,745 hours of seeding by 24 generators.

The five river basins in which seeding was extended include: the Dolores, La Plata, Animas, Florida, and Pine. The area identified by number 1 on Figure 1 shows the San Juan mountains program area. All parties were satisfied with the results of the seeding. Descriptions of the success of this Trial Extension were presented at the June, 2006 Weather Modification Workshop held in Boulder, Colorado.

3. Water Year 2007 Proposed Activities

Building on the success, goodwill and momentum gained in the 2006 Trial Extension, in July 2007 the Basin States reached tentative agreement regarding proposed activities to be implemented in WY 2007. The vehicle for implementation would be an agreement among the Lower Basin contractors and each of the states of Colorado, Utah, and Wyoming. The form of the agreement is a base agreement with an Annual Supplement which would be developed for each WY that activities are proposed.

As part of the cooperative nature of this arrangement, all of the Basin States contribute to the programs, either: direct funding, administrative and regulatory assistance, data collection, management and sharing, land and right-of-way access, technical and logistical assistance, or public education and outreach.

Activities proposed for WY 2007 represent modest extensions of existing programs without acquiring additional equipment. Activities should increase runoff to the Colorado River System reservoirs as well as build cooperation and local support for future programs. The Lower Basin contractors have each pledged approximately \$75,000 for the proposed activities.

In Colorado it is proposed that operations be extended in the Blue River, Roaring Fork, San Juan and Grand Mesa areas, and the initiation of studies. In Utah extensions are proposed for the High Uinta and Southern Utah Projects, and in Wyoming funds are being provided for the lease of equipment for data collection in the Wind River Range Target area and Green River Basin (Figure 1).

4. Five-Year Plan for Weather Modification Activities in the Colorado River Basin

The Five-Year Plan (Plan) endeavors to identify long-term goals, gather data, conduct preliminary planning for long-term projects, gain experience by using different methods, leverage funding of activities, balance current operations with research to prepare for long-term operations, implement what is being learned from other ongoing studies, and coordinate activities with the Basin States' process.

