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Ms. Dedina Williams
Bureau of Reclamation, Lower Colorado Basin Region
Ms. Marcie Bainson
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Salt Lake City, Utah 84138
Submitted via email to: CRinterimops@usbr.gov

Re: *Supplemental Environmental Impact Statement for the Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions*

Dear Ms. Williams and Ms. Bainson:

Thank you for the opportunity to comment on the *Supplemental Environmental Impact Statement for the Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions* ("SEIS"; "*Operational Strategies*").

The Sierra Club's mission is "to explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments."

The Grand Canyon (Arizona) Chapter was formed in 1965 in order to focus attention on stopping dams in Grand Canyon. Our work to protect the Colorado River and Grand Canyon National Park continues today. Our 13,000 members and supporters have a significant interest in the *Operating Strategies* and how they will affect the health of the Colorado River and water deliveries. Our members recreate in Grand Canyon and on the Colorado River, and many rely on Colorado River water for their drinking water and livelihoods.

We are submitting this letter in addition to the letter submitted by the Sierra Club's Colorado River Task Force and incorporate that letter by reference.

Background and Legal Framework

The Secretary of the Department of the Interior (DOI) and the National Park Service (NPS) have the responsibility to "conserve the scenery and the natural and historic objects and the wild life therein" (National Park Service Organic Act of 1916 (16 U.S.C. Sec. 1-18f, 39 Stat 535). Further, the Endangered Species Act (Endangered Species Act of 1973 [Public Law 93-205, 87 Stat. 884]) requires that:

> Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an ''agency action'') **is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species** which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. **In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available.** (Sec. 7(2) [16 U.S.C. 1536], emphasis added)

The Grand Canyon Protection Act (GCPA) (1992) specifies that Glen Canyon Dam "shall" be operated in a manner that is protective of Grand Canyon National Park and Glen Canyon National Recreation Area:

> "The Secretary shall operate Glen Canyon Dam… in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use." (Grand Canyon Protection Act (GCPA) (1992), Section 1802(a))

When the GCPA was passed in 1992, it was passed with the intention of reversing damage that Glen Canyon Dam's hydropower production was inflicting on Grand Canyon. Senate bill sponsor John McCain explained, "widely fluctuating water releases from the dam, primarily for the maximum generation of hydroelectric peaking power, are contributing to the irreversible erosion of river beaches. It is critical to recognize that river beaches are not merely convenient resting spots for river rafters, hikers, and Grand Canyon campers. The beaches are extremely valuable biological resources which support riparian vegetation and diverse forms of wildlife. They are precious and fragile ecosystems which are as vital a part of the canyon as a view from the South rim and just as deserving of protection."[1]

Congressman George Miller, who sponsored the bill in the House elaborated, "In the name

[1] USBOR. No date. "Grand Canyon Protection Act" PowerPoint presentation. Available at: https://www.usbr.gov/uc/rm/amp/amwg/mtgs/10aug24/Attach_07c.pdf, accessed 11/11/2016; p. 342 in Congressional Record: Proceedings and debates of the 101st Congress, Second Session. Thursday, June 28, 1990. Vol. 136 No. 85-Part II.

of more electric power production mindless and unnecessary damage is being inflicted every day on the resources of the Grand Canyon, one of the most precious park resources in the world... the daily operation of Glen Canyon dam to produce hydroelectric power was wreaking havoc on the beaches and wildlife habitat at the bottom of Grand Canyon."[2]

The GCPA specifically mentions compliance with the Colorado River Storage Project Act of 1956 (Public Law 84-485) (CRSP), the law that authorized the construction of Glen Canyon Dam, in reference to water:

> Compliance With Existing Law. -- The Secretary shall implement this section in a manner fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in Arizona v. California, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River basin. (GCPA Sec. 1802(b))

Regarding hydropower, GCPA only discusses the need to replace Glen Canyon Dam's power with other power supplies. Through the GCPA, "the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established" were prioritized above Glen Canyon Dam's hydropower production:

> SEC. 1809. REPLACEMENT POWER.
>
> The Secretary of Energy in consultation with the Secretary of the Interior and with representatives of the Colorado River Storage Project power customers, environmental organizations and the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming shall identify economically and technically feasible methods of replacing any power generation that is lost through adoption of long-term operational criteria for Glen Canyon Dam as required by Section 1804 of this title. The Secretary shall present a report of the findings, and implementing draft legislation, if necessary, not later than two years after adoption of long-term operating criteria. The Secretary shall include an investigation of the feasibility of adjusting operations at Hoover Dam to replace all or part of such lost generation. The Secretary shall include an investigation of the modifications or additions to the transmission system that may be required to acquire and deliver replacement power. (GCPA, Sec. 1809)

This need to protect Grand Canyon from damage associated with power production, while adhering to water delivery requirements, was emphasized in the words of Bill McDonald, Colorado River Basin States' Governors' Representative for Colorado River Reservoir Operations and the Upper Colorado River Commission:

> "Monthly and annual reservoir operations at Glen Canyon Dam are of the most concern

[2] USBOR. No date. "Grand Canyon Protection Act" PowerPoint presentation. Available at: https://www.usbr.gov/uc/rm/amp/amwg/mtgs/10aug24/Attach_07c.pdf, accessed 11/11/2016.

> to the States' Representatives and the Commission. Restrictions on within-the-month fluctuations for power releases are of concern only if those restrictions interfere with the volume of water to be released in any given month."[3]

The same sentiment is presented in this unattributed quote from a Bureau of Reclamation PowerPoint on the subject:

> "The purpose and intent of section 3 is simple. This language is intended as a clear, concise directive to the Secretary on how to operate Glen Canyon Dam. The Secretary must operate the dam to protect the downstream resources within the context of the Secretary's water compact responsibilities and other elements of the "Law of the River." For the last fifteen years, the Secretary appears to have ignored the resource protection responsibilities in favor of maximizing production of peaking power. Section 3 is intended to provide clear direction to the Secretary as to what his responsibilities are."[4]

Hydropower generation is intended to be "incident" to other purposes set forth in the Colorado River Storage Project Act of 1956 (Public Law 84-485), the act which authorized Glen Canyon Dam. The Secretary of the Interior was authorized to "construct, operate, and maintain" Glen Canyon Dam:

> ". . . for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for the reclamation of arid and semiarid land, for the control of floods, **and for the generation of hydroelectric power, as an incident of the foregoing purposes**…" (Section 1 of the Act (43 United States Code [U.S.C.] ' 620, emphasis added)

The Department of Interior (DOI) and Bureau of Reclamation (BOR) have a clear responsibility to use Glen Canyon Dam to manage water according to the obligations in CRSP and GCPA. Because hydropower cannot be prioritized above other purposes under CRSP and GCPA, BOR has the liberty to manage Glen Canyon Dam to effectively conserve water and natural resources without the additional burden of providing hydropower from the dam.

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[3] Ibid.
[4] Ibid.

The Federal government must "protect, mitigate adverse impacts to, and improve" the Colorado River Ecosystem (CRE) in Grand Canyon.

1) Science and legal obligations should dictate the Purpose and Need and the Proposed Action.

At least 13, and up to 22, animal species have been extirpated from the Colorado River ecosystem since Glen Canyon Dam closed in 1963[5], and non-native plant species are now prevalent in riparian habitats (at one time the razorback sucker was thought to be extirpated but it has since been found in newly exposed river segments above Lake Mead). Three of eight native main stem fish (Colorado pikeminnow, bonytail chub, roundtail chub) have been extirpated from Grand Canyon and four more (humpback chub, razorback sucker, flannelmouth sucker, and bluehead sucker) require intensive management to avoid serious decline.[6] Changes in all aspects of the natural flood regime threaten the survival of riparian and aquatic species: flow magnitude, frequency, duration, timing, and rate of change across hourly to century scales[7].

The effects of this problem were recognized decades ago, leading to an important mandate from Congress to mend the river ecosystem:

> "The Secretary shall operate Glen Canyon Dam… in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use." (GCPA) (1992), Section 1802(a))

Among the needs that BOR offers for initiating the *Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions* are:

> It is foreseeable that without appropriate responsive actions and under a continuation of recent hydrologic trends, major Colorado River reservoirs could continue to decline to "dead pool"—elevations at which water cannot be regularly released from a reservoir—in coming years…
>
> Lake Powell and Lake Mead face extraordinary risks over the next 12-24 months, and that additional actions are needed to protect the reservoirs from rapidly declining to critically-low elevations: reductions totaling millions of acre-feet in

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[5] Stevens et al. No Date. AMP GOAL 3: Assessing Restoration Potential Of Taxa Of Management Concern In The Colorado River Ecosystem Downstream From Glen Canyon Dam. Available at https://www.usbr.gov/uc/progact/amp/twg/2011-06-28-twg-meeting/Attach_09b.pdf, accessed 12/20/22, attached as Ex. 1. Also see http://gcdamp.com/index.php/EXTIRPATED, accessed 12/20/22.

[6] https://www.nps.gov/grca/learn/nature/fish-native.htm, accessed 12/14/22.

[7] Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg.1997. The natural flow regime. Bioscience 47:769-784, attached as Ex.2; Schmidt, J.C., and P.E. Grams. 2011. Understanding Physical Processes of the Colorado River. Chapter 2 in: Effects of Three High-Flow Experiments on the Colorado River Ecosystem Downstream from Glen Canyon Dam, Arizona. U.S. Geological Survey Circular 1366. T.E. Melis, ed., 147 pp., attached as Ex. 3.

reductions of use across the Basin could be needed to stabilize the reservoirs.[8]

The Purpose and Need for the new *Operational Strategies* must include recognition that the CRE in Grand Canyon lies vulnerably between the two aforementioned reservoirs, a vital natural system that must be a forethought and not omitted from any Colorado River planning processes.

Sediment in Grand Canyon is severely limited by Glen Canyon Dam upstream. The sediment limitation has not only caused degradation of habitats, cultural sites, and recreational beaches, but it has also cost millions for studies and attempted remediation. Previous implementation of the Interim Guidelines via equalization flows between the reservoirs in 2011 caused irreparable damage to Grand Canyon by scouring sediment from beaches and sandbars that will never be fully replaced.[9] Because Grand Canyon depends upon proper dam management, unlike past guidelines, the new ones must be sensitive to resultant impacts on the river resource.

The 2019 *Colorado River Conversations Final Conference Report*, compiled by the University of Arizona Center for Climate Adaptation Science and Solutions, recorded the need identified by participants to see the river as a system, and to protect Grand Canyon's precious sediment:

> "Participants noted that the future management of the system must consider the river as a whole, not as two individual basins or as a series of separate segments between dams that are operated to optimize particular objectives. Considering the river as a whole requires accounting for groundwater, tributaries, sediment, temperature, salinity, the Salton Sea, and the Delta – not just the volumes of surface water that can be diverted from the mainstem under different flow regimes. It also means empowering the full array of stakeholders and affected parties to engage in discussions about the River's future…"[10]
>
> and
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> "Sediment balance should be added into the management considerations. The fundamental dilemma for Grand Canyon is the stream water is out of balance with sediment supply… Equalization flows wipe out sand bars. There are ecological consequences of moving that much water all at once."[11]

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[8] https://www.federalregister.gov/documents/2022/06/24/2022-13502/request-for-input-on-development-of-post-2026-colorado-river-reservoir-operational-strategies-for, accessed 12/13/22.

[9] Figure 8 in Ashley, T.C., B. McElroy, D. Buscombe, P.E. Grams, and M. Kaplinski. 2020. Estimating bedload from suspended load and water discharge in sand bed rivers. Water Resources Research 56:https://doi.org/10.1029/2019WR025883, attached as Ex. 4; p. 25 in Jacobs et al. 2019. Colorado River Conversations Final Conference Report. https://ccass.arizona.edu/sites/default/files/CRC_Conference_Report_Final_05.10.2020.pdf, accessed 12/13/22, attached as Ex. 5; Figure 2 in Grams, P.E., D. Buscombe, D.J. Topping, M. Kaplinski, and J.E. Hazel Jr. 2018. How many measurements are required to construct an accurate sand budget in a large river? Insights from analyses of signal and noise. Earth Surface Processes and Landforms 44:160-178, https://doi.org/10.1002/esp.4489, attached as Ex. 6.

[10] p. 4 in Jacobs et al. 2019. Colorado River Conversations Final Conference Report. https://ccass.arizona.edu/sites/default/files/CRC_Conference_Report_Final_05.10.2020.pdf, accessed 12/13/22, attached as Ex. 5.

[11] p. 25 in Id.

The new *Operational Strategies* must address the river as a holistic system, and must protect Grand Canyon from further harm. Despite efforts to mimic flood flows, manage introduced species, and translocate native fish, the ecological integrity of the CRE in Grand Canyon continues to struggle.

The geography of Grand Canyon creates both opportunities for and challenges to protecting native fish species. Tributaries, many of which have retained their natural hydrography, water quality, and temperature regimes, remain as refugia for native fish and their food bases, including threatened species.[12] Lowered reservoir levels have revealed more than 100km of aquatic habitat upstream of Lake Mead that is protected from most non-native fish invasions by Pearce Ferry Rapid, enabling western Grand Canyon to become "a rare contemporary example of native fish populations regaining dominance over invasive fishes in the desert southwest."[13] Simultaneously, lower reservoir levels above Glen Canyon Dam are allowing warmer waters into the CRE in Grand Canyon that benefit both native fish and warm water exotic species; unfortunately, warm water exotic species such as smallmouth bass (*Micropterus dolomieu*) are colonizing Grand Canyon and could greatly reduce native fish populations if they take hold.[14]

Experimentation, monitoring, and modelling reveal a number of factors that will optimize conditions for Grand Canyon's native fish assemblage. Maintaining a barrier to non-native fish migration at Pearce Ferry, preventing non-native fish from moving through Glen Canyon Dam, preserving natural flow regimes in tributaries, restoring a flow regime based upon pre-dam conditions in the mainstem, and protecting a Colorado River temperature that is too cold to allow warm water exotic species establishment in tributary streams are all essential to the CRE.[15]

As BOR figures out how much water it will annually release through Glen Canyon Dam, the agency should aim to release water in a way that mimics a historically-timed hydrograph. On other rivers where dams have been operated to mimic the historic hydrograph,

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[12] Healy, B.D., R.C. Shelly, C.B. Yackulic, E.C. Omana Smith, and P. Buddy. 2020. Remarkable response of native fishes to invasive trout density, temperature, and annual hydrology. Canadian Journal of Fish and Aquatic Science 77:1446-1462, attached as Ex. 7; Healy, B.D., E.C. Omana Smith, R.C. Schelly, M.A. Trammell, and C.B. Nelson. 2019. Establishment of a Reproducing Population of Endangered Humpback Chub through Translocations to a Colorado River Tributary in Grand Canyon, Arizona. Journal of Fisheries Management 40:278-292, attached as Ex. 8; Sabo, JL, Caron, M, Doucett, R, et al. Pulsed flows, tributary inputs and food-web structure in a highly regulated river. J Appl Ecol. 2018; 55: 1884– 1895. https://doi.org/10.1111/1365-2664.13109, attached as Ex. 9.

[13] Keggeries, R.B., B. Albrecht, M.C. McKinstry, R.J. Rogers, R.A. Valdez, A.L. Barkalow, E.I. Gilbert, H.E. Mohn, B. Healy, and E.O. Smith. 2020. Small-bodied fish surveys demonstrate native fish dominance over 300 kilometers of the Colorado River through Grand Canyon, Arizona. Western North American Naturalist 80:146-156, attached as Ex. 10.

[14] Dibble, K.L., C.B. Yackulic, T.A. Kennedy, K.R. Bestgen, and J.C. Schmidt. 2021. Water storage decisions will determine the distribution and persistence of imperiled river fishes. Ecological Applications 31:1-9, attached as Exhibit 11.

[15] Ibid; Keggeries et al. (2020), attached as Ex. 10; Healy, B.D., P. Buddy, M.M. Conner, and E.C.O. Smith. 2022. Life and death in a dynamic environment: invasive trout, floods, and intraspecific drivers of translocated populations. Ecological Applications e2635; https://doi.org/10.1002/eap.2635, attached as Ex. 12; Healy, B.D., C.B. Yackulic, and R. Schelly. 2022. Impeding access to tributary spawning habitat and experimental fall-timed floods increases brown trout immigration into a dam's tailwater. Canadian Journal of Fisheries and Aquatic Sciences https://doi.org/10.1139/cjfas-2022-0231, attached as Ex. 13; Deemer, B.R., C.B. Yackulic, R.O. Hall, Jr., M.J. Dodrill, T.A. Kennedy, J.D. Muehlbauer, D.J. Topping, N. Voichick, and M.D. Yard. 2022. Experimental reductions in sub-daily flow fluctuations increased gross primary productivity for 425 river kilometers downstream. PNAS Nexus 1:pgac094, https://doi.org/10.1093/pnasnexus/pgac094, attached as Ex. 14; Healy, B.D., R.C. Shelly, C.B. Yackulic, E.C. Omana Smith, and P. Buddy. 2020. Remarkable response of native fishes to invasive trout density, temperature, and annual hydrology. Canadian Journal of Fish and Aquatic Science 77:1446-1462, attached as Ex. 7.

benefits extended to a multitude of aquatic and riparian resources.[16] Evidence is accruing that the same would be true for Grand Canyon.[17] Likewise, when daily fluctuations are minimized in a manner more akin to pre-dam patterns, downstream primary productivity increases.[18] Unfortunately, the Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) makes a historically timed, spring or early summer experimental flood pulse, difficult to implement.[19] The SEIS should create a way to operate Glen Canyon dam in a manner that is more similar to pre-dam conditions to favor the CRE in Grand Canyon.

Importantly, drought should not be used as an excuse to postpone or cancel any flow management action intended to benefit native fish or redistribute sediment in Grand Canyon. In 2021 and again in 2022, a High Flow Experiment (HFE) was skipped despite U.S. Geological Survey scientists reporting the proper conditions for a 192 hour (8 day) HFE for the first time ever under LTEMP, and while sandbar size was the lowest in ten years.[20] BOR decided not to implement the HFE because of "concerns about pool elevation and the Basin Fund, although there would have been a positive effect on sediments especially given the unprecedented drought conditions."[21] This is despite the acknowledgement that HFEs do not affect annual water release volumes.[22] Again, we point to the Grand Canyon Protection Act, which is clear about the obligation that the Secretary of Interior has to operate the dam "in such a manner as to protect, mitigate adverse impacts to, and improve" Grand Canyon. In this case, the Secretary had an unprecedented opportunity and let it pass without an adequate reason.

Ecologically beneficial flow implementation is more vital than ever as we face the changed circumstance of new warm water-adapted introduced fish species (such as smallmouth bass) which require an urgent response. Scientists are now developing plans to experimentally manage these species with flow actions, and those actions must not be delayed. We should listen to the capable scientists working on this problem. The process of developing new *Operational Strategies* should not interfere with the upcoming Environmental Assessment on warm water exotic species in Grand Canyon, nor with its implementation.

Of course, all of our recommendations depend upon the ability to move water through Grand Canyon. Regardless of how we choose to manage Glen Canyon and Hoover Dams, researchers warn us that the only way we will save the Colorado River

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[16] Richter, B.D., R. Mathews, D.L. Harrison, and R. Wigington. 2003. Ecologically sustainable water management: managing river flows for ecological integrity. Ecological Applications 13:206–224, attached as Ex. 15; Rood, S.B., C.R. Gourley, E.M. Ammon, L.G. Heki, J.R. Klotz, M.L. Morrison, D. Mosley, G.G. Scoppettone, S. Swanson, and P.L. Wagner. 2003. Flows for Floodplain Forests: A Successful Riparian Restoration. BioScience 53:647- 656, attached as Ex. 16.

[17] Healy, B.D., P. Buddy, M.M. Conner, and E.C.O. Smith. 2022. Life and death in a dynamic environment: invasive trout, floods, and intraspecific drivers of translocated populations. Ecological Applications e2635, attached as Ex. 12. https://doi.org/10.1002/eap.2635; Healy et al. (2022), attached as Ex. 12; Healy et al. (2020), attached as Ex. 7..

[18] Deemer et al. (2022), attached as Ex. 14.

[19] Healy et al, (2022), attached as Ex. 13.

[20] pp. 11-12 in Glen Canyon Dam Adaptive Management Program Technical Work Group Meeting October 13-14, 2021. Available at https://www.usbr.gov/uc/progact/amp/twg/2021-10-14-twg-meeting/20211014-TWGMeeting-FinalMinutes-508-UCRO.pdf, accessed 12/14/22, attached as Ex. 17.

[21] Ibid.

[22] Ibid.

or its reservoirs is to decrease the amount of water we remove from the river.[23] We must do away with piecemeal planning and rapidly devise a holistic plan that sees the river as an interconnected entity, inseparable from the people who live in the Basin and depend upon its water.

Recommendation: Include within the Purpose and Need statements for the *Development of Post-2026 Colorado River Reservoir Operational Strategies for Lake Powell and Lake Mead Under Historically Low Reservoir Conditions* the protection and restoration of the CRE in Grand Canyon as required by the Grand Canyon Protection Act, the Endangered Species Act, and the purpose and significance of Grand Canyon National Park.

Recommendation: The *Operational Strategies* should require flows to be released from Glen Canyon Dam in a way that minimizes daily fluctuations, creates flood pulses in the spring (similar to pre-dam flood pulse timing) when sediment levels are adequate, optimizes sediment retention downstream, and keeps water temperatures in the Colorado River through Grand Canyon as cold as possible.

Recommendation: The *Operational Strategies* must include clear and unambiguous language requiring flows that benefit the CRE, native fish, and/or sandbars in Grand Canyon to be implemented as advised in LTEMP, the Expanded Non-Native Aquatic Species Management Plan, or as analyzed in any other previous or future Environmental Assessment, Environmental Impact Statement, or management plan unless it is physically impossible to pass water through Glen Canyon Dam. Since "regulating flow" and "control of floods" are primary purposes of Glen Canyon Dam in CRSP, and hydropower is not a primary purpose of the dam, regulated flows and controlled floods should be incorporated into the new *Operational Strategies* as tools to further the intent of the GCPA. Low water levels and hydropower should not be an excuse to avoid actions that will have no net impact on annual downstream water delivery.

2) BOR must plan for dam modifications now, before we are in an emergency situation.

We now understand that climate can cause reservoir levels to fluctuate beyond the levels anticipated at the time of dam construction. Significantly, a report by the National Research Council (NRC) that studied the Colorado River's flow over the last several hundred years with tree ring data has found that previous droughts were longer and more severe than anything in the historical record.[24] Current and future droughts will be longer and more severe because of a regional warming trend, and more challenging for native species to survive.[25] The NRC report also stated that "the preponderance of scientific evidence suggests that warmer future temperatures will reduce future Colorado River streamflow and water supplies. Reduced streamflow would also contribute to increasing

[23] Bruckerhoff, L.A., K. Wheeler, K.L. Dibble, B.A. Mihalevich, B.T. Neilson, J. Wang, C.B. Yackulic, and J.C. Schmidt. 2022. Water Storage Decisions and Consumptive Use May Constrain Ecosystem Management under Severe Sustained Drought. JAWRA Journal of the American Water Resources Association n/a–n/a. https://doi.org/10.1111/1752-1688.13020, attached as Ex. 18.

[24] National Research Council. 2007. Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability. Washington DC: National Academies Press, attached as Ex. 19.

[25] Udall, B. and J. Overpeck. 2017. The twenty-first century Colorado River hot drought and implications for the future. Water Resources Research. 53:2404-2418, attached as Ex. 20.

severity, frequency, and duration of future droughts."[26] The BOR was one of the sponsors of this study.

The SEIS must specifically create a plan for providing water to the Colorado River in Grand Canyon during extended drought periods. The water must be of sufficient quality and appropriate temperature to protect Grand Canyon's native species, and delivered in such a manner as to protect the CRE in Grand Canyon.

To insure against the loss of a flowing river through Grand Canyon, BOR must create a plan for releasing water through Glen Canyon Dam if levels fall below the dam's intakes. BOR must include in its disclosure predictions for what the water quality and temperature will be when reservoir levels drop. In this regard, BOR should consider an alternative including dam modifications such as bypass tubes at or near the base of the dam, to enable flows when the reservoir level falls below dead pool. These tubes might pass through the dam or they might pass through the sandstone walls surrounding the dam. BOR must start planning now because we know that bypass development will take years to achieve.

As recent projections indicate, minimum power pool appears imminent.[27] If we are interpreting the graphs correctly, BOR predictions of reservoir end of month elevations have overestimated observed annual means for some portion of the year in at least 15 out of the past 32 years, though BOR asserts, "The Probable Minimum inflow scenario reflects a dry hydrologic condition which statistically would be exceeded 90% of the time."[28] We recognize that long range hydrologic predictions are extremely difficult, but whether BOR's most recent 24-month Lake Powell End of Month Elevations are correct or not, we must prepare for crisis.[29] It is time to speak frankly – and urgently – about the problem that BOR may have moving water through Grand Canyon in the very near future.

Should the Minimum Probable Inflow from the most recent Lake Powell End of Month Predictions prove correct, Powell reservoir could fall below minimum power pool in a year.[30] If the reservoir drops another 50-60 feet beyond minimum power pool, the Upper Basin will be unable to deliver water to the Lower Basin and Mexico as required by the Colorado River Compact, and if the reservoir drops 120 feet below minimum power pool, we will be in a deadpool situation.[31]

The Bureau should consider at what point river management — specifically, water and

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[26] NRC (2007), attached as Ex. 19.
[27] BOR. December 2022 24-Month Study Projections Lake Powell and Lake Mead: End of Month Elevation Charts. https://www.usbr.gov/uc/water/crsp/studies/images/PowellElevations.pdf, accessed 12/12/22, attached as Ex. 21.
[28] Id. at 1; NOAA National Weather Service Colorado River Basin Forecast Center GLDA3 Water Supply Verification Annual/Official Verification https://www.cbrfc.noaa.gov/rmap/wsup/point.php?rfc=cbrfc&mode=verif&id=GLDA3, accessed 12/12/22, attached as Ex. 21.
[29] BOR (December 2022). https://www.usbr.gov/uc/water/crsp/studies/images/PowellElevations.pdf, accessed 12/12/22, attached as Ex. 21.
[30] Ibid.
[31] Figure 6, p. 19 in Utah Rivers Council, Glen Canyon Institute and the Great Basin Water Network. 2022. Antique plumbing and leadership postponed: How the Glen Canyon Dam's archaic design threatens the Colorado River water supply. https://www.glencanyon.org/wp-content/uploads/2022/08/Final-Antique-Plumbing-at-Glen-Canyon-Dam.pdf, accessed 12/12/22, attached as Ex. 22.

power needs — would be better served by maximizing water storage in Lake Mead rather than dividing it between Mead and Powell reservoirs. The Bureau should assess the comparative loss of water from bank storage and evaporation between maintaining both reservoirs, maintaining only Lake Mead, and an alternative where Lake Powell is kept low to reduce losses to infiltration and evaporation. Hydropower needs may be more secure if water is concentrated above Hoover Dam, where it will have a higher hydraulic head. Installing river outlets low on Glen Canyon Dam would enable BOR to keep Powell reservoir low without risking the inability to pass water through Glen Canyon Dam. BOR should also consult with entities on the Navajo Nation who are planning solar energy projects adjacent to existing power lines and in already disturbed areas to determine what the electric capacity of those projects will be, and whether they might serve to replace hydropower losses.

Because Powell reservoir is likely to fluctuate around its current level into the future, continuing the risk of allowing more warm water non-native fish in Grand Canyon, BOR should also examine the potential for other dam modifications that will limit fish passage through the dam. One possibility is upstream screening. Because it will take some time to analyze the feasibility of this action, BOR should begin to study it now.

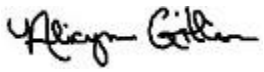
Recommendation: As part of this process, BOR must immediately begin to plan a way to move water around the dam at the base of Glen Canyon Dam. This will: 1) maintain flow through Grand Canyon and enable reliable water deliveries by eliminating the possibility of reaching dead pool, 2) enable water to be concentrated above Hoover Dam while maintaining the flexibility to move water downstream from a low Powell reservoir, and 3) allow cold water to be released from the deepest part of the reservoir, even when reservoir levels are low.

Recommendation: Assess the comparative loss of water from bank storage and evaporation between maintaining both reservoirs, maintaining only Lake Mead, and an alternative where Lake Powell is kept low to reduce losses to infiltration and evaporation.

Recommendation: As part of this process, BOR should implement screening upstream of Glen Canyon Dam to prevent future exotic species passage through the dam.

Thank you for your time and attention. Please keep us informed as this process moves forward.

Sincerely,



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