CURRENT PLANNING ENVIRONMENT

THIS CHAPTER PROVIDES AN OVERVIEW OF CURRENT AND EMERGING ISSUES THAT ARE LIKELY TO INFLUENCE WATER SUPPLY AND DEMAND CONDITIONS IN SOUTHERN NEVADA OVER THE 50-YEAR PLANNING HORIZON.

INTRODUCTION

As discussed in Chapter 1, water supply availability and demand conditions have evolved significantly in Southern Nevada over the past century. As a result, new resource strategies have been needed to adapt to changing conditions. Time and again, the community rose to these challenges, developing new water resources and facilities, and significantly reducing water demands through aggressive water conservation efforts.

At the beginning of the 21st century, new issues began to emerge that have required a similar approach: close monitoring and adaptive response. Drought, climate change and changing economic conditions have become the persistent challenges of this century. Individually or combined, these factors significantly influence local water demands, as well as the resources and facilities needed to support those demands over time.

This chapter describes the challenges that exist within the current planning environment, as well as potential impacts to SNWA water supplies and facilities. This chapter also details the planning and response efforts taken by the SNWA, with community support, to minimize those impacts and ensure reliable water supplies. As detailed in Chapter 3 (SNWA Resource Portfolio) and Chapter 4 (Meeting Future Demands), SNWA has sufficient resources to meet the needs of the community over the 50-year planning horizon.

The SNWA is well prepared to respond to evolving conditions as they arise through close monitoring, proactive planning and adaptive management. As discussed in the latter portion of this chapter, shortages and declining lake levels associated with drought in the Colorado River Basin are being addressed to avoid impacts to current customers.

DROUGHT

Colorado River water supplies are derived primarily from snowmelt and runoff from the Rocky Mountains, as well as the Wind River, Uintah and Wasatch mountains (collectively referred to as the Upper Colorado River Basin). Beginning in 2000 and continuing today, the Colorado River Basin has experienced drought conditions that quickly developed into the worst drought in the basin's recorded history.

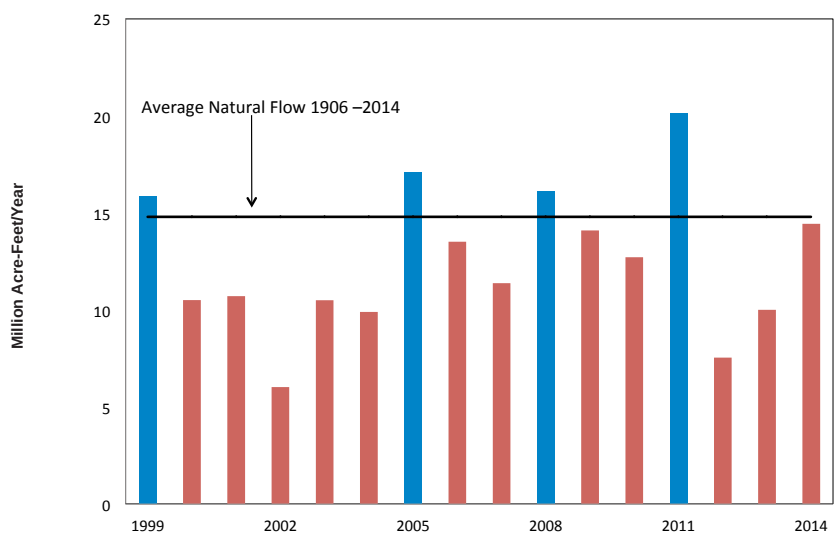

FIGURE 2.1 **Annual Colorado River Natural Flow 1999–2014**

Between 2000 and 2014, snowfall and runoff into the basin were well below normal, representing the lowest 15-year average on record (Figure 2.1).[1] As a result, combined water storage in the Colorado River's two primary reservoirs (Lake Mead and Lake Powell) decreased to just 44 percent at the end of 2014.[2]

There are two primary consequences for Southern Nevada associated with continued Lake Mead water level declines: possible reduction of Colorado River resources and operating challenges associated with SNWA's water intake facilities at Lake Mead.

Potential Supply Impacts

In 2007, the Secretary of the Interior issued a Record of Decision for the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, also referred to as "Interim Guidelines."[3] Among other things, the Interim Guidelines established how shortages in the lower basin will be implemented, based upon Lake Mead's elevation.

According to the Interim Guidelines, the Secretary of the Interior will make a shortage declaration based on a projection of Lake Mead water levels as determined by the U.S. Bureau of Reclamation's Colorado River modeling efforts. The forecast is reviewed annually in August; if Lake Mead is forecasted to be at or below 1,075 feet on January 1 of the following year, a shortage declaration will be made.

Under a shortage declaration, the amount of Colorado River water available for use to the states of Nevada and Arizona will be reduced as shown in Figure 2.2. A shortage declaration will also restrict the use of other temporary supplies as identified in SNWA's Water Resource Portfolio (Chapter 3).

LAKE MEAD WATER LEVEL	NEVADA SHORTAGE	ARIZONA SHORTAGE
1,075 - 1,050 FT.	13,000 AFY	320,000 AFY
1,050 - 1,025 FT.	17,000 AFY	400,000 AFY
BELOW 1,025 FT.	20,000 AFY	480,000 AFY
	RECONSULTATION	

FIGURE 2.2 **Interim Guidelines Shortage**

Modeling efforts conducted by the U.S. Bureau of Reclamation in August 2015 indicate an approximate 20–60 percent probability of shortage in years 2017–2020. There is a high probability (ranging from 60 to 70 percent) in the years thereafter.[4] The model applies historical flows to simulate future conditions, representing both wet and dry years on the Colorado River.

Potential Facility Impacts

Lake Mead's surface elevation declined by more than 130 feet between 2000 and the end of 2014,[5] reaching its lowest level to date since the lake began filling in the 1930s (Figure 2.3). Based on current and forecasted conditions, there is a high probability that Lake Mead water levels will continue to decline, potentially reaching an elevation of 1,000 feet or lower within the next decade.

Currently, SNWA's intake and pumping facilities have a combined water supply and treatment capacity of 900 MGD, consisting of two water treatment facilities, three

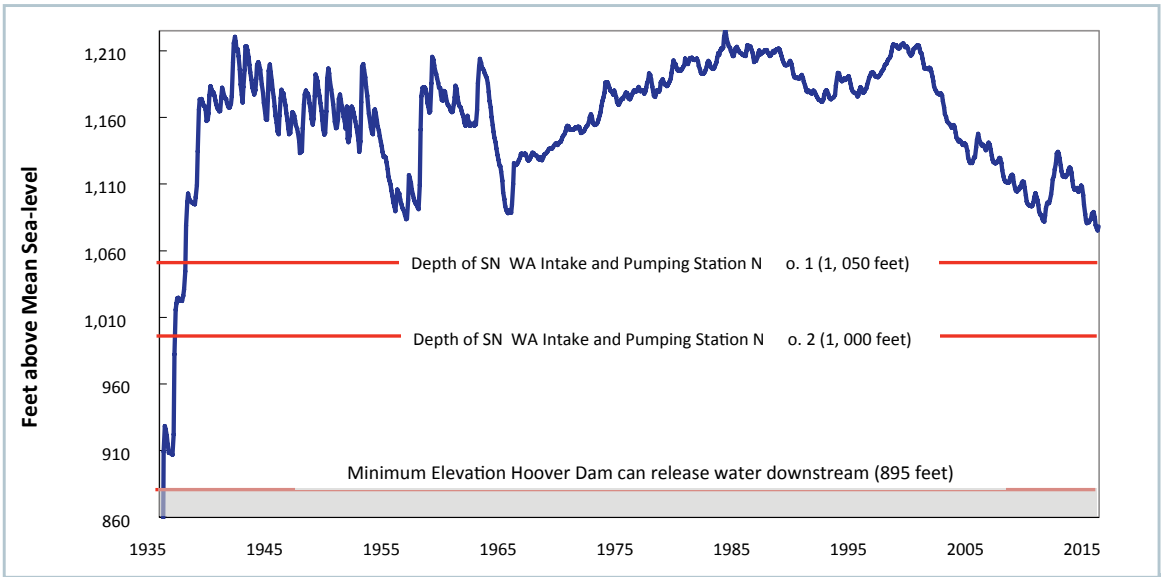

FIGURE 2.3 **Historical Lake Mead Elevations**

raw water intakes and associated pumping facilities. These facilities are limited in their operating range relative to Lake Mead elevation. As Lake Mead approaches an elevation of 1,050 feet, Intake No. 1 and Pumping Station No. 1 will become inoperable. If this happens, Intakes Nos 2 and 3 and Pumping Station No. 2 will be used to meet Southern Nevada's water needs down to a Lake Mead elevation of 1,000 feet.

A new Low Lake Level Pumping Station is being constructed to preserve Southern Nevada's access to Colorado River resources below 1,000 feet.

CLIMATE CHANGE

In addition to droughts, which are temporary and cyclical events, climate change is expected to have lasting effects on the availability of future water supplies. Mounting scientific evidence indicates that climate conditions are changing due to global warming, primarily a result of increased concentrations of greenhouse gases (GHGs) in the Earth's atmosphere. Since the late 19th century, observations indicate that global mean annual air temperatures have warmed 1.5 degrees Fahrenheit.[6]

Consistent with global trends, warming has also occurred in the southwestern United States. While climate change models predict that warming trends will continue, the magnitude of change at a given location will depend in part on global mitigation efforts to reduce GHG emissions (Figure 2.4).

Compared to relatively uniform projected temperature increases in the southwest, precipitation patterns are highly variable and show substantial shifts in where and how the precipitation falls. In addition, rising temperatures will cause a greater percentage of precipitation to occur in the form of rain rather than snow, and snowpack will melt earlier and more rapidly due to increasing temperatures. In some areas, this may result in significant reductions in supply, while other areas experience greater frequency and severity of flood events.[7]

From a resource planning perspective, the most direct climate change impact will revolve around water quantity, particularly the form and distribution of precipitation. Rising air temperatures can also have an effect on soil moisture, and ultimately reduce the volume and timing of snowmelt runoff. In addition, changes to water quality from rising stream flow temperatures and changes in reservoir volumes are also important considerations.

Climate Change Assessments

In 2014, two important climate change studies were released: The U.S. Global Change Research Program's National Climate Assessment and the Intergovernmental Panel on Climate Change's (IPCC) Climate Change 2014 Impacts, Adaptation, and Vulnerability report.[8] Each of these studies concludes that climate change is occurring and is expected to significantly affect water resources.

According to the National Climate Change Assessment, "future droughts in the Colorado River basin are projected to be substantially hotter, more frequent and longer lasting than in the instrumental record."

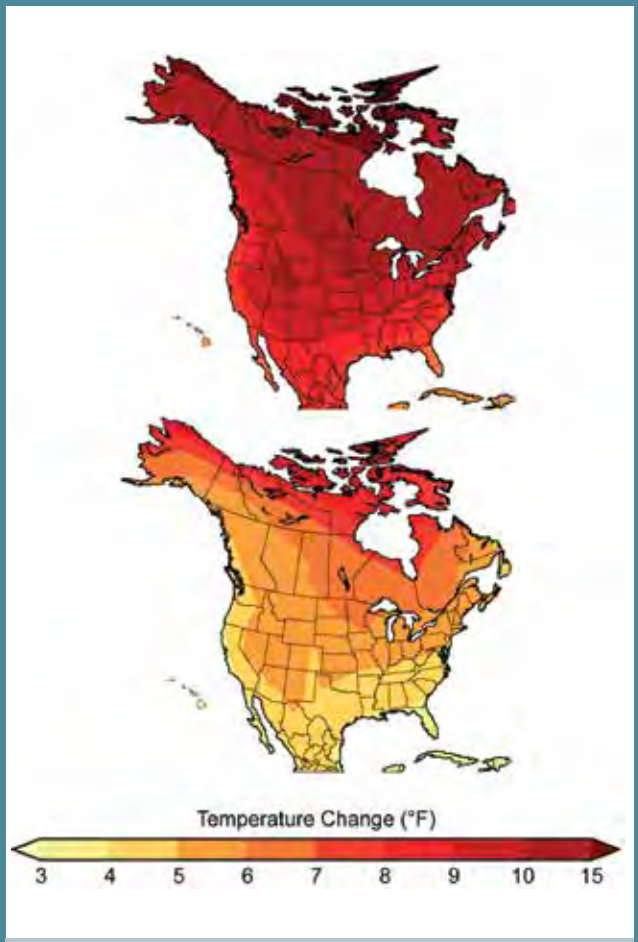

FIGURE 2.4 **CLIMATE CHANGE**
Range of possible future warming in North America 1999 – 2100 under high and low GHG emission scenarios. [9]
(2014) National Climate Assessment.

To help inform future decision-making efforts in the Colorado River Basin, the Bureau of Reclamation, in partnership with the seven states and numerous other stakeholders, initiated a comprehensive water supply and demand analysis. The process represented a concerted effort by Colorado River stakeholders to better understand possible future water supply and demand imbalances.

This effort resulted in the Colorado River Basin Water Supply & Demand Study (Colorado River Basin Study),[10] released in 2012. The study considered a range of supply and demand projections using the best available climate change science and global models to evaluate projected increases in temperature by 2060, and changes in precipitation over the same period. The combined impact of projected changes in air temperature and precipitation translated into diminished stream flows in the Colorado River watershed over the mid- to long-term, worsening over time. The study recognizes that climate change will not only affect the amount of water available for use, but is also likely to affect overall water demands. As temperatures warm, water evaporation and evapotranspiration rates will increase, resulting in higher water demands for agricultural irrigation and landscaping uses.

Potential Supply and Demand Impacts

The Colorado River Basin Study projects a median imbalance of 3.2 million AFY in Colorado River supply and demand by the year 2060 through a combination of climate change and increased demand.[11] In Southern Nevada, the impacts of climate change are expected to be similar to that of drought. This includes extended durations of low Lake Mead elevations, water quality changes, possible reductions of Colorado River resources, and potential increases in water use to compensate for warmer and drier conditions.[12]

ECONOMIC DECLINE AND RECOVERY

Southern Nevada's economic situation changed drastically in 2007, when the national economy began to experience its most significant decline since the 1930s. Southern Nevada was hit harder than almost any other region in the nation. This period of recession marked the first time in decades that the Las Vegas area experienced a sustained period of little or no growth (Figure 2.5).[13] For years following the downturn, gaming and tourism revenues declined followed by a record spike in unemployment. Most new residential and commercial development projects came to a halt and home foreclosures flooded the real estate market.

Between 2002 and 2014, per capita water use dropped significantly, mostly due to the community's early drought response efforts. In contrast to voluntary drought response efforts, drying pools and landscapes at foreclosed properties provided strong visual cues that water use patterns had also changed as a result of economic pressures.

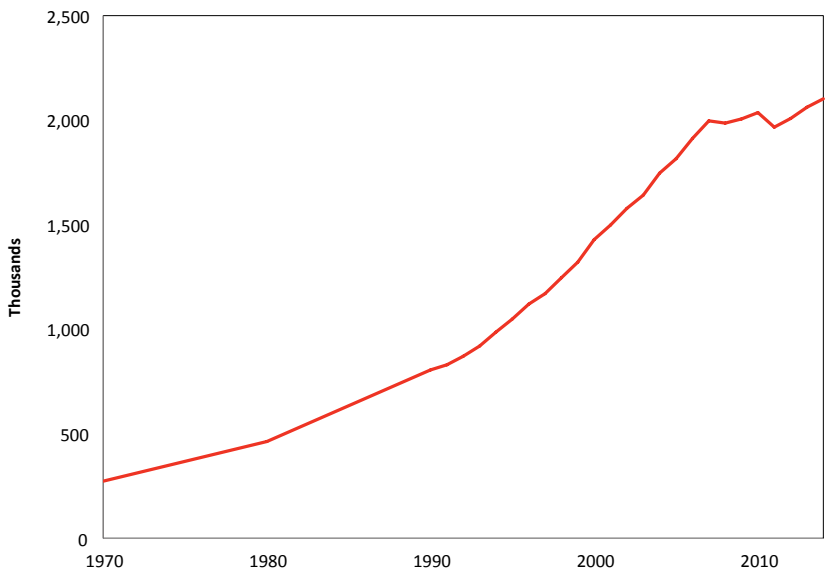

FIGURE 2.5 **Historical Clark County Population**

However, economic conditions have improved steadily in the region over the past three years. According to the U.S. Bureau of Economic Analysis, the Las Vegas metropolitan area's economic output rose 2 percent per year between 2011 and 2013.[14] As of 2014, building permits were also on the rise. According to the Clark County Development Services Department, the number of permits issued that are likely to generate new water demands increased by 22.2% year-over-year between 2012 and 2013.[15]

Potential Supply and Demand Impacts

The University of Nevada Las Vegas Center for Business and Economic Research (CBER) forecasts that Southern Nevada population growth will continue, although actual growth rates will occur faster or slower than forecasted as demonstrated by Southern Nevada's unpredictable past.[16] While the region's economy appears to be rebounding, it is difficult to predict future population changes and how these changes will translate into water demands over the long-term planning horizon.

ADAPTIVE MANAGEMENT

Adaptive management relies on continuous assessment, flexible planning and action. As the region's wholesale water provider, SNWA is responsible for anticipating future demands and taking the steps necessary to meet those demands over time. As discussed earlier in this chapter, the current planning environment contains significant uncertainties—drought and climate change have the potential to impact water facilities, water supply availability, water quality and—to some extent—long-term water demands. In addition, factors associated with Southern Nevada's local economy and its rate of recovery make predicting future water demands challenging, particularly in light of the region's previous growth history.

The following sections detail how SNWA plans to address these challenges—while some steps are being taken now to protect current water supplies from the effects of drought, others steps are considered long-term continuous efforts that will remain a priority for many years to come.

Adaptive Management in Action

The SNWA took a number of adaptive management steps to reduce impacts to water supplies and facilities in response to persistent drought conditions. These include:

- Reduced consumptive use of Colorado River supplies between 2002 and 2014 by nearly 100,000 AFY (32 billion gallons), despite the addition of 500,000 new residents.
- Significantly increased water banking, storage and recharge efforts, resulting in nearly the 6-year storage equivalent of Nevada's Colorado River allocation.
- Retrofitted existing and added new intake and pumping facilities in response to declining Lake Mead water levels and constructed new facilities.
- Initiated legal and environmental permitting associated with the development of in-state groundwater resources.
- Acquired and developed approximately 40,000 AFY of permanent and temporary water resources in Clark County through resource lease and purchases on the Virgin River, Muddy River and in Coyote Spring Valley.

Intake No. 3 Construction

Lake Mead Facility Improvements

To mitigate impacts associated with a potential Lake Mead water level decline below 1,000 feet and potential water quality concerns during low reservoir conditions, the SNWA constructed a new intake and initiated construction of pumping facilities that will ensure continued access to Colorado River resources. These facilities are being developed to address current and future projected drought conditions, as well as the potential effects of long-term climate change.

In 2005, the SNWA authorized construction of a new Intake No. 3. The new intake is at an elevation of 860 feet, approximately 35 feet below the minimum elevation that Hoover Dam can release water downstream. In May 2015, the SNWA awarded a pre-construction services contract to a construction contractor for the Low Lake Level Pumping Station, which will work in tandem with Intake No. 3. These efforts are based in part on the recommendation of SNWA's Integrated Resource Planning Advisory Committee (IRPAC), which determined that the risk of Lake Mead's elevation falling below 1,000 feet is not acceptable for Southern Nevada due to the potential impacts on water delivery and resource availability.

New intake and pumping facilities will preserve existing capacity and will allow SNWA to pump from a Lake Mead elevation of 875 feet. Work on Intake No. 3 will be complete in 2015; the new pumping station is expected to be complete and operational by 2020.

Water Conservation

The SNWA continues to implement one of the most aggressive water conservation programs in the nation and will continue to evaluate higher levels of conservation as goals are achieved. As detailed in Chapter 3, the SNWA and its member agencies utilize regulation, pricing, education and incentives to affect necessary water conservation savings.

While there is a high potential for shortages to be declared over the next several years, SNWA does not anticipate any near-term customer impacts. This is due in large part to the success of local conservation efforts. The Southern Nevada community took both serious and sustained action as the drought took hold in the early 2000s. These efforts have provided a significant buffer against water supply impacts over the near-term planning horizon. As of 2015, Southern Nevada's use of Colorado River resources is well below any restrictions that could be imposed under the current Interim Guidelines.

Interstate Collaboration

The Colorado River Basin states are also working collaboratively with federal partners to protect water supply and facility access for lower basin users. These efforts range in nature from contributing funds for cloud seeding designed to increase the potential yield of snowfall in the Colorado River Basin, to system conservation efforts that benefit the system as a whole.

In 2014, the SNWA entered into two agreements (discussed below) to help bolster reservoir elevations. These efforts are intended to forestall the declaration of and reduce the severity of shortage, and will help stabilize Lake Mead water levels. This will provide the SNWA with a buffer of time as the organization works to complete development of its Low Lake Level Pumping Station.

Pilot System Conservation Agreement. The SNWA, Department of the Interior and other Colorado River water users have initially committed to fund up to $14 million in 2015 and 2016 for conservation projects that benefit the Colorado River system.[17] In accordance with a 2014 agreement, project partners evaluate and select projects, compensating users for voluntary water use reductions. Projects being considered include land fallowing, water efficiency, desalination, reuse and other conservation projects.

Unlike other water resources in the SNWA Water Resource Portfolio, water conserved as a part of this agreement will benefit the entire Colorado River System by increasing reservoir elevations; these resources cannot be recovered by any individual water user.

Drought Response Actions. The SNWA, Department of the Interior and other lower basin water users and states set a goal of developing 1.5 to 3 million acre-feet of water in Lake Mead before 2020 to serve as a "protection volume." This water is intended to help stabilize water levels.

As part of a 2014 memorandum of understanding the parties will use their best efforts to create a total of 750,000 acre-feet between 2014 and 2017.[18] The SNWA's commitment to the program is 45,000 acre-feet. Southern Nevada's current water

use is well below the state's 300,000 AFY Colorado River allocation and SNWA plans to meet its commitment by foregoing offstream banking of its unused apportionment. During this period, SNWA does not anticipate water demands to exceed SNWA's remaining Colorado River allocation.

Moving Forward Process. To support continued work associated with the 2012 Colorado River Basin Study, the Bureau of Reclamation initiated the "Moving Forward" effort. This is a process designed to inform future Colorado River management efforts. As part of the process, three workgroups were formed to investigate various aspects of: municipal and industrial conservation and water reuse; agricultural conservation, productivity and water transfers; and environmental and recreational flows. A Phase I report was released in May 2015.[19] Phase II will further expand upon these efforts by implementing pilot projects.

Water Banking Efforts. Over the last several years, the Seven States have worked collaboratively to store or "bank" available Colorado River water and other unused supplies through various storage efforts. As of 2015, SNWA has banked resources in the Southern Nevada Water Bank, in the Arizona and California water banks, and in Lake Mead (in the form of Intentionally Created Surplus). As discussed in Chapter 3 and to the extent possible, SNWA will continue water banking efforts to help offset potential supply shortages associated with drought and climate change, to help meet future demands and to help stabilize Lake Mead water levels.

Applying Best Available Climate Science

To better understand and adapt to climate change effects on water-related infrastructure and water resources, SNWA initiated collaborative efforts with both climate scientists and other water agencies. The SNWA was recently awarded a WaterSMART grant from the Bureau of Reclamation to evaluate potential changes in Lake Mead water quality using SNWA's advanced Lake Mead model. The Lake Mead study considers potential impacts of low lake elevations and increasing air temperatures due to climate change.[20]

The SNWA is also a founding member of the Water Utility Climate Alliance (WUCA), which is comprised of ten of the largest water agencies in the United States. WUCA is dedicated to enhancing climate change research and improving water management decision-making to ensure that water utilities will be positioned to respond to climate change and protect water supplies.

The SNWA is collaborating with other WUCA members to: advocate for climate change research that better meets the needs of the water sector; evaluate methods used to understand the influence of climate change on water providers; and identify decision and adaptation strategies employed to address long-term climate change.[21]

Supply and Demand Forecasting

The SNWA has taken a scenario-based planning approach with its 2015 Water Resource Plan to address possible changes to water supply availability and demands. As detailed in Chapter 4, SNWA has developed a range of demands that brackets what is likely to be experienced during the planning horizon.

The plan includes a series of future planning scenarios that consider various water demand and supply conditions, including impacts of declared shortage. This is a conservative approach that recognizes that planning assumptions are generally more accurate in the near term and that the potential for change is likely to increase over time.

Lake Mead Water Level Decline

CHAPTER CONCLUSION

The concept of uncertainty is not unique to Southern Nevada. It is a condition increasingly faced by water managers across the United States. This is particularly true in the Colorado River Basin where climate variability (the result of drought and/or climate change) and economic conditions are influencing both water resource availability and the demand for those resources over time.

While the water supply challenges presented in this chapter need to be taken seriously, SNWA has worked diligently to ensure both resources and facilities are available to meet the community's short- and long-term water resource needs.

By applying adaptive management—evaluating, planning and action—SNWA is well prepared to meet whatever challenges lie ahead, including efforts to:

- Continue setting and achieving water conservation goals through aggressive water conservation efforts;
- Develop new intake and pumping facilities at Lake Mead to preserve Colorado River supply access in the event that existing facilities become inoperable;
- Collaborate with Colorado River stakeholders for conservation and flexible use of Colorado River supplies (for example, water banking), as well as protect Lake Mead's elevation against future water level declines;
- Continue to secure temporary resources to offset long-term impacts associated with shortage while working to bring other permanent resources online when needed;
- Address uncertainty by planning to a range of future supply and demand possibilities; and
- Collaborate with climate scientists and other agencies to understand and evaluate climate change, and its potential impacts to water supplies and facilities.

Hoover Dam Spillway, 2013

ENDNOTES

1 The U.S. Bureau of Reclamation and the U.S. Geological Survey estimate the yearly "natural flow" of the Colorado River at Lees Ferry, defined as the flow of the river without reservoirs, dams or diversions. Natural flow estimates for the period 1906 to 2012 are official, while estimates for the period 2013 and 2014 are provisional, March 2015, U.S. Bureau of Reclamation.

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3 "Record of Decision Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, December 2007," signed December 13, 2007 by Dirk Kempthorne, Secretary of the Department of Interior.

4 The U.S. Bureau of Reclamation developed the Colorado River Simulation System (CRSS), a long-term planning and operations model. The probabilities of shortage correspond with August 2015 CRSS results, applying historical Colorado River flows, provided by U.S. Bureau of Reclamation to Southern Nevada Water Authority August, 2015.

5 "Historical Reservoir Levels, Lake Mead at Hoover Dam," U.S. Bureau of Reclamation.

6 IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Quin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

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9 "Climate Change Impacts in the United States: The Third National Climate Assessment." U.S. Global Change Research Program, 2014, Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds. Climate Science Supplement, Supplemental Message 5, Figure 33.20: Projected Annually-Averaged Temperature Change, http://nca2014.globalchange.gov/report/appendices/climate-science-supplement#tab2-images.

10 "Colorado River Basin Water Supply and Demand Study," December 2012, U.S. Bureau of Reclamation.

11 Ibid.

12 "Changes in Water Use Under Regional Climate Change Scenarios," 2013, Water Research Foundation (Project #4263) prepared by Jack C. Kiefer, John M. Clayton, Benedykt Dziegielewski, and James Henderson.

13 Clark County Population data 1970 – 1980 are decadal counts from the U.S. Census Bureau. Clark County Population data 1990-2014 are annual estimates prepared by the Clark County Comprehensive Planning Department.

14 Real Gross Domestic Product by Metropolitan Area, 2015, U.S. Bureau of Economic Analysis.

15 Clark County Nevada Building Department, permits issued. Data retrieved June 2014 for calendar year 2012-2013.http://www.clarkcountynv.gov/Depts/development_services/Pages/MonthlyValuationReports.aspxn.

16 "Clark County Nevada Population Forecast 2015-2050," June 2015, Center for Business and Economic Research at the University of Nevada, Las Vegas.

17 "Agreement among the United States of America, through the Department of the Interior, Bureau of Reclamation, the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, Denver Water, and the Southern Nevada Water Authority, for a Pilot Program for Funding the Creation of Colorado River System Water through Voluntary Water Conservation and Reductions in Use," entered into July 30, 2014.

18 "Memorandum of Understanding among the United States of America, through the Department of the Interior, Bureau of Reclamation, the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, the Arizona Department of Water Resources, the Colorado River Board of California and the Colorado River Commission of Nevada for Pilot Drought Response Actions," entered into December 10, 2014.

19 "Colorado River Basin Stakeholders Moving Forward to Address Challenges Identified in the Colorado River Basin Water Supply and Demand Study Phase 1 Report," 2015, U.S. Bureau of Reclamation.

20 The SNWA's Lake Mead Model was developed with Flow Science Inc., with funding from SNWA member agencies and the National Park Service. Funding for climate change model simulations was provided through a WaterSMART Grant from the Bureau of Reclamation, with matching contributions from the City of San Diego, Metropolitan Water District of Southern California and the SNWA.

21 The Water Utility Climate Alliance (WUCA) has funded and published several reports and whitepapers on climate change. The publications are accessible at: www.wucaonline.org/html/actions_publications.html.