

Plumbing California



California's Pipe Dream

A heroic system of dams, pumps, and canals can't stave off a water crisis.

By Joel Bourne

Photograph by Edward Burtynsky

On a blistering day in the megalopolis that is southern California, Shivaji Deshmukh of the Orange County Water District offers me a cup of cool, clear water that just yesterday was swirling around in an Anaheim toilet bowl. We're standing outside the second largest water-reclamation facility in the world, a high-tech assemblage of micro-filters, membranes, and UV lights that every day recycles 70 million gallons of Orange County sewage into water so clean it's almost distilled. "It's OK," Deshmukh reassures me, casually taking a slug from his own cup. "It's the same technology they use on the space station."

After spending the past century building one of the most elaborate water-delivery systems on the planet, replete with giant pumps and thousands of miles of pipes and canals, California has come to

this—akin to the last desperate act of lifeboat-bound sailors drinking their own bodily fluids. The reasons are multiple and complex, but the bottom line is that the state's world-renowned plumbing is now perilously stressed. A three-year drought has drained most of the state's major reservoirs to their lowest levels in nearly two decades, forcing mandatory water restrictions for many residents. And warming temperatures have been shrinking the all-important snowpack in the Sierra Nevada, the largest storehouse of surface water in the state.

The biggest and weakest link in the system is the Sacramento-San Joaquin Delta, a former 700,000-acre marsh that has been drained, diked into islands, and farmed for more than a century. Much of the land has subsided, and many islands now sit more than 20 feet below sea level, creating California's own little slice of Holland in the middle of the Central Valley.



Photograph by Edward Burtynsky

Southern California draws much of its water from the Sacramento-San Joaquin Delta, which was diked and divided into farms more than a century ago. Many of the aging levees are at risk of failure.

The delta is also the state's hydraulic heart. Water flows in through two great arteries: the Sacramento and San Joaquin Rivers. Much of it is then pumped south via two massive, man-made rivers—the Central Valley Project and the California Aqueduct—and therein lies the problem. Sea level rise combined with more severe storms now threaten to topple the weaker levees and flood the lowest islands, inundating farmland and poisoning the big delta pumps with salt water from San Francisco Bay. A major earthquake—already overdue in the area—could take out hundreds of miles of levees in seconds, slashing water supplies for two-thirds of Californians. Experts say it could take years to put California's Humpty Dumpty hydraulics back together again.

More immediately, water exports from the delta have been partly to blame for crashing populations of protected chinook salmon and tiny delta smelt, forcing court-ordered cutbacks on water deliveries and leaving some Central Valley farms high and dry. In large protests and in lawsuits, farmers are demanding that they be given precedence over the fish. All the while the population of southern California continues to increase by more than 200,000 each year.

"The way the system works now is a disaster," says Lester Snow, California's secretary of natural resources. "The majority of water for the state's economy is coming out of critical habitat for endangered species. Every year there are more restrictions on that water."

The Sacramento-San Joaquin Delta has become such a bottleneck that last fall Governor Arnold Schwarzenegger and the California legislature hammered out the most sweeping overhaul of the state's aging water infrastructure in nearly half a century. The suite of new laws mandates water conservation and attempts to restore the delta ecosystem and secure reliable water supplies for the state's growing population. It also resurrects a proposal that's been controversial for 30 years—a giant, ten-billion-dollar ditch known as the Peripheral Canal that would bypass the delta altogether. For decades, northern Californians have seen the mammoth project as just one more water grab by the state's crowded, parched south. Southern Californians see it as, by and large, the key to their continued prosperity and survival.



Photograph by Edward Burtynsky

As developments such as Discovery Bay increase in the Sacramento-San Joaquin Delta, so does the flood hazard. More than a million people now live behind delta levees.

If built, the Peripheral Canal would be the latest link in a Rube Goldberg system of pumps, pipes, dams, tunnels, and canals constructed over the past century that now slake the thirst of more than two-thirds of the state's population. The system also waters nearly all the state's eight million acres of irrigated cropland as well as the tenth largest economy on Earth—in a climate that varies from temperate rain forest in the northwest to true desert in the south. It's probably no coincidence that Goldberg, a cartoonist famous for drawing absurdly complex machines, began his career as a water and sewer engineer for the city of San Francisco.

The reason behind the convoluted system is simple math. Roughly 70 percent of California's available water falls as rain or snow in the less populated north. Meanwhile, 80 percent of the demand lies in the southern two-thirds of the state, much of which gets just a few inches of rain a year. Former governor Pat Brown, who some 40 years ago built the California Aqueduct to connect the delta to southern California's cities, said he did so to "correct an accident of people and geography."

But as anyone familiar with the state's fractious water history will tell you, southern California's ever swelling population was no accident. Rather, it was the result of numerous audacious water projects designed to keep people coming. "The value of our homes, businesses, and the security of our jobs all depend upon an ample water supply," shouts a 1928 government film made to whip up support for an aqueduct from the Colorado River. "If we are to survive and to grow, we must have the water that will enable us to maintain our mastery of the desert!"



Photograph by Edward Burtynsky

Once the city's main water source, the Los Angeles River is now a concrete channel fed by storm drains. City residents rely on water piped in from hundreds of miles away.

That mastery began in the early 1900s, after shallow aquifers and seasonal rivers could no longer sustain Los Angeles. Out of desperation, city engineers began buying up land and water rights in the Owens Valley, east of the Sierra Nevada. In 1913 they completed the 223-mile-long Los Angeles Aqueduct, which sent the entire flow of the Owens River south to the growing city. Within a decade Owens Lake became a dust bowl, and the desert scrubland of the San Fernando Valley was worth millions. The infamous water grab—fictionalized in the 1974 film *Chinatown*—addicted Los Angeles

to water imports and inspired in the rest of the state a deep-seated mistrust of the city that lingers to this day.



Photograph by Edward Burtynsky

Steamboats once plied Owens Lake, before Los Angeles diverted the Owens River into an aqueduct. Dust from the dry lake bed is now a major source of air pollution.

The heyday of California water development began in the late 1930s with construction of the colossal Central Valley Project, or CVP. To get water from the wet north to the dry south, the federal Bureau of Reclamation took advantage of the fact that the state's two largest rivers, the Sacramento and San Joaquin, funnel vast amounts of runoff from the High Sierra into a shared delta the size of Rhode Island. By building a big pumping station in the delta at Tracy and connecting it to nearly 500 miles of canals south of the delta, the CVP became a lifeline for the Central Valley. Today it waters more than 10 percent of the entire country's irrigated farmland and enables California to produce fully half the nation's fruits, nuts, and vegetables.



Photograph by Edward Burtynsky

An 82-mile-long lifeline, the All-American Canal links California's Imperial Valley to the Colorado River. This new, concrete-lined section saves 22 billion gallons of water a year over its leaky, earthen forerunner.

The 1960s brought the State Water Project (SWP), which includes the Oroville Dam, another pumping plant near Tracy, and the 444-mile-long California Aqueduct. The SWP now serves 23 million Californians, from north of the Bay Area to the Mexican border, and irrigates 755,000 acres of farmland.



Photograph by Edward Burtynsky

Tractors kick up dust in the Imperial Valley, where rainfall averages three inches a year. Irrigation enables California's farmers to grow half of all U.S. vegetables, fruits, and nuts.

The Peripheral Canal was supposed to be the system's final link, a liquid superhighway around the delta's slow-moving twists and turns. But the state ran out of money, the federal government wanted no part of it, and the growing environmental toll of the previous big water projects sapped political support. In 1982 northern Californians defeated a referendum on the project in a landslide. It was a dead issue—until a three-year drought and a sardine-size fish brought the state to its knees.

Not since the endangered snail darter briefly held up the Tellico Dam in Tennessee during the 1970s has there been such a monumental mismatch. In one corner: the delta's two mighty pumping stations, marshaling a total of nearly half a million horsepower. In the other corner: a silvery fish that lives a year or two at best, requires plenty of cold, clean water, and exists nowhere else on Earth. A 2009 trawl survey netted the fewest smelts ever recorded—less than 2 percent of the number counted in 1993, when the fish was first declared endangered. Chinook salmon had plummeted as well. Invoking the powers of the Endangered Species Act, a federal court placed limits on the pumps at Tracy in an attempt to save the fish.

The cutbacks may have helped the salmon and smelt, but they've been disastrous for farmers such as Joe Del Bosque, whose spread lies in the hard-hit Westlands Water District, west of Fresno. Del Bosque and other Westlands farmers received notice at the start of the 2009 growing season that they would get no water from the Central Valley Project. As a result, nearly half the district—some quarter million acres—is now growing tumbleweeds and dust devils instead of cantaloupes, canning tomatoes, onions, or any of the 50 other crops usually raised in the district. Officials in the farm town of Mendota, the "Cantaloupe Center of the World," organized food drives to help the hungry as the jobless rate hit 40 percent.

The drama has fomented large protests and rants against the Endangered Species Act. But local economist Jeffrey Michael, who studies Central Valley employment at the University of the Pacific in Stockton, says the smelts aren't a major cause of the misery. A dependence on seasonal farmwork and the shuttering of several large packing plants has caused Westlands to suffer a high jobless rate for years. "Even when they had full water allotments, unemployment was at 30 percent," Michael says.



Photograph by Edward Burtynsky

Year-round sun, mild winter temperatures, and millions of gallons of water from the Colorado River and underground aquifers make the desert bloom in the Coachella Valley at the foot of the Santa Rosa Mountains. Agriculture is big business in the valley, where grapes, citrus, dates, and dozens of row crops bring in half a billion dollars a year.

Del Bosque, for his part, says farmers can "roll with the punches. We can roll with weather, decreasing prices, government red tape. But without water—we can't roll with that punch. It's a knockout punch for us."

The Peripheral Canal, he believes, would disentangle his water supply from the delta—and from the endangered fish. Others say it could also protect the state from another knockout punch, this time from Mother Nature, that could paralyze its vast plumbing in an instant.

The Sacramento-San Joaquin Delta sits just east of the Hayward Fault, one of the most dangerous earthquake zones in the country. Geologists now say that the area has a two-out-of-three chance of being hit by a major quake in the next 30 years. Many of the islands in the central and western delta are protected by levees with foundations shoveled up by Chinese laborers in the late 1800s. A catastrophic earthquake could liquefy hundreds of miles of levees in a matter of seconds, allowing seawater to flood a huge swath of the delta and shutting off the pipes for months until a patch could be built.

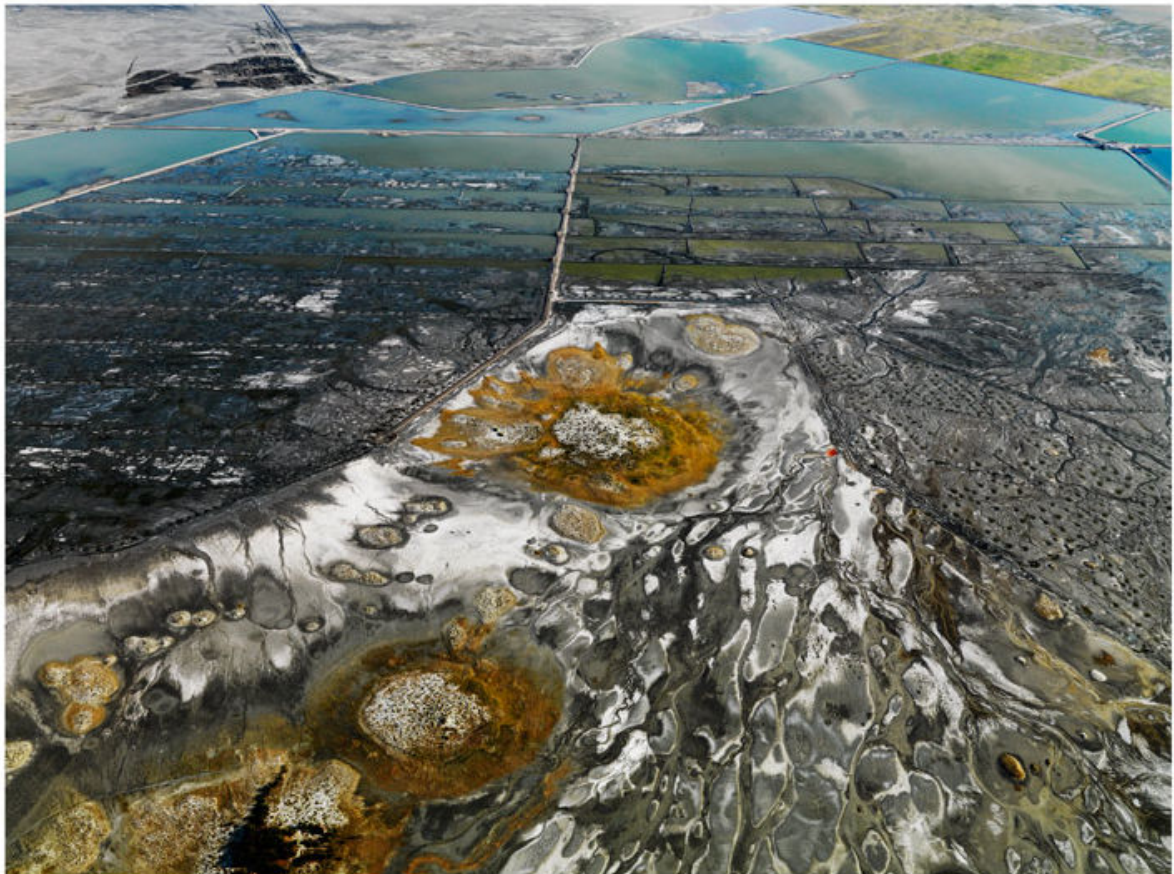
Even without an earthquake the levees are increasingly vulnerable because of the continued subsidence and sea level rise. A run-of-the-mill winter storm in 2006 nearly flooded several islands, requiring heroic efforts to save them. In two recent reports, researchers from the Center for Watershed Sciences at the University of California, Davis, and the Public Policy Institute of California documented the extreme vulnerability of the delta, warning that the average island now has a 90 percent chance of flooding in the next 50 years.

"This is the dead meat of the delta," says Jeff Mount, an author of the reports, as he sweeps a finger across a map of some 60,000 acres of farmland. "This is going to be aquatic habitat at some point in time, I'm 99 percent certain."

Some fisheries biologists now believe building the Peripheral Canal could also improve the delta's ecosystem—as long as the fish were guaranteed adequate water. Some of the lowest islands could be allowed to flood, providing habitat and food for smelt, salmon, and other native species. But the Peripheral Canal is still such a hot topic that it wasn't mentioned explicitly in any of the water legislation passed last fall—even as those bills opened the door for its construction. The canal's future now lies with the delta's water exporters, who must develop a plan for restoring smelt and salmon

habitat before they can legally increase pumping. If their plan is approved, water agencies in the Central Valley and southern California have pledged to foot the bill for construction.

"A new canal could take the pressure off the delta, but it could also be the kiss of death—because you'd have the capacity to take all the water," says Leo Winternitz, a water-policy expert with the Nature Conservancy. "But there's an old Chinese proverb: 'Unless you change direction, you're apt to end up where you're headed.' And where we're headed in the delta is not a place we want to be."



Photograph by Edward Burtynsky

Sand, salt, and scrub color the dry bed of Owens Lake, poster child for the unintended consequences of water-transfer schemes. In 1913 the entire flow of the Owens River was diverted into the Los Angeles Aqueduct, eventually draining the lake dry and creating the largest source of air particle pollution in the nation. Portions of the lake have been reflooded to protect the health of people living downwind.

To get a firsthand look at the fish that started all the fuss, I dropped by the University of California, Davis, smelt lab, which sits within a few hundred yards of the pumps that are partly responsible for the species' predicament. There, biologist Joan Lindberg is raising thousands of delta smelts in a

captive-breeding program as a possible safety net against extinction. A graduate student pulled an adult smelt from a tank and held it in the palm of his hand—a frisky, wide-eyed, bullet-nosed fish that quickly leaped back into the tank.

After the brief tour I thanked Lindberg and got back in the car, but before I could drive away she ran up to my window with a concerned look on her face. "If you think about how we settled the West, it was all limitless, limitless resources," she said, rather out of the blue. "But now we're running up against limits, and people don't want to think about that."

Therein lies a crucial part of the solution, water experts say, one much simpler and closer to home than a massive plumbing patch: learning to live within the water resources of an arid landscape. Fully 70 percent of residential water in southern California is used outside the home for lawns, pools, and other niceties. Reducing that demand by using drought-resistant plants and recycling wastewater offers the fastest and cheapest potential water savings in the state.

To that end, the raft of new laws passed last fall calls for cities to cut water use 20 percent by 2020. Water agencies that supply farms must develop water conservation plans and monitor groundwater usage. And in November, California voters will decide whether their state—already crippled by a \$20-billion budget deficit—should take on another \$11 billion in debt to fund new water-storage projects, conservation efforts, wastewater recycling, and desalination plants.

Even without the bond, southern Californians are focused on increasing efficiency and developing new drought-proof sources. San Diego, which pipes in 90 percent of its water, is considering following Orange County's example and opening its own wastewater-recycling facility. And the largest desalination project in the country broke ground late last year in Carlsbad, which will daily produce 50 million gallons of potable water from 100 million gallons of seawater. Despite their high cost and energy use, some 19 more plants are on the drawing board in the state.



Photograph by Edward Burtynsky

Like many of the 120 golf courses in the Palm Springs area, the Eldorado Country Club uses half a million gallons of water a day on average to keep its emerald turf in top condition. The club retrofitted its irrigation system a few years ago to use recycled wastewater, but it's still waiting for its supply from the local water agency.

Back in Orange County, the proffered cup of purified sewage is still in Shivaji Deshmukh's hand. The thrum of the big pumps forcing all that wastewater through the micromembranes nearby ripples the surface of the clear liquid. I take a gulp. It's bold, bright, and refreshing. It tastes like California's future.



Photograph by Edward Burtynsky

Grass is not an option in Salton City, which survives on water pumped in from the Colorado River. With 20 million more residents expected in California by 2050, the quest for water is never over.