Managing the "New Normal" at the Lake Mead NRA

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Introduction

Lake Mead National Recreation Area (LMNRA), home to both lakes Mead and Mohave, spans two states (Arizona and Nevada), and hosts approximately 7 million visitors each year (Figure 1). Lake Mead serves as the primary drinking water reservoir for more than 25 million people across Nevada, Arizona, California, and Mexico. At full capacity, Lake Mead is the largest reservoir in the United States, spanning more than 157,900 acres with over 700 miles of shoreline. As the first and largest National Recreation Area in the United States, LMNRA maintains public access to the waters, shorelines, and surrounding areas of the park for a diverse array of land and water-based recreation opportunities in close proximity to several urban centers in the desert Southwest. The National Park Service is charged with managing the area in a means to enhance the recreational potential, while preserving the natural, scientific, historic, and scenic values. In pursuit of its mission, and in cooperation with additional legislative requirements and community needs for the reservoir, LMNRA works closely with a number of partner agencies including the Bureau of Reclamation, Southern Nevada Water Authority, Nevada Department of Wildlife, Arizona Game and Fish Department, Nevada Division of Environmental Protection, and the U.S. Geological Survey.

History

Lake Mead was formed after completion of the Hoover Dam impounded the Colorado River in 1935, and was designated by Congress as part of the 1.5 million-acre Lake Mead National Recreation Area in 1964 "for the general purposes of public recreation, benefit, and use, and in a manner that will preserve, develop and enhance, so far as practicable, the recreation potential, and in a manner that will preserve the scenic, historic, scientific, and other important features of the area…" (PL 88-639 1040).

As a unit of the National Park Service, management of LMNRA is guided by several laws, policies, executive orders, regulations, and management plans, including the 1916 Organic Act and the General Authorities Act of 1970. LMNRA operates under the 1986 *General Management Plan / Environmental Impact Statement*, the 1993 LMNRA *Statement for Management*, strategic plans (1998 and 2001), and the *Lake Management Plan* prepared in 2002 that provides specific guidance for long-term management of lakes Mead and Mohave within LMNRA. In addition, LMNRA has been operating under a Low Water Amendment to its General Management Plan since 2005 that addresses management down to a lake level elevation of 1,050 feet

Figure 1. Shoreline recreation at Lake Mead National Recreation Area. Credit: Lake Mead National Recreation Area.

because of persistent drought that has lowered the water level of Lake Mead. An environmental assessment is being prepared for a second GMP Amendment to guide operations down to a lake elevation of 950 feet so decisions are in place regarding the suitability of the continued use of existing Lake Mead marinas, launch ramps, and other visitor facilities.

From 1973 through 2001, Lake Mead operated within a 40-foot lake level fluctuation range, between approximately 1,175 and 1,215 feet mean sea level (msl) (Figure 2). The majority of infrastructure development around Lake Mead occurred during this time, with the development of two hotels and six active marinas: Overton Beach, Echo Bay, Temple Bar, Callville Bay, Las Vegas Bay, and Boulder Harbor (Lake Mead Marina). In addition to the above marinas, launch ramps were originally built at Pearce Ferry, Meadview (South Cove), and Government Wash. The National Park Service has ranked LMNRA among its top 10 most visited park sites since the park's establishment.

More than 400 million people have visited the area since 1937. Recreating at LMNRA includes boating, swimming, camping, hiking, observing wildlife, or simply marveling at the contrast of the largest reservoir in the U.S. against the Mojave Desert (Figure 3). Each unique visitor experience brings with it an added benefit to the local economy. In 2014, a study by Earth Economics estimated the regional recreational value of LMNRA exceeded $479 million annually, which constitutes the single most valuable water recreation resource in the Colorado River Basin. This valuation only includes the regional recreation value of LMNRA. The overall economic services of the Colorado River exceeds trillions of dollars annually, when considering power production, the agricultural industry, and having access to the reliable source of freshwater contained in Lake Mead.

Drought

With the onset of widespread regional drought in the western United States beginning in 2000, it became apparent that past visitor experiences and management decisions would need to adapt to a changing environment. Lake Mead's elevation has dropped from 1,197.27 feet msl in January 2001 to a current level of 1,078.99 feet msl in October 2015. In June 2015, the lake dropped to its lowest elevation, 1,074 feet msl, since it was filled in the 1930s. This decline of more than 120 feet in elevation has impacted both the physical infrastructure and public perception of Lake Mead, and has also necessitated rapid measures to account for this tremendous decline in impounded waters. Every two-foot drop in elevation can equal up to 60 feet of new shoreline. According to the Bureau of Reclamation December 2015 projections, Lake Mead may decline to 1,063.31 feet msl in June 2017.

Infrastructure effects and costs

LMNRA management is committed to enabling visitors to fully experience the park despite drought conditions, while preserving the natural, scientific, historic, and scenic values. While the lake is large enough to accommodate thousands of visitors, the drought has created access issues, requiring the National Park Service to extend launch ramps and reconfigure marinas to maintain visitor access. Although it took nearly 60 years to establish this infrastructure, responding to dropping lake levels has happened quickly. From 2002 to 2012, the National Park Service invested $36 million to extend launch ramps, create new ramps and parking areas, extend utilities, relocate docks, reposition navigational aids, and mark new boating hazards. Two marina locations have closed, and three launch ramps have become inaccessible (Overton Beach Marina and launch ramp, Echo Bay Marina, Government Wash launch ramp, and Las Vegas Bay launch ramp). In 2015, LMNRA spent $1.5 million to extend five launch ramps and dredge a boating channel. Additional extensions may be needed in 2016. The park's concessions operators are also burdened with costly expenses associated with drought. Management is now adjusting its low-water amendment, planning for operational adjustments for critically low water levels down to 950 feet msl.

In addition to infrastructure decisions, LMNRA managers are considering the impacts to natural and cultural resources within the park. As the lake recedes, recreation and habitats also change, creating new variables for natural and cultural resources within LMNRA. This may include visitors forging their own road to gain access to the new water level, or causing exposed land where weeds and invasive plants begin to grow. While LMNRA managers have to mitigate damage to natural resources, they also have to address the exposure of once submerged cultural resources to the harsh desert environment, as well as the potential for impacts of theft and vandalism. However, dropping lake levels also provide opportunities to interpret previously inaccessible resources such as the historic town site of St. Thomas, Nevada. This town was submerged by the waters of Lake Mead in 1938 and has

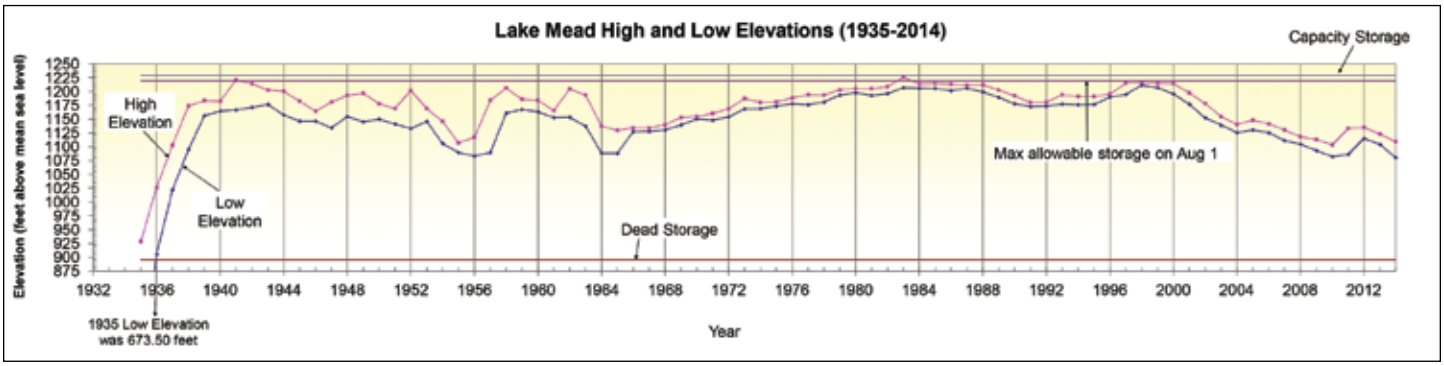

Figure 2. Water Elevation for Lake Mead from 1936-2014. Credit: U.S. Bureau of Reclamation (http://www.usbr.gov/lc/region/g4000/lakemead_line.pdf).

Figure 3. Water-based recreation at Lake Mead National Recreation Area, including kayaking, fishing, and boating. Credit: Lake Mead National Recreation Area.

resurfaced over the years, most recently in 2002. LMNRA visitors and descendants of the people who established St. Thomas can now walk the streets and tour the remains of this once thriving town (Figure 4).

Public perception

Despite outreach efforts and the fact that Lake Mead is among the top five largest reservoirs in the U.S. at its current capacity, perception still resonates that the drought has nearly drained Lake Mead: "... Lake Mead now resembles a mammoth desert mud puddle evaporating after a hard summer's rain." (*LA Times*, April 29, 2015), "Lake Mead drying up" (*CBS*, May 6, 2015), "Dry as a Bone: Lake Mead's H_2O Situation Just Got a Whole Lot Worse" (*Yahoo! News*, July 16, 2014).

The public perception of the availability of water, as well as the recreational potential of LMNRA has likely outstripped any true actual lack of access. Lake Mead's visual impact is probably the most prevalent; visitors' memories recall expansive stretches of water, and now those memories are replaced with large areas of lakebed and the ever prominent 120-foot tall bathtub ring line (Figure 5).

Operational changes

Given the importance of Lake Mead as a water and energy source for the desert Southwest and as an international recreation destination, federal, state, and local agencies have an obvious interest in the overall water quality and environmental health of the lake. Multiple agencies have adapted their monitoring efforts to determine if and how the drought may impact the lake's health. In addition to the challenges of low water, quagga mussels were introduced to lakes Mead and Mohave in 2007. The mussels, although now established in more than 600 bodies of water throughout the United States, present a serious environmental threat to other water bodies throughout the West. LMNRA management has a three-pronged approach to slow their spread, including education and outreach, research, and monitoring.

In 2011, algal blooms were observed in lakes Mead and Mohave. In March 2015, cyanotoxins were detected. The

Figure 4. Crumbled remnants of old St. Thomas, now above water. Credit: Lake Mead National Recreation Area.

cause of these blooms is unknown; however immediate action was taken by park management to educate the public about risks associated with harmful algal blooms (HAB). NPS along with partnering agencies have further coordinated their efforts to monitor water quality and inform and educate the public regarding HAB and their potential effects to recreation at LMNRA. Accommodations must be made in long-term monitoring efforts in order to account for changes in the location of the shoreline, as previous sites used to monitor water quality are now in some cases dry land, and sampling sites dependent on depth are no longer conforming to the parameters set forth when projects were established. All of these changes have led to alterations in park operations, including the fundamental way that information is delivered to park visitors. In 2014, LMNRA management established an aquatic resources outreach team. This team primarily educates visitors about aquatic invasive species while also providing up-to-date information on current water levels and water-related risks, such as harmful algal blooms. During the pilot season for this program, over a period of 50 days during the summer season at LMNRA, this team contacted 35,648 visitors and potential visitors. The team provided them with information; answered questions and concerns; and provided information regarding visitor use and water condition to managers throughout the park. This adaptive method of visitor contact has enabled NPS to better accommodate the constantly changing conditions of the lakes.

Conclusion

Lake Mead is experiencing the current drought in western North America under a unique set of circumstances, while being central to the economic, social, and ecological viability of the desert Southwest. The importance of this body of water has necessitated a shift in the management practices cultivated over half a century of stable water levels. Management is adapting to a new reality that consists of rapid and less predictable water level fluctuations, as well as changing ecological processes not previously experienced. The 15-year drought and altered aquatic conditions have forced management to quickly adapt operations in order to fulfill the requirements of the park's enabling legislation to preserve, develop, and enhance recreation potential while preserving important features of the area.

Literature Cited

Batker, D., Z. Christin, C. Cooley, W. Graf, K.B. Jones, J. Loomis and J. Pittman. 2014. Nature's value in the Colorado River Basin. *Earth Economics;* Tacoma, WA.

Figure 5. Changes in water elevation at Lake Mead National Recreation Area. Credit: Lake Mead National Recreation Area.

CBS News. 2015. Lake Mead drying up. *CBS News*. http://www.cbsnews.com/pictures/drought-dries-up-lake-mead/

Dwyer, L. 2014. Dry as a bone: Lake Mead's H2O situation just got a whole lot worse. *Yahoo! News*. http://news.yahoo.com/dry-bone-lake-meads-h2o-situation-just-got-132345544.html

Glionna, J.M. 2015. Lake Mead water level falls to a landmark low, and is likely to get worse. *Los Angeles Times*. http://www.latimes.com/nation/la-na-lake-mead-low-20150429-story.html

National Park Service. 2002. Lake Mead National Recreation Area lake management plan and final environmental impact statement. 2(1): 328; http://www.nps.gov/lame/learn/management/upload/Lake_Managment_Plan_Vol_1.pdf

National Park Service. 2015. NPS stats: National Park Service visitor use statistics. *National Park Service, Department of the Interior*. https://irma.nps.gov/Stats/Reports/Park/LAKE

Public Law [PL] 88-639- *An Act: To provide an adequate basis for administration of the Lake Mead National Recreation Area, Arizona and Nevada, and for other purposes.* 1964. *U.S. Government Publishing Offices*. http://www.gpo.gov/fdsys/pkg/STATUTE-78/pdf/STATUTE-78-Pg1039.pdf

Rosen, M.R., K. Turner, S.L. Goodbred and J.M. Miller. 2012. A synthesis of aquatic science for management of lakes Mead and Mohave. *U.S. Geological Survey Circular 138: U.S. Department of the Interior. U.S. Geological Survey*. http://pubs.usgs.gov/circ/1381/

Tietjen, T. E. and G. C. Holdren. 2010. Lake Mead limnology and ecosystem management: Preface. *Lake and Reservoir Management,* 26(4): 229-229.

U.S. Bureau of Reclamation. 2015. Lake Mead at Hoover Dam, Elevation (feet). *U.S. Bureau of Reclamation*. http://www.usbr.gov/lc/region/g4000/hourly/mead-elv.html

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our citizenry. The effects of drought that lake managers must deal with can include the following: increased salinity due to reduced dilution, increased water temperatures, and increases in nutrient, turbidity, and algal levels due to reduced flushing. This in turn leads to elevated chances for harmful algal blooms and other microorganisms. Drought can also cause a buildup of materials in these systems resulting in large post-drought flood loadings of pH, major ions, nutrients, and carbon. Losses or destruction of fish and wildlife habitat due to shrinking amounts of water can further concentrate contaminants. While we will continue to cycle between wet and dry periods in the future, we as lake managers must continue to look for innovative ways to manage our vital water resources for everyone's benefit.

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