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IT'S HARD TO FILL A BATHTUB WHEN THE DRAIN IS WIDE OPEN: THE CASE OF LAKE POWELL

(August, 2018)

Across the Colorado River Basin, the elevation of Lake Mead is a common point of discussion and concern. Even casual observers have come to recognize 1075'–roughly 4 feet below current (late August 2018) levels—as the elevation at which curtailments begin, and for many, the point at which the Colorado River crisis becomes real. As of today, it is highly unlikely that this threshold will be reached on January 1st of 2019, and Lower Basin curtailments will be narrowly avoided for the fourth straight year. But this is not all good news, and is not evidence of successful crisis management. The reality of the situation is that the dominos have already begun to tumble, and the proof lies upstream in Lake Powell.

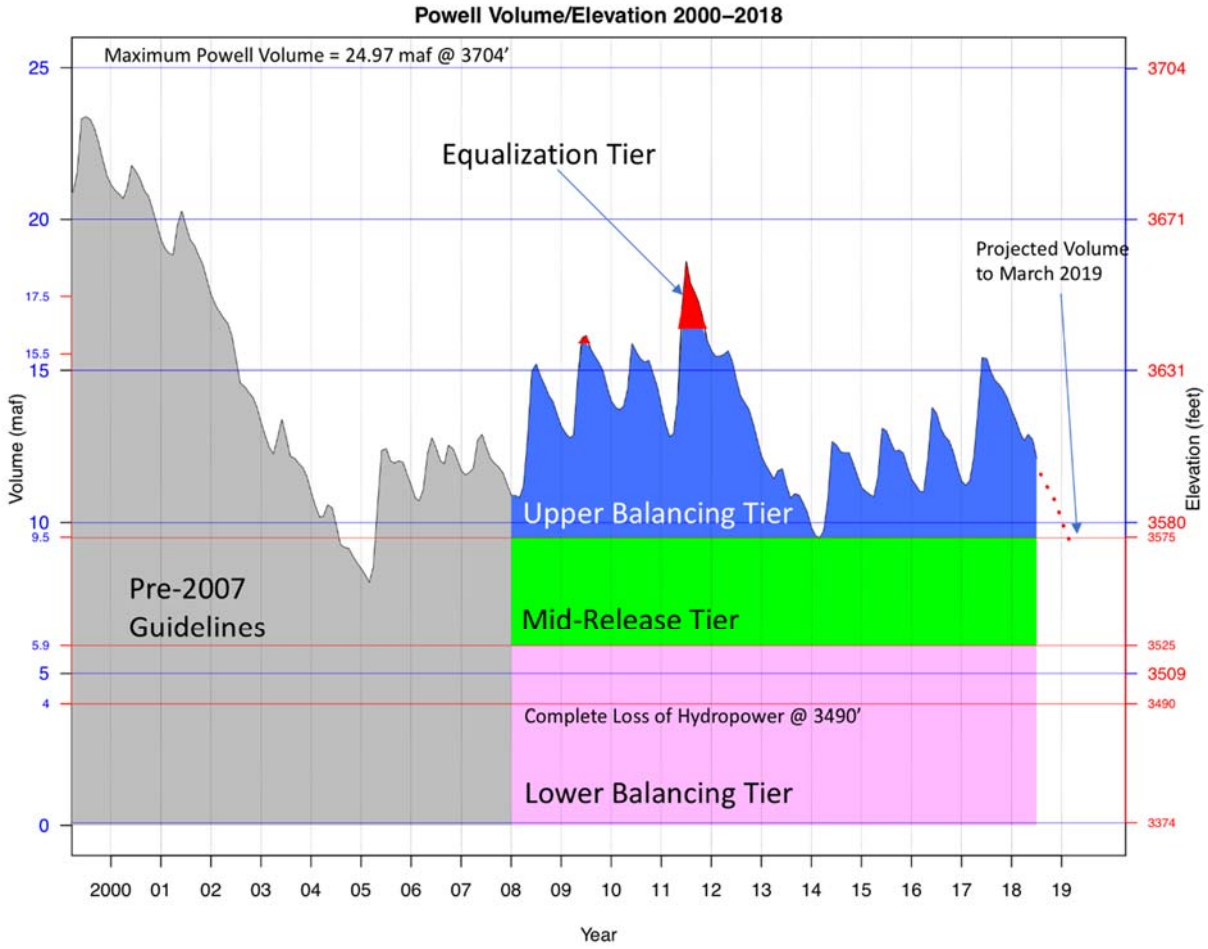
From 2000 through the end of 2018 (projected), Lake Powell's elevation will have dropped approximately 94 feet despite Upper Basin consumption only averaging about 4.5 million acre-feet (maf)/year. Several particularly dry years—including 2018—in a process of continuing aridification contributed to the drop, but ultimately it is the operational rules that are slowly but surely draining Lake Powell. Through 2018, cumulative releases since 2000 from the reservoir will be approximately 11 maf higher than the 8.23 maf/year baseline traditionally utilized by Reclamation (see figure on page 3). Had those excess releases remained in Lake Powell, the lake level would not have declined. However, those extra releases—now governed by the 2007 Interim Guidelines—are the only thing that has kept Lake Mead from dropping into shortage conditions. Current storage in Lake Mead is approximately 10 maf.

Continuing this operational pattern will further drain Lake Powell and erode the benefits associated with its water storage, including Lower Basin water deliveries, Glen Canyon hydropower generation, and perhaps most importantly, the delicate interbasin truce brokered by the Law of the River and made operational by the two massive reservoirs. The structural deficit is the true villain in this story, mixing with the operational rules to drain Lake Powell.[1] The process is already well underway. If storage in Lake Powell cannot rebound in an era where the Upper Basin consumes less than two-thirds of its legal apportionment, then the crisis is already real.

[1] The term "structural deficit" refers to the ongoing consumption of more water from the Colorado River in the Lower Basin than reliable inflows (minus evaporation) to Lake Mead. The CRRG has discussed this in: *A Look at the Interim Guidelines at Their Mid-Point: How Are We Doing?* (December, 2015), at https://www.coloradoriverresearchgroup.org/publications.html.

Deciphering the Story of Lake Powell Elevations

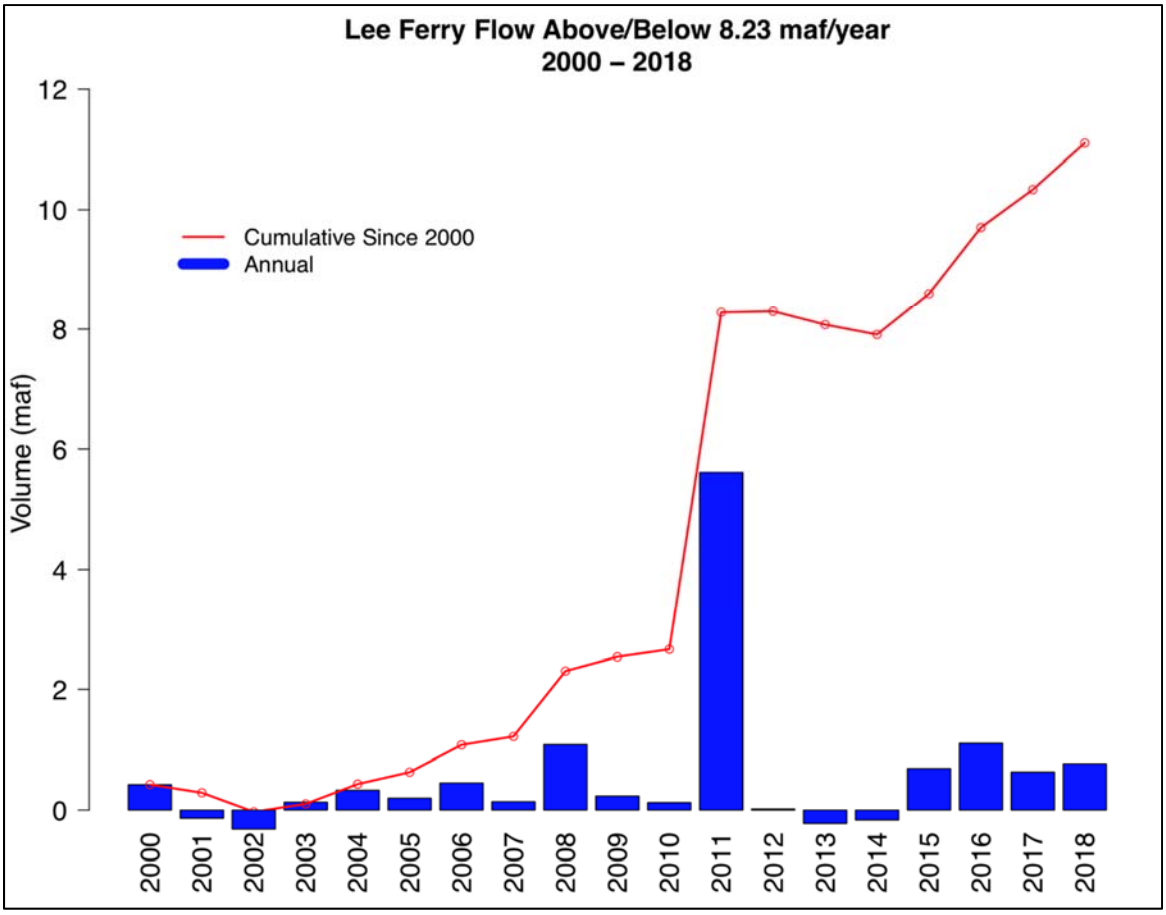
Lake Powell entered the 21st century nearly full at 3681' (21.4 maf), then declined rapidly before stabilizing at an uncomfortably low level (as shown below). Although Lake Powell does not have shortage triggering elevations as does Lake Mead, further elevation declines at Lake Powell prompt a variety of operational issues at Glen Canyon Dam's hydropower facilities (via vortex and cavitation problems). This likely begins around 3525' (approximately 5.9 maf); the official minimum power pool occurs at 3490' (roughly 4.0 maf of live storage). This is significant for more than just hydropower users, as many key environmental and salinity control programs are funded from these hydropower revenues.[2] Should the reservoir decline further, Lake Powell would move through the upper, mid and lower operational tiers that dictate the release volumes downstream to restore Lake Mead storage. At 3370', Powell is at dead pool, and releases of any kind are impossible. To put these numbers in context, Powell is expected to end 2018 around 3587' (approximately 10.5 maf, or half the 2000 value), while Lake Mead will hover around 1080' (roughly 10 maf).



[2] Among other things, Glen Canyon hydropower revenues support the Glen Canyon Dam Adaptive Management Program, the Upper Colorado River Endangered Fish Recovery Program, the San Juan Recovery Program, and the Colorado River Basin Salinity Control Program.

In the Lower Basin, the reasons behind Lake Mead declines, and the solution to those declines, is now widely understood: it is all about the structural deficit—i.e., the practice of consuming more water each year (including system losses) than enters the reservoir. Those simple inflow/outflow mathematics also apply to Lake Powell, but Powell ultimately tells a more complex story. For starters, storage in Lake Powell responds to the whims of nature with sudden, dramatic movements. Dry periods, such as 2002-2005 and 2012-2013, have an immediate impact (as shown above). We will see more of these dry periods, which become especially problematic when the reservoir is already low.[3] In fact, 4 of the 10 lowest runoff years in record (going back to 1906 and using estimated values for 2018) have occurred since the turn of this century. Our hydrology is changing; so must our water use practices.

The story told by the wet years, however, is perhaps more illuminating. In reservoirs designed to provide multi-year carryover storage, declines are expected in dry years, and recovery is expected in wet years. In the case of the Colorado, wet years occurred about 50% of the time in the 20th century, but since 2000 have occurred only 25% of the time. When large inflows do occur, current operational rules immediately trigger large releases. The experience in 2011 is illustrative: inflow was more than 5 maf higher than usual, but so was the subsequent release (as shown below). The inability of Lake Powell to achieve a lasting recovery in the wet years is another causality of how the Lower Basin structural deficit works its way through the operational rules. To view the structural deficit as a Lower Basin and/or a Lake Mead problem is thus much too simplistic; it is central to all the basin's water supply woes.



[3] For more info, see: *When is Drought Not a Drought?: Drought, Aridification, and the "New Normal"* (March, 2018), at https://www.coloradoriverresearchgroup.org/publications.html.

Addressing the Lake Powell Problem

The ability of Lake Powell storage to recover in wet years could be enhanced by new operational rules, perhaps including changes to the location of the "balancing tiers" and/or the equalization threshold, the establishment of Upper Basin ICS (Intentionally Created Surplus) programs, and a wide range of other possibilities that reduce water consumption. These items will undoubtedly be discussed further in coming years. Better options might be found by thinking outside of this familiar framework. Lakes Mead and Powell, after all, are essentially one giant reservoir (bisected by a glorious ditch) if not for the Lee Ferry accounting station and the administrative delineation of Upper and Lower Basins. Managing—and thinking—of these facilities as two distinct reservoirs, one for the benefit of the Upper Basin and one for the Lower, now seems outdated. Even tinkering with these familiar elements of basin administration and the Law of the River are categorically off-the-table for many interests, but it might be worthwhile to think about what could be achieved in terms of water security, Grand Canyon (and perhaps Glen Canyon) restoration, and other objectives if we allowed ourselves more flexibility in managing (and perhaps modifying) the massive infrastructure investments already in place. Long-term, we may have no choice to consider reform on this scale.

Currently, the future of Lake Powell—and for that matter, Lake Mead—is largely tied to the drought contingency plan (DCP) negotiations underway in both basins. The primary focus in the Lower Basin continues to be on avoiding deep curtailments, while the Upper Basin is increasingly coming to terms with potentially needing to manage a compact call or, at least, a loss of hydropower generation in Lake Powell. Already, these negotiations are pressing up against the deadline for starting negotiations on version 2 of the Interim Guidelines. For many in the basin, the next generation of Guidelines are the place to adopt a comprehensive solution—a sustainable water budget. This is something the current rules do not provide, even though they have extended the window of time for doing so. The new framework can potentially take many forms, but at a minimum, will need to recognize the linked future of the two basins, and the political necessity of addressing equity concerns among users, sectors, and regions. Admittedly, this is a tall order on a tight deadline, but the recent history of Lake Powell shows us that the status quo is untenable. In different ways, both reservoirs illustrate the same lesson: it is impossible to keep a bathtub full while the drain is left open.