Gauging the Vulnerability of Big Projects

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Water transfer projects play a critical role in today's urban and agricultural communities in the Southwest, even though they are not usually the sole source of water. How vulnerable are they to the effects of aging infrastructure, imbalances in supply and demand, climate change, and environmental needs?

Aging Infrastructure

Many of the big water transfer projects are now 70 years old or more. Are they holding up? For the most part, yes—these projects were built to last. While annual maintenance costs are not insignificant (a few million to hundreds of millions of dollars), none of the operators reported surprises from parts wearing out sooner than expected. Colorado-Big Thompson (CBT) is still using its original pumps after half a century; the pumps of the Colorado River Aqueduct were rebuilt in the late 1980s and now produce about 12 percent more than their original design.

Many operators cited the value of proactive maintenance in keeping their systems going. California's State Water Project (SWP) noted that as its system aged, maintenance shifted from being time-based (serviced at fixed intervals) to condition-based, utilizing annual assessments.

Perhaps the biggest area of infrastructure vulnerability is the more than 1,000 miles of levees in the Sacramento-San Joaquin Delta. They were built without strict engineering standards decades before the Central Valley Project (CVP) and SWP and are irregularly maintained, primarily by local districts. Their original purpose was to reclaim marshland for agriculture, but the levees are now critical for preventing salt water intrusion into the fresh water that is pumped to Southern California—thus they are important to both CVP and SWP operations. The destruction of New Orleans' levees by Hurricane Katrina focused attention on the deteriorating state of California's levees and their vulnerability to a flood or earthquake: one bad breach could impact water quality for millions of people.

Supply and Demand

Are the water transfers able to meet the demand? Generally, yes, even through recent drought years. The 2002-2003 drought spurred the Colorado River Basin states to come up with a plan for sharing future shortages, but no shortage

The Sutter Bypass levee in the Sacramento-San Joaquin Delta failed in the 1997 floods.

has yet been declared. 2003 was the only year that CBT deliveries were based on supply rather than demand, and San Juan-Chama diversions reached a 10-year low.

This year in California, however, supply is not keeping up with demand. Severe drought and court-ordered limits to pumping from the Sacramento-San Joaquin Delta have reduced allocations to SWP and CVP contractors to around 35 percent of requests, and farmers are suffering. California's Department of Water Resources (DWR) is seeking additional surface storage and new ways to move water through the delta to address the situation (see page 24), but implementation of any solution will take time.

Yearly variations in demand from the water transfer projects are generally less than 10 percent, although there has been some shift from agricultural to urban use. Growing communities are seeking alternative water sources rather than expecting more from existing projects. In many cases this is because the projects are permitted for specific quantities: the Central Arizona Project (CAP), for example, carries all of the Colorado River water available to it, and Arizona's allocation of that water is not likely to change.

But most of the projects do not operate at full capacity, leaving open the option of adding other sources of water or moving large amounts quickly if needed. CBT shares its additional capacity with the smaller Windy Gap project, and Metropolitan Water District of Southern California expects to increase its supply of water from the Colorado River Aqueduct through transfers between other agencies.

Climate Change

Project operators agree that the most certain prediction about climate change impacts in the West is that the water supply variability will increase. Many feel that big water projects are better equipped to handle increased variability because their water supplies come from larger areas and they generally have more storage.

Photo: California Department of Water Resources

While operators tend to think current climate predictions are not certain enough or detailed enough to be useful for their specific area, most have done some modeling to consider the impacts of less water on their systems. Modeling efforts range from simply reducing the supply 10 to 15 percent for a set period to using tree-ring-based paleoclimate reconstructions that look at water supply variability over 2,000 years. The results help evaluate storage capacity needs under different scenarios.

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Based on model results for the Colorado River Basin and Arizona's status of having lowest priority for Colorado River water, CAP's approach to prepare for climate change is to store, store, store underground every extra drop of water it can, including from additional sources such as treated effluent. Other projects also are seeking to increase storage, although most operators report they feel adequately prepared to manage climate change impacts.

California's DWR is less optimistic. As stated in the Draft State Water Project Delivery Reliability Report for 2007, future water deliveries will be impacted by climate change, which has already altered hydrologic conditions in the state. The report says that delivery reliability will continue to erode if no actions for improvement are taken. An 82-year simulation of potential climate change modeled by DWR using current methods of conveying water through the delta and existing court-ordered pumping restrictions showed annual SWP deliveries during multiple dry

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years fell to around 35 percent of the maximum delivery designated in long-term contracts—as is occurring this year.

Environment

How much of an impact do environmental concerns have on water transfer operations? It depends on the project. Those that consist primarily of constructed systems—canals and pipelines—have been least impacted. For example, CBT and CAP report that no changes to their operations have resulted from environmental needs.

Projects that use natural waterways as part of their conveyance system are experiencing the greatest impacts from environmental concerns, especially in drought years.

- California's SWP and CVP deliveries are severely reduced this year to protect endangered fish in the delta.
- In the Rio Grande basin, a 2002 district court decision gave the U.S. Bureau of Reclamation discretion to withhold water from contractors in order to supply water for the endangered Rio Grande silvery minnow, a ruling that was later modified to allow Reclamation to lease San Juan-Chama water from willing contractors for Endangered Species Act (ESA) needs.
- Users of Colorado River water have not been required to make significant changes in their operations due to environmental concerns, yet all are participants in the Lower Colorado River Multi-Species Conservation Program designed to meet environmental and human needs and prevent a California-delta-type situation from developing.

Approval of new projects is clearly affected by an environmental awareness not present decades ago. ESA requirements forced major changes to the design and construction of the yet-to-be-completed Animas-La Plata project. The project was significantly scaled down, all non-Indian irrigation uses were eliminated, and allowed depletions were reduced. The groundwater transfer proposed by the Southern Nevada Water Authority (see page 30) is currently undergoing scrutiny by state and federal agencies to determine how much water could be removed from basins without causing environmental damage; whatever amounts are approved will be subject to future reduction if impacts are observed to develop.

So how vulnerable are big projects? According to their operators, many are in quite good shape. But two of the biggest, California's CVP and SWP, lost about two-thirds of their water this year because of drought and environmental needs. Even though the state has been proactive about predicting climate change impacts and has long been aware of the deteriorating ecological health of the delta, a crisis developed. Those who not only consider but take action to prepare for future challenges of aging infrastructure, climate change, and environmental needs will be in the best position to face them.