

Officials fear 'complete doomsday scenario' for drought-stricken Colorado River

[Joshua Partlow](#) December 1, 2022 at 6:00 a.m. EST



A camper parked along Lake Powell in Big Water, Utah. Scientists fear the lake's water level could reach a low that would make power generation at Glen Canyon Dam halt. (Joshua Lott/The Washington Post)

PAGE, Ariz. — The first sign of serious trouble for the drought-stricken American Southwest could be a whirlpool.

It could happen if the surface of Lake Powell, a man-made reservoir along the Colorado River that's already a quarter of its former size, drops another 38 feet down the concrete

face of the 710-foot Glen Canyon Dam here. At that point, the surface would be approaching the tops of eight underwater openings that allow river water to pass through the hydroelectric dam.

The normally placid Lake Powell, the nation's second-largest reservoir, could suddenly transform into something resembling a funnel, with water circling the openings, the dam's operators say.

If that happens, the massive turbines that generate electricity for 4.5 million people would have to shut down — after nearly 60 years of use — or risk destruction from air bubbles. The only outlet for Colorado River water from the dam would then be a set of smaller, deeper and rarely used bypass tubes with a far more limited ability to pass water downstream to the Grand Canyon and the cities and farms in Arizona, Nevada and California.

Such an outcome — known as a “minimum power pool” — was once unfathomable here. Now, the federal government [projects](#) that day could come as soon as July.

Worse, officials warn, is the possibility of an even more catastrophic event. That is if the water level falls all the way to the lowest holes, so only small amounts could pass through the dam. Such a scenario — called “dead pool” — would transform Glen Canyon Dam from something that

regulates an artery of national importance into a hulking concrete plug corking the Colorado River.

Anxiety about such outcomes has worsened this year as a long-running drought has intensified in the Southwest. Reservoirs and groundwater supplies across the region have fallen dramatically, and states and cities have faced restrictions on water use amid dwindling supplies. The Colorado River, which serves roughly 1 in 10 Americans, is the region's most important waterway.

The 1,450-mile river starts in the Colorado Rockies and ends in the Sea of Cortez in Mexico. There are more than a dozen dams along the river, creating major reservoirs such as Lake Powell and Lake Mead.

On the way to such dire outcomes at Lake Powell — which federal officials have begun both planning for and working aggressively to avoid — scientists and dam operators say water temperatures in the Grand Canyon would hit a roller coaster, going frigid overnight and then heating up again, throwing the [iconic ecosystem](#) into turmoil. Lake Powell's surface has already fallen 170 feet.

In October 2022, Lake Powell was a quarter full due to a historic drought, which threatened power supplied to millions by the Glen Canyon Dam in Page, Ariz. (Video: John Farrell/The Washington Post)

Lucrative industries that attract visitors from around the

world — the rainbow trout fishery above Lees Ferry, rafting trips through the Grand Canyon — would be threatened. And eventually the only water escaping to the Colorado River basin's southern states and Mexico could be what flows into Lake Powell from the north and sloshes over the lip of the dam's lowest holes.

"A complete doomsday scenario," said Bob Martin, deputy power manager at Glen Canyon Dam, as he peered down at the shimmering blue of Lake Powell from the rim of the dam.

[*The Colorado River is in crisis and it's getting worse every day*](#)

'A catastrophe for the entire system'

In August, the Bureau of Reclamation [announced](#) it would support studies to find out if physical modifications could be made to Glen Canyon Dam to allow water to be released below critical elevations, including dead pool. That implies studying such costly and time-consuming construction projects as drilling tunnels through the Navajo sandstone at river level, said Jack Schmidt, a Colorado River expert at Utah State University.

"There was a time in my professional career that if anybody from Reclamation ever said that, they'd be fired on the spot," said Schmidt, who served as the chief of the U.S. Geological

Survey's Grand Canyon Monitoring and Research Center during the Obama administration. Even raising that issue is "a huge sea change telling you how different the world is."

This year, the Biden [administration called](#) on the seven states of the Colorado River basin to cut water consumption by 2 to 4 million acre-feet — up to a third of the river's annual average flow — to protect power generation and avoid such dire outcomes. But negotiations have not produced an agreement. And the Interior Department has not yet mandated those cuts, despite missing its own August deadline to reach an agreement.

But these types of ominous scenarios are starting to be considered. With Lake Powell at one-quarter full, Reclamation has begun a [feasibility study](#) on the prospect of harnessing the deeper bypass tubes for power generation. The entity that markets Glen Canyon's electricity — the Western Area Power Administration, known as WAPA and part of the Energy Department — is working with two national laboratories to assess what electricity would be available for purchase if Glen Canyon shut down.

And construction is also underway on a project to install deeper pipes to protect the city of Page, Ariz., and its 7,000 residents, from losing its supply of drinking water.

The chances of hitting minimum power pool (lake elevation

3,490 feet above sea level) within the next two years is part of Reclamation's minimum probable forecast, and more likely scenarios have water levels staying above that threshold. But researchers including Schmidt have documented how Reclamation's projections have been too optimistic in recent years amid the warming climate and historic drought that is wringing water out of the West on a grand scale.

"The critical part about what's been happening and what [climate change](#) is forcing us to do is: We have to look more at the extremes," said Tom Buschatzke, director of Arizona's Department of Water Resources, said in an interview. "We've got to plan for the low end."

Reclamation said in a statement it now relies on a more recent 30-year climatology window — 1991 to 2020 — to make forecasts, which leaves out the wet years of the 1980s and incorporates more drought, which "will improve accuracy and remove some biases."

Buschatzke has also been raising the alarm about Lake Powell reaching dead pool — an elevation 120 feet below the threshold for producing power.

"It is a possibility. I can't tell you the probability," he said. "But that's an outcome that would be not only an ecological disaster, but the world would have its attention on such an outcome in a very negative way."

If that happens, "you're not going to have a river," he added. "It would be a catastrophe for the entire system."

'Huge problems for the Grand Canyon'

In the 23rd year of the Western drought, Lake Powell's once crowded boat ramps end in sand. Dirt bikes roar across newly exposed shores. Exquisite arches and rock formations, lost when the reservoir filled in the 1960s, are [re-emerging](#).

As the water has receded, so has the ability to produce power at Glen Canyon, as less pressure from the lake pushes the turbines. The dam already generates about 40 percent less power than what has been committed to customers, which includes dozens of Native American tribes, nonprofit rural electric cooperatives, military bases, and small cities and towns across several southwestern states. These customers would be responsible for buying power on the open market in the event Glen Canyon could not generate, potentially driving up rates dramatically.

The standard rate paid for Glen Canyon's low-cost power is \$30 per megawatt hour. On the open market, these customers last summer faced prices as high as \$1,000 per megawatt hour, said Leslie James, executive director of the Colorado River Energy Distributors Association.

"That will be very financially damaging," said Bryan Hill, the

utility manager for Page, one of the cities that relies on the dam's low-cost hydropower for one-third to half of its electricity needs. "Huge, for everybody. For businesses. For single moms. It will be a financial hardship."

Glen Canyon's electricity is important for the nation in other ways. The dam is what's known as a "black start" facility for the country's largest nuclear plant, the Palo Verde Generating Station in Arizona. This means the dam could bring the nuclear plant back online if it shut down and needed to restart.

In September, Glen Canyon sent about 80 megawatts of power to California for three hours at the height of its record-breaking [heat wave](#), helping the state [narrowly avoid](#) rolling blackouts. It was the second time in the past few years that the dam has been called on to ramp up during emergencies threatening the electric grid, said Adam Arellano, an executive with the Western Area Power Administration.

"Those emergencies would probably happen more frequently without Glen Canyon Dam just because there's such a small margin of available electricity during those really hot days," he said. "That's a very big thing."

When Martin began working at Glen Canyon eight years ago, the drought had already taken a toll on the lake, but he never envisioned a day when the turbines might stop spinning.

"Everybody that works here, your focus, your mission, is to keep these units either running or keep them available to run," he said. "So if you came into a powerhouse and it was quiet, that would kind of go against everything you've dedicated your career to."

Being forced to switch to the four smaller bypass tubes would instantly cut the dam's capacity to release water by two-thirds. If water levels and pressure fell further, these pipes would quickly lose the ability to deliver the millions of acre-feet of water the lower basin states consume each year, the Glen Canyon Institute wrote in a [report](#) in August on low water scenarios.

"That dam is just not capable of delivering water at lower levels. It's going to create huge problems for the Grand Canyon," said Eric Balken, the institute's executive director.

Martin and others are now planning ways to stay productive if lake levels reach power pool, even temporarily. They expect a surge in maintenance projects — far easier to complete when turbines aren't spinning — and are lining up materials for the jobs. He compared it to a farmer in winter, whose work doesn't stop.

"What would have been a maintenance nightmare to coordinate, now the equipment is off and you can dive right in there and get all kinds of work done," he said. "So kind of,

we're making lemonade with the lemons, I guess."

Julie Fleuridas rested on a red rock in Waterholes Canyon, her face flushed in the afternoon sun. For six hours, the 56-year-old Trader Joe's employee and her friends had been paddleboarding down the Colorado River — from Glen Canyon Dam down to [Lees Ferry](#), a 16-mile stretch popular with kayakers, fishermen and flotillas of paddleboarders.

"How far to Lees Ferry from here?" she asked Ted Kennedy, a U.S. Geological Survey research ecologist who was passing by.

"If you stay in the current, it will be less than an hour," he said.

"Last time I did this, like six years ago, it was much quicker," she said. "It's just the water level is so low that the water is just not running fast. So it's a lot of paddling."

There are few people more intimately aware of those flows — and their impact on the web of fish and insect life through the Grand Canyon — than Kennedy. Since 2002, he has worked at the Grand Canyon Monitoring and Research Center in Flagstaff, Ariz., and he has watched this stretch of river throughout this historic drought.

With Lake Powell so diminished, water temperatures have risen dramatically — from the high 40s when he started, to a

record high of near 70 degrees this summer — as water closer to the surface is now passing through the dam. Swimming, once for the hardiest, is now commonplace.

The habitat for fish has also transformed. Warming waters have helped recover populations of the humpback chub in the Grand Canyon — a species [reclassified](#) from endangered to threatened last year — as it became warm enough to spawn. But the fate of these and other native fish are now confronting fresh threats: the smallmouth bass, a voracious predator.

“This is basically the start of an invasion of a new species,” Kennedy said.

Dozens of these bass, including juveniles, have been caught this year in the first 15 miles below Lake Powell — as more of the surface swimmers get sucked through the turbines — prompting an aggressive effort to assess their numbers and block them from the Grand Canyon.

“I believe the smallmouth bass presents a clear and present danger to the humpback chub and other threatened native fish in the Grand Canyon,” Ed Keable, superintendent of Grand Canyon National Park, said in an interview. The record-high temperatures “could allow smallmouth bass to reproduce within the entire river system for the first time.”

The federal government has begun fighting back on several fronts — from poisoning tributaries to shocking the water with electricity. Some fishing guides worry these methods to eliminate bass will be both futile at stopping the predator and harmful to another important industry: the renowned rainbow trout fishery and the lodges that service it.

Water temperatures have [already risen](#) so high — and dissolved oxygen levels fallen so low — as to start harming the trout, according to fishermen and scientists. Dave Foster, a former USGS scientist who has been guiding fishermen for more than three decades, has turned away clients this year after catching weakened trout he can't revive. He worries an expanded electro-fishing effort will be another major blow.

"There will be a negative impact on the trout population," he said. "It's really pretty disconcerting to me."

The trout and the threatened chub could get a reprieve, at least temporarily, if lake levels continue to fall. If the dam drops below power pool, and switches to the deeper bypass tubes, water temperatures in the Grand Canyon would suddenly drop by as much as 15 degrees. This could limit the ability of smallmouth bass to reproduce.

"Going below power pool, initially, could be a good thing if your biggest concern is smallmouth bass," Kennedy said. "But then if you get lower and lower, closer to the dead pool,

you get back to that zone where both of those bad things are happening: You're going to have water temperatures in the river that are conducive to their spawning and you're going to be passing large numbers of them through."

'Less like a river, and more like an irrigation ditch'

Arguments against Lake Powell have been around as long as the lake. Its existence, to some, amounts to an ecological atrocity, the drowning of miles of intricate slick rock canyons. Some argue it is unnecessary for water storage, power generation or the tourist economy — despite having more than 3 million visitors last year.

"Everybody keeps running around saying how can we prevent this from happening," said Dan Beard, who served as the Bureau of Reclamation's commissioner from 1993 to 1995. He added that he wouldn't be surprised to see dead pool in the next three years. "My question is: Why should we prevent it from happening?"

But the federal government has already taken unprecedented steps to protect Lake Powell from dropping to dangerous levels.

In May, Reclamation reduced the amount of water it planned to release from the dam from 7.48 million acre-feet to a

record low 7 million, the first such midyear cut. It moved another 500,000 acre-feet into Lake Powell from an upstream reservoir. The ongoing negotiations to cut more Colorado River use, if successful, could significantly improve conditions for Lake Powell and Lake Mead, located in Nevada and Arizona.

'Where there's bodies, there's treasure': A hunt as Lake Mead shrinks

In late October, the Interior Department signaled it may take further unilateral action by [announcing](#) it could revise the guidelines — set in 2007 and revised in 2019 — that regulate water use from Lake Powell and Lake Mead. Interior Secretary Deb Haaland said the administration is “committed to taking prompt and decisive action necessary to protect the Colorado River System and all those who depend on it.”

Some say the gravity of the threat is enough to spur the states and federal government to make the necessary cuts in water use.

“I’m actually very optimistic that we’re not going to go below power pool,” said Arellano, the WAPA executive. “This is the number one issue for pretty much everybody in the hydropower industry.”

But the reservoirs remain vulnerable. The most recent [five-](#)

[year hydrology projection](#) estimates the chance at reaching minimum power pool (elev. 3,490) at 10 percent next year and 30 percent in 2024, as dry La Niña conditions are expected to continue. Reclamation predicts there is zero chance of reaching dead pool (elev. 3,370) at Lake Powell over the next five years.

“If there was a line in Vegas, and I was a betting man, I think I’d probably bet we’ll go below 3,490,” said Charles Yackulic, a research statistician with USGS who is part of a team that was tasked in August to study how power pool or dead pool would impact the Colorado River.

Below that threshold, as Glen Canyon dam is able to release less and less water — the change between how much water is flowing at night or during the day would also diminish. That would lessen the “tides” that now characterize life in the Grand Canyon, water flows that fluctuate based on demand for hydropower.

Ultimately, the Colorado River would “become less like a river,” Yackulic said, “and more like an irrigation ditch.”

Joshua Partlow is a reporter on the The Washington Post’s national desk. He has served previously as the bureau chief in Mexico City, Kabul, Rio de Janeiro, and as a correspondent in Baghdad. [Twitter](#)