

FEATURE

Reimagining Water Infrastructure for a Changing California

Heather Cooley



California has made tremendous strides in reducing demand through water efficiency improvements, diversifying its water supply portfolio, adopting green infrastructure and encouraging residents to plant climate-appropriate gardens and landscapes, like this one in Sacramento. We must build on these successes to enhance resilience in the face of a hotter, drier future and more intense floods and droughts. Source: California Department of Water Resources.

WATER IS THE LIFEblood OF CALIFORNIA, PROVIDING for the household needs of nearly 40 million people and supporting the health and viability of the state's aquatic and terrestrial ecosystems, one of the most productive agricultural regions in the world, and an economy that would make it the fifth largest after the United States, China, Japan, and Germany.

For much of the 20th century, California's water

supply strategy has relied on building large reservoirs and conveyance systems to store and divert surface water and drilling ever deeper wells to tap declining aquifers. This approach has brought many benefits but has also come at great social, economic, and environmental costs. Moreover, these traditional water supplies are tapped out. Even in wet years, the state's major rivers are overallocated and major aquifers

severely overdrafted. Dry years intensify these issues.

Persistent water challenges, the severe drought, and the intensifying effects of climate change highlight the vulnerability of California's water systems and the need for new approaches. Infrastructure will continue to play a major role in maintaining the reliability, quantity, timing, and quality of California's water supply, but we must look beyond traditional definitions of infrastructure. We must adopt a more expansive definition of infrastructure—one that prioritizes water conservation and efficiency, embraces non-traditional water sources, and values green infrastructure. These strategies typically provide greater water supply and other benefits at lower cost. In addition, they are far less controversial than building new reservoirs or expanding existing ones.

Fortunately, we are already seeing progress. California households, businesses, and farmers are adopting more water-efficient technologies and practices and water managers are diversifying their water supply portfolios. Without these efforts, our current challenges would be much worse. Demands on limited water supplies even higher, and ecosystem destruction more severe. But we can and must do more in the face of a hotter, drier climate and more frequent, intense droughts.

Water Efficiency

As supply options have become more limited and costly, water efficiency is increasingly recognized as less expensive and faster to implement. Further, it often results in co-benefits such as reduced energy use and improved water quality. Water efficiency improvements can be achieved with a wide range of technologies and practices that reduce water use without affecting the benefits water provides.

In the urban sector, such efficiency improvements include installing high-efficiency devices as well as replacing lawns with low-water use plants and installing drip irrigation and smart irrigation systems. Agricultural efficiency measures include precision irrigation equipment, improvements in soil health and retention, and integration of soil moisture and weather data into irrigation schedules. Additionally, new technologies and practices can help reduce losses in water conveyance and delivery systems.

As evidence of the progress already achieved, California water use has seen a dramatic "decoupling" from population and economic growth in the past 40 years. Between 1967 and 2018, the population doubled, and gross state product increased by nearly a factor of six, while water use increased by just 18%. This trend was due to improvements in urban and agricultural efficiency, as well as shifts to higher-value crops and less water-intensive commercial and industrial activities.

Even with this progress, California's water efficiency

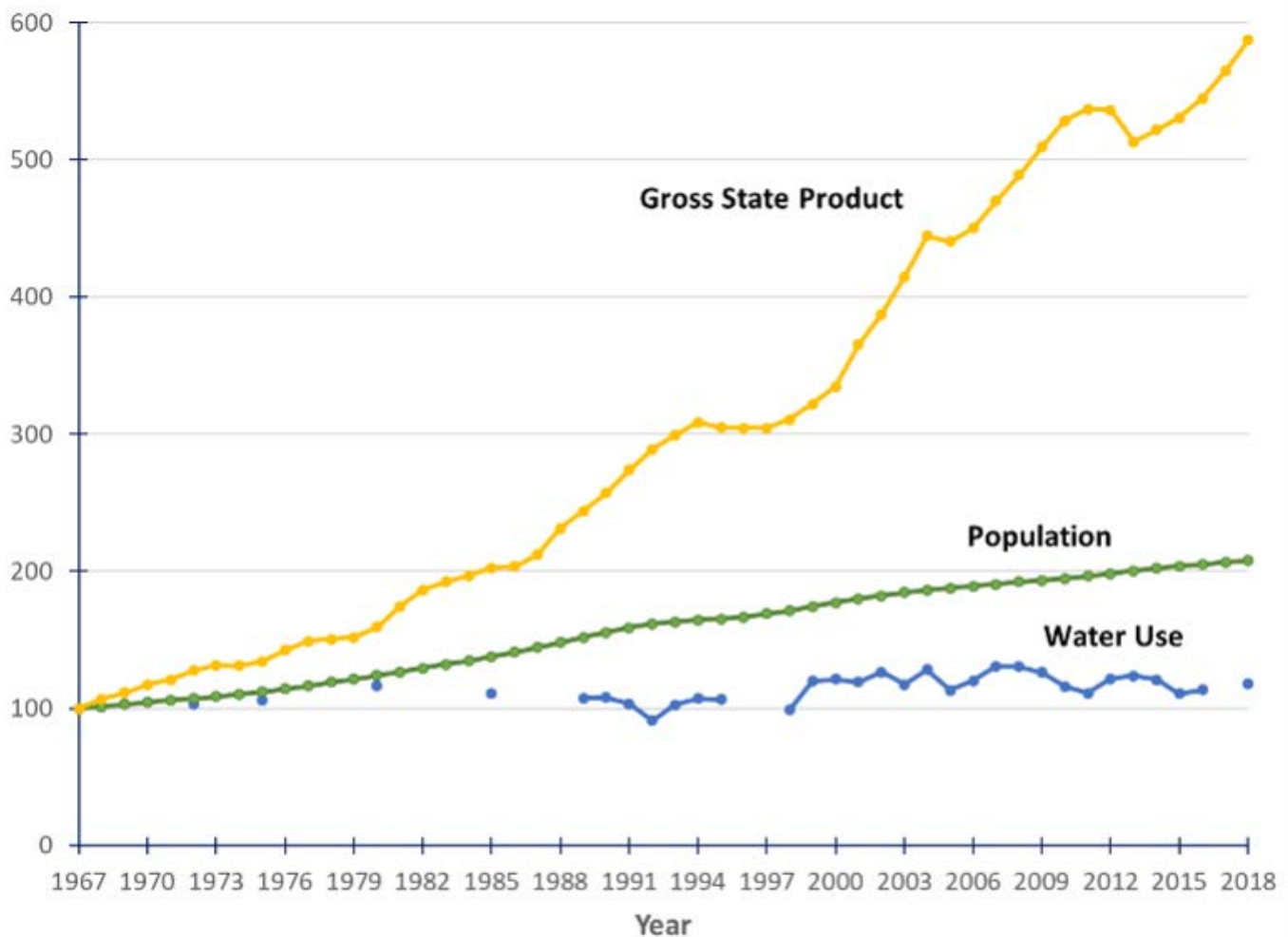
potential remains large. A recent [Pacific Institute](#) analysis estimates that upgrading homes, businesses, and institutions in California to the standards required for new developments would reduce urban water use by 2.0 million acre-feet per year (AFY), or 30%. Upgrading homes and businesses with available leading-edge technologies and practices that are not yet mandated could cut urban water use by 3.1 million AFY, or 48% (Cooley et al. 2022). These efficiency opportunities can be found across the state but are greatest in the most populated parts of the state, i.e., the South Coast hydrologic region, followed by the San Francisco Bay and Sacramento River hydrologic regions.

Agriculture can also significantly improve water-use efficiency. While data are limited, previous efficiency studies suggest that agricultural water use could be reduced by 5.6 million to 6.6 million AFY, [while maintaining productivity and total irrigated acreage](#). These savings represent a reduction in the amount of water withdrawn from rivers, streams, and groundwater aquifers, resulting in improvements in water quality and the timing and amount of instream flows and reductions in energy use and greenhouse gas emissions, among other benefits. Some of these savings, ranging from 0.6 million to 2.0 million AFY, represent reductions in consumptive use that make water available for other beneficial uses or can be left in storage. Drip irrigation, for example, reduces unproductive evaporative losses, and the water saved can be put to other uses.

Non-Traditional Sources of Water

California communities have also made progress to diversify water supplies through non-traditional sources like water reuse and stormwater capture. Since 1970, for example, the reuse of municipal wastewater in California increased by more than 300% to 728,000 acre-feet in 2020. Additionally, a growing number of communities are integrating stormwater capture into their water supply portfolios, with the added benefits of reducing flooding, improving water quality, and greening urban environments. Desalination, both brackish and seawater, is also expanding.

Communities across California can build on recent successes to further diversify their water supply portfolios with non-traditional water sources. For example, just 23% of municipal wastewater generated each year is currently beneficially reused. While some of the municipal wastewater treated and discharged in waterways is needed to support instream flows and other environmental uses, a new Pacific Institute analysis finds that an additional [1.8 million to 2.1 million AFY of municipal wastewater is potentially available for reuse in California](#). Of this amount, nearly three-quarters are currently discharged to marine environments and



California's population and economic productivity has surged since the middle of the 20th century. Increases in water use have been comparatively modest. Still, there is room for increased water efficiency. Source: Heather Cooley

recognized as a high priority for future reuse. The same study found that the stormwater capture potential in California's urban areas overlying public supply aquifers ranges from 580,000 AFY in a dry year to 3.0 million AFY in a wet year. This potential exists across scales—at the community, neighborhood, and even parcel scale—each of which will be essential for it to be realized.

Green infrastructure

Infrastructure has been traditionally defined as human-made physical structures and facilities like pipelines and treatment plants. There is growing recognition of the critical role of nature, including forests, floodplains, and wetlands, in supporting water systems. As a result, the term “green infrastructure” has emerged. This is more than a shift in terminology. In 2016, Governor Brown signed AB 2480, declaring that source watersheds are “integral components of California's water infrastructure” and making their maintenance and repair eligible for the same forms of financing as other water collection and treatment infrastructure.

Green infrastructure projects are being implemented across California, and many are helping communities respond to a hotter, drier climate and intensifying droughts. Los Angeles, for example, is replacing some paved areas with rain gardens and other forms of green infrastructure to capture, treat, and store stormwater while simultaneously supporting a healthier environment. Likewise, in June 2022, Governor Newsom launched a new beaver restoration program within the [Department of Fish and Wildlife](#) that builds on the successes of projects implemented by native Tribes, non-governmental organizations, and others. From storing water on the landscape and improving water quality to creating habitat complexity, beavers have been hailed by the Department as “[an untapped, creative climate solving hero that helps prevent the loss of biodiversity facing California.](#)”

Persistent Challenges, New Opportunities

Persistent water challenges, the ongoing severe drought, and the intensifying effects of climate change highlight

the vulnerability of California's water systems. They also offer a new opportunity to rethink state and local water policies and strategies. Communities throughout the state are rethinking water "supply and demand" and increasing investments in green infrastructure, water conservation and efficiency, water reuse, and stormwater capture. Laudable progress has been made, but much more can be done to provide both effective drought responses in the near-term and permanent water-supply reliability and other co-benefits for the state. ■

Persistent water challenges, the severe drought, and the intensifying effects of climate change highlight the vulnerability of California's water systems and the need for new approaches.

Heather Cooley (hcooley@pacinst.org) is director of research at the [Pacific Institute](https://www.pacificinstitute.org/).



AWRA WEBINAR WEDNESDAY!

May 24, 2023 | 1:00 - 2:00 PM ET



Is the Maternal Wall Causing a Critical Leak in the STEMM Pipeline?

REGISTRATION IS OPEN!

Free = AWRA Members; \$25 = Non-members

Featuring:

Isabel Torres, Co-founder & CEO | Mothers in Science