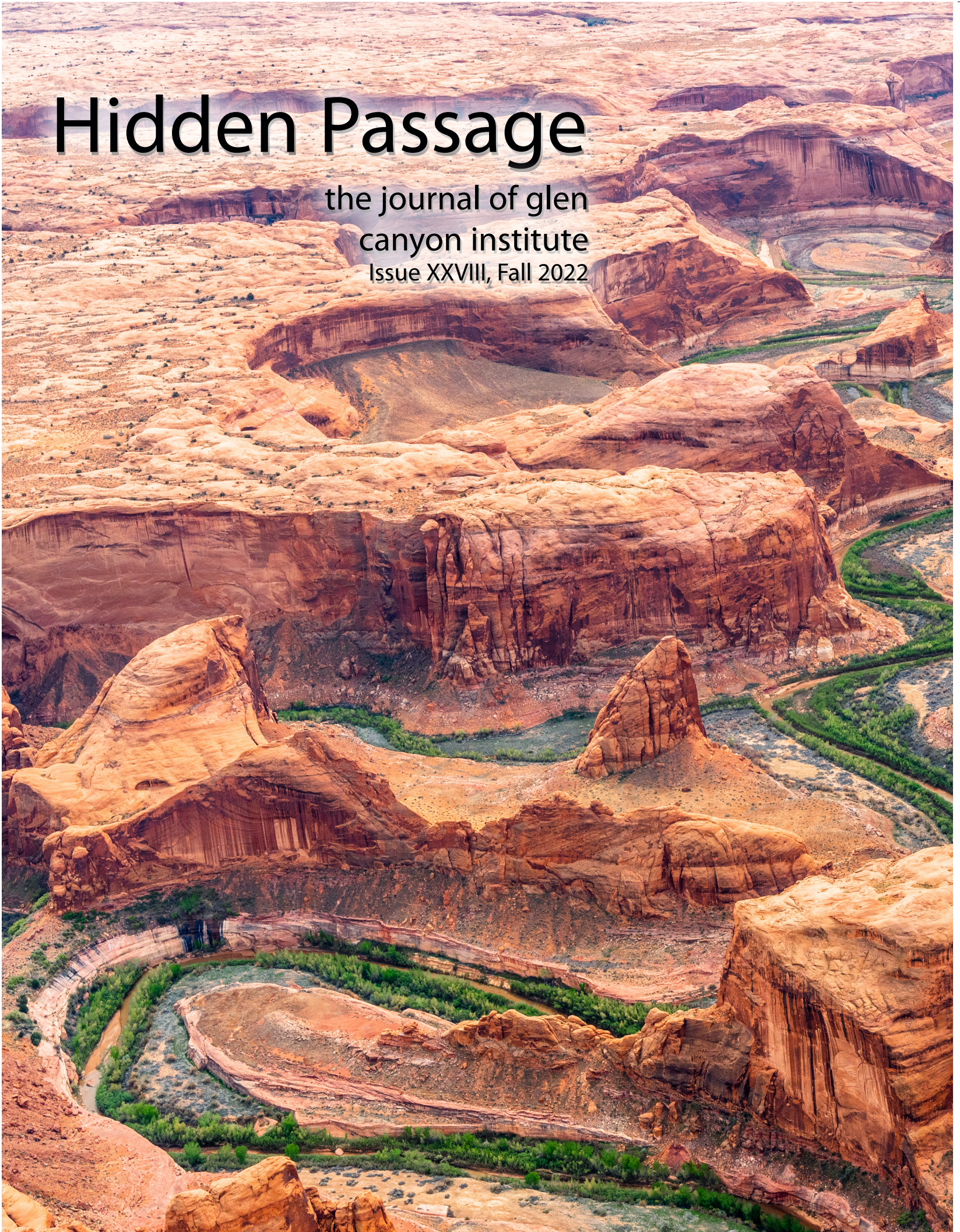


Hidden Passage

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Hidden Passage
Issue XXVIII Fall 2022

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Cover: Life returns on the Escalante as the reservoir retreats. Photo by Bruce Gordon/ Eco Flight.

Editor's Introduction

by Wade Graham

We are now witnessing what has long been predicted: the deep drawdown of the levels of Lake Powell and Lake Mead, brought by the one-two punch of climate change and profligate water consumption by the river's users.

In consequence, we are seeing the impressive restoration of Glen Canyon's ecosystems and river rapids. In some places the rebirth has been limited, in others spectacular. Nowhere are the new landscapes exactly the same as they were pre-dam, since the reservoir's deposition of sediment changed topographies, leaving behind in some places richer vegetation than pre-dam, in others, poorer. Yet, the evidence is clear and strong that the canyons restore themselves as the reservoir recedes.

The contents of this issue document these processes in the new restoration zones. Researcher Seth Arens details his work conducting plant surveys in Cataract Canyon and central Glen Canyon. We have two reports on the continued, pioneering work being done by the Returning Rapids Project: on the mainstem Colorado, as reported by Jack Stauss; and Mike DeHoff reporting on RRP's first reconnaissance of the lower San Juan. The restored landscapes and rapids they describe are stunning, surprising in the speed and extent of change, and profoundly hopeful for the future restoration of the rest of the Glen. Both projects are supported by Glen Canyon Institute.

Anyone watching the trends over the past decades could have seen this moment coming: the graphed lines of supply and demand crossed in 2001, and will likely never meet again. The overdraft of the Colorado's limited bounty was a fait accompli from the point that Americans began to divert it, as Major John Wesley Powell predicted it would be. In 1893, he told a room full of avaricious farmers, speculators, and politicians: "I tell you gentlemen you are piling up a heritage of conflict and litigation over water rights, for there is not enough water to supply the land." He wasn't listened to, and resigned from his position heading the US Geological Survey a year later.

In the 26 years since its founding in 1996, GCI has advocated for a national discussion on how to manage the ongoing drawdown of Lake Powell and the Colorado Basin's other reservoirs. This presents a tangle of serious, complex issues: sediment, water supply, hydropower, river access, endangered fish species, and cultural and archaeological resources to begin with. Their importance goes beyond the water users, even beyond the Basin, as they concern resources of national significance.

We are still calling for that discussion, but with new urgency. Inaction has allowed events to overtake planning, and the Basin faces a series of nested, mounting crises:

- Dam operations. Glen Canyon Dam has a plumbing problem: just as we learned in 1983 that the dam was not designed to accommodate high water, we are now learning that it was also not designed to accommodate low water, and its ability to continue to deliver legal water obligations is in doubt.

- Sedimentation. The dam created problems of too much and too little. Huge deposits exist in several areas, altering river channels and threatening river flow if they are left stranded. The starvation of sediment from Grand Canyon downstream continues to degrade its ecosystem. Ultimately, a sediment bypass solution must be implemented.

- River recreation access. Low water levels have left all but one boat ramp unusable, fundamentally challenging continued reservoir recreation. Severe problems exist at the North Wash takeout for river runners emerging from Cataract canyon.

Glen Canyon Institute subscribes to the belief it is better to act late than never. And that, like persistence, optimism helps to untie the tightest knots. As Albert Einstein is reported to have said: "In the midst of every crisis, lies great opportunity." Let us respond to the current batch with alacrity and creativity, and protect the irreplaceable resources of Glen Canyon and the Colorado Plateau.

Tales from the Restoration Zone: an Update on the Glen Canyon Plant Surveys

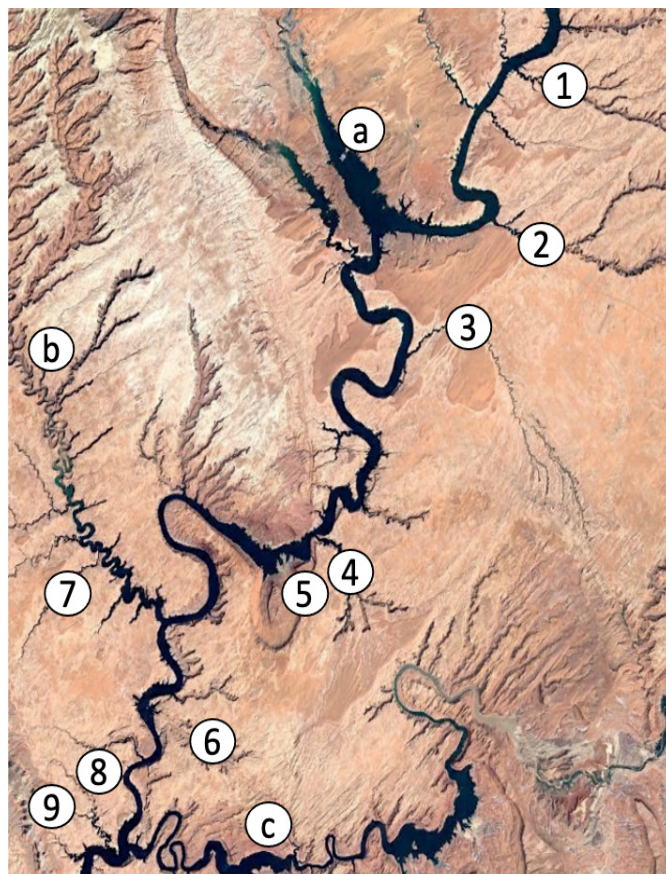
by Seth Arens

On the surface, dwindling water levels at Lake Powell seem disastrous. The reservoir is in real danger of dropping to an elevation where power generation will cease, as water cuts outlined in the 2019 Drought Contingency Plan seem unlikely to stem the declines in Lakes Powell and Mead. As the federal government threatens to impose further cuts in water delivery to the Lower Basin, views from popular access points to Lake Powell reveal a near-wasteland of lake sediments sparsely covered by non-native plant species. These impacts are real and calamitous. However, there is a bright spot: an unintended consequence of 20 years of climate change-fueled drought. Iconic geological features and tributaries to Glen Canyon are emerging from a long slumber beneath the waters of Lake Powell. These landscapes were not destroyed by Glen Canyon Dam's flood, but they are irrevocably changed. And with change comes the opportunity for renewal and restoration.

Glen Canyon is unique among similar canyons along the Colorado River and in the Colorado Plateau because of the abundance of spring-fed, perennially-flowing tributary creeks. Water is the key to life in the desert Southwest and the relative abundance of water in Glen Canyon is driving rapid restoration of riparian ecosystems. Unlike the barren landscapes in places like Bullfrog Bay, plants are establishing and riparian ecosystems are quickly evolving in spring-fed tributaries to Glen Canyon.

The speed of physical and ecological change in the Glen Canyon region is remarkable. Physical changes drive the subsequent changes in the ecology of landscapes. From July, 2019 to April, 2022, Lake Powell elevation dropped 100 feet, exposing 47,000 acres of land. A very active monsoon in Summer 2021 caused widespread flash flooding in the region which moved large volumes of reservoir-deposited sediment out of tributary canyons. For example, flash flooding in August, 2021 moved approximately 25 feet of sediment out of Cathedral in the Desert, nearly uncovering its original, pre-dam floor. These rapid physical changes mediate rapid ecological changes in tributary canyons with perennial streams. In Moqui Canyon, landscapes that were underwater in Summer 2019 developed robust ecosystems dominated by willow and native grasses by Summer 2022. (Figure 1) Some rapid changes involved the establishment of native plants, others involved invasive plants; each tributary of Glen Canyon provides a unique natural experiment in ecological succession. In October, 2021, the first mile of Cottonwood Gulch above the reservoir was nearly devoid of plants. On a return trip in August, 2022, the first mile of the valley was completely covered with barn-awn grass, an aggressive invasive grass that grows to 5 feet in height.

Summer 2022 was the first year of a four-year study I undertook to understand what types of plants and ecosystems are re-establishing in Glen Canyon and how these systems are



Map of sites established in the 2022 plant surveys.

changing. In 2022, I established vegetation monitoring sites at 42 locations in 9 tributary canyons. In 2023, I plan to establish study sites in Glen Canyon between the Dirty Devil River and Bullfrog Bay and along the San Juan River and Arm. In 2024-25, I will re-visit sites to assess how ecosystems are changing. In locations that have been exposed since 2000 or 2011, substantial restoration of riparian ecosystems has already occurred. Hanging gardens are growing in isolated locations above 3,660 feet and thriving riparian ecosystems with extensive stands of willow and cottonwood exist. In general, landscapes that emerged from the reservoir three or more years ago have relative native assemblages of species, while non-native plant species are more common on newer riparian landscapes.

Glen Canyon is most certainly an explored and known place; Native Americans inhabited the canyon for thousands of years, Spanish missionaries traversed Glen Canyon in 1776 and John Wesley Powell became the first American to float the canyon in 1869. Despite the canyon's history of inhabitation and exploration, every trip I take to Glen Canyon feels like exploration. There are many places I travel during field work



A photo match of rapidly growing Goodings willow trees in May, 2021 (left) and September, 2022 (right). Photos: Eric Balken.

that have not seen a human footprint since inundation in the 1960s. Others have certainly trod these locations, but not since changes wrought by Lake Powell. The emerging landscape of Glen Canyon is simultaneously unfathomably old and achingly new.

During Summer 2022 field work, I pondered the definition of exploration. In *Beyond the 100th Meridian*, Wallace Stegner writes about John Wesley Powell's second expedition down the Colorado River: "The second passage down the river was not an exploration, but a survey; what rendered it scientifically important rendered it dramatically second-hand. Exploration, like seduction, puts a premium upon the virgin."

For Powell, exploration was an absolute, something that can be accomplished only once; he sought to become the first American to run the Colorado River and survey the last great blank spot on the post-Civil War map. For me, exploration is relative and motivated by a desire to see new landscapes and explore less-traveled corners of our world. With respect to studying emergent landscapes of Glen Canyon, the work sits squarely in the middle of Stegner's concept of survey and exploration.

At its core, the work I am undertaking in the canyon is a survey. I seek to understand what plants and ecosystems inhabit this new landscape and how these systems change over time. To survey. But I also explore. Exploring on a personal level by visiting new places, but also exploring in the tradition of Major Powell. In a sense, the emerging landscapes of Glen are akin to The Great Unknown that Powell describes in his travels down the Grand Canyon in 1869. Collectively, we must make these new landscapes in Glen Canyon known.



A massive cottonwood tree in the restoration zone of Lake Canyon. Photo: Eric Balken.

The End of Lake Powell and a New Beginning for Glen Canyon

by Eric Balken

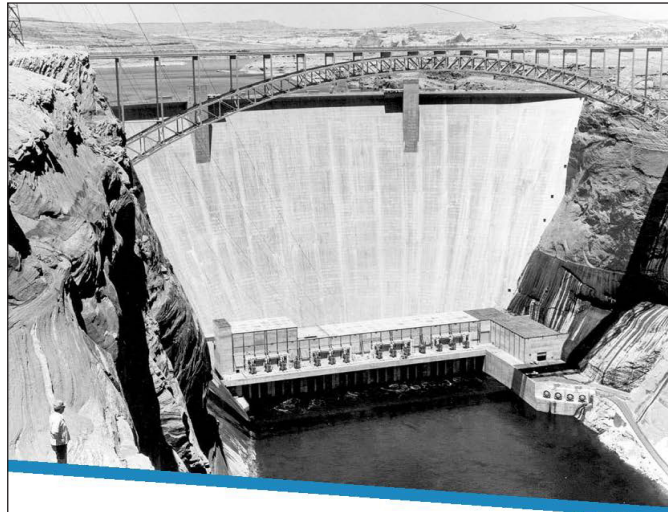
When the history books are written, 2022 may well mark a paradigm shift for Glen Canyon and the entire management of the Colorado River. In April, Lake Powell reservoir dropped to 3,522 feet above sea level, the lowest it's been since 1968. The reservoir's water levels are dropping to a point where the intended purpose of the dam—water storage and delivery—is coming into question. Most importantly, the Bureau of Reclamation announced it is looking at physical modifications of Glen Canyon Dam to operate below dead pool, i.e., draining Lake Powell. It was a mere bullet point in a press release, but it marks a historic turning point for Glen Canyon. Meanwhile, multiple NEPA processes are underway that will determine the fate of the river.

In June, Reclamation commissioner Camille Touton announced that Basin states must come up with a plan to reduce consumptive use of Colorado River water by 2-4 million acre feet —about a third of the river—in a shockingly brief window of 60 days. Heretofore, conservation efforts in the Basin have been incremental at best, and in many cases regressive. The demand from Reclamation was an order of magnitude larger than any previous cuts, with the logic that Lake Powell must be propped up to protect its hydropower intakes, which become inoperable at elevation 3,490, also known as minimum power pool. While the 60 day timeline lapsed with no plans from the states, the agency is releasing an additional 500,000 acre feet from Flaming Gorge Reservoir and withholding 480,000 acre feet from Lake Mead downstream. Even with these efforts, Reclamation's projections show that Powell could drop below power pool as soon as 2023.

Glen Canyon Dam's Big Plumbing Problem

While hydropower has dominated much of the conversation, a joint report published by Glen Canyon Institute, Utah Rivers Council, and the Great Basin Water Network demonstrated that the real cause for concern (and urgency from Reclamation) is that Glen Canyon Dam will struggle to deliver water downstream below the hydropower intakes, rapidly losing its release capacity the lower the reservoir drops. At elevation 3,440, it's physically incapable of releasing enough water downstream to meet its delivery obligation to the Lower Basin states and Mexico. The delivery obligation is the reason why Glen Canyon Dam was built in the first place - so Upper Basin states could send its required delivery downstream, and not one drop more.

Simply put, Glen Canyon Dam was not designed to operate at low levels. Reclamation has signaled concerns about the dam's structural stability below power pool. The only remaining way to release water below its hydropower intakes are four



ANTIQUE PLUMBING & LEADERSHIP POSTPONED

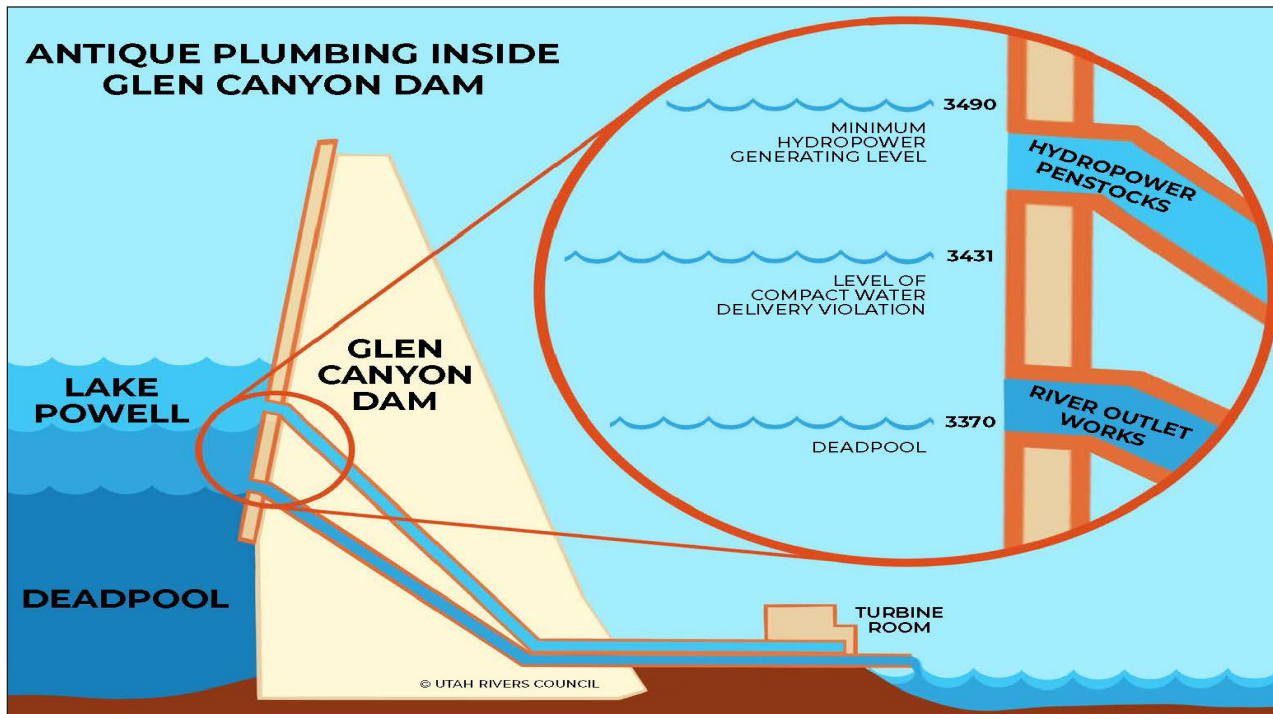
HOW THE GLEN CANYON DAM'S ARCHAIC DESIGN
THREATENS THE COLORADO RIVER WATER SUPPLY

A recommendation for immediate action from the Utah Rivers Council,
Glen Canyon Institute and the Great Basin Water Network

A joint report by GCI, Utah Rivers Council, and Great Basin Water Network on Glen Canyon Dam's plumbing problem and what it means for the Basin. Available at www.glencanyon.org.

“river outlet works” tunnels at elevation 3,370 (dead pool elevation), which weren't designed to be used as the sole outlet for the dam. If they were to fail, there would be no other way to allow water to flow downstream through the Grand Canyon and to the Lower Basin.

Even if the river outlet works operated perfectly, a whole host of dilemmas emerge when Powell drops near dead pool: limited and damaging flows into the Grand Canyon, wildly fluctuating reservoir levels behind the dam, an expedited timeline of siltation in the reservoir, and toxic algal blooms. At those levels, any benefits that once existed from reservoir recreation and hydropower will be long gone. Once the reservoir dips below power pool, it quickly deteriorates into more of a liability than an asset.



A cross section of Glen Canyon Dam's plumbing. At elevation 3,431 feet above sea level, the dam is incapable of releasing enough water to meet Colorado River Compact obligations. Graphic by Utah Rivers Council.

One Step Closer to Bypass

For 26 years, GCI has been leading the call for Reclamation to modify Glen Canyon Dam to act as a run-of-river facility. In the last Glen Canyon NEPA process, the LTEMP EIS, we advocated the Fill Mead First proposal, prioritizing storage in Lake Mead and giving Glen Canyon a chance to continue restoring. The agencies considered it “outside of the scope” of the process, but given the new hydrology of today’s Colorado River, it has become a seriously discussed option among the media and the public. Not only would it make the full restoration of Glen Canyon possible and avoid the quagmire of dead pool, it may prove to have benefits for system efficiency, adaptability, and ecological health for the Grand Canyon.

Today, we can’t even fill Mead—if all of Lake Powell’s water were released to Mead, it would still be less than half full. But the idea was prescient, and shaped today’s policy discussions around Glen Canyon. When we launched the public debate about filling Mead first, it gained a lot of public attention, most notably from the *New York Times*. Researchers from Utah State University were compelled to analyze the idea, finding big problems with reservoir operations near dead pool. The research suggested that if the goal is to restore Glen Canyon and naturalize the ecosystem of the Grand Canyon, full bypass of Glen Canyon Dam would be the best way to do it.

Written off as an academic exercise at the time, Reclamation is now acknowledging the possibility of the reservoir dropping to the levels described in the Fill Mead First proposal unintentionally—a result of our new climate-driven hydrology. The idea of modifying the dam is no longer fringe, and may

actually prove to be a necessity. That’s why Reclamation made the announcement at an August press conference that they are looking at modifying both Glen Canyon and Hoover dams to operate below dead pool. Reclamation officials wouldn’t deny that they are studying how to bypass Glen Canyon Dam. It has now become a policy reality.

But the path to Glen Canyon’s full restoration is not guaranteed. In October, the Department of the Interior launched a Supplemental Environmental Impact Statement (SEIS)—an expedited NEPA process to address the Colorado River water crisis. This is in addition to the existing NEPA process that is expected to be completed in 2025, for which GCI submitted extensive “pre-scoping” comments. One of the alternatives in the SEIS invokes Interior to exercise its authority to make sweeping decisions on managing Powell and Mead. Given the plumbing problems at Glen Canyon Dam, it’s likely that Reclamation will hold back more water behind Glen Canyon Dam instead of letting it flow downstream in a last ditch effort to prop up the reservoir.

How far the federal government will go to prop up Lake Powell is unknown. Only so much water can be sent down from Flaming Gorge, and holding back water from the Lower Basin is a short term reaction that will not be sustainable in the long run. How much will they sacrifice to salvage what’s left of Powell? Draining every other reservoir in the system will only lead to diminishing returns. No additional information has been released about Reclamation’s study to bypass the dam, but GCI and our partner organizations will continue to apply pressure and highlight the benefits of Glen Canyon’s restoration.



Seth Arens collecting data on a vegetation transect in Cottonwood Gulch. Photo by Eric Balken.

GCI's Work in the Canyon

This is why GCI's current work is so critical. As decision makers reshape Colorado River policy in real time, GCI has been working at full steam to show them and the world that Glen Canyon is more than a storage tank—it is a place worth protecting. From Spring through Fall 2022, GCI's board and staff made nearly thirty trips into the canyon. We led multiple trips with stakeholders, including representatives from the Water and Tribes Initiative to broaden the conversation about how tribes will play a role in managing the new Glen Canyon. We ran a blitz of media expeditions, garnering primetime coverage on CBS News, ABC Australia, KUTV Utah, NPR, and KUER's RadioWest show. We generated feature articles from *Smithsonian Magazine*, *Deseret News Magazine*, *The Tucson Daily Star*, *The Arizona Republic*, the *Salt Lake Tribune*, and more.

We've deepened our partnership with the Returning Rapids Project by officially making them a program of GCI, funding a significant portion of their work this year, and assisting them with their on-the-ground efforts. The project has had its most productive year to date, leading 16 trips into Cataract Canyon and Glen Canyon. The team produced a substantive field binder describing changes taking place in Cataract Canyon, a breakthrough report on the return of the San Juan River, and a field guide to upper Glen Canyon. They've made multiple presentations around the basin for outfitters, advocacy groups, historical societies, and the Cline Library at Northern Arizona University. Most importantly, they have been working closely

with leadership at the Park Service to improve management of Glen Canyon National Recreation Area, a place that's physically changing by the week. They have built strong partnerships with scientists from the US Geological Survey, Grand Canyon Monitoring and Research Center, and multiple universities, which have led to research and the first published studies of the changes happening along the emerging Colorado River.

GCI's ecological survey work with Seth Arens of Western Water Assessment made great strides in 2022. The study established 42 survey sites across nine canyons, leading the way to develop an understanding of Glen Canyon's emerging ecosystems. The initial findings show that in places where canyons have been out of the reservoir for several years, much of the dominant vegetation is native plants like willows and cottonwoods. This multi-year research effort will play a critical role for Glen Canyon in ongoing policy negotiations, proving that Glen is indeed a living, thriving habitat.

These programs are part of our long term mission to restore Glen Canyon and a free-flowing Colorado River, but they are moving the needle on the public dialogue around western water right now. Stakeholders who rarely acknowledged Glen Canyon are now talking about the value of what's emerging. Major outlets like the *Salt Lake Tribune* have officially endorsed restoring Glen Canyon and phasing out what's left of the reservoir. The idea of reclaiming "America's lost national park" is no longer fringe, it has become a central part of the dialogue. As the Colorado River faces immense challenges, there exists the opportunity of a generation to reclaim Glen Canyon.

An October Outing with the Returning Rapids Project

by Jack Stauss



Brenda Bowen, Christine Rumsey, and Sam Bagge take a water sample at Gypsum rapid. Photo: Jack Stauss.

In October I found myself at Potash for the second time this season. I was about to launch on my third Returning Rapids Project (RRP) fall science trip. The previous year, principal investigator for RRP, Mike DeHoff, had put together a scientific tour de force: groups from the US Geological Survey (USGS), University of Utah (U of U), Utah State University, Grand Canyon Monitoring Center, and more scrambled in a dozen boats performing tests, collecting samples, and mapping the entire river corridor for the first time in a hundred years. Much of that work had been completed, and was published after 2020 and 2021. So, this trip was particularly exciting because it would start to open new questions for the team. And, we would not take out at North Wash, but continue another 50 miles downstream, into Glen Canyon, through the Delta, ultimately spilling out into Lake Powell and Bullfrog Marina.

We had four boats and a dozen people. We'd be on the river together for eight days to explore the next steps for the project. There were a couple sites U of U geologist Brenda Bowen wanted to revisit with graduate students to study Dominy sediments. Christine Rumsey from USGS would take water quality samples along the way. And Carrie Johnson, also from the U of U, was very curious about the Delta zone. The rest of us would learn from them, help row and haul gear, and work to match the stack of photographs that Mike, Meg Flynn, and

Peter Lefabvre had brought.

Some of the photos were recent—2019, 2011 and some were much older—1960s, 1920s. The name Clyde LaRue, a USGS surveyor, was on the tip of everyone's tongues. Matching a LaRue was particularly exciting because you could hunt around a river bank for a while with the photo in hand, squinting at the banks and "marker rockers" trying to line it up. Eventually you realize you're there—the exact spot where LaRue would have stood 101 years earlier.

We spent a leisurely three days in Meander and Upper Cataract Canyons. Quick sunrise hikes to the Doll's House, fun nights around the campfire, and turns at the oars or driving the floatilla kept spirits high. I caught up with fellow river advocate and mentor, Mike Fiebig from American Rivers, whose work is influencing wild and scenic legislation across the Southwest, working in concert with the tribes that have called the place home for millennia. I took turns chatting with old friends and new, like river guide Davide Ippolito, who shared many interests with me. And, I gave the river my attention. I basked on a front tube and watched the water and cliff roll by as we moved downstream.

As we entered the rapids, we were joined by T Berry Young, the head river ranger for Canyonlands National Park. DeHoff, who I think of as the expert, says he learned much of what he

knows from T Berry. We looked at new changes in Rapids 14 and 15, far upstream from the reservoir-impacted zone. A historic flood had altered these rapids more than these guides had seen in their entire careers, moving massive amounts of gravel and boulders into the river channel. We surveyed the new waves and rocks, measuring change and taking photos.

I rode through the Big Drops with T Berry in his snout rig. As we bounced the inflatable motorboat off of river cobbles in the splashy rapids, he told me stories of old Moab river runners who had epic adventures in the area, and of even more epic mishaps. We eventually made our way into the lower section of the canyon, where we'd spend the next few days photo matching, hiking, and enjoying the freshly deposited white sand beaches.

Brenda Bowen and her team of geologists and paleontologists were particularly interested in extrapolating what had been found in sediment banks in Waterhole Canyon on previous Returning Rapids trips, downstream to other canyons. In Gypsum, they spent the day measuring, surveying, and sampling these layers. They wanted to understand if the phenomenon of change we saw in Waterhole is happening elsewhere: different layers of reservoir rise and decline. In Gypsum, it seemed like this was the case.

After another day of following LaRue's photos down the river, we regrouped at Dark Canyon. Once the site of one of the river's most notorious rapids, DeHoff thinks there is now likely too much reservoir sediment "armoring" the original rapid. But in the last two years, the character of the canyon has changed drastically from monsoonal floods, and it's only a matter of time until new rock is blasted out of the canyon mouth and into the river. The river current at Dark is unsettled, starting to show some riffles. In the fading light, Pete and I hiked up to a high lookout and created a new photo match location. We hoped that in the years to come we would see more changes to the river surface, perhaps even a new rapid.

Out Beyond the Map

After one more day of pushing downstream to North Wash, we shuffled some folks on and off boats at the ramp. Davide had done ten commercial Cataract trips that summer, and was happy to not be wrestling the boats up the steep ramp. We just swapped out passengers, and pushed back into the current. Carrie Johnson, an expert geologist from the U of U, joined us. I had worked with her on prior trips and was excited to once again learn from her expertise. She is particularly interested in the changes taking place at the reservoir deltas. Little work has been done to understand them, and this would be her first reconnaissance trip to the area to gather baseline information. Between North Wash and The Horn, the river has reclaimed another 12 miles.

It's a quiet, wild place mostly untraveled by visitors. It runs past sweeping red rock walls and towers, and channels through wild Dominy banks—snaking through fins of "mud glaciers" that resemble the spines of dinosaurs. We navigated this for an

hour or two, rowing through little corridors, different skinny slots. Mud rapids kept rowers on their toes, reading strange breaking waves. I took it all in as best as I could—it may very well be the only time I would see the river like this, as it changes so quickly.

After passing through the channels, we pulled into our Glen Canyon camp at the confluence of White Canyon and the Colorado River. We were astonished to find a "volcano" there: a giant cone of sediment that looked like a pimple, bubbling water up from below. None of us had ever seen anything like it. The brown, glistening mountain bubbled and burped. Mike DeHoff wondered if it was methane. Could we light it on fire? Would it explode? We lowered Davide to the rim of the cone with a lighter in hand. He flicked the lighter as the volcano gurgled a release, and a small fireball erupted. Cheers of excitement would have been heard for miles.

At White Canyon, Mike Fiebig and I wandered all the way up to the old reservoir high water mark, way above the river corridor. Lines of drift wood, old trash, and a distinct color change in the earth reminded us of its inundation. It was melancholy to look down and see how much the place had been altered—an ancient dwelling knocked over, rock art ruined, the river itself perched on a hundred feet of sediment. But as the day turned to evening, it was also comforting watching the river flow in this quiet part of the world. As we explored the site of an ancient dwelling, we saw writing on the rock. Upon deeper inspection, Fiebig found a 150 year old inscription. It matched historical photographs we had, a fascinating discovery for our trip. As the sun set, we followed coyote and bobcat tracks back to camp.

The next morning we pushed off and DeHoff fired up the depth finder to continue mapping the river channel. While Meg, Mike, and I closely watched the river depth, Christine had her water sampling tools at the ready and collected data along the way, testing for salinity and PH. We approached The Horn and watched apprehensively as the water current and color changed.

The surface of the river goes from mud rapids to mud waves: strange little scallops of rich silty water that indicate the delta zone. And, around the last corner before The Horn, we saw the harbinger of the Delta—driftwood. An unfathomable amount of wood and trash is suspended there, hanging in the water. There was everything from dead tamarisk and fishing bobbers to tires and oil drums just moving along slowly with the mud. After having spent the previous week on the wild Colorado, seeing the still water full of this Anthropocene fodder made the impact of this misbegotten reservoir more tangible and sorrowful for me.

We spent a night out on the still, cold waters of the reservoir. Davide read the Vaughn Short poem "Floyd's Void", a fitting bookend to my summer in the canyon. We all shared a moment of thanks for one another, and to the river for showing us defiance in the face of human interference. That last night I slept out on a raft, dreaming of what was next for the land and water, and for our lives along the arid, wild Colorado.

Photos from the Glen



The Henry Mountains overlook a free-flowing Colorado River at Hite. Photo by Elliot Ross.



Gregory Bridge in March, 1990 (left) and in March, 2022 (right). Photos by Bill Wolverton.



The crew of GCI's 2022 member trip with Ken Sanders and Holiday River Expeditions in front of a newly-flowing Colorado River in lower Cataract Canyon. Photo: Jack Stauss.



Vibrant cottonwood foliage lights up the restoration zone in Davis Gulch. Photo: Elliot Ross.

A Story of Time in Glen Canyon

by JoJo Matsen, Archeologist for the Navajo Nation

In the face of climate threats entrenched in fear, we often close ourselves off from truth to avoid the pain. Whether it is from terror, depression, agony, or guilt, we become deaf and blind to one another. The story we are told is creating a dangerous place where change for the better is nearly impossible. The story of Lake Powell is one now known across the country, if not the world. One of doubt and despair as a mega drought threatens our current systems of power and water across the southwest. One of disbanded management of water rights and allocations within a Compact built on faulty estimates. One of an inequitable system of access to the most vital resource, water. Is this the story we want told?

Since I moved west, I've dreamt about what Lake Powell looked like and what it had buried. From years guiding on the Colorado River, I intimately learned the beauty and magic of water in an arid desert. The rainbow sands and stones that rise and fall across the Four Corners have been etched slowly by the patient hand of time. Drop by drop, grain by grain, the path of life traveling towards the sea to return again as a drop. The beautiful networks and systems of creatures are built so perfectly for their place in the cycle. Tucked away hidden in the bends of canyons, high on cliff benches, and in sandstone alcoves are the echoes of those that call this home. The signs of their relationship with the land still vibrating off the walls. Stacked rocks and wooden roof beams, elaborately decorated home goods like pottery and baskets, and vibrant stories etched and painted on stone. How could we let beauty like that get buried and destroyed? The convoluted choices made between the time those families walked these canyon floors and I now float above them are deplorable. This is where we can take our story and change its course.

To begin this journey, I believe we must first learn how to heal our wounds to each other and the land. My efforts as an archaeologist in integrative public lands management and conservation have taught me how to listen to stories and gain the wisdom of time and place. To be a gardener, you must know the beauty of what patience and love can create. I often talk on my hopes to someday manage our landscapes like I take care of my garden. Adam Duran, War Chief of the Pueblo of Pojoaque, chuckled at this and replied, "My people have always lived that way, we are just waiting to come back." That moment captured me. A concept so simple and resilient, of time immemorial. Something I as an American have never experienced. Knowledge so deep and beautiful that it has survived the millennia intact. A message of balance and connectivity that cannot translate to numbers or dollars. A story told for a family that has yet to revisit the steps of their people. The hardships and atrocities endured over the generations to persevere for one another. The connection to all things that bring life to



JoJo boating a restoring San Juan River. Photo: Eric Balken.

acknowledge you are a part of the entire picture, not just a component of it. Like a drop of water in a river, you are part of every inch, animal, plant, cloud you might touch. This is the story that needs to be told.

The Navajo Nation is the largest reservation in the United States, yet its boundaries still don't represent their traditional ancestral landscape. The connections and knowledge of the systems that once were, are alive in communities across this country and globe. Many stories I'm told by elders of memories in the Southwest rivers now submerged in Lake Powell have the glimmer of recognition, as if it was still alive. I resisted this hope with my predetermined thoughts of what we had turned this place into. Luckily, I may be wrong. Just as First Nations' patience and knowledge lays in wait, Glen Canyon is reawakening in ways no one had expected. Like a song known by memory, each beach, side canyon, spring, and river bend is sprouting up through the sediment tomb that captured its essence for decades. Even the marks of the families, timeless and delicate, are not entirely lost. A place to move forward together, in balance, across boundaries, for those yet to come. The stories are still here, and this is where we need to start.

A Natural Incursion: Notes from a Trip Down the Reservoir-Affected Areas of the San Juan River

—by Mike DeHoff



Ernie Basinger admires an impressive grove of cottonwoods that has established in the restoring section of the San Juan River. Photo: Eric Balken.

Two big turns in the river ago you could have convinced me that I was floating through Labyrinth Canyon on the Green River. Wingate sandstone cliffs define the skyline. Proud buttresses are offset by stark maroon and desert varnish columns serrated with dihedrals. Below that prominent layer, the Chinle sits as an apron of mud and silt stones that falls away toward the river's edge. I wasn't ready to see how healthy the riparian zones would be, how much native vegetation has established itself, how thick the willows, privet, and cottonwoods had grown.

On this current bend, you could tell me that I was in Gray Canyon, also on the Green. There are gray, brown, and yellow-tan blocks of broken cliffs pushing and defining the river channel. Healthier native plants line the banks; sumac and rabbitbrush. The river bends, revealing yet another vista in this odd downstream parade—all in an area that used to be under a hundred feet of reservoir water.

The objective of this river trip was to see what could be learned from traversing the reservoir-affected areas of the San Juan River and contrast it with what we are seeing in our main study area of the Colorado River in Cataract Canyon.

The voices of the team murmur from upstream and downstream. It is the early “getting to know each other” small talk that happens in the first days of a river trip. Often there is an interspersed statement of amazement, “look at how big that

cottonwood is!” or, “wow, this sure doesn't feel like it came out of the reservoir less than fifteen years ago.”

Our research team is small—only eight of us are floating on this expedition. We have a mix of Bureau of Land Management (BLM) river rangers, a U.S. Geological Survey (USGS) scientist, an archeologist who works with the Dine' (Navajo), a few professional river guides, and a well-spoken advocate for Glen Canyon. I'm the leader, but all that entails with this group is to provide some structure and let them do the rest. As usual, I fall back into my head, watch the world go by, and try to make sense of what we are observing in the landscape; to figure out how to communicate what is happening here.

On the Colorado River through Cataract Canyon, our Returning Rapids Project started out following a trail of questions about when and where the next rapid may show itself. As our curiosities expanded, we learned that the reservoir-caused sediment deltas were as much an issue as the actual dam and reservoir were.

All Southwestern rivers carry some amount of sediment load. When their flow gets stalled out by a reservoir, the sediment precipitates out. Where this dropout occurs in tributaries of Lake Powell, massive deltas form, and are filling in the pre-Glen Canyon Dam river corridor.

To compare the Colorado and San Juan Rivers, it helps to think about how much sediment there would be if you dipped

a 5-gallon bucket into each to take a sample. Both rivers experience a great deal of variance in sediment load, but it is fair to say that overall, the San Juan bucket would hold more sediment than the Colorado's. According to a 1975 paper by Gordon C. Jacoby comparing the two main river arms of Lake Powell from 1964-1974, the San Juan delivered only 13% of the total water but delivered close to half the total suspended sediments for the whole reservoir.

A record of an extreme event shows the San Juan had as much as 75% of volume of sediment; “the river ran with a smooth, oily movement and presented the peculiar appearance of a stream of molten red metal instead of its usual rough choppy surface” (Pierce, 1917—thanks Gene Stevenson for this citation.) A fun science fact—at a volumetric concentration of greater than 40-50% of sediment load you have to start calling it a “debris flow” or “mud flow”—not a river.

I have watched the San Juan's volume shrink in my lifetime. When I was young, I recall my grandmother telling me the translation of the Dine' word for the San Juan was “river gone wild” —whether she was linguistically correct or just pushing her own mythology, that river flows less and less wild now. Our Anglo cultural appetite for water grows and keeps bringing climate change and a great aridification to the Southwest. The river used to have big spring run offs of 10,000-15,000 cubic feet per second where giant muddy thalwegs would roar around the turns of the river and sand waves would cycle through the night. Now, flows like that are increasingly rare.

The San Juan River exits the confined Cedar Mesa Sandstone near a place known as Clay Hills Crossing. In this geologic transition, the parade of water that holds a great mass of suspended sediment is no longer restricted by a narrow-walled canyon. The resulting dynamic is a great amount of sediment that is released across a wide area. Over a period of hundreds of years the river channel has probably migrated all over this open area. But as Anglos, who tend to conquer first and ask questions later, we didn't have that understanding prior to making big plans to harness the river and subsequently affect the landscape.

It is ironic that the place where the river would have been dynamically affected by its natural sediment load and change in geologic landscape, is also the high stand of the reservoir. Below Clay Hills, the filling reservoir served as a sediment trap, causing the delta to grow as the San Juan dropped its mud in the clear waters of Powell. The growing delta would go on to affect areas upstream and downstream in ways no one could have anticipated.

The monsoons this summer have been heavy and richly laden with moisture. On this day, the humid quiet between midday rain storms brings a thick calm to the air. When birds fly over, their wings are muffled in its humidity. It makes the green of the shoreline trees seem lush—as though you can breathe the fresh oxygen from their photosynthesis.

The last time I rowed a boat through here was in 2010. Now, in 2022 we are floating on moving water through areas that were reservoir bays. There is an undeniable sense of rapid



The new river below Nokai Canyon. Photo: Eric Balken.



DeHoff standing next to Fatt Falls. Photo: Eric Balken.



DeHoff navigates a constricted section of the emerging river corridor. Photo: Eric Balken.

change here as the reservoir retreats from this river canyon. The water stored behind Glen Canyon Dam is dropping at a rate that is surprising to everyone who pays any attention. There is an ongoing concern about what will happen next. If one uses satellite photos to monitor the San Juan arm of Lake Powell, you can see a “disappearance of water” as the level of the reservoir is drawn down. But the rest of the story should be told from the perspective of the San Juan’s constant deposition of sediment, where a mass of silt, sand, and mud is migrating down the corridor.

Non-native plants initially colonize the mudflats of the lower river. The first plants grow quickly, then provide shade for the natives which can slowly out compete the non-natives. The emerging river and prograding delta is providing a natural incursion, bringing all the parts of an ecosystem that rivers tend to carry. It isn’t the same river corridor as it was prior to Glen Canyon Dam—but the river persists where it can, flowing into new areas with life.

I shake my head. There will be no returning rapids on the lowest part of the San Juan River, on this part of “Lake” Powell. We will never again see what this river was actually like prior to the dam. We will only have front row seats to watch the river reclaim its corridors by filling them with sediment as a way to

lay siege to their unnaturally caused inundation. This has taken a long time for me to come to terms with. This is what I am seeing and don’t want to see. But rivers are always changing, always different—it’s part of their charm.

For the San Juan River, an analogy can be drawn between the sediment flow and a lava flow. On Pacific Islands there is active building, contribution, and birthing of new parts of an island from igneous lava flows. Here, on a massive sedimentary strata plateau, is where erosion is an apex predator. It also brings new masses of land—depositional locales where a cottonwood can grow and branch 40 feet in as little as 15 years. Where rivers can flip the middle finger to dam builders who got it wrong.

I toggled back and forth on whether or not to give up on all these studies and collected observations. But now I feel I have a greater understanding. Things will never be the same. But given the chance, natural forces and all the power of a river’s sediment and water will take back areas where they can. It is surreal. It is peaceful. And it takes years to observe.

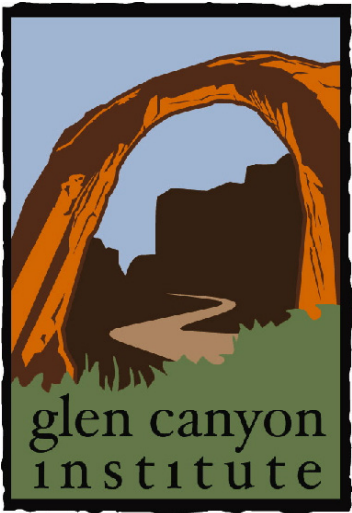
In the Great Bend the river narrows significantly around sharp corners. It pushes against the shore and the current digs towards walls of newly-emerged sandstone. These currents scour a little of the reservoir’s bathtub ring away with each small surge. There are dynamic constrictions here. Fins of mud haunt the water like great white sharks and the sound of water eddying back on itself tells you to pay attention—tells you that there is a history of flowing water in this canyon. I listen to that, trying to hear the wild river. I need to pay more attention to rowing my boat. The 650 cubic feet per second of water will soon carry us across the “nick point” of the giant sediment delta.

Far above the river there are traces of what pre-dam river runners detailed. What was mentioned as favorite characteristics of the lowest part of the San Juan River’s canyons: scrub and gambel oak, hanging gardens with paint brushed seeps of algae and varnished walls, accented by a symphony of curving and subtlety dramatic sweeps of Navajo sandstone cliffs. All this combined with the light of a September afternoon can make one forget all the cares in the world in one simple view.

There were times of silence in our group as we floated through this area that can only be compared to church; akin to religion, of a quiet respect, and great reverence. Then we neared a place and a moment we all knew was coming: the end of the 30 some miles of returning river. The end of the delta and the beginning of impounded water. The end of the San Juan River’s flow for this day. The moment when flowing foot-deep water turns clear and the bottom drops to 80 feet.

This one zone of acute change always seems to carry a lot of importance. The river-to-reservoir transition always happens quicker than you expect. But it is moving.

Twelve years ago, the river-to-reservoir delta was 20 some miles further upstream. It was all the way on the other side of the Great Bend. Now it is here, so much further into the basin of Lake Powell than I would have imagined. And the one resounding thought that I keep coming back to: I am amazed at how fast the river can return if only given the chance.



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"It touches the sea.
It flows in Glen Canyon,
and where it has been displaced it is replaced."

—Meg Flynn of the Returning Rapids Project's answer to
what she would wish for the Colorado River 5 years into
the future.

New vegetation at LaGorce Arch. Photo by Elliot Ross.

