

LOOKING UPSTREAM

Analysis of low water levels in Lake Powell and the impacts on Water Supply, Hydropower, Recreation, and the Environment

A Companion Report to *The Bathtub Ring: Implications of Low Water Levels in Lake Mead on Water Supply, Hydropower, Recreation, and the Environment*



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OVERVIEW OF THE COLORADO RIVER BASIN AND LAKE POWELL

The Colorado River, is one of the most important natural resources to the region. Providing water to approximately 40 million people, the Colorado irrigates nearly 4.5 million acres of farmland, sustains 22 federally recognized tribes, provides the setting for a recreational economy crucial to the region, and produces enough hydro-electricity to power between 3-4 million U.S. homes.

This report considers impacts associated with reservoir declines in Lake Powell, and is intended to be a companion study to *The Bathtub Ring*, a similar report assessing impacts to Lake Mead. Together they comprehensively consider challenges across the entire Colorado River Basin. Looking Upstream examines how operating Lake Powell at low reservoir levels may affect water supply deliveries, hydropower generation, recreation, and environmental programs in the Upper Colorado River Basin.



PROJECT OBJECTIVES AND FINDINGS



DETERMINE THE FACTORS CONTRIBUTING TO THE UPPER BASIN'S VULNERABILITY TO WATER SHORTAGES



FACTORS CONTRIBUTING TO WATER SUPPLY VULNERABILITY ARE DIVERSE



PREDICT IMPACTS TO THE RECREATIONAL USE OF LAKE POWELL



RECREATIONAL VISITATION COULD DECLINE BY MORE THAN A QUARTER



DEFINE THE OPERATIONAL AND FINANCIAL IMPLICATIONS OF REDUCED RESERVOIR LEVELS ON HYDROPOWER GENERATION AT GLEN CANYON DAM



FIRMING PURCHASE COSTS COULD INCREASE UP TO A FACTOR OF TEN



DETERMINE THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH DECLINING RESERVOIR LEVELS IN LAKE POWELL

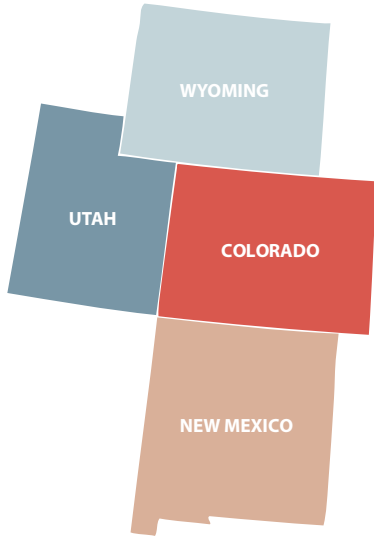


DECLINING RESERVOIR LEVELS COMPOUND WIDESPREAD ENVIRONMENTAL IMPACTS



FACTORS CONTRIBUTING TO WATER SUPPLY VULNERABILITY ARE DIVERSE

Hydrologic, social, and legal factors challenge the ability of the Colorado River to equitably meet future Upper Basin water needs. The *2007 Interim Guidelines* do not clearly dictate water delivery reductions for the Upper Basin; vulnerabilities are incremental and dictated by ongoing trends. Each Upper Basin state has its own set of vulnerabilities related to declining water levels; however, our analysis draws a variety of broad conclusions.



Models show increases in regional temperature, reductions in snowpack, and reductions in annual runoff and streamflow.



Major population centers are generally located outside of the hydrologic basin, increasing the demand for transbasin exports.



Many users reliant on Colorado River water have limited access to substitutable water sources.



Overall water use and population are expected to grow.



Municipal, industrial and energy sectors are expected to use more water in the future.



Great uncertainty remains as to how compact curtailments would be implemented in the event of substantial water shortages.



Upper Colorado River Basin states

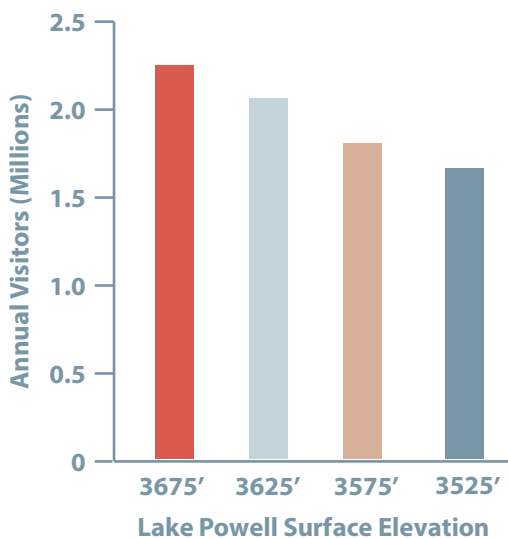


RECREATIONAL VISITATION COULD DECLINE BY MORE THAN A QUARTER

Using the relationship between past visitation numbers and lake volume, visitation is predicted to experience a significant overall decline on Lake Powell. No access points, including marinas, boat ramps and the Castle Rock Cut, will be operable below 3525' without additional investments or improvements. However, since 2011 the National Park Service has observed changing visitation patterns which may indicate a recent influx in land-based recreation. Over time, this may temper the impacts of declining lake levels on overall visitation.



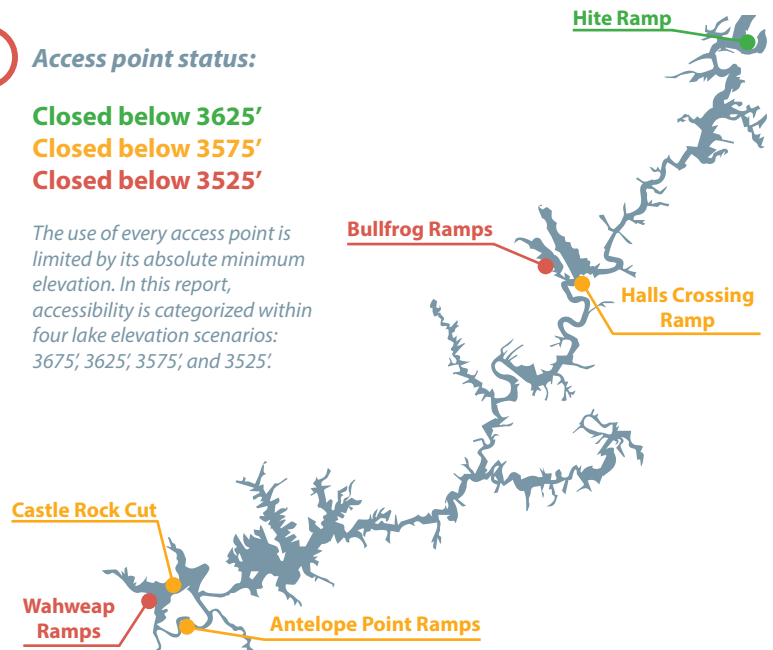
Predicted yearly Lake Powell visitation at four different elevation scenarios



Access point status:

- Closed below 3625'
- Closed below 3575'
- Closed below 3525'

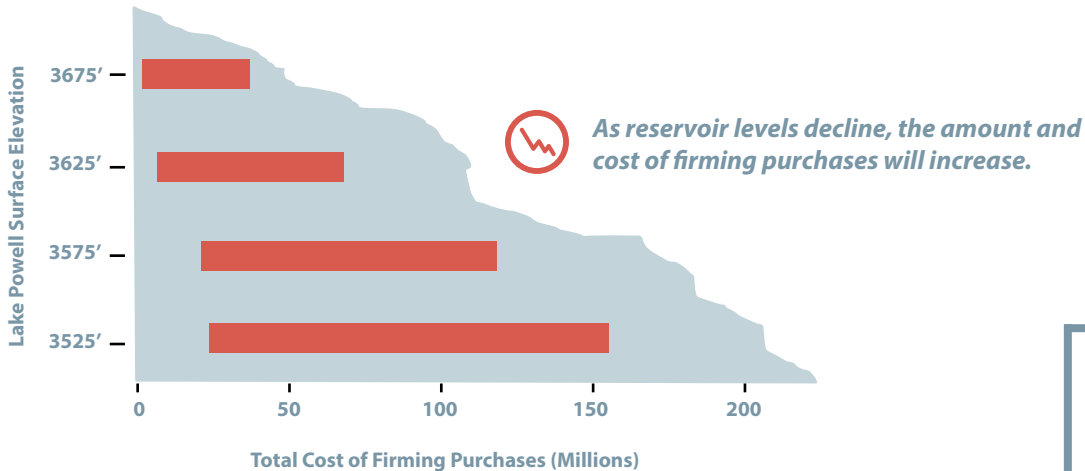
The use of every access point is limited by its absolute minimum elevation. In this report, accessibility is categorized within four lake elevation scenarios: 3675', 3625', 3575', and 3525'.





FIRMING PURCHASE COSTS COULD INCREASE BY A FACTOR OF FIVE TO TEN

The cost of firming purchases will increase as Lake Powell shrinks. Firming purchases are wholesale electricity purchases made by the Western Area Power Administration in order to meet contractual obligations when hydropower generation is limited. When power generation is limited at Glen Canyon by decreased reservoir elevations in Lake Powell, more firming purchases will be necessary.



Power generated at Glen Canyon Dam is consolidated with power from the Salt Lake City Area Integrated Projects (SLCA/IP) to form an aggregated energy product that is sold to utilities throughout the region.



Sustainable Hydropower (SHP) is the amount of power Western guarantees SLCA/IP customers. The concept of SHP was created by the 1996 Glen Canyon Environmental Impact Statement Record of Decision.



Western makes firming purchases on the wholesale market to meet its SHP obligation during times of shortage.

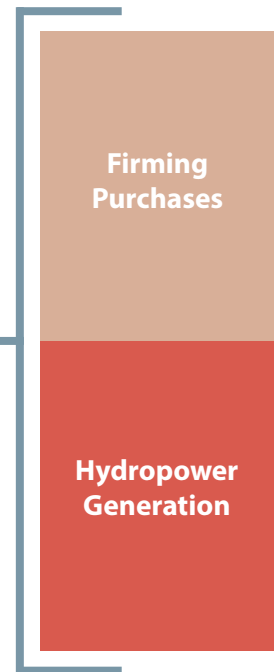


SHP is less than the full energy capacity that SLCA/IP customers are entitled to receive, known as the Contract Rate of Delivery (CROD).



SLCA/IP customers have a variety of options to reach their CROD entitlement.

Sustainable Hydropower (SHP)



Western's SHP obligations are made up of hydropower generation and firming purchases



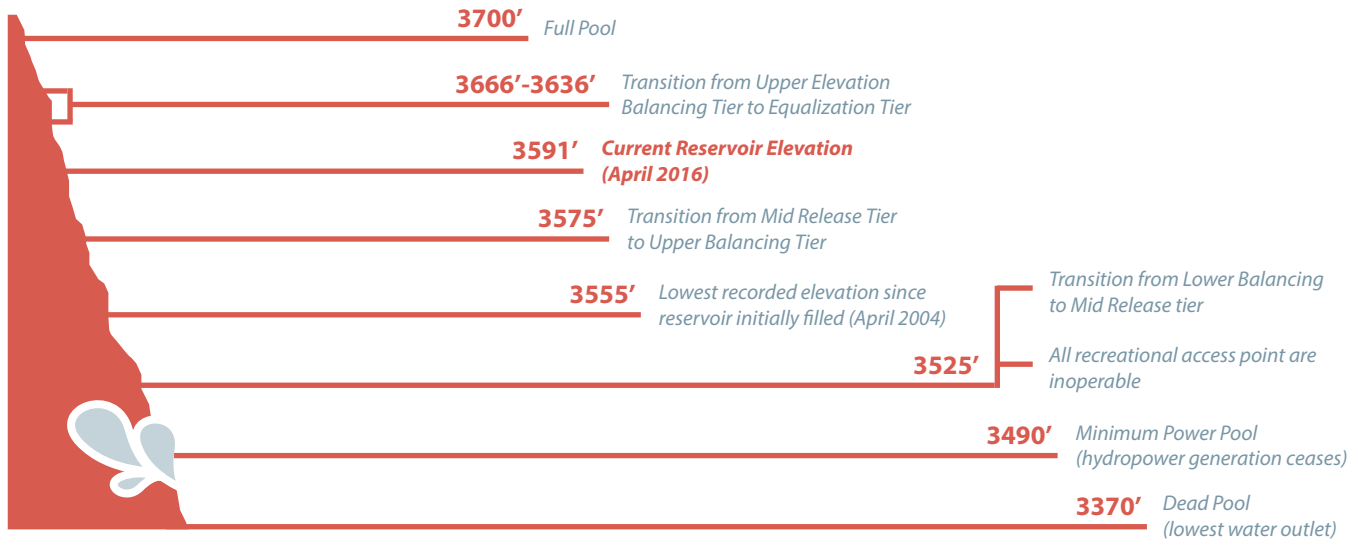
DECLINING RESERVOIR LEVELS COMPOUND WIDESPREAD ENVIRONMENTAL IMPACTS

Environmental restoration programs have had positive impacts on restoring some of the ecological conditions necessary for the health of threatened in-stream species. Continued restoration projects, including High-Flow Experiments, Salinity Control Programs, and Fish Recovery Programs can help reduce negative impacts, while the Long-Term Experimental and Management Plan provides a framework for adaptive management over the next two decades. Lower reservoir elevations can decrease power-generation efficiency and negatively impact hydropower revenue. These revenues, at least in part, support the restoration programs, so declining reservoir levels will either decrease existing funding, or require funds to be shifted from other programs, straining already limited management budgets.





CRITICAL ELEVATIONS AT LAKE POWELL



DROUGHT CONTINGENCY PLANNING

Stakeholders, states, federal and municipal agencies from throughout the Colorado River Basin are jointly active in creating contingency plans to keep Lake Mead and Lake Powell from dropping below levels necessary to produce hydropower and deliver water. In the Upper Basin, contingency plans include efforts to move water from upstream *Colorado River Storage Project Act* reservoirs to sustain levels at Lake Powell, hydrologic system augmentation such as cloud seeding and removal of highly water consumptive vegetation, and demand management strategies. Looking Upstream contributes to these efforts by illustrating how declining reservoir levels may impact key sectors in the Upper Basin.



CONCLUSIONS

Water supplies in Lake Powell are used to comply with Lower Colorado River Basin delivery requirements, generate hydropower, provide recreational opportunity, and maintain environmental health. Our findings demonstrate that declining reservoir levels could carry significant implications for each of these sectors, including higher risk to Upper Basin water supplies, an increased cost of power for utilities served by Glen Canyon Dam, reductions in recreational visitation to Lake Powell, and the exacerbation of existing environmental challenges within the Colorado River system. This analysis of potential Upper Basin drought impacts is intended to provide quantitative and qualitative information that may inform long-term decision-making and regional planning. Should low lake levels become the norm, these findings are a glimpse into the conditions that will be faced by the broader Colorado River System.

ACKNOWLEDGEMENTS:

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TEAM PHOTO:

