Scientists study Lake Powell sediments to see how climate change, humans are affecting the water

Bullfrog Marina • Water is hardly the only substance Glen Canyon Dam holds back.

When Lake Powell's water passes through the dam's hydropower turbines, it comes out the other side clear and cold, completely different than the turbid flows coming in from the Colorado and San Juan rivers and tributaries with names like Dirty Devil and Muddy Creek.

This is because the sediments carried by these rivers and their tributaries draining the Colorado Plateau accumulate on the lakebed.

After 55 years, those deposits are now up to 200 feet thick at the upper ends of the lake. Some contain toxic metals emanating from a century of hard rock mining in the San Juan's headwaters, sending unknown amounts of arsenic, cadmium, copper, mercury, lead, selenium and zinc downstream.

For years, federal hydrologists such as Scott Hynek have wanted to study Lake Powell's sediments, which hold clues to how human activity and climate change are affecting the landscape and degrading the reservoir's water quality.

The disastrous 2015 Gold King Mine discharge, which sent 3 million gallons of mine sludge into the San Juan River, was the event that prompted federal and Utah agencies to finally act and turn Hynek loose on Lake Powell with a floating drill rig. He and his team with the U.S. Geological Survey spent last November extracting and processing a comprehensive set of cores from the

lakebed using a barge lashed to houseboats.

(Brian Maffly | The Salt Lake Tribune) Scott Hynek, a hydrologist with the U.S. Geological Survey, displays a sediment core extracted from the bed of Lake Powell. He is pictured in a makeshift structure, called the Core Shack, his team built on the barge deck for processing the 212 3-meter-long cores recovered in the monthlong drilling operation in November.

“We set out to do four to six holes in each arm, but we ended up with 30 holes. We exceeded all expectations and are slightly over budget,” he said, while riding the barge as it slowly made its way down the Colorado arm for the last day of drilling. The drill barge logged about 500 miles of travel by the time it was taken out at Page, Ariz., at the end of November.

The sediments were extracted with a hydraulic piston corer, rather than a rotary drill. The result was 212 cores, 2.5 inches in diameter and 3 meters long, encased in clear acrylic tubes. That’s more than 2,000 feet of cores that now have to be analyzed. Preliminary results will be ready by early next year.

“This study will help us understand whether human activities such as mining

in the San Juan River watershed have impacted or pose a risk to the important recreational, aquatic life, and cultural resources of the San Juan River and Lake Powell," said Erica Gaddis, director of the Utah Division of Water Quality. "This project is a great example of applying science to inform water resources management."

The coring project is the initial phase of a multiyear analysis in partnership with the Utah Department of Environmental Quality, the National Park Service and the U.S. Bureau of Reclamation. The agencies have set aside $1.3 million for the study, about half going toward extracting the cores.

During the monthlong coring operation, the hydrologists spent much of their time in a makeshift structure dubbed the Core Shack that Hynek built on the barge with $400 worth of materials from Home Depot. Every 30 minutes, the drill crew brought up a 3-meter core and delivered it to the Core Shack, where it was cut in half, labeled, and its acrylic tube plugged with a blue cap on the upper end.

(Brian Maffly | The Salt Lake Tribune) U.S. Geological Survey hydrologists Scott Hynek, left, and Will Lund, right, make their way to a drill platform on Lake Powell on Nov. 29, 2018. The two are conducting a sediment survey that pulls cores out of lakebed.

At the end of the trip, the samples were transported to Salt Lake City to be sliced in half lengthwise, imaged and characterized by sediment qualities. One side will undergo further analysis; the other will go to a core archive in Minnesota, where they will be available for future studies.

The Gold King disaster, which released an estimated 540 tons of toxic metals that settled in the lake, motivated the study, but its findings will be useful on a variety of issues for years to come.

“We could look at the total mass of the sediments, look at the metals in there,” Hynek said. “We would have total metal content, but it’s not distributed evenly. Are there nasties in there? Where are they? At what levels? Are they susceptible to be remobilized when lake levels come down?”

With cores from both major arms, the study can compare the mine-tainted sediments in the San Juan with the sediments from the Colorado, which drains an area that saw little hard rock mining, but did see plenty of uranium prospecting before the 710-foot-high dam was completed in 1963.

Understanding the volume, distribution and biological availability of the metals will shed light on the risks to the environment and human health, and help resource managers make more-informed decisions for Lake Powell, which has been shrinking by about 475,000 acre-feet a year since 2000.

The Glen Canyon National Recreation Area hosts 2.5 million visitors a year, many coming for the boating and fishing the lake provides. Yet, since 2012, a fish consumption advisory has been in place because of high mercury levels in certain fish populations.

Now about 100 feet below its level of two decades ago, the receding lake has exposed vast stretches of sediments at the deltas where the San Juan and Colorado rivers used to enter the lake. Now those rivers cut through these

sediments, pushing them farther downlake to be deposited on top of layers that settled years ago.

Hynek and other hydrologists are keenly interested in rates of sedimentation on the lakebed and how climate change is altering them.

In the 23 years after the lake began impounding the Colorado River, it accumulated 868,000 acre-feet of sediments, eliminating 3.2 percent of its water-holding capacity, according to an earlier study. At that rate, Glen Canyon could become clogged with mud in a few hundred years.

Hydrologists suspect climate change, which has the Colorado Plateau receiving more of its precipitation as rain and less from snow, could be speeding up rates of deposition. This is because monsoonal storms carry more erosive power that snowmelt.

Hynek hopes the cores can be read like the cross-section of a tree with its annual growth rings. If specific sediment layers can be pegged to particular years, whose weather data are already in the scientific record, scientists could better understand the lake's precarious future in the face of environmental and economic pressures that show no signs of relenting.