

# The 'power of aridity' is bringing a Colorado River dam to its knees



*Alex Hager*

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*KUNC*

Bob Martin, who manages hydropower at Glen Canyon Dam, is grappling with the reality that generators could soon be shut off because of low water levels in Lake Powell. The Colorado River faces a growing supply-demand imbalance, and normal operations at the dam may suffer.

Deep in the bowels of the Glen Canyon Dam, an awful lot stays the same. Under the mass of concrete it's pleasantly cool all year long, even when the Arizona sun beats down above. As the decades march on, the machinery inside

remains unchanged, too.

The dam's innards are a time capsule of 1960s engineering. Bolts as thick as a forearm hold together the hulking metal casing for hydroelectric generators. Here, the Colorado River surges through turbines, producing power for about 5 million people across seven states.

Now, the Colorado River is on the decline, and the dam faces threats that could soon render it useless after decades as a symbol of American engineering achievement.

In a room that evokes the inside of a submarine, Bob Martin opened a heavy door to reveal one of those turbines. A gleaming silver cylinder whirred along inside.

"This is all original," he said. "This is like pulling your grandpa's 1964 Cadillac out of the garage and it's in the same condition it was in 1964. That's the world class maintenance that we've done – generations have done – at Glen Canyon."

Martin is deputy power manager for the U.S. Bureau of Reclamation. He oversees the hydroelectric facilities within the dam, and has a front row seat to the threats they face.



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Climate change has cut deep into the Southwest's water supply, and policymakers in the seven states that share the river have failed to agree on a plan to significantly reduce demand. That has left Lake Powell, held back by Glen Canyon Dam, at less than a quarter of its capacity.

The Colorado River is shrinking at the hands of climate change. About 23 years of drought have reduced its water supply, and policymakers in the seven states that share the river have [failed to agree](#) on a plan to significantly reduce demand. That means record-low water levels in the nation's second-largest reservoir – Lake Powell – which is held back by the Glen Canyon Dam.

At just 24% its total capacity, Powell barely has enough water to keep hydroelectric turbines spinning. Electricity

output has already decreased because of weaker flows, and if water levels drop any lower, they would fall below the hydroelectric intake and allow air pockets into the turbines, a process called cavitation. At that point, running the generators could cause irreparable damage.

"The thought, honestly, of these being quiet, goes against everything," Martin said over the roar of the turbine.

"Anybody in hydropower, their whole career is based on the reliability of these units. So to come into a power plant being quiet would be very, very disturbing for me."

Martin describes his generation of Glen Canyon Dam workers as carrying the torch left behind by those who built the concrete behemoth, but the climate reality has put that in serious jeopardy.

## **From hypothetical to possible**

Lake Powell bears a lot of responsibility. Beyond its [role in power generation](#), it holds water for millions of people and sprawling fields of crops downstream. The reservoir's ability to follow through on either of those key duties might soon disappear.

Below the hydropower intake is the pipe which allows water to pass from Lake Powell to the river on the other side. Water levels could conceivably drop below that, too. At that point,

the only pass-through would be a set of four rarely-used backup tubes near the bottom of the concrete. Those tubes, known as the "river outlet works," were originally meant to be a failsafe pr to pass water in high flow years, and aren't wide enough to carry the legally required amount of water from one side to the other.

A [century-old agreement](#) mandates that the Upper Basin states of Colorado, Wyoming, Utah and New Mexico must deliver a specific amount of water downstream to the Lower Basin states of California, Arizona and Nevada each year. The bulk of that water [starts as high-mountain snow](#) in the Rockies. Because winter snowpack varies widely year to year, the Upper Basin states resolved to add some insurance in the form of Lake Powell. Since the 1960s, it has served as a way to bank excess during wet years, and ensure enough would flow to the Lower Basin during dry years.



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Glen Canyon Dam started holding back water in 1963. Water policy analysts say its architects never expected reservoir levels to drop this low. Now, the dam could lose hydropower production as early as summer 2023.

The reservoir provided that reliable supply until climate change began to [supercharge drought](#) across the Southwest starting in 2000. Since then, abnormally dry conditions have plunged the region into its [worst drought](#) in 1,800 years. Some scientists warn that the dry conditions are not temporary, and that the region should prepare for ongoing aridification instead of hoping for the return of wetter weather.

The effects of those conditions show up in regular forecasts from Reclamation. Every month, the agency releases a "24-

Month Study" with projections of reservoir levels for the next two years.

Over the past few years, the increasingly bleak forecasts have instilled a new sense of alarm among those responsible for keeping crops green and kitchen faucets flowing. Water levels continue their steady downward creep, and the point at which they fall below the hydropower intake draws nearer.

Reclamation's [most recent study](#) was predictably grim. Data shows water dropping below the hydropower intake as soon as June 2023. In response, Reclamation announced December 2 that it would cut back on the amount of water released from the reservoir, part of a drought response plan agreed upon by state water agencies in 2019.

"The adjusted releases are designed to help protect critical elevations at Lake Powell until the spring runoff materializes," the agency said in a press release. The West's reservoirs typically see a temporary boost from melting snow each year, but Powell would need many consecutive years of above-average runoff to move away from the brink of hydropower cutoffs.



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Bob Martin, who manages hydropower at Glen Canyon Dam, said his generation of dam workers is carrying the torch left behind by those who built it. But the Colorado River's supply-demand imbalance has put that in serious jeopardy. "To come into a power plant being quiet would be very, very disturbing for me," he said.

In October, the agency [filed plans](#) to study future releases, signaling that steeper cuts may be on the way in 2023 and 2024. A draft of that plan is expected to be released in spring 2023.

Over the past few years, water managers have responded to Powell's dropping levels with a [patchwork](#) of [emergency measures](#). Upper Basin states have tapped into other reservoirs upstream to stave off Lake Powell's decline and keep its hydropower turbines running.

Those smaller reservoirs, scattered hundreds of miles upstream of Powell, are also finite. That leaves water managers with few options once they deplete backup supplies.

Kyle Roerink, director of the nonprofit Great Basin Water Network, said Reclamation may have to abandon hydropower at the Glen Canyon Dam, drill new, lower pass-throughs for the Colorado River, and perhaps decommission the dam entirely.

“I think what this signifies is that the architects of the dam never expected us to be at this precipice, to be at this juncture where we are considering such drastic actions and new engineering designs to the dam,” Roerink said.



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Bob Martin, who manages hydropower at Glen Canyon Dam, shows the effects of cavitation on a decommissioned turbine. When air pockets enter hydroelectric equipment, they cause structural damage. Water managers have scrambled to keep Lake Powell's water levels above the hydropower intake, an effort to stave off cavitation.

In August, Roerink's group was among those to [highlight risks](#) to the river outlet works, asking Reclamation to make expensive and unprecedented modifications inside the dam itself. In August, the agency said it would speed up studies on the future use of those bypass tubes. Any changes to releases from Powell will put new pressure on Lake Mead, the reservoir which stores water for use in the Lower Basin. Similar threats to hydropower at Mead's Hoover Dam become more acute with each change to releases from Powell.

At this point, it's likely that broad changes to water demand won't come until 2026, when the current set of guidelines for managing the river are set to expire. States are [on the cusp](#) of renegotiating those rules, and discussions promise to be contentious.

"I think these next couple of years are going to be so important," Roerink said. "How do we rewrite the wrongs of the past? How do we ensure a stable future for our fellow Americans, tribes and folks in Mexico as well?"

## **The end of an era?**

The Glen Canyon Dam was constructed during a wave of dynamic industrial progress. When it first started holding back water in 1963, the nation was in the throes of the space race. The Western U.S., particularly its Sun Belt, was experiencing a boom in population growth. Building a dam to wrangle some of the region's water was seen as existentially important to the area's success.

In footage produced by the Bureau of Reclamation around the time of the dam's construction, a narrator straight out of Mad Men central casting stares into the camera.

"The story of winning the Great American West has been, essentially, a story of its dams," he says in a mid-Atlantic accent. "For without water, controlled in abundance, few of the cities, farms, industries, and recreational facilities that have made the west the El Dorado of our day, would have been possible."

Dressed in a gray blazer and thin necktie, the narrator describes the Herculean construction task over footage of workers dangling above the river and gargantuan construction trucks belching smoke as they haul loads of rock around the site.

"[The Glen Canyon Dam] will be the second highest dam in the United States," he says, "the fourth largest concrete structure in the world, and one of the greatest construction

projects of the 20th century."



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Rail tracks, part of a system to cart away rock during the construction of Glen Canyon Dam in the 1950s and 60s, recently popped above water for the first time in decades thanks to rapidly-dropping levels in Lake Powell.

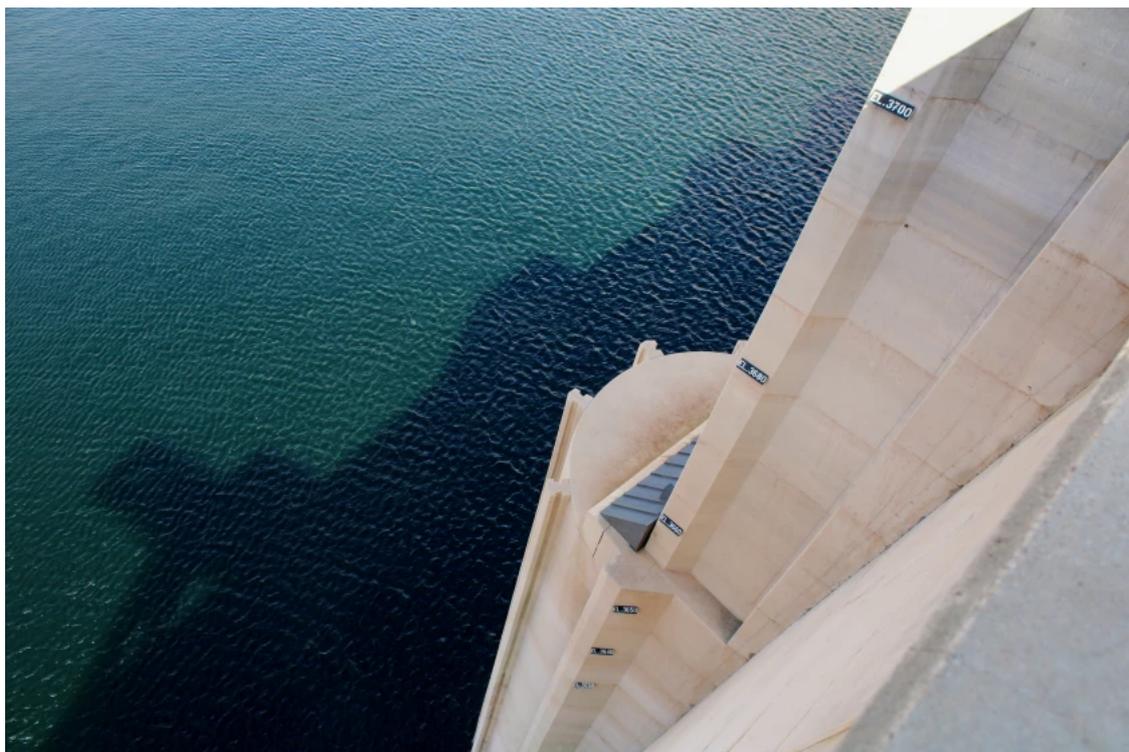
The government's effort to develop faucet-like control of the Colorado River saw a massive infusion of money and a sharp pickup in speed after World War II, said Sarah Dant, a history professor at Weber State University in Utah.

"It's providing jobs. It's taming a wild river. It just seemed like a win-win-win all the way across," Dant said. "If one dam is good, ten dams is better. That attitude that we're conquering the arid West, we're making the desert bloom, that was this

really powerful sense of accomplishment."

The dam itself remains a relic of that era. Along the hallways encased by the dam's concrete wall, beige tiles and art-deco details hint at the bygone decade during which it was born. The curved gray monolith still stands imposingly in the canyon, more than 700 feet tall and about four football fields across.

But from the top of the dam, signs of drought provide a stark reminder of the changing river pressed against it. A vertigo-inducing peer over the edge reveals a line of water level markers below. Every 20 feet, they show where the water used to be. Even lower, a series of markers placed ten feet apart come to an abrupt stop, with the shimmering blue-green surface of Lake Powell still more than a hundred feet below.



Markers on the side of the dam once tracked the elevation of Lake Powell. With the nation's second-largest reservoir at 24% of its original capacity, water now falls below the lowest marker.

A flotation ring, the kind you're supposed to throw to someone who fell in the water, is bolted to the waist-high wall. Here, it seems entirely vestigial. With water levels this low, it's hard to imagine anyone surviving a tumble over the edge. Down below, a rusty set of rail tracks is peeking out from a rock shelf near the edge of the water. They once helped cart rock away from the dam construction site before the creation of the reservoir.

All of these changes at Lake Powell are rare glimpses into the way the abstraction of a Western water crisis is visible.

In most places, crops still grow because water management agencies keep delivering amounts determined before this millennium's drought. In cities, showerheads still run because local governments have steadily taken strides to conserve water, stretching finite supplies across growing populations.

But the crisis at the Glen Canyon Dam is an example of a forced shift to the region's relationship with water, Dant said.

“I think it's this very stark and obvious indication that we have so long not understood the power of aridity,” she said.

Even John Wesley Powell, the explorer for whom Lake Powell is named, warned that the development of a lush, green West would have its limits. In his 1878 “Report on the Lands of the Arid Region of the United States,” [Powell hinted](#) that the settlement of the arid West would have to look different than the green East.

Those in power chose not to listen because the drive to settle the West was so potent, Dant said, “And we've been putting off this reckoning with aridity for a long time now.”

The consequences of that attitude are coming home to roost, setting in motion changes to life in the West, and creating the kinds of tense confrontations that line that path.

*This story is part of ongoing coverage of the Colorado River, produced by KUNC in Colorado and supported by the Walton Family Foundation. KUNC is solely responsible for its editorial coverage.*