CLIMATE CHANGE
Through the Eyes of Water Managers

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Severe droughts experienced throughout the Southwest in the past decade have captured the attention not only of climate scientists: water managers began to rethink their long-term management plans as well. *Southwest Hydrology* interviewed several water managers from across the region to find out how their agencies are responding to the information coming from climate scientists.

Generally, managers agree that current climate predictions indicate certainty that temperatures will increase in the Southwest, although the magnitude remains unclear, and that both the magnitude and direction of precipitation change is unclear. Charlie Ester, manager of water resources operations at the Salt River Project (SRP) in Phoenix, has seen predictions for both a wetter and drier Arizona. Either way, the variability of climatic conditions is expected to increase. Jeff Johnson, senior hydrologist at Southern Nevada Water Authority (SNWA), said the predictions in his area do not suggest less water so much as changes in the timing and form of precipitation—more rain and less snow. These changes, he said, may be more of a concern in the Upper Colorado River Basin where reservoirs are smaller and may end up spilling more often, as opposed to in the Lower Basin where there is more usable storage.

Using Climate Data to Manage Water

Denver Water is one of the larger water suppliers in the Rocky Mountain West to actively look at the impacts climate change could have on its system. As part of the recent update of its long-range plan, the utility employed a simple climate change scenario in order to evaluate safety factors in the plan's section on water supply risks.

> *Water managers will have to deal with greater extremes in the water system.*

Because climate models show general agreement that temperatures are likely to increase in the Denver region and less agreement about how precipitation amounts might change, Marc Waage, water resources director of Denver Water, said the utility evaluated only a temperature change scenario. Change in streamflow that might occur from various changes in temperature were estimated from an EPA report (Nash and Gleick, 1993) in order to determine the affect on Denver's water supply. To estimate the change in demand resulting from higher temperatures, the utility used USGS regional climate change studies to estimate the change in evapotranspiration rates for turf. Putting these estimates together, Waage's group calculated that the result could be as much as a 12 percent decrease in dry year water supply and a concurrent 6 percent increase in water use.

At SRP, the major water provider for the Phoenix metropolitan area, scientists are compiling research and analyses to determine a consensus on the predicted impacts of climate change on the Salt/Verde river system, SRP's primary water supply. The findings will be used with tree-ring records of historic drought to simulate the future water-supply resilience of the system. In addition, the utility is upgrading its supplemental groundwater pumping capacity to attempt to return to its historic pumping capacity, which had been gradually reduced as urban sprawl isolated the once agriculturally based distribution system.

SNWA used historical precipitation and streamflow data to project likely future conditions in the Colorado River system. However, Johnson admitted that the recent drought was unexpected—the magnitude of variability was not in their projections—consequently, stochastic data will be used in the future to help build in the needed variability. SNWA is less concerned about climate change impacts on their groundwater supplies—currently just 10 percent of their total supply—because climate change effects manifest themselves much more slowly in groundwater than in surface water supplies.

According to Johnson, the value of climate data to SNWA is in showing the need to manage water resources more proactively in that region. Tree-ring studies are revealing the variability that could occur, which might not be captured in current

Elephant Butte Reservoir on the Rio Grande in southern New Mexico near the height of the 2004 drought.

analyses. While the predicted climate changes have not yet caused the utility to make significant changes to current policies or plans, the utility pays close attention to the information that comes out.

Tucson Water is working with the Climate Assessment for the Southwest (CLIMAS) program at the University of Arizona to try to better understand the climate change trends and long-term resource challenges that may potentially develop. In planning for a future of increasing uncertainty and variability in water supplies, Tucson Water is building multipurpose underground storage and recovery facilities to bank excess renewable supplies and provide water for both "normal" years and those times when resource shortages may develop.

Climate Data Wish List

All utilities would like more certainty about what is going to happen to their particular water source, and no doubt climate scientists would like to be able to tell them. Waage at Denver Water provided a specific list of the kind of information he would like to see in the future:

- More information on what changes in timing and annual volume of streamflow could be expected.
- Better understanding of the changes in precipitation in the West, particularly at the watershed scale.
- A hydrologic model for the basin that incorporates climate data to more carefully analyze the effects of various climatic regimes and potential management strategies.
- Better understanding of what climate change means to watersheds in terms of land cover. This includes the direct effects of vegetation change, as well as indirect effects such as the proliferation of the pine beetles that are killing trees in large regions.
- An unbiased entity to review the climate change arguments used by skeptics and believers alike and objectively evaluate what is known and what is predicted, in order to improve the confidence of upper management to make significant climate change-related operational and management decisions.

Photo: Brent Tanzy, USBR

At SRP, Ester wants to know how the summer monsoon will respond in a warmer world. If it strengthens, as some predictions indicate, the utility could benefit from increased runoff. Improved understanding of the response of the ecosystem across the watershed to climate change would also be helpful for determining how future runoff may be generated.

Ralph Marra, water resources administrator at Tucson Water, said the increasing importance of Colorado River water as the utility's primary source of renewable supply means that future climate trends that relate to that watershed are of great interest. Furthermore, improved understanding of possible local climate change trends would help the agency better prepare for changes in the onset of the peak demand season and its duration.

The Bottom Line

Tony Willardson, associate director of the Western States Water Council, predicts that storage will become the primary issue related to western water supplies. Whether due to population increase, climate change, Endangered Species Act-related requirements, or other circumstances, water managers will have to deal with greater extremes in the water system. Drought management plans are critical for large facilities, as current projections may not take into account the kind of variability that will be experienced in the future.

The water managers all agreed that the future inevitably will bring greater variability in water supplies. Marra spoke for many in concluding, "As a water provider, our practical and immediate focus needs to be on the near- to mid-terms, but it is important to keep a watchful eye on the long term so that we can maintain flexibility and respond to change."

Reference

Nash, L.L., and P.H. Gleick, 1993. The Colorado River Basin and Climate Change: The Sensitivity of Streamflow and Water Supply to Variations in Temperature and Precipitation, prepared for the U.S. EPA, report EPA-230-R-93-009.