Southern Nevada Water Authority
Water Smart Landscapes Rebate Program
($1,500,000)

Applicant:
Southern Nevada Water Authority

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TABLE OF CONTENTS

1. Technical Proposal: Executive Summary

Date: March 19, 2019
Applicant: Southern Nevada Water Authority
Location: 1001 South Valley View Boulevard
Las Vegas, NV 89153 (Clark County)

Project Overview:
As severe and sustained drought conditions in the Colorado River Basin continue to threaten water supplies and delivery systems, water conservation is a critical tool used to ensure a safe and reliable drinking water supply for Southern Nevada. Since 1991, the Southern Nevada Water Authority (SNWA) and its member agencies have implemented one of the most comprehensive and aggressive water conservation programs in the United States. Conservation initiatives have helped to save billions of gallons of water annually, extending the availability of Nevada's 300,000 acre-feet per year (AFY) Colorado River water appropriation. Within the SNWA's member agencies' service areas, nearly all water used meets municipal demands.

This project proposal seeks $1,500,000 from the Bureau of Reclamation's (Reclamation) WaterSMART: Water and Energy Efficiency Grants program to support Southern Nevada's continued water conservation efforts. Funding will support a portion of the SNWA's 2020/2021, 2021/2022, and 2022/2023 Water Smart Landscapes Rebate Program (WSL Program). The SNWA will provide a minimum matching contribution of $25 million for a total project cost of $26.5 million. This project will result in an estimated recurring annual savings of 1,632 AFY by converting 9,532,374 square-feet of lawn to water-efficient landscaping. Over the life of the improvement (50 years), the cumulative recurring impact of this project is estimated to result in a savings of 81,600 AF.

Task Area:
The proposed project fits within *Eligible Projects C.3.1.1. – Water Conservation Projects* as identified in Funding Opportunity BOR-DO-19-F004. The SNWA's WSL Program provides a financial incentive for property owners to replace lawn with water-efficient landscaping. The program has proven to be the region's most effective way to achieve significant and lasting conservation gains, providing water savings that directly extend the region's existing supplies.

Length of Time and Estimated Completion Date
The proposed project encompasses landscape conversion rebates that are distributed under the SNWA's WSL Program during fiscal years 2020/2021, 2021/2022, and 2022/2023 (July 1–June 30). All project work will be completed by June 30, 2023. Program participation is dependent on customer demands, which has increased in recent years.

2. Technical Proposal: Background Data

The SNWA was formed in 1991 by a cooperative agreement among the following water and wastewater agencies in Southern Nevada:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

Together, these seven agencies provide water and wastewater service to more than 2.1 million residents in the cities of Boulder City, Henderson, Las Vegas and North Las Vegas, and areas of unincorporated Clark County (the service area is shown in the map included as Appendix A). As their wholesale water provider, the SNWA is responsible for water treatment and delivery, as well as acquiring and managing the region's short and long-term water resources. Since its inception, the SNWA has worked to seek new water resources, manage existing and future water resources, construct and manage regional water facilities, and promote conservation.

The severe and sustained drought conditions on the Colorado River underscores the critical role of conservation in helping to meet current and future demands. As drought conditions continue, Southern Nevada may be subject to declared Colorado River shortages as early as 2020—making Southern Nevada's conservation efforts even more important. In addition, further declines in Lake Mead's water level could result in additional shortages, which would further stress the ability of water supply facilities to meet water demands. Water conservation helps to mitigate these concerns.

The SNWA and its member agencies depend on the Colorado River for approximately 90 percent of the community's drinking water needs. The SNWA's primary resource is its share of Nevada's consumptive-use apportionment of 300,000 AFY of Colorado River water. In addition to this apportionment, the SNWA also has access to groundwater rights in the Las Vegas Valley, purchased/leased rights along the Muddy and Virgin rivers, and Coyote Spring Valley groundwater rights, which can be conveyed to the Colorado River for Intentionally Created Surplus (ICS) credit.

In Southern Nevada, the SNWA serves as a regional water wholesaler, which eliminates the need for direct marketing between municipalities. Instead, unused Colorado River resources are stored for the community's future use in water banks located in Southern Nevada, California and Arizona. The Southern Nevada water bank, established in 1987, has approximately 336,000 AF of credits, including water banked for the Las Vegas Valley Groundwater Management Program. The SNWA's California water bank has accumulated approximately 330,000 acre-feet of credits, while Arizona's bank has accumulated 601,000 acre-feet since the inception of Nevada Interstate Banking in 2002. SNWA's water conservation gains have helped further its banking efforts. Since 2002, water-efficiency programs have helped the SNWA to contribute approximately 425,000 AF of unused Nevada Colorado River water toward interstate banking efforts.

In the event that Colorado River shortages are implemented, the SNWA intends to utilize banked resources to help temporarily offset supply availability. Conservation improves the ability to respond to shortages both by directly reducing demand and freeing up resources that can be banked for times of emergency.

System Overview
The SNWA manages the Southern Nevada Water System's (SNWS) regional pumping, treatment and delivery facilities. SNWS diverts and treats raw Colorado River water from Lake Mead and delivers potable water to Southern Nevada's municipal water purveyors (Las Vegas Valley Water District, City of Henderson, City of North Las Vegas and City of Boulder City).

Water is extracted via two 600 million gallons per day (MGD) raw water intakes submerged within Lake Mead (located at elevation 1,050 and 1,000 feet, respectively). Water collected at these diversion points is transported to and treated at one of the SNWA's two water treatment facilities. These facilities treat and deliver an average of approximately 400 MGD and have a maximum capacity of 900 MGD. Treated water is delivered to the municipal water purveyors through more than 160 miles of large diameter pipeline, which traverse the Las Vegas Valley and connect to purveyor systems. SNWA facilities support water distribution to more than 500,000 customer accounts and more than 2.1 million residents in Southern Nevada.

Relationship with Bureau of Reclamation
The SNWA has established long-standing relationships with Reclamation, and has coordinated on a number of initiatives including the Brock Reservoir System Efficiency Project and the Yuma Desalting Plant Pilot Project; development and implementation of interstate water banking agreements with Arizona and California; Colorado River accounting and procedures for return-flow credits; a Xeriscape Conversion Study; and environmental restoration and stabilization initiatives in the Las Vegas Wash. Since 2010, the SNWA has received 12 WaterSMART grants from Reclamation in direct support of the SNWA's turf conversion efforts. In 2018, the WaterSMART: Water and Energy Efficiency Grants Program awarded the SNWA $300,000 in support of the WSL program for fiscal year 2019/2020.

Program Description
Since its creation in 1991, the SNWA has implemented a number of conservation programs focused on reducing water use. While the SNWA actively promotes indoor conservation, in Southern Nevada the greatest opportunity for water conservation lies in curbing outdoor water use. According to consolidated data provided by SNWA member agencies, residents account for approximately 59 percent of water use. Approximately, 60 percent of Southern Nevada's total annual water supply is used consumptively, meaning it can be used just once—commercial and residential landscape irrigation is collectively the single largest consumptive use.

The SNWA has realized significant water savings as part of its lawn conversion program. As a measure of success, since 2002 Southern Nevada's consumptive water use has declined by approximately 33 billion gallons annually, despite the addition of 400,000 new residents and millions of annual visitors. In addition, total water use stated in gallons per capita per day (GPCD) has been reduced 36 percent (from 314 GPCD in 2002 to 127 GPCD in 2017) and significant recent progress has been made toward the community's new conservation goal of 116 GPCD by 2035.

The SNWA has expended more than $224 million to the WSL program to date, resulting in the removal of more than 188 million square-feet of turf. This represents a cumulative savings of approximately 397,000 AF and annual recurring savings of more than 32,000 AFY. Reclamation's WaterSMART: Water and Energy Efficiency Grants program will provide an important contribution to continuing the impact and capacity of this program.

3. Technical Proposal: Water Smart Landscapes Program Description

In Southern Nevada, nearly all water used indoors is recovered, treated and returned to the Colorado River system for return-flow credits. The recycling of Colorado River water used in Southern Nevada is accrued according to the 1984 U.S. Bureau of Reclamation "Procedure for Determining Return-Flow Credits to Nevada from Las Vegas Wash" and subsequent administrative updates authorized by Reclamation. This process extends Nevada's Colorado River water supply by nearly 70 percent. As a result, the SNWA's conservation efforts emphasize reducing outdoor water use, which cannot be recovered through return-flow credits.

The WSL Program is a key component in the SNWA's efforts to meet its conservation goals. The WSL Program encourages property owners to convert unused lawn by providing a financial incentive to offset a portion of the cost associated with the conversion. The program currently rebates $3.00 per square-foot for the first 5,000 square-feet converted per property, and $1.50 per square-foot for each additional square-foot converted. The maximum award for any property in a fiscal year is $500,000.

Based upon a joint Reclamation/SNWA research project conducted from 1995 to 2000, every square-foot of grass replaced with desert landscaping saves an average of 55.8 gallons of water per year (see Evaluation Criteria A – Quantifiable Water Savings from Turf Removal for scientific basis of estimate). Since 1999, the WSL Program has supported the removal of more than 188 million square-feet of lawn– resulting in cumulative conservation savings of more than 397,000 AF of total water, and an annual recurring savings of more than 32,000 million AFY.

The SNWA will contribute $25 million in matching contributions to the proposed project, which will be derived from SNWA budgeted 2020/2021, 2021/2022, and 2022/2023 WSL Program funding. Using the current average rebate rate of $2.78 per square foot this project will result in the conversion of 9,532,374 square-feet of turf and will save an additional 1,632 AFY.

Water Smart Landscapes Program Process:

The following details the general process that applicants to the WSL program follow to qualify for and receive landscape conversion rebates:

1. **Application** - Single-family property owners must submit an application to the WSL Program via mail or internet. Commercial and institutional properties contact a Programs Coordinator directly.

2. **Pre-conversion site inspection** – All properties must meet eligibility requirements. At the pre-conversion site inspection, SNWA staff document the existing landscape, determine eligibility to participate in the program and explain the program requirements to the property owner or agent.

   (**Step 1-2 Duration: 14 days)**

3. **Six month performance period** – After SNWA deems the property eligible for participation, the property owner is given up to six months to complete a landscape conversion. Subject to SNWA approval, participants may be granted up to six additional months.

   (Step 3 Duration: Customer dependent up to 6 months)

4. **Post-conversion site inspection** – Upon notice from the applicant that a conversion is complete, SNWA will inspect the landscape to ensure it meets minimum requirements and to determine the square footage eligible for rebate. If program requirements are not met, the applicant is given an additional 60 days or the remainder of the six-month time period to take corrective action.

5. **Rebate issuance** – Following a successful post-conversion site inspection, the customer is notified of the rebate amount. The customer acknowledges the amount by signing a form and returning it. A rebate check is then processed and mailed.

   (Step 4-5 Duration: 21 days)

   On average, this entire process takes approximately 3 to 4 months from initial customer request.

Project Planning:
The SNWA has developed a number of planning documents that guide the management, acquisition and conservation of its water resources. To help plan for the future, the SNWA has developed and maintains a comprehensive Water Resource Plan (available at http://www.snwa.com/ws/resource_plan.html). This document includes a 50-year planning horizon where future water resources are assessed against projected demands. The plan is reviewed annually and updated as needed to reflect rapidly changing conditions driven by drought and growth. The plan considers both water conservation initiatives and banking arrangements as important goals and resources. The WSL Program is specifically highlighted as an important conservation tool, which extends the region's water resources.

In addition, and in accordance with Reclamation requirements for Section 210(b) of the Reclamation Reform Act of 1982, the SNWA maintains a regional water conservation plan that identifies water conservation strategies and goals to protect and extend Southern Nevada's available water resources (available at http://www.snwa.com/assets/pdf/about_reports_conservation_plan.pdf). The SNWA works closely with its member agencies to refine conservation strategies and programs that are appropriate for the community. The 2014-2018 SNWA Conservation Plan is currently on file with Reclamation. This plan sets a new target goal of 199 GPCD by 2035. The Conservation Plan identifies the WSL Program as a critical tool in achieving this conservation goal.

Estimated Project Schedule:
As a customer rebate program, the WSL Program is dependent upon customer demand. Historically, rebate issuance has remained relatively steady through the fiscal year. If approved, SNWA will be able to proceed as soon as an agreement is entered. By quarter, expenditures for this portion of the FY 2020/2021, 2021/2022, and 2022/2023 WSL Program are anticipated to track the following estimated forecast.

This chart depicts the estimated amount of landscape converted using the current average rebate of $2.78 per square foot:

Fiscal Year 2020-2021	Percent	Landscape Converted	Rebate Issuance
Q1 - July 1 – September 30	25	794,364.50 square-feet	2,208,334
Q2 - October 1 – December 31	25	794,364.50 square-feet	2,208,333
Q3 – January 1 – March 31	25	794,364.50 square-feet	2,208,333
Q4 - April 1 – June 30	25	794,364.50 square-feet	2,208,333
Total	100	3,177,458 square feet	$8,833,333

Fiscal Year 2021-2022	Percent	Landscape Converted	Rebate Issuance
Q1 - July 1 – September 30	25	794,364.50 square-feet	$2,208,334
Q2 - October 1 – December 31	25	794,364.50 square-feet	$2,208,333
Q3 – January 1 – March 31	25	794,364.50 square-feet	$2,208,333
Q4 - April 1 – June 30	25	794,364.50 square-feet	$2,208,333
Total	100	3,177,458 square feet	$8,833,333

Fiscal Year 2022-2023	Percent	Landscape Converted	Rebate Issuance
Q1 - July 1 – September 30	25	794,364.50 square-feet	$2,208,334
Q2 - October 1 – December 31	25	794,364.50 square-feet	$2,208,333
Q3 – January 1 – March 31	25	794,364.50 square-feet	$2,208,333
Q4 - April 1 – June 30	25	794,364.50 square-feet	$2,208,333
Total	100	3,177,458 square feet	$8,833,333

Total Project	**Percent**	**Landscape Converted**	**Rebate Issuance**
Year One (2020-2021)	33.33	3,177,458 square feet	$8,833,334
Year Two (2021-2022)	33.33	3,177,458 square feet	$8,833,333
Year Three (2022-2023)	33.33	3,177,458 square feet	$8,833,333
Total	100	9,532,374 square feet	$26,500,000

Performance Measures:
Performance measures for this program will be calculated in *rebates issued, turf converted* and *water saved*. Total program performance measures include the issuance of $26,500,000 in rebates, 9,532,374 square-feet of turf converted and the recurring annual conservation of 1,632 AFY.

As described in the table below, using the current average rebate of $2.78 per square foot, Reclamation's $1,500,000 contribution to this program will result in the conversion of approximately 118,705 square-feet of lawn and the recurring annual conservation of 163 AFY.

Agency	Contribution	Turf Converted (square feet)	Water Conserved (AFY)
SNWA	$25,000,000	1,068,345	1,468.80
Reclamation	$1,500,000	118,705	163.20
Total	$26,500,000	1,187,050	1632

The total number of rebates issued will be available upon project completion.

Conservation progress is measured by annually comparing the community's actual water use to the expected water use without conservation measures in effect. To measure conservation, the SNWA uses an explanatory regression model to determine the variables that influenced Southern Nevada's water use during the preceding year. Although the model has identified a substantial number of relevant variables, the most significant are related to population, weather and economic indicators. This data is obtained from other agencies on an annual basis.

To track and monitor the effectiveness of the WSL Program, the SNWA developed the Conservation Incentive Archive and Database (CiCADA). Developed in-house and launched in 2017, the CiCADA database tracks all participants, processes and results related to the WSL Program. Important features include individual participant tracking, Clark County Assessor property record information, rebate application information, site assessment information, converted square footage, and rebate amounts. Other functions include the ability to run various reports on program participation, to track quality assurance performed on staff work, and to run queries on numerous tracking and enrollment options. All of these functions allow the database to serve as the primary method for tracking performance measures. Information regarding results of the program can be made available to Reclamation as needed, or quarterly through progress reporting processes. At project completion, Reclamation will be provided with a report summarizing the number of square feet converted, rebates issued, acre-feet per year saved and other relevant program information.

4. Technical Proposal: Evaluation Criteria

***Evaluation Criteria A - Quantifiable Water Savings from Turf Removal**:*

On May 31, 2018, the SNWA Board of Directors authorized an increase of the WSL rebate to $3.00 per square foot for the first 10,000 square feet of turf removed and $1.50 per square foot thereafter. The current average rebate is $2.78 per square-foot. Applying this average rebate rate to the total project cost of $26,500,000, the SNWA estimates that 9,532,374 square-feet of turf grass will be removed during the grant performance period.

$$\textbf{Total Square Feet Converted} \quad \frac{\$26{,}500{,}000}{\$2.78/\text{square-foot}} = 9{,}532{,}374 \text{ square-feet}$$

In 1995, a multi-year Xeriscape Conversion Study was implemented as a result of a cooperative agreement between SNWA and Reclamation. Funded in part by Reclamation, the final report finished in 2005. This research involved hundreds of participants that were divided into three treatment groups: Xeric Study, Turf Study, and control groups. Data on both household water consumption and water consumption through irrigation submeters was collected. Submeters were installed to determine per-unit area water application for both xeric- and turf grass-dominated landscapes. The per-unit area savings of xeric- versus turf dominated landscapes as revealed by the submeter data was found to be 55.8 gallons per square-foot per year. This results in a significant savings of 76.4 percent when considered in the context of all available residential water conservation measures.

Based on the data gathered from the Xeriscape Conversion Study, the SNWA is able to determine the water savings realized from landscape conversion projects completed through the WSL Program. The number of square feet of lawn converted to Xeriscape under the requirements of the WSL program will determine the number of gallons of water saved.

Using an average rebate of $2.78 per square foot, this project will result in a 1,632 AFY savings per year.

$$\textbf{Total AFY Saved} \quad \frac{55.8 \text{ gal} \times 9{,}532{,}374 \text{ square-feet}}{325{,}851 \text{ gal/AF}} = 1{,}632 \text{ AFY}$$

The SNWA estimates the expected life of the improvements to be 50 years. Over the life of the improvement, the cumulative recurring impact of this portion of the 2020/2021 WSL Program is estimated to result in savings of 15,700 AF.

Cumulative Recurring Impact estimating a rebate rate of $1.80 per sq. ft.	1,632 AFY x 50 years	= 81,600 AF

Evaluation Criteria B - Water Supply Reliability*:*
Up to 18 points may be awarded under this criterion. This criterion prioritizes projects that address water reliability concerns, including making water available for multiple beneficial uses and resolving water related conflicts in the region.

The SNWA and its member agencies depend on the Colorado River for approximately 90 percent of the community's water resource needs. The SNWA's primary resource is its share of Nevada's consumptive-use apportionment of 300,000 AFY of Colorado River water.

In Southern Nevada, the SNWA serves as a regional water wholesaler, which eliminates the need for direct marketing between municipalities. Instead, unused Colorado River resources are stored for future use in water banks located in Southern Nevada, California and Arizona. The Southern Nevada water bank, established in 1987, has approximately 359,000 AF of credits, including water banked for the Las Vegas Valley Groundwater Management Program. The SNWA's California water bank has accumulated approximately 162,000 acre-feet of credits, while Arizona's bank has accumulated 601,000 acre-feet since the inception of Nevada Interstate Banking in 2002. SNWA's water conservation gains have helped further its banking efforts. Since 2002, water-efficiency programs have helped the SNWA to contribute approximately 269,000 AF of unused Nevada Colorado River water toward interstate banking efforts.

In the event that Colorado River shortages are implemented, the SNWA intends to utilize banked resources to help offset supply availability. Conservation improves the ability to respond to shortages both by directly reducing demand, and by freeing up resources that can be banked for times of emergency.

Evaluation Criteria C – Implementing Hydropower
Up to 18 points may be awarded for this criterion. This criterion prioritizes projects that will install new hydropower capacity to utilize our natural resources to ensure energy is available to meet our security and economic needs.

The proposed project does not include construction or installation of a hydropower system. However, it does increase energy efficiency in water management. Water treatment and delivery is energy intensive. Under the proposed project, each acre-foot of water saved will yield an estimated 2,118 kilo-Watt hours (kWh) of energy conserved. These savings are estimated by calculating the power required to treat and deliver one acre-foot of water to the average customer (includes wholesale and purveyor power uses).

The SNWA obtains energy from a number of sources. In 2017, these included 106,425 MWH from the hydropower generated at Hoover Dam and purchased from Reclamation (10 percent), 812,700 MWH

market purchases (79 percent), and small quantities of power purchased from NV Energy (61,500 MWH) or generated by SNWA solar and hydropower projects (48,375 MWH).

Through the proposed portion of the WSL Program, it is estimated that the region will save 3,456,576 kWh each year with a total savings of more than 172 million kWh through the life of the project (50 years).

Energy Savings		kWh Saved Annually	kWh Saved Over the Life of the Project
Using an estimated rebate rate of $2.78 per sq. ft	1,632 AFY x 2,118 kWh	= 3,456,576 kWh	x 50 years = 172,828,800

The SNWA is committed to conserving energy and utilizing renewable resources when possible to ensure energy is available to meet Southern Nevada's security and economic needs. The SNWA voluntarily committed to meet 25 percent of its energy needs through renewable resources by 2025, which parallels Nevada's Renewable Energy Portfolio Standards. At present, more than 18 percent of energy used by the SNWA is generated through renewable resources. The savings generated by the proposed project will allow the SNWA to further reduce its non-renewable market purchases, increasing the emphasis on renewable energy.

Criteria D – Complementing On-Farm Irrigation Improvements

Up to 10 points may be awarded for projects that describe in detail how they will complement on-farm irrigation improvements eligible for NRCS financial or technical assistance.

This project does not complement on-farm irrigation improvements.

Criteria E – Department of the Interior (DOI) Priorities

Up to 10 points may be awarded based on the extent that the proposal demonstrates that the project supports the Department of the Interior priorities.

1. *Creating a conservation stewardship legacy second only to Teddy Roosevelt by utilizing science to identify best practices to manage land and water resources and adapt to changes in the environment.*

   Since 1991, the SNWA has developed and implemented one of the most progressive and comprehensive water conservation programs in the nation. Conservation efforts in the Las Vegas Valley have helped reduce the community's Colorado River consumption by 28 billion gallons between 2002 and 2017, even as the population increased by nearly 660,000 residents during that time. The community is currently ahead of schedule to achieve its water conservation goal of 116 GPCD by 2035.

   In 2017, Southern Nevada used 127 gallons per capita per day, representing a 36 percent decline the community's per capita water use since 2002. (This number reflects water from all sources used by residents and businesses served by municipal water providers, as well as recovered indoor water treated and returned to the Colorado River system and water used by 40 million annual visitors).

   The SNWA's role is to facilitate information sharing and collaboration. This has resulted in the creation of successful community-wide water-efficiency policies, such as permanent mandatory

watering restrictions and limitations on lawn installation in new construction. Education, outreach and incentive programs are largely managed by the SNWA through committed involvement from its member agencies, community stakeholders and the public. Participation in the SNWA's rebate programs has realized record-breaking results:

- Water Smart Landscape Rebate Program
  - 185 million square feet of grass removed
  - 119 billion gallons of water saved since the program began in 1999
- Pool Cover Instant Rebate Coupon Program
  - 43,000 coupons received
  - 512 million gallons of water saved annually
- Water Efficient Technologies Program
  - 1.5 billion gallons of annual water savings by businesses
- Water Smart Homes
  - Nearly 13,000 homes have been built via this program
  - 14 billion gallons of water saved since the program began in 2005

2. *Foster relationships with conservation organizations advocating for balanced stewardship and use of public lands;*

   As the wholesale water provider to Southern Nevada's municipal water agencies, the SNWA is responsible for managing the region's current and future water resources. This includes managing all water supplies available to Southern Nevada through an approved water budget; managing regional water resources and conservation programs; ensuring regional water quality meets or exceeds state and federal standards; allocating and distributing regional water resources among its member agencies; water resource planning; presenting a unified position on water issues facing Southern Nevada; and building and operating regional facilities to provide a reliable drinking water delivery system to all member agencies.

3. *Utilizing our natural resources ensuring American Energy is available to meet security and economic needs.*

   This project supports DOI priorities by ensuring American Energy is available to meet security and economic needs. Water treatment and delivery is energy intensive. Under the proposed project, each acre-foot of water saved will yield an estimated 2,118 kilo-Watt hours (kWh) of energy conserved. Since its inception, the WSL Program has avoided the use of 903,672,980 kWh, which was made available for other uses, including security and economic concerns.

Evaluation Criteria F- Implementation and Results

Up to 6 points may be awarded for these subcriteria.

Subcriterion F.1: Project Planning
Does the applicant have a Water Conservation Plan and/or System Optimization Review (SOR) in place? Please self-certify, or provide copies of these plans where appropriate to verify that such a plan is in place.

To support its water planning and management responsibilities, the SNWA developed and maintains a Water Resource Plan (copy attached). The SNWA Water Resource Plan projects demands and identifies a portfolio of existing and planned water supply options available to meet those demands over time. The plan, first developed in 1996, is reviewed annually and updated as needed. As demonstrated in past revisions, adjustments to the plan are made to account for various uncertainties such as drought, conservation achievements, resource availability and changes in population and demand projections. The Water Resource Plan is scheduled to be updated in 2019.

Conservation plays an important role in water resource management. For this reason, the SNWA maintains a Conservation Plan (copy attached), which is updated every five years. Last updated in 2014, this plan helps the SNWA effectively manage its water resources. The plan is currently being updated and will be submitted for approval this summer.

Subcriterion F.2: Performance Measures
Points may be awarded based on the description and development of performance measures to quantify actual project benefits upon completion of the project.
Performance measures will be based on actual water saved. See Section 4 on Page 9 of this proposal.

At the end of the project, the SNWA will prepare a closeout package for the Bureau of Reclamation, which will outline the actual project performance results achieved. For example, here is a blurb from a closeout letter explaining the final outcomes for Agreement R16AP00118, which was submitted for closeout in July of 2018.

> In our grant proposal, we estimated a conversion of 6,321,839 square feet, an annual water savings of 1,082 AFY, and a cumulative savings of 54,100 AF. This project accomplished the conversion of approximately 6,911,832 square feet of lawn to water-efficient landscaping, a recurring annual water savings of approximately 1,184 AFY, and a cumulative savings of 59,200 AF.

Subcriterion F.3: Readiness to Proceed
Points may be awarded based upon the extent to which the proposed project is capable of proceeding upon entering into a financial agreement.

The SNWA will be ready to start this project immediately upon receipt of a financial assistance agreement. See Estimated Project Schedule on Page 8 of this proposal.

Evaluation Criteria G- Nexus to Reclamation Project Activities

Up to 4 points may be awarded if the proposed project is in a basin with connections to Reclamation project activities.

Reclamation is a critical partner in SNWA's water management and conservation efforts. The SNWA diverts 90 percent of its water supply from the Reclamation-managed Colorado River system. The SNWA receives delivery of Colorado River water from Reclamation under several contracts held by the SNWA or its member agencies, as listed below:

SNWA Contracts:
- Contract Number 2-07-30-W0266, Amendment Number 1, Amended and Restated Contract with the Southern Nevada Water Authority, for the Delivery of Colorado River Water
- Contract Number 7-07-30-W0004, Amendatory and Supplemental Contract between the United States and the State of Nevada for the Delivery of Water and Construction of Project Works

SNWA Member Agency Contracts:
- Contract Number 14-06-300-978, "Boulder Canyon Project Arizona-California-Nevada Contract for the Delivery of Water," City of Boulder City
- Contract Number 0-07-30-W0246, Contract for Delivery of Water to City of Henderson
- Contract Number 14-06-300-2130, "Boulder Canyon Project Contract for Delivery of Water to Las Vegas Valley Water District"
- Contract Number 2-07-30-W0269, "Boulder Canyon Project Contract with the Big Bend Water District, Nevada, for the Delivery of Colorado River Water"

The water delivered by SNWA under these contracts is diverted at Reclamation approved diversion points in the Colorado River at Lake Mead and below Hoover Dam. This includes delivery of water through the Robert B. Griffith Water Project (formerly the Southern Nevada Water Project) constructed by Reclamation, as authorized by an Act of the United States Congress.

In addition, the SNWA has established long-standing relationships with Reclamation, and has coordinated on a number of initiatives including funding for the Brock Reservoir System Efficiency Project and the Yuma Desalting Plant Pilot Project; development and implementation of interstate water banking agreements with Arizona and California; Colorado River accounting and procedures for return-flow credits; a Xeriscape Conversion Study; and environmental restoration and stabilization initiatives in the Las Vegas Wash.

Since 2010, the SNWA has received 12 WaterSMART grants from Reclamation in direct support of the SNWA's turf conversion efforts. In 2016, the SNWA received a 3-year grant in support of the WSL program — $1,000,000 was awarded by the WaterSMART: Water and Energy Efficiency Grants Program for fiscal years 2016/2017, 2017/2018 and 2018/2019.

Evaluation Criteria H- Additional Non-Federal Funding

Up to 4 points may be awarded to proposals that provide non-Federal funding in excess of 50 percent of the project costs.

This project proposal seeks $300,000 from Reclamation's WaterSMART: Water and Energy Efficiency Grants program. Funding will support a portion of the SNWA's 2020/2021, 2021/2022, 2022/2023 Water Smart Landscapes Rebate Program (WSL Program). The SNWA will provide a minimum matching contribution of $25 million for a total project cost of $26.5 million. If the proposed project is funded by Reclamation, the non-federal share will be 90 percent.

5. Project Budget: Funding Plan

The SNWA has four key funding sources, which include quarter-cent sales tax, connection fees, commodity fees and reliability charges. These revenue sources provide the organization with a mix of funding sources, which help to ensure the financial stability and capacity of the organization. Matching

contributions for the 2019/2020, 2021/2022, and 2022/2023 WSL Program will be derived from bond proceeds currently held in the SNWA Enterprise Fund.

Adequate funding to support project activities and matching contributions will be allocated in the SNWA's Fiscal Year 2020/2021, 2021/2022, and 2022/2023 budget. The proposed work will not result in operations and maintenance obligations in future calendar years. No in-kind contributions are incorporated into this proposal. In addition, no funding will be provided by a source other than the applicant.

In addition to this request, a complementary request for $300,000 (one year program) has been submitted under Funding Group I of the WaterSMART Grants Program. Necessary match funding is available for both program grants.

6. Project Budget: Budget Proposal

BUDGET ITEM DESCRIPTION	**COMPUTATION**		**RECIPIENT FUNDING**	**RECLAMATION FUNDING**	**TOTAL COST**
	$/Unit and Unit	**Quantity**			
SALARIES AND WAGES	N/A	N/A			
FRINGE BENEFITS	N/A	N/A			
TRAVEL	N/A	N/A			
EQUIPMENT	N/A	N/A			
SUPPLIES AND MATERIALS	N/A	N/A			
OTHER (REBATES)					
Customer Rebates (current average rebate)	$2.78/per square foot	9,532,374 sq. ft.	$25,000,000	$1,500,000	$26,500,000
CONTRACTUAL	N/A	N/A			
Regulatory and Environmental Compliance	N/A	N/A			
TOTAL DIRECT COSTS			$25,000,000	$1,500,000	$26,500,000
INDIRECT COSTS – 0%			$0.00	$0.00	$0.00
TOTAL PROJECT COSTS			**$25,000,000**	**$1,500,000**	**$26,500,000**

7. Budget Narrative

All costs included in this proposal are directly related to rebate and contract costs. Program costs for salaries/wages, fringe benefits, travel, equipment and other supplies and materials are not being requested for consideration as either match or reimbursable expenditures. All costs are direct and necessary for project implementation. The non-federal contribution is 90 percent; federal contribution is 10 percent.

Salaries and Wages
Reclamation funding will not be expended for program administration. In addition to the SNWA's matching contribution, the SNWA will assume all overhead costs necessary to operate the program, including staffing, administration, marketing and other duties associated with assuring a successful program.

Fringe Benefits
Not applicable to this project.

Travel
Not applicable to this project.

Supplies and Materials
Not applicable to this project.

Other (rebates)
Expenditures totaling $26,500,000 in customer rebates will result in the estimated conversion of 9,532,374 square-feet of turf. The variance between estimated average rebate issuance and actual average rebate issuance will be within a plus/minus 5 percent.

Contractual
Not applicable to this project.

Regulatory and Environmental Compliance
Not applicable to this project.

Total Direct Costs
Reclamation is being requested to contribute $1,500,000 toward direct WSL program. The SNWA will provide a cash match of $25 million.

Indirect Costs
Not applicable to this project.

8. Environmental and Cultural Resource Compliance

(1) Will the project impact the surrounding environment?

The elements of this proposal are not anticipated to have any environmental impacts that would require consideration under NEPA or NHPA. Work will be implemented on private land, within urbanized Southern Nevada communities, all of which have been previously disturbed.

(2) Impact on listed or candidate species?

The Colorado River watershed contains a number of sensitive and protected species. Management of the river's resources is key to protecting these species and their habitats. Although conversion of turf landscaping provides no direct benefits to threatened or endangered species, water conservation achievements can indirectly increase Reclamation's flexibility in managing Lake Mead and Colorado River water resources.

Construction activities associated with the conversion of lawn will not harm or negatively impact any of Southern Nevada's threatened or endangered species. All landscape conversions will be completed by private parties and implemented on private land within previously developed residential and commercial areas in Southern Nevada.

(3) Wetlands or other surface waters inside the project boundaries?

Not applicable.

(4) When was the water delivery system constructed.

The majority of the SNWA and its member agencies water system has been constructed over the past 45 years. This project is not anticipated to impact any infrastructure that might be classified as historic.

(5) Modification to individual features of an irrigation system?

System modifications are made to individual property owner's residential and commercial irrigation systems. The exact date of construction can vary widely but typically does not exceed 30 years.

(6) Are there any buildings, structures or features listed or eligible for listing on the National Register of Historic Areas?

The potential project area includes private residences and commercial residences throughout a large section of Southern Nevada, all of which have been previously impacted. There are a number of historic properties or candidate sites throughout the area. However, it is not anticipated that any of these sites will be candidate projects for the issuance of rebates.

(7) Are there any known archaeological sites in the proposed project area?

The potential project area includes private residences and commercial residences throughout a large section of Southern Nevada, all of which have been previously impacted. There are a

number of archaeological areas throughout the area. However, it is not anticipated that any of these sites will be candidate projects for the issuance of rebates.

(8) Will the project have a disproportionally high and adverse effect on low income or minority populations?
No.

(9) Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?
No.

(10) Will the project contribute to the introduction, continued existence or spread of noxious weeds or non-native invasive species known to occur in the area?
Not applicable.

9. Required Permits or Approvals
As a non-construction program, it is not anticipated that the implementation of this project will require the issuance of any permits. Property owners of exceptionally large projects may be required to seek permits applicable to the size and scope of work being performed. However, acquisition of such a permit would be the responsibility of the property owner. Such an occurrence is an exception and is not reflective of the standard landscape conversation project.

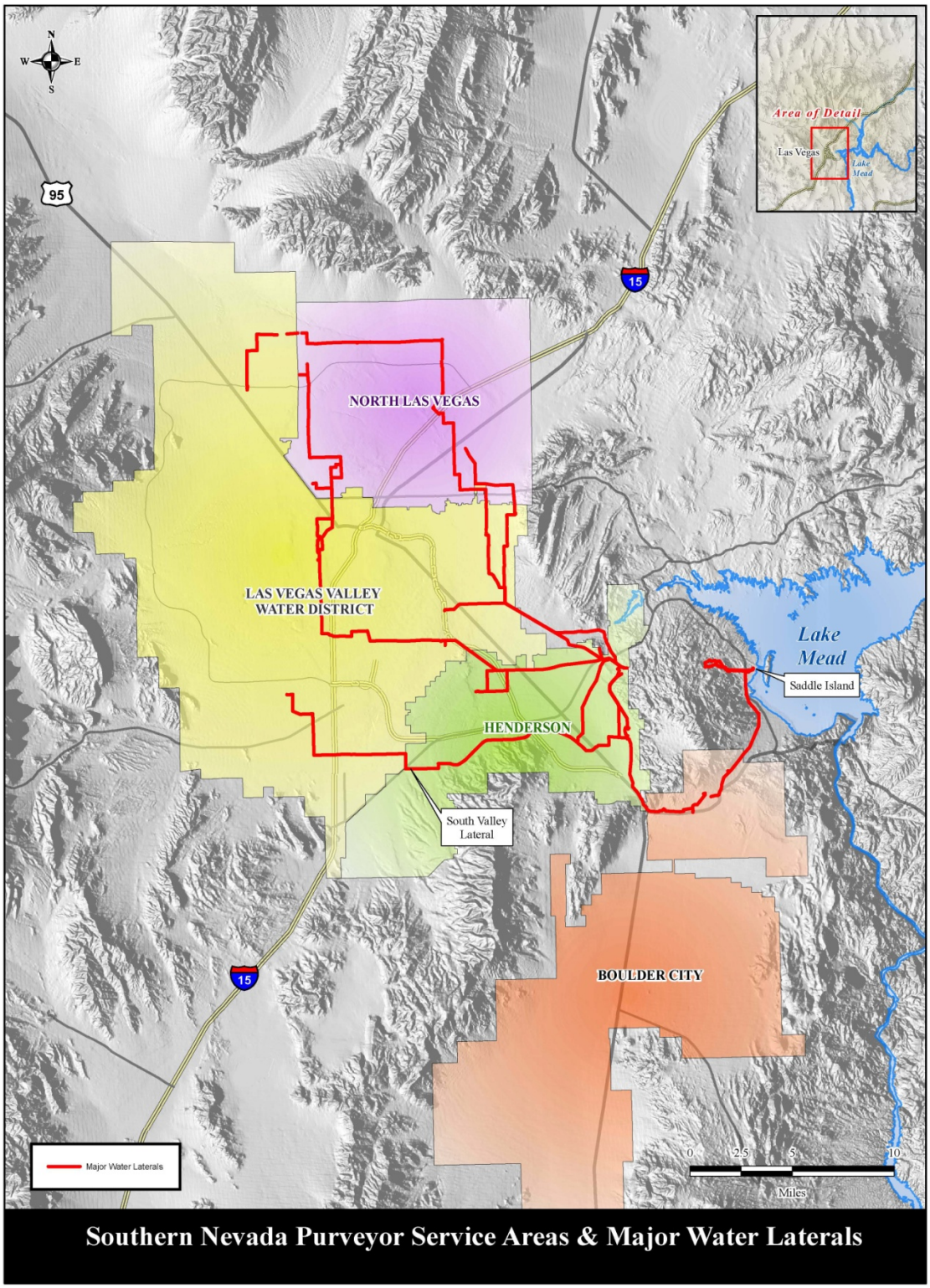
10. Letters of Support – Not applicable.

11. Official Resolution
An official resolution authorizing the submission of this proposal and confirming the subject matching requirements will go before the SNWA Board of Directors at its March 21, 2019 meeting. A copy will be forwarded to Reclamation at that time, which is within the 30-day deadline.

12. Unique Entity Identifier
The SNWA maintains an active registration in SAM.gov. It's Cage Code is 3NRT9. The SNWA's unique entity identifier or DUNS No. is 135965650.

SF 424A SUBMITTED VIA GRANTS.GOV

Appendix A – SNWA System



SOUTHERN NEVADA WATER AUTHORITY®

Water Conservation Plan

2014-2018

MAY 2014

TABLE OF CONTENTS

OVERVIEW OF THE SOUTHERN NEVADA WATER AUTHORITY

The Southern Nevada Water Authority (SNWA) was formed in 1991 by a cooperative agreement among seven water and wastewater agencies in Southern Nevada:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

Collectively, these agencies provide water and wastewater services to nearly 2 million Southern Nevada residents and 40 million annual visitors.

As the wholesale water provider to Southern Nevada's municipal water agencies, the SNWA is responsible for managing the region's current and future water resources. This includes managing all water supplies available to Southern Nevada through an approved water budget; managing regional water resources and conservation programs; ensuring regional water quality meets or exceeds state and federal standards; allocating and distributing regional water resources among its member agencies; water-resource planning; presenting a unified position on water issues facing Southern Nevada; and building and operating regional facilities to provide a reliable drinking water delivery system to all member agencies.

Although the SNWA plays a critical role in managing water, it does not have the authority to regulate water use by end users or to establish customer rates. Such policies, codes and regulations are implemented through its member agencies. In terms of regulatory issues, the SNWA's role is to facilitate information sharing and collaboration. This has resulted in the creation of successful community-wide water-efficiency policies, such as permanent mandatory watering restrictions and limitations on lawn installation in new construction. Education, outreach and incentive programs are largely managed by the SNWA through committed involvement from its member agencies, community stakeholders and the public.

THE ROLE OF CONSERVATION IN RESOURCE PLANNING

Water conservation plays a critical role in water resource planning and management efforts; the ability to increase efficient water use and reduce water waste has a direct impact on the amount of resources that will be needed in the future. The more successful a community's conservation achievement becomes, the lower the community's projected demand for water (relative to levels that would have occurred in the absence of conservation).

To support its water planning and management responsibilities, the SNWA developed and maintains a Water Resource Plan. The SNWA Water Resource Plan projects demands and identifies a portfolio of existing and planned water supply options available to meet those demands over time. The plan, first developed in 1996, is reviewed annually and updated as needed. As demonstrated in past revisions, adjustments to the plan are made to account for various uncertainties such as drought, conservation

achievements, resource availability and changes in population and demand projections. The last major update to the Water Resource Plan was in 2009. SNWA is planning the next significant update of the Water Resource Plan following the Integrated Resource Planning Advisory Committee process, which should conclude in late 2014 or early 2015.

The SNWA has worked to develop and manage a flexible portfolio of diverse water resource options. This approach is commonly used in the field of resource planning and is essential in responding to future conditions that may result from drought or other conditions that may limit the availability of resources. The portfolio approach allows the SNWA to assess its overall resource options and make appropriate decisions regarding what resources to bring on-line when necessary. The SNWA Water Resource Plan includes water conservation, reclaimed water, Colorado River water, in-state water resources and groundwater in its portfolio of current and future resources that will be used to meet demands as needed.

Water conservation is a key resource in the SNWA Water Resource Plan, helping lower projected demands and extend the availability of current and future water resources. The plan projects an estimated saving of 276,000 acre-feet of water in 2035 by achieving its current water conservation goal. Gradual savings increases are estimated to occur in following years.

While conservation is an important water management tool, the more aggressive and responsive a community is to the call for conservation, the more difficult it becomes to realize additional conservation gains. This phenomenon of diminishing returns is referred to as "demand hardening." For communities such as Southern Nevada where a majority of the water supply comes from one source, the prospect of demand hardening requires development of additional alternative water supplies regardless of conservation levels achieved.

This concept has become increasingly important in recent years. The Colorado River, which provides approximately 90 percent of Southern Nevada's water supply, continues to experience serious and sustained drought conditions. As a result, Lake Mead's water levels have dropped more than 100 feet since January 2000, and Lake Mead is at less than half of capacity. Mandatory water shortages and critical infrastructure outages are possible should these conditions persist. As a result, the SNWA has aggressively pursued development of non-Colorado River in-state resources, worked with the Colorado River Basin States on management strategies to offset the risk of further surface level declines, and is completing the construction of a new Lake Mead intake to preserve system capacity.

INTEGRATED RESOURCE PLANNING ADVISORY COMMITTEE

An SNWA stakeholder group comprised of nearly two dozen citizens representing a broad spectrum of community interests has been meeting since 2012 to address water resource and funding issues in Southern Nevada. The Integrated Resource Planning Advisory Committee (IRPAC) divided its work into two phases. The IRPAC met 14 times between June 2012 and September 2013 to discuss funding-related matters. The second phase, which began in February 2014, is focusing on the development of recommendations for conservation, water resources, facilities and water quality. The citizens' advisory committee is expected to complete the second phase in late 2014 or early 2015.

When IRPAC completes its work, the committee may provide recommendations to the SNWA Board for conservation programs or goals. Because this Conservation Plan is due in spring 2014, SNWA is updating this plan based on best management practices. The SNWA Board is expected to receive the IRPAC recommendations in early 2015 and may direct staff to implement them at that time.

CONSERVATION ACHIEVEMENTS

The SNWA has developed and implemented one of the most progressive and comprehensive water conservation programs in the nation. Conservation success is measured through the achievement of regional conservation goals. Since adoption of the first goal in 1991, the SNWA has consistently exceeded all adopted conservation goals and subsequently adopted more aggressive targets.

During the mid-1990s, the SNWA purveyor members agreed to follow a series of conservation "best management practices" published by the Bureau of Reclamation. The agreement was an important first step in implementing more consistent conservation measures across the service boundaries of SNWA purveyor member agencies. The agreement was updated in 1999 and a comprehensive five-year Conservation Plan was approved by the SNWA Board of Directors. An update to the Conservation Plan was submitted to and approved by the Bureau of Reclamation in 2004 and again in 2009.

What is GPCD? GPCD is a metric used by some communities to measure water consumption. For the SNWA, it provides a general means of monitoring water-use trends and for tracking conservation progress. A variety of factors influence GPCD including climate, population dynamics, water-use accounting practices and economic conditions. SNWA calculates "gross" GPCD by totaling water diversions, which includes direct and indirect reuse, by its member agencies, adjusting the water use for weather variations, and then dividing the total diversion by the estimated SNWA population served by SNWA's member agencies. That number is then divided by 365 – the number of days in a year.

"Net" GPCD refers only to the portion of water that is consumptively used since direct and indirect reuse allows the water to be used more than once. The concept of consumptive use is a tenet of water law used by both the State of Nevada and U.S. Bureau of Reclamation.

When calculating population, the SNWA does not include the approximately 40 million annual visitors to the region. This visitor load is equivalent to more than 465,000 additional people supported by the water system each day.

Southern Nevada made consistent progress towards its conservation goal throughout the 1990s. However, beginning in 2000, the pace of conservation began to slow. In response, the SNWA and its member agencies launched a conservation strategic planning process in 2001. In 2002, as drought conditions in the Colorado River Basin became more severe, the SNWA member agencies recognized that an immediate and actionable community response was necessary. As a result, the conservation strategic planning effort evolved to address drought conditions and ultimately set the stage for development of the SNWA Drought Plan, which was approved by the SNWA Board of Directors in February 2003 and implemented thereafter by SNWA's member agencies.

Following the implementation of the Drought Plan in 2003, conservation and drought savings rebounded with a 23.1 percent savings for that year. In 2004, Southern Nevada achieved its goal of 25 percent conservation by 2010 originally established in the mid-1990s. This is equivalent to roughly 280 GPCD.

In an effort to maintain and build upon this success, a citizens' advisory committee recommended that the SNWA pursue a strategy to decrease total water demand from 2004 levels to 250 GPCD by 2010 and to 245 GPCD by 2035. The SNWA Board of Directors adopted this goal in 2005.

The following years witnessed extraordinary conservation achievements. Participation in the SNWA's rebate programs realized significant results, including peak participation levels in almost every area. A summary of key SNWA conservation accomplishments is provided in **Appendix A**.

These conservation efforts resulted in a reduction of Southern Nevada's annual water consumption by nearly 29 billion gallons (between 2002 and 2012), despite a population increase of more than 400,000 people during that span. In 2008, the SNWA achieved its 2004 conservation goal of 250 GPCD – two years ahead of schedule. While some of the reductions in water use can be attributed to the economic downturn in recent years, there is no question the community's conservation efforts played a critical role.

These past achievements provide the basis for current efforts. The following sections provide an overview of the SNWA's current conservation goal and a description of how the SNWA will make progress toward this goal during the five-year planning period. A table with discussion and analysis also is provided in **Appendix B**.

The 2014-2018 Conservation Plan will be submitted to the U.S. Bureau of Reclamation in fulfillment of the requirements for Section 210(b) of the Reclamation Reform Act of 1982 and to the State of Nevada Department of Conservation and Natural Resources, Division of Water Resources in fulfillment of the requirements for Nevada Revised Statutes Chapter 540.

CONSERVATION GOALS

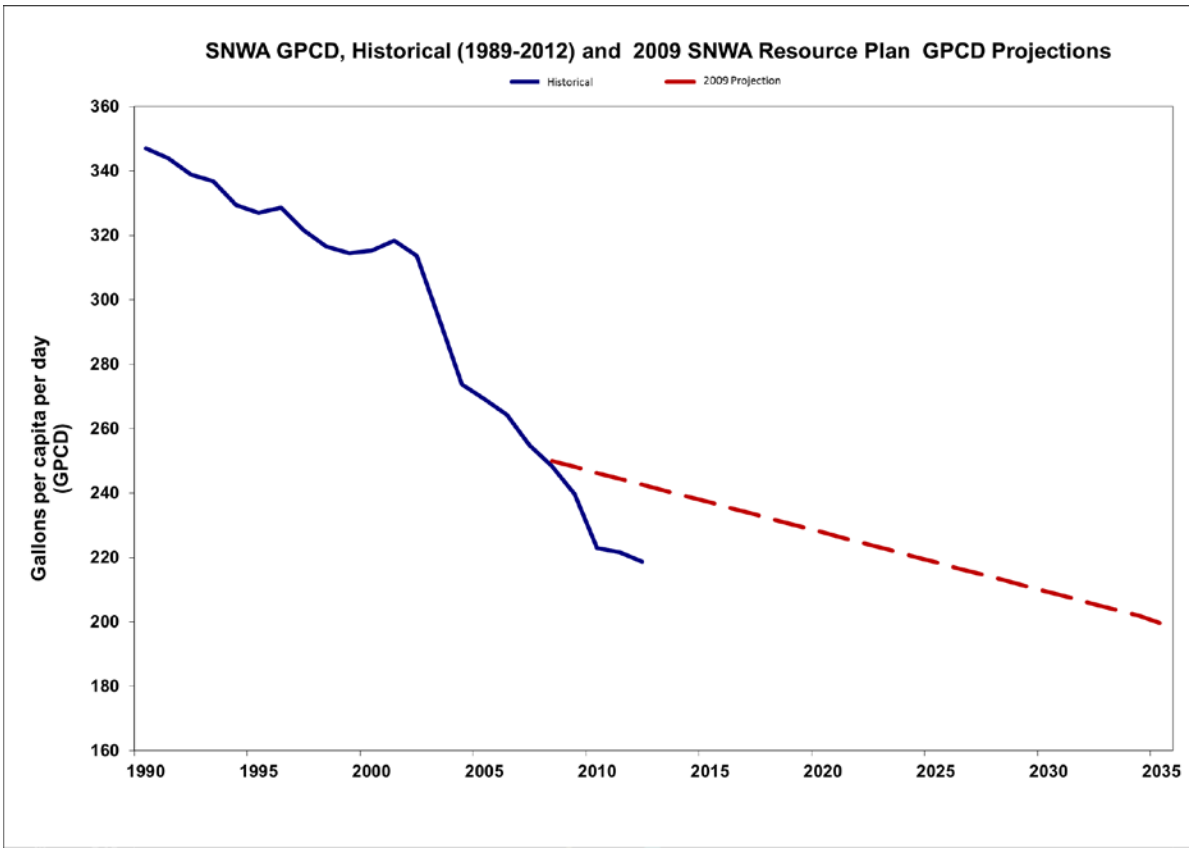
Building upon previous success, the SNWA Board of Directors in 2009 adopted a new conservation goal for the community of 199 GPCD by 2035. **Figure 1** outlines the SNWA's previous conservation achievements (described above) and provides projected achievements through the year 2035.

In 2009, SNWA and its member agencies, recognizing the ongoing drought, adopted permanently the major drought alert demand reduction measures identified in the SNWA's Drought Plan. These include landscape development restrictions limiting most turf installations in new development, watering restrictions, golf course water budgets, and increased fines for water waste. Further contingency plans for assuring reliability of supply are found in Chapter 4 of the 2009 Water Resource Plan.

The Southern Nevada community has been reducing its overall water use faster than originally anticipated in order to meet the 199 GPCD goal. For example, the 2009 SNWA Water Resource Plan projected a community GPCD of 243 in 2012, however the actual GPCD was 219 in that year.

Several factors may have contributed to this rapid reduction in water use, including the impacts of a slow economy, a stabilization in population and participation in SNWA Conservation programs. Southern Nevada has successfully achieved conservation goals in the past, and the SNWA will continue to monitor and track the community's progress in achieving 199 GPCD by 2035.

Figure 1 – Conservation Achievements (1990-2012) and Projections (2008-2035)



The SNWA estimates that more aggressive conservation outreach and education, and continuance of incentive programs, rate setting and regulation will yield these additional GPCD savings. **Figure 2** and **Figure 3** compare the estimated volume of water that would be saved by conservation pre- and post-adoption of the SNWA's current conservation goal. A table with projected annual GPCD reductions for the 2014-2018 planning period is provided in **Appendix C**.

FIGURE 2 – SNWA Water Demands and Conservation
(250 GPCD by 2010 and 245 GPCD by 2035 Conservation Goals)

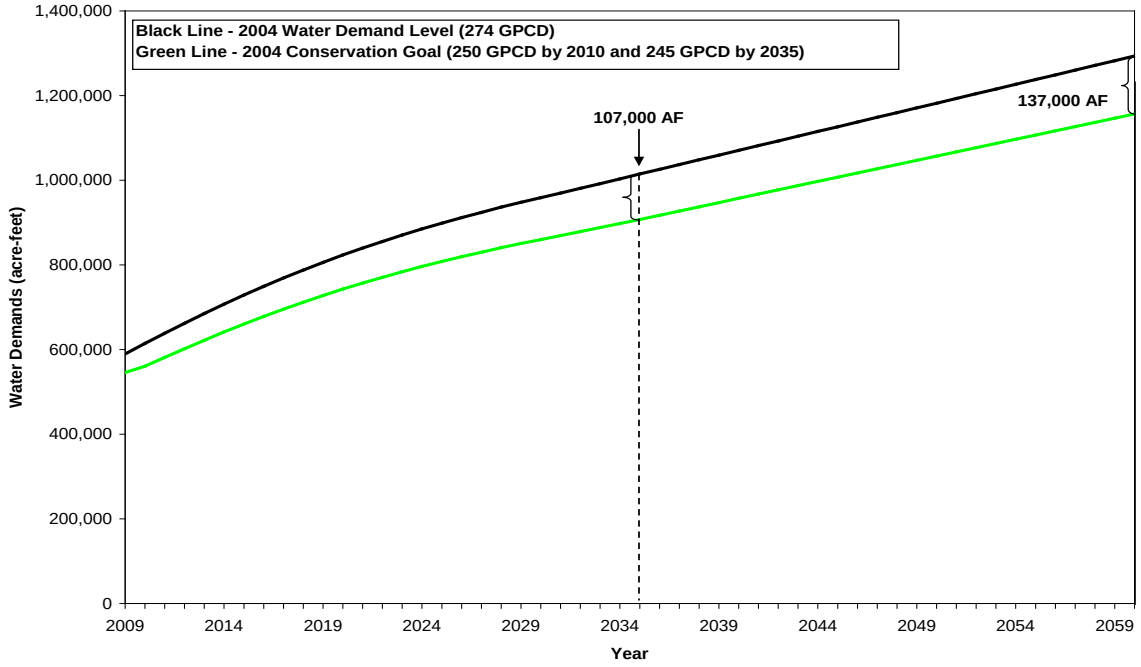
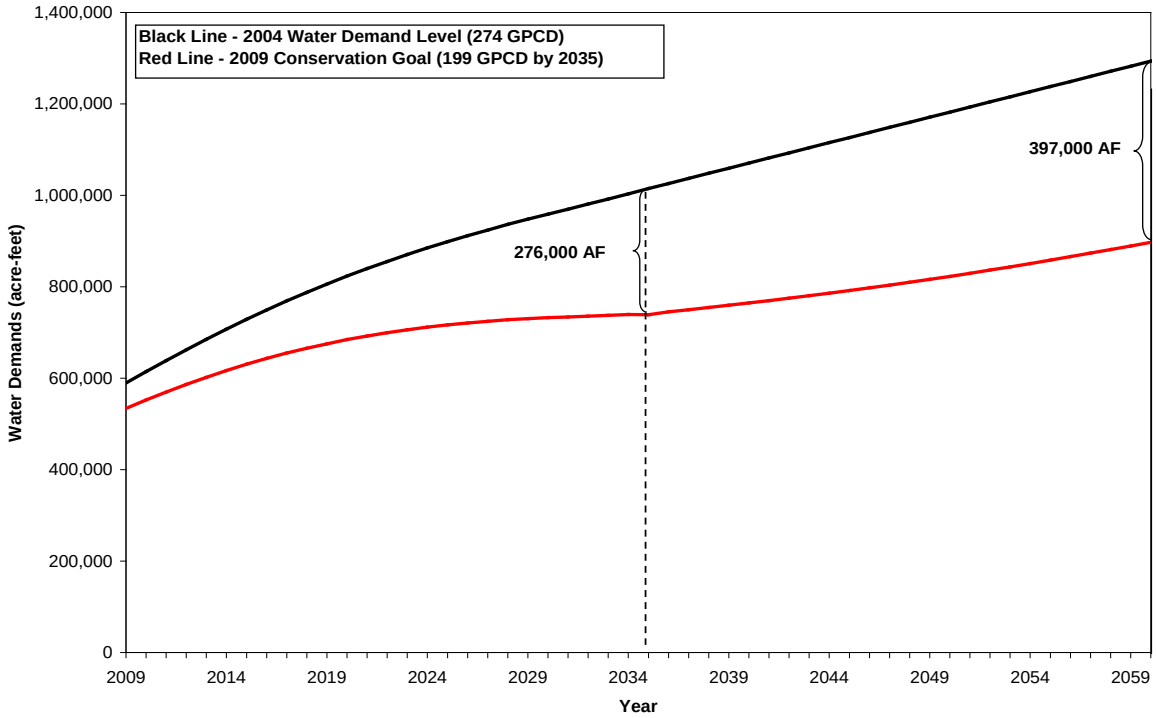


FIGURE 3 – SNWA Water Demands and Conservation
(199 GPCD by 2035 Improved Conservation Goal)

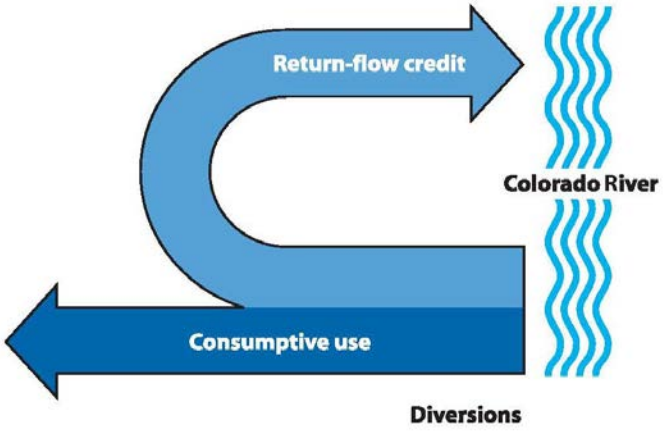


CONSERVATION STRATEGIES

Although the SNWA supports and promotes water conservation both indoors and outdoors, significant effort goes into promoting more efficient water use outdoors. Approximately 60 percent of the water delivered to customers is used consumptively, meaning it can be used just once. Landscape irrigation is collectively the single largest consumptive water use.

In Southern Nevada, nearly all indoor water use that reaches the sanitary sewer is reclaimed. It is either returned to the Colorado River, or delivered to other municipal uses, such as golf course irrigation or power plant use. In accordance with Bureau of Reclamation return-flow credit policy, the SNWA receives credit to withdraw one acre-foot of water from the Colorado River for every acre-foot of Colorado River water that is treated and returned (**Figure 4**). Since this water is already fully reused, additional reuse efforts and indoor conservation measures do not enlarge the SNWA's resource portfolio.

Figure 4 – Return-Flow Credits



Throughout this plan, gross GPCD is expressed as a measure of total diversions, as defined on page 4. Since Southern Nevada directly and indirectly reuses nearly all treated wastewater effluent, the consumptive impact on the Colorado River and groundwater resources is much lower. For example, in 2012 the SNWA's gross demand was approximately 219 gallon per capita per day, but the net consumptive portion was just 129 GPCD.

The SNWA's conservation success is partly dependent upon the water management and business practices of its individual member agencies. There are three key areas related to demand management that are within the purview of the member agencies: metering, managing non-revenue water and tiered water rates. The SNWA and its member agencies will continue to use these base water management practices to sustain previous GPCD reductions and achieve future gains.

Metering – Metering is the foundation of sound demand-management programs. SNWA member agencies fully meter all customer connections for all classes of water in accordance with American Water Works Association standards.

All purveyors operate on-going meter maintenance and replacement programs. Meters are read monthly and data is classified and retrievable on the basis of customer class, meter size, land use and other relevant variables. Purveyors have the ability to identify unusual water use patterns, such as spikes in consumption due to leaks, and to notify customers of unusual account activity. In addition, the three largest purveyors, Las Vegas Valley Water District (LVVWD), City of Henderson and City of North Las Vegas have implemented automated meter reading (AMR) systems. AMR systems eliminate the need for individual manual reads, improve meter-reading efficiency and provide customers with improved billing processes.

Non-Revenue Water – All water delivery systems experience losses. In the water industry, these losses are known as non-revenue water or unaccounted-for-water. Non-revenue water losses are predominantly associated with leaks, variations in meter accuracy and theft. Compared to similar communities in the United States, the SNWA and its member agencies have a low rate of non-revenue water.

The SNWA and its member agencies have a variety of active programs to more effectively account for the total water production. While these ongoing efforts will continue to improve accounting accuracy for and minimize loss of non-revenue water, measurable GPCD savings are not attributed to this management tool. The following programs generally are conducted throughout the region:

- The SNWA's member agencies have created and adopted the Uniform Design and Construction Standards. These detailed construction standards assure that delivery systems meet or exceed industry standards.

- Efforts are ongoing in all service areas to identify older infrastructure deemed susceptible to leaks. For example, most cast iron mains are being systematically replaced, as are polyethylene service connections that do not appear to be meeting longevity expectations.

- Prior to installing facilities, soil testing is conducted to identify potential threats to the distribution system's integrity. For example, where testing indicates that soil chemistry will be destructive to copper piping, plastic sleeves are installed over the service line to prevent corrosion.

- Reservoirs are thoroughly inspected at regular intervals to assure their integrity; special monitoring devices beneath each reservoir detect and report leakage.

- Production meters are regularly maintained and calibrated.

- Customer meters are monitored for consumption anomalies. Small customer meters are subject to a planned replacement program based upon life expectancy and large meters are regularly maintained and calibrated.

- A substantial portion of purveyor distribution lines have permanent listening devices installed that can signal patrolling employees of leaks that fail to surface and assist in accurately determining the leak location for excavation.

- Interagency collaboration speeds leak repairs through fast-tracking line location ("call-before-you-dig") and prompt repair. Records are kept of the estimated system loss for each leak repaired.

Water Rate Setting – All potable water purveyors will continue to use multi-tier increasing block rate structures. These pricing structures provide financial incentive for all water users to implement and participate in conservation measures.

Over the years, local purveyors have implemented major rate restructuring and increases specifically for the purpose of accelerating conservation. This restructuring involved significant price increases in the higher tiers and a compression of tier thresholds. The impact of water rates on GPCD reductions is discussed in "Water Pricing".

CONSERVATION MEASURES

In addition to municipal water management practices discussed in the preceding section, the SNWA and its member agencies will continue to utilize a variety of demand-management measures to promote conservation and reduce overall water use. These include a combination of the following:

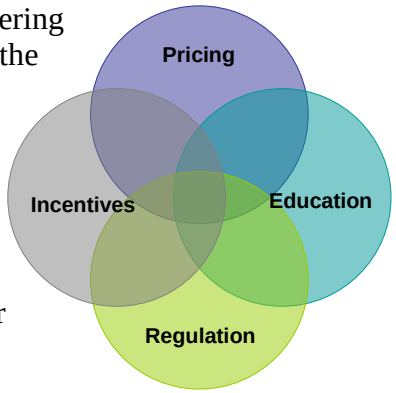
- Water Pricing: tiered-rate structures charge higher rates as water use increases. These rate structures encourage efficiency, while ensuring the affordability of water for essential uses.

- Incentives: incentives are flexible tools that invite the community to participate in the conservation effort. The SNWA has a number of "water smart" programs that are critical to achieving its conservation goals.

- Regulation: city and county governments have adopted a variety of land-use codes and water-use ordinances to promote the efficient use of Southern Nevada's water resources.

- Education: the SNWA's public-education programs are designed to elicit buy-in from the community and help residents understand that responsible water use is a critical part of living in a desert environment.

These measures work in conjunction with one another to promote efficient water use. For example, water pricing (including water rates and water-waste fees) provides a financial signal for customers to reduce water use, which in turn, may lead some customers to improve efficiency. Through passive and active education, customers learn about regulations (such as day-of-week watering restrictions) and incentive programs, which, when acted upon, help the customer save water, and therefore reduce the impact of rates. Ideally, these measures all drive customers to higher levels of efficiency.



The complex and inter-related nature of these conservation measures makes it difficult to attribute specific GPCD reductions to any single measure. A table of the estimated GPCD reduction, and the amount of water estimated to be saved each year over the five-year planning horizon, is included in **Appendix B**.

The following sections detail how the SNWA will utilize each of these conservation measures to achieve its conservation targets throughout the five-year planning horizon.

Water Pricing

Price can be an effective instrument for reducing water demand. Research has consistently shown that water users respond in an inverse manner to changes in the price of water – in general, as the price of water increases, water use decreases. This principle, however, may only hold true for discretionary water use, the portion of a person's water use beyond what is necessary to meet their perceived basic needs.

Economists measure the relationship between pricing and demand as Price Elasticity of Demand (PED). Water PED measures the degree of customer water demand responsiveness due to changes in water rates, holding all other factors constant. Mathematically, PED is the percent change in water demand divided by the percent change in water rates. Water is typically considered relatively inelastic; that is, the response to

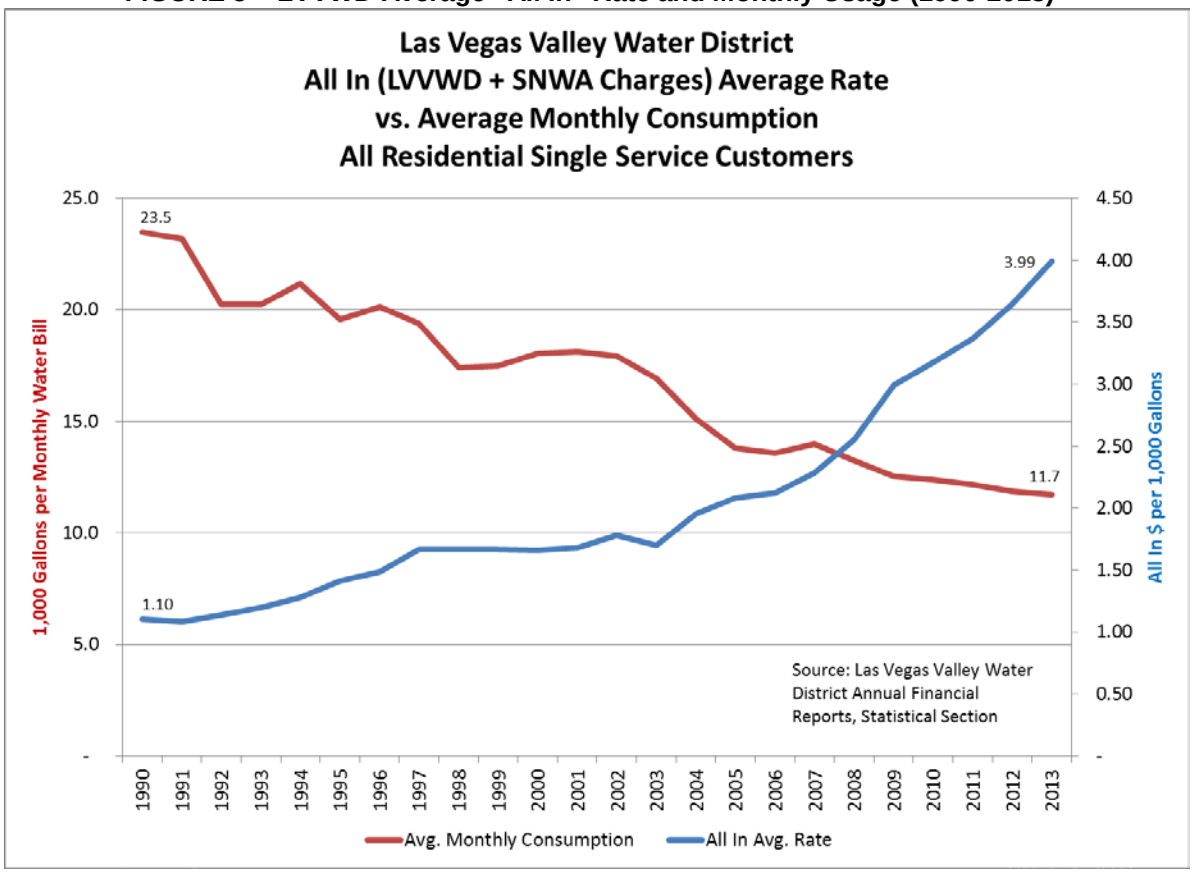
a change in price is less than the degree of the price change. PED can only be estimated in retrospect and can be substantially influenced by economic conditions in the community, including income levels and other factors.

Water users respond to changes in water rates by changing water use practices and implementing available water conservation measures. In the short-run, water users may respond by reducing car washing or their showering time. This short-run response is difficult to quantify and may not be permanent as customer water-use patterns change over time. For the longer term, water users respond to rates by taking advantage of water conservation measures. These measures may include replacing fixtures and appliances with more efficient devices or participating in incentive programs, such as the SNWA's Water Smart Landscapes Rebate Program. In fact, research shows that water bills are a principal reason for customer participation in incentive programs.

A common strategy for managing demand through pricing is the use of increasing block rates. The increasing block rates encourage water conservation by charging water users higher rates for higher volume use. Since 1995, SNWA member agencies have subscribed to a Memorandum of Understanding in which they agree to utilize progressive rate structures to manage demand. All SNWA member agencies currently use increasing block rates to encourage water conservation among high water users, while maintaining overall affordability. In 2005, the SNWA adopted the recommendations of a citizens' advisory committee to promote water rates that sustain and advance conservation achievements by ensuring water rates keep pace with inflation.

While each of the SNWA's member agencies set water rates independently, all utilize similar rate principles to manage demand. For example, the Las Vegas Valley Water District (LVVWD), which delivers nearly 70 percent of the public water supply in Southern Nevada, has a long history of encouraging conservation through water rates. **Figure 5** illustrates that as water pricing increased over the past two decades, water use has declined significantly as a result of conservation and pricing.

FIGURE 5 – LVVWD Average "All In" Rate and Monthly Usage (1990-2013)



The SNWA's conservation goal of 199 GPCD by 2035 is predicated upon continued performance in all conservation measures. Because SNWA and its member agencies operate some of the most aggressive regulatory, education and incentive programs in the nation, these programs may approach their practical limitations over the planning period. Rates, on the other hand, have long-term potential to continue to influence demand as needed. As such, SNWA member agencies recognize the influence of pricing on water demands and will consider conservation when adjusting rates to a level necessary to meet its conservation goal.

While rates are an important conservation measure, public water agencies also have an obligation to the well-being and vitality of the communities they serve, thus pricing must be appropriate and balance the need for conservation and the community's economic health.

Incentives

The SNWA recognizes that long-range demand management requires not only implementing progressive conservation strategies for new customers (such as landscape codes for new development), but also creating incentives for existing customers to improve water efficiency. The SNWA is nationally-renowned for its customer-incentive programs. The following incentives will continue to play a significant role over the next five years in helping the community meet its water conservation goal.

Water Smart Landscapes Rebate Program – The Water Smart Landscapes (WSL) Program offers financial incentives to residents who replace water-thirsty lawn with water-efficient landscaping. Since the majority

of Southern Nevada's water is used outdoors on landscaping, the WSL program targets the largest consumptive water uses. The current program rebate amount is $1.50 for the first 5,000 square feet of lawn removed and $1 for additional lawn removed, up to $300,000 per fiscal year. The program opportunities have been enhanced by grants from the Bureau of Reclamation which has expanded the program's reach. To assure sustained results, participants must grant a conservation easement that promises the project will be sustained in perpetuity. The WSL program is projected to remain a major demand-reduction tool as the SNWA continues toward achieving its conservation goal.

Rebate Coupons – The SNWA offers a variety of instant rebate coupons for single-family, residential property owners. These coupons help customers purchase swimming pool covers, smart irrigation controllers, and rain sensors. These rebates contribute to GPCD reductions and offer customers' easy access to rebates while minimizing program management costs to SNWA.

An exposed pool can lose approximately 50 gallons of water per square foot per year to evaporation. Pool covers reduce evaporation, limit windblown debris and conserve energy. Southern Nevada pool owners are encouraged to cover their pools to conserve water and save money on their water bills. The SNWA Pool Cover Instant Rebate Coupon value is $50 or 50 percent off the purchase price of a pool cover, whichever is less, or $200 or 50 percent off the purchase of a permanent, mechanical pool cover.

Smart irrigation controllers can assist homeowners in watering as efficiently as possible by automatically adjusting their watering schedule according to weather and plant demands. With SNWA's Smart Irrigation Controller Rebate Coupon customers can save up to $200 or 50 percent off the price of a smart controller. An option for commercial properties and homeowners associations exists that provides up to $40 per valve or 50 percent off the product costs for smart irrigation controllers.

Rain sensors shut down irrigation systems during and after rain. The Rain Sensor Rebate Coupon provides up to $25 or 50 percent off the purchase price of a rain sensor.

Water Efficient Technologies – The Water Efficient Technologies (WET) Program offers financial incentives to commercial and multi-family property owners who install water-efficient devices that save at least 250,000 gallons annually. The SNWA offers a menu of pre-approved water-saving technologies with predictable savings and a defined monetary incentive, including high-efficiency toilets, showerheads, and urinals; converting a grass sports field to an artificial surface; converting from old water cooled ice machines to air-cooled machines; and retrofitting standard cooling towers with high-efficiency drift elimination technologies. Additionally, businesses can work directly with the SNWA to implement a custom technology that meets their needs. Currently, the SNWA offers a rebate of up to $8 per 1,000 gallons conserved annually for reducing nonconsumptive-use water or $25 per 1,000 gallons conserved annually for reducing consumptive-use water through technology improvements.

Single-family Indoor Retrofit – SNWA provides free retrofit kits to service area homes that include a premium high-efficiency showerhead, aerators, a fixture flow tester, and toilet leak detection tablets. Retrofit items are WaterSense labeled and exceed applicable efficiency codes and standards.

Regulation

The SNWA works collaboratively with its member agencies to develop and implement regulations that promote water conservation.

Development Codes and Policies – Member agencies adopted landscape and plumbing codes in the mid-1990s to limit water use. Under the 2003 Drought Plan, all agencies adopted more stringent policies for landscape watering, vehicle washing, lawn installation, mist systems and golf course water budgets during declared drought. In 2009, based on input from a citizens' advisory committee, SNWA and member agencies permanently adopted these drought restrictions as a way to help meet long-term resource needs for the community. These policies and previously adopted development codes, which are among the most stringent in the United States, include:

- Landscape watering: watering groups are mandatory and limit watering to one day a week in winter, three days a week in spring and fall, and prohibit watering from 11 a.m. to 7 p.m. from May through September.
- Vehicle washing: a positive shutoff nozzle is required for residential vehicle washing. Commercial vehicle washing is prohibited unless water is captured to the sanitary sewer where that water can be treated and reused.
- Lawn installation: turf installation is generally prohibited in new residential front yards and is limited to a maximum of 50 percent the landscape area in backyards. The use of turf is prohibited in non-residential development.
- Mist systems: commercial use of mist systems is limited from May through August from 12 p.m. to 12 a.m.
- Golf course water budgets: golf courses are subject to mandatory water budgets (6.3 acre feet of water per year per irrigated acre).
- Fountains and ornamental water features: the development and use of water features is restricted in all jurisdictions.
- Water waste: ordinances and service rules prohibit water waste (allowing water to leave the property or violating watering schedules). Fees double with subsequent violations.
- Plumbing fixtures: each new, remodel or replacement of plumbing fixtures in residential or commercial buildings incorporate standards for plumbing fixtures, including water-use standards for toilets, faucets, showerheads and urinals.

Education

In addition to extensive conservation and incentive programs, the SNWA continues to maintain an education and public outreach campaign to assist residents and businesses with conservation efforts. Currently, the campaign utilizes a variety of media to educate customers on the need for conservation, to provide practical tips on how to conserve, and to put customers in touch with SNWA experts who can help them reduce water use at their properties. The efforts include advertising, community events, publications, an interactive website, public-private partnerships, and demonstration gardens to inspire water-efficient landscape designs. Education is an ongoing initiative for the SNWA that will contribute to GPCD reductions during the five-year planning period.

The SNWA believes education and outreach help drive the community towards its incentive programs where specific reductions are measurable. Without education and promotion, these programs are not likely to have realized the level of conservation gains achieved to date or that are projected in future years.

The following section describes education and public outreach initiatives employed by the SNWA. While actual products and services may vary among member agencies, the SNWA expects to continue to provide this type and level of service throughout the five-year planning horizon.

Demonstration Gardens – Through the combined efforts of the SNWA and its member agencies, there is a demonstration garden in every part of the valley. The SNWA also promotes visits to the Springs Preserve, a 180-acre facility that offers hundreds of examples of water-efficient landscaping, as well as classes by master gardeners and horticulturists. Advice from the Springs Preserve staff is available seven days a week. Free tours also are available for area students.

The SNWA supports development of smaller demonstration projects throughout the Las Vegas Valley to show the public that water-smart landscaping is attractive and the most water-efficient choice for Southern Nevada. Currently, schools may apply for SNWA conservation grants of up to $5,000 annually to develop demonstration projects for their own campuses. Grants also are available for conservation-related curriculum programs or other approved activities.

Public Outreach – The SNWA employs a variety of community outreach efforts to educate customers on the need for conservation and about available programs and services. Customers may easily access this information through the Conservation Helpline, a phone center that connects customers to rebate and conservation program information and provides free landscape publications, landscape watering schedules, and a place to report water waste. The same information is available online at **snwa.com**. The SNWA's website includes interactive features such as the online watering schedule application that allows customers to enter their address and receive the landscape watering schedule based on their assigned watering days. Other interactive features include online rebate program applications, water-smart landscape photo galleries, a database of drought tolerant plants, and multimedia demonstrations for setting irrigation clocks and finding and fixing leaks. In addition, the SNWA produces a variety of outreach materials to educate consumers. These include:

- Landscape Watering Schedule: This schedule explains mandatory watering restrictions, illustrates which day(s) of the week each watering group may water, and offers practical tips for irrigating efficiently. The schedule has been included with customer water bills, published in SNWA newsletters and is available on member agency websites.

- Water Smart Living: This tri-annual publication is mailed to more than 700,000 single- and multi-family homes in Southern Nevada. It includes drought updates, information on conservation programs and incentives, and tips for landscape care and using water more efficiently outdoors.

- Sample Landscape Designs: The SNWA teamed with the American Society of Landscape Architects to produce six sample landscape designs. The designs include a variety of water-efficient plants to help homeowners convert their existing landscape or to install the right landscape from the start. The designs are available on snwa.com.

- Water Smart Calendar: This annual publication enables the SNWA to provide information on water-smart plants and conservation tips, and keeps that information in front of customers year-round. The twelve-month calendar is available free of charge in all customer service lobbies of SNWA member agencies and includes landscape watering restrictions and water-smart landscape inspiration.

- Water Ways: This monthly television program airs on local government cable channels and includes segments focusing on water conservation. The program airs daily.

- Videos and Multimedia: Instructional videos are available free of charge to customers, and snwa.com features how-to multimedia demonstrations to help people learn how to find and fix leaks, convert grass to a water-efficient landscape and set their irrigation clocks.

- Interactive Website: The award-winning snwa.com features a wealth of information, videos, multimedia demonstrations, other features to help Southern Nevadans save water. Customers can find their watering group by typing in their address, submit a water waste report, sign up for rebate programs, print coupons, and calculate water savings by converting from grass to a water-smart landscape. The website also includes a database of nearly 1,000 drought tolerant plants with photos and information to help water users plan landscape upgrades and installations.

- Social Media: Through Facebook and Twitter, SNWA is engaging with customers on a daily basis with conservation tips, weather-related landscaping information and how-to photos and videos.

The SNWA also participates in a variety of community events to educate customers on conservation issues, and SNWA and member agency representatives provide valuable landscape and irrigation expertise through classes taught at several venues in Southern Nevada.

Advertising Campaigns – A long-term commitment to water conservation includes an aggressive advertising campaign utilizing television, radio and print advertisements to reach target audiences. Community advertising campaigns challenge homeowners, businesses and community associations to take conservation to the next level by taking control of their irrigation clocks and replacing more grass with water-smart landscaping.

The SNWA also created a bicultural campaign, which includes television, radio, and print ads designed specifically for the Spanish-speaking audience. This allows the SNWA to effectively communicate the need for conservation as well as inform residents of the rebate programs available to them.

Youth Education Programs **–** The valley's youth play an important role in SNWA outreach efforts and the SNWA is committed to educating the next generation on the importance of water resources and conservation. The SNWA has partnered with the Springs Preserve to develop a comprehensive education program known as H2O University for teachers in the Clark County School District with lessons and activities available online at H2OU.org. One innovative component of the program is the Youth Advisory Council, which allows select high-school students to pursue an interest in water-related issues and further develop leadership skills. Previous Youth Advisory Council projects include planting a demonstration garden at a local elementary school, helping to restore wetlands in the Las Vegas Wash and creating the first water-smart home with a local homebuilder.

In addition, the SNWA offers the Water Education Institute, a continuing education program for teachers. Elementary and secondary teachers attend 15 hours of training and earn a Professional Development Education credit. The Water Education Institute workshop includes field trips and takeaway lesson plans. More than 600 teachers have participated in the program.

Local and National Partnerships – The SNWA partners with the local private sector to promote conservation efforts, and it has teamed with the Environmental Protection Agency and other forward-thinking organizations to implement the annual WaterSmart Innovations Conference.

The SNWA hosts the annual WaterSmart Innovations Conference and Exposition held in Las Vegas each year. It is the largest urban-water efficiency conference in the world. Since inception in 2008, approximately 6,400 attendees from 45 states and 27 foreign nations have participated in the conference, which provides entrepreneurs with connections to some of the most innovative water agencies and market partners in the world. Each year, new water-efficient technologies are introduced at the conference and research results are shared with the conservation community.

Local partnerships include:

- Water Conservation Coalition (WCC): Established in 1995, the WCC is a group of local business and community leaders who help promote water-efficient practices in the Southern Nevada business community. WCC members speak to professional and civic organizations to explain the benefits of increased water-efficient practices, encourage other businesses within their industries to participate in SNWA incentive programs and identify water conservation projects within the community to organize and sponsor. In 2012, the WCC partnered with the Southern Nevada Regional Housing Authority to help low-income residents revitalize their neighborhoods with water-efficient landscapes. The WCC Safe Village project converted approximately 230,000 square feet of grass to desert landscaping, providing an estimated water savings of more than 12 million gallons per year. The WCC has participated in several large community projects such as this one, including a conservation upgrade project for the Boys Town Nevada campus and E.W. Griffith Elementary School.

- Water Upon Request: The Nevada Restaurant Association, WCC and SNWA partner with local restaurants, which agree to serve water only when patrons request it. This program saves participating restaurants water, time and money by eliminating unconsumed glasses of water. For every glass of water not served, as much as 1.5 to more than 3 gallons of water is saved. There are currently more than 250 restaurants participating in the program.

- Water Smart Contractor: The key to preventing many water waste problems is efficient landscape design. The SNWA provides a course in water-efficient landscape and irrigation design and installation for licensed landscape contractors. Contractors who complete the course and pass an exam become authorized as Water Smart Contractors. Classes are offered in both English and Spanish. More than 75 companies providing local service are participating in the program.

- Water Smart Home: The SNWA has partnered with the Southern Nevada Home Builders Association to develop a program that certifies new homes as water smart. Based on research conducted, these homes save over 90,000 gallons annually versus traditional residential development. This is the nation's largest program for water efficiency in new homes, with more than 10,000 water smart homes constructed so far.

  In addition, the SNWA consistently engages with the Environmental Projection Agency (EPA) in developing new national standards for WaterSense, a partnership program that provides information on products to save water and protect the environment. The SNWA's Water Smart Home program is the principal model for the WaterSense New Homes Program. In 2006, the

SNWA was the first water agency to receive the EPA's Water Efficiency Leadership Award for its comprehensive suite of progressive water efficiency programs.

- Water Smart Car Wash: This program encourages residents to use commercial car wash facilities instead of washing their vehicles at home by offering residents instant coupons on snwa.com for dozens of valley car washes. Water Smart Car Washes recover all of their wastewater for treatment and reuse. Water used at these facilities is either reused on site, or treated and returned to Lake Mead for return-flow credits.

- Linen Exchange: Nearly two dozen resorts and other leading properties participate in this voluntary program through which linens are changed only on the third day of a guest's stay, unless otherwise requested. The average savings is about 50 gallons per room each day.

RESEARCH

In addition to existing demand-management tools, ongoing research enables the SNWA to make informed decisions regarding water policy and programs. The SNWA recognizes the value and necessity for research and innovation in water conservation and has developed a number of research initiatives to foster cutting edge techniques and technologies. These research initiatives are expected to continue during the five-year planning horizon.

The following section outlines present research initiatives and their impacts to the community's water conservation efforts. A listing of completed research initiatives is included in **Appendix D**.

Current Research Initiatives

Water Use Calculator: SNWA has collected significant research on customers' usage, particularly in the largest using sector, single-family homes. Based upon a brief customer survey, this interactive web tool will estimate appropriate water use and illustrates the potential of additional conservation measures.

Innovative Conservation Program: The SNWA has partnered with Metropolitan Water District (MWD) of Southern California to sponsor the Innovative Conservation Program. This program encourages developments of new water efficiency technologies by providing grants of up to $50,000 for research and demonstration projects. MWD, SNWA, the United States Bureau of Reclamation, and the Central Arizona Project have combined resources to provide a total of $450,000 for such projects.

Golf Course Play Areas Study: Southern Nevada's golf industry has dramatically reduced water demand by limiting the use of turf in areas where golfers rarely play. In this study SNWA is providing golfers with GPS logging devices to identify where they actually travel on the golf course using a methodology developed by the United States Golf Association (USGA). The data provides detailed information to help distinguish functional and nonfunctional turf and aid in finding future areas for conversions.

Evaporative Suppressant Study: Open bodies of water lose significant water due to evaporation. Products are available to suppress evaporation by forming a one-molecule evaporation suppressing layer atop a water surface, called a monolayer. In this research, The Lakes Association, a vendor of a monolayer evaporative suppressant product, and SNWA have conducted research on suppression of evaporative losses at Lake Sahara with use of a suppressant. In addition to providing analyses of effectiveness, SNWA is providing water quality monitoring assistance for this research project.

CONCLUSION

The SNWA has one of the most dynamic and comprehensive water conservation programs in the nation. While the general strategies employed will continue to yield results, the SNWA constantly pursues refinement and innovation.

The 2009-2013 planning period witnessed significant conservation results that helped safeguard Southern Nevada's resources. Over the past five years, the community has lowered its GPCD from 248 in 2008 to 219 in 2012. Several factors may have contributed to this reduction in water use, including the impacts of a slow economy, a reduction in population and participation in SNWA conservation programs. Southern Nevada has successfully achieved conservation goals in the past, and the SNWA will continue to monitor and track the community's progress in achieving 199 GPCD by 2035.

To ensure Southern Nevada continues to move toward its 2035 conservation goal, the SNWA supports continuing cycles of program planning, implementation and evaluation. This on-going process allows the agency to succeed in meeting community needs under a diverse set of circumstances. These efforts are expected to yield new opportunities that may result in further improvement of this five-year plan.

As programs such as the Water Smart Landscapes Rebate peak in customer response, the SNWA will continue to consider progressive programs to ensure a strong community commitment to conservation. In addition, when the Integrated Resource Planning Advisory Committee completes its recommendations regarding water resources and conservation initiatives, the SNWA will review and integrate as appropriate recommendations into its conservation programs and long-term resource planning.

Appendix A
Conservation Achievements

The SNWA has achieved substantial conservation including the following noteworthy accomplishments since inception of its major initiatives:

- The Water Smart Landscape (WSL) Rebate Program has helped the community to upgrade more than 167 million square feet of lawn to water-efficient landscaping, saving more than 68 billion gallons of water since its inception. SNWA has provided more than 189 million dollars in rebates to customers to accomplish this. In terms of accomplishments, the WSL program is the largest water efficient landscaping program in the county.

- More than 32,000 coupons for more than 1.7 million dollars have been distributed to participants in the Pool Cover Instant Rebate Coupon Program, producing estimated savings of more than 2 billion gallons of water.

- Participating businesses in the Water Efficient Technologies (WET) Program have saved more than 6.5 billion gallons of water and received over 1.9 million dollars in rebates for their efforts.

- The SNWA's WaterSmart Homes Program is the most successful water efficiency home program in the country. More than 10,000 new Water Smart homes have been built producing an estimated savings of more than 750 million gallons annually compared to traditional residential developments.

- The Water Smart Innovations Conference and Exhibition (watersmartinnovations.com) has become the world's largest water conservation focused conference. In 2013 it drew nearly 900 participants from 35 states and 11 nations and featured over 100 professional sessions and 70 exhibitors.

- SNWA achieved per person demand reductions at a rate higher than anticipated. The projected weather adjusted 2012 GPCD in the 2009 Conservation Plan was 241. The achieved GPCD was 219. While many factors contributed to the reduction, it is clear that SNWA has made significant progress towards achieving the plan goal of 199 GPCD by 2035. Figure 2 and Appendix C demonstrate SNWA's successes in reducing per capita demand.

Appendix B
2014-2018 Conservation Plan Measures,
Estimated Annual Savings and Implementation Schedule

2014 - 2018

	Water Pricing Influence Coefficient	Water Pricing Influence GPCD	Education & Ethic Influence Coefficient	Education & Ethic Influence GPCD	Other Influence Coefficient	Other Influence GPCD	TOTAL REDUCTION (GPCD)
Water Smart Landscapes Program	40%	0.152	40%	0.152	20%	0.076	0.38
Water Efficient Technologies Program	40%	0.064	20%	0.032	40%	0.064	0.16
Coupon Programs	40%	0.016	30%	0.012	30%	0.012	0.04
Adoption of improved equipment, appliances and fixtures	25%	0.1875	25%	0.1875	50%	0.375	0.75
Landscape Development Codes	0%	0	0%	0	100%	0.35	0.35
Other	40%	0.068	40%	0.068	20%	0.034	0.17
TOTAL	N/A	0.49	N/A	0.45	N/A	0.91	1.85

Note:

Calculations assume a linear annual decrease in total GPCD consistent with achieving a 199 GPCD by 2035 conservation goal. Actual savings may be higher or lower in a given year.

As discussed on pages 9-10, these figures represent estimated savings based on SNWA demand-management measures. Water Pricing and Education & Ethic achievements are embedded in the total GPCD reduction. For the purposes of this plan, those estimated contributions have been outlined in the table above.

Appendix C
Historical and Projected SNWA Total Water Use
GPCD Estimates

YEAR	Estimated and Projected SNWA Population	SNWA Total Usage (acre-feet)	Historical SNWA GPCD	Projected SNWA GPCD
1989	708,704	276,407	348	
1990	750,621	291,760	347	
1991	790,099	304,435	344	
1992	839,295	318,650	339	
1993	886,207	334,282	337	
1994	954,106	352,107	329	
1995	1,002,411	367,244	327	
1996	1,075,331	395,908	329	
1997	1,123,316	404,626	322	
1998	1,193,489	423,182	317	
1999	1,265,475	445,853	315	
2000	1,364,248	481,798	315	
2001	1,439,973	513,580	318	
2002	1,517,885	533,154	314	
2003	1,577,737	519,376	294	
2004	1,679,845	515,025	274	
2005	1,747,536	526,995	269	
2006	1,846,561	546,516	264	
2007	1,930,414	550,955	255	
2008	1,922,069	534,776	248	
2009	1,938,407	520,624	240	248
2010	1,956,915	488,537	223	246
2011	1,901,945	472,329	222	244
2012	1,945,277	476,672	219	243
2013				241
2014				239
2015				237
2016				235
2017				233
2018				231

Note:

The SNWA considers weather adjusted water use in tracking water conservation and in long-term planning to account for variation in weather among years. Weather-adjusted GPCD for 2013 will be reported at a later date upon completion of 2013 data collection and verification process. Projected 2009-2018 SNWA GPCD corresponds with the SNWA's 2009 Water Resource Plan.

SOUTHERN NEVADA WATER AUTHORITY™

2018 WATER RESOURCE PLAN & WATER BUDGET

SOUTHERN NEVADA WATER AUTHORITY

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The Southern Nevada Water Authority (SNWA) is a cooperative, not-for-profit agency formed in 1991 to address Southern Nevada's unique water needs on a regional basis.

SOUTHERN NEVADA WATER AUTHORITY

MISSION

Our mission is to provide world class water service in a sustainable, adaptive and responsible manner to our customers through reliable, cost effective systems.

GOALS

Assure quality water through reliable and highly efficient systems.

Deliver an outstanding customer service experience.

Anticipate and adapt to changing climatic conditions while demonstrating stewardship of our environment.

Develop innovative and sustainable solutions through research and technology.

Ensure organizational efficiency and manage financial resources to provide maximum customer value.

Strengthen and uphold a culture of service, excellence and accountability.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

SINCE ITS INCEPTION IN 1991, THE SOUTHERN NEVADA WATER AUTHORITY HAS WORKED TO SEEK NEW WATER RESOURCES FOR SOUTHERN NEVADA, MANAGE EXISTING AND FUTURE WATER SUPPLIES, CONSTRUCT AND OPERATE REGIONAL WATER FACILITIES, AND PROMOTE CONSERVATION.

The Southern Nevada Water Authority (SNWA) was formed in 1991 by a cooperative agreement among seven water and wastewater agencies. Collectively, the SNWA member agencies serve approximately 2.2 million residents in the cities of Boulder City, Henderson, Las Vegas, North Las Vegas and areas of unincorporated Clark County. As their wholesale water provider, the SNWA is responsible for water treatment and delivery, as well as acquiring and managing long-term water resources for Southern Nevada.

SNWA Member Agencies:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

The SNWA Cooperative Agreement calls for the adoption of a water resource plan and a water budget to be reviewed annually by the SNWA Board of Directors. In accordance with the agreement, SNWA is presenting a combined Water Resource Plan and Water Budget (2018 Plan). The plan provides a comprehensive overview of projected water demands in Southern Nevada, regionally and by SNWA member agency, as well as the resources available to meet those demands over time.

THE CURRENT PLANNING ENVIRONMENT

Beginning in 2000 and continuing today, a number of water supply and demand changes have occurred—both locally and regionally—that create uncertainty for water planning agencies across much of the western United States. By far, the most significant change affecting Southern Nevada has been the onset and persistence of drought in the Colorado River Basin.

Between 2000 and 2018, overall snowfall and runoff into the basin were well below normal, representing the lowest 19-year average flow on record. These conditions have resulted in significant water level declines in major system reservoirs. As of late 2018, the combined water storage in the Colorado River's two primary reservoirs (Lake Mead and Lake Powell) was at just 42 percent of capacity.

Beyond the current challenges presented by drought, climate change is another unpredictable variable associated with the long-term availability of water supplies. According to the U.S. Bureau of Reclamation's 2012 Colorado River Basin Water Supply and Demand Study, the Colorado River is projected to experience a median imbalance of 3.2 million acre-feet per year (AFY) between supply and demand by the year 2060 as a result of climate change and increased demands within the basin.

In the near term, hydrologic modeling indicates a high probability that Lake Mead water levels will continue to decline. This creates two distinct challenges for Southern Nevada, which depends on the Colorado River for approximately 90 percent of its overall resource supply. Among other things, lowering Lake Mead water levels will reduce the availability of community water supplies during declared shortages and put SNWA's current Lake Mead intake pumping facilities at risk.

The current planning environment also includes uncertainty associated with the availability of future resources, as well as the accuracy of long-term water demand forecasts. These supply and demand considerations, as well as how they are addressed in the 2018 Plan, are detailed briefly in the following sections.

SUPPLY & DEMAND

Water resource planning is based on two key factors: supply and demand. Supply refers to the amount of water that is available or that is expected to be available for use. Water demand refers to the amount of water expected to be needed in a given year. Water demand projections are based on population forecasts and include assumptions about future water use, such as expected achievements toward water conservation goals.

Projecting future demands is uncertain, particularly during periods of significant social and economic change. Assumptions are a necessary part of the planning process and conditions are unlikely to occur exactly as assumed. Likewise, climate variations, policy changes, implementation of new regulations and other factors can influence water resource availability over time.

The SNWA has worked for more than 25 years to develop and manage a portfolio of water resource options that can be used flexibly to meet short- and long-term water demands. The portfolio approach allows SNWA to assess water demand conditions and resource options, and make appropriate decisions regarding what resources to bring online when necessary.

SNWA's water resource portfolio includes permanent, temporary and future resources. Some of these resources are available for immediate use, such as Nevada's Colorado River allocation, Las Vegas Valley groundwater and banked resources, while others may require the construction of additional infrastructure or are pending state and/or federal review processes.

Likewise, water conservation plays a critical role in helping the community to balance supply and demand. Conservation helps to reduce demands and extend the availability of current and future water supplies. SNWA projects an estimated savings of 32,000 - 36,000 acre-feet of water in 2035 by achieving the community's current water conservation goal of 116 gallons per capita per day (GPCD) by 2035. As of 2017, Southern Nevada's use is at 127 GPCD.

To promote water efficiency and reduce water waste, the SNWA continues to implement one of the most comprehensive water conservation programs in the nation. The program has helped the region reduce per capita water use by approximately 36 percent between 2000 and 2017, despite the addition of approximately 660,000 new residents.

While conservation gains have been remarkable over the past two decades, consumptive use of Colorado River supplies and GPCD have experienced a slight increase in recent years. This could be the result of several factors, including favorable economic conditions, warmer and dryer local weather conditions, and/or a fading community conservation drought response. As described in latter portions of this plan, continued water conservation must remain a top priority for the community over the long-term planning horizon.

PLANNING FOR UNCERTAINTY

While preparing the 2018 Plan, SNWA also considered a number of other factors related to water supply and demand conditions, including:

- The potential impact of continued drought and climate change on water resource availability, particularly for Colorado River supplies; and
- The potential impact of economic conditions, climate change and water use patterns on long-term water demands.

As in prior years, the SNWA used a scenario-based planning approach for its 2018 Plan. Key factors evaluated include possible shortages of Colorado River supplies, variation in future demands, and additional conservation.

As part of its planning process, SNWA considered the increasing likelihood that a federal shortage declaration will be imposed for Colorado River operations in the near-term planning horizon. While modeling performed by the U.S. Bureau of Reclamation in August 2018 indicate normal Colorado River operations for calendar year 2019, there is 57 percent probability that a shortage declaration will be made for 2020.

Under a level 1 shortage declaration, Nevada must limit its Colorado River water use to 287,000 acre-feet per year (AFY). The probability of a shortage declaration and the magnitude of possible supply reductions increases in future years.

The SNWA also considered economic growth in Southern Nevada. Long-term projections indicate that the region will continue to grow in the future. However, a high level of uncertainty remains as to the magnitude and timing of population change, and what impact that change will have on associated short- and long-term water demands.

As further described in Chapter 4, SNWA's five planning scenarios consider these factors and bracket the range of reasonable supply and demand conditions that may be experienced over the 50-year planning horizon. This is a conservative approach that demonstrates how SNWA plans to meet future needs, even if conditions change significantly over time.

ADAPTIVE MANAGEMENT

Working with the community, SNWA has implemented several adaptation strategies to mitigate drought impacts. From the development of new facilities and aggressive water conservation to water banking and system conservation initiatives, these efforts have reduced the potential for customer impacts.

SNWA's adaptation response measures include the construction of a new Low Lake Level Pumping Station at Lake Mead to help protect Southern Nevada from potential impacts of continued Lake Mead water level declines. When complete in 2020, the pumping station will work in conjunction with SNWA's Lake Mead Intake No. 3 to preserve Southern Nevada's access to Colorado River water supplies below 1,000 feet.

Likewise, aggressive water conservation has reduced the potential for near-term supply impacts associated with a shortage declaration. Nevada's Colorado River consumptive use was approximately 243,000 AFY in 2017. This is well below 280,000 AFY, the minimum amount of basic Colorado River supply available to Nevada under current shortage rules.

Water conservation has far-reaching benefits to the community and the Colorado River system as a whole. Locally, water conservation increases water efficiency and reduces demands. It also allows SNWA to store or "bank" unused supplies. This, in turn, provides SNWA with added flexibility in responding to drought conditions and meeting future demands. As of 2018, the SNWA has stored more than 1.8 million acre-feet (AF) of conserved water, nearly eight times the community's 2017 Colorado River consumptive use.

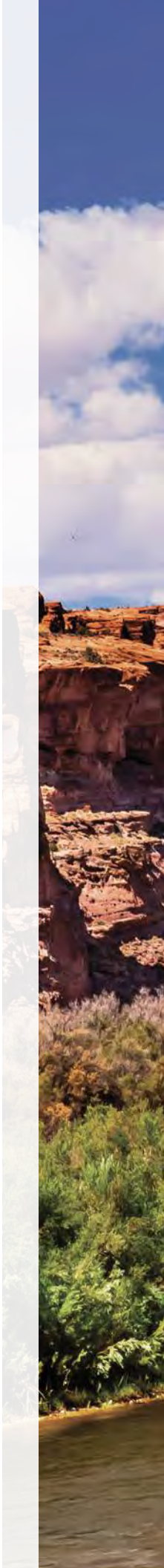
Likewise, water conservation has helped SNWA to meet its commitments with interstate and federal partners to store water in Lake Mead. The partners have bolstered Lake Mead storage by approximately 1.9 million acre-feet of water through Intentionally Created Surplus, as well as System Conservation and other initiatives that benefit the Colorado River system as a whole. These efforts have provided SNWA with time to complete new intake and pumping infrastructure, and helped to forestall a Colorado River shortage declaration. To date, collaborative efforts have reduced Lake Mead's water level decline by approximately 25 feet.

CURRENT PRIORITIES

As discussed in the chapters that follow and with continued progress toward the community's water conservation goals, SNWA has sufficient permanent, temporary and future resources to meet all future planning scenarios described in Chapter 4.

Continued persistence and resolve will be required as the region faces prolonged drought, and as the entire Southwest region responds to hydrologic challenges related to climate change. Top priorities for SNWA are to:

- Preserve access to Colorado River supplies by completing development of new facilities at Lake Mead.
- Reduce water demands and maximize the use of available resources through aggressive water conservation.
- Work with interstate and federal partners on initiatives designed to slow the decline of Lake Mead water levels, forestall the declaration of shortage and reduce the magnitude of potential supply reductions.
- Bank conserved resources and grow temporary supplies that can be used flexibly to meet demands and/or offset potential supply reductions.
- Continue to make progress on water rights and environmental permitting processes for the development of future resources, participating in legal and regulatory processes as needed to protect the availability of future resource options.



PLAN INTRODUCTION

THIS CHAPTER PROVIDES AN OVERVIEW OF SNWA RESOURCE PLANNING EFFORTS. IT INCLUDES AN ABBREVIATED HISTORY OF WATER IN SOUTHERN NEVADA, FOCUSING ON MAJOR ISSUES AND INITIATIVES THAT OCCURRED DURING THE LAST CENTURY.

INTRODUCTION

For much of its past, the area now known as Clark County was little more than a collection of scarce watering holes for various trails through the Mojave Desert. With the coming of the railroad in 1905, the privately operated Las Vegas Land and Water Company was formed to build and operate the area's first system for conveying local spring water. In these early years, the community viewed its supply of artesian water as virtually inexhaustible and more than adequate to meet the needs of any growth that might occur.[1]

In 1922, the Colorado River Compact defined the geographic areas of the upper and lower basins of the Colorado River, apportioning 7.5 million acre-feet of water per year (AFY) to each. Of the lower basin's 7.5 million AFY, the Boulder Canyon Project Act authorized the apportionment of 300,000 AFY to Nevada, 2.8 million AFY to Arizona and 4.4 million AFY to California. At the time, Nevada's negotiators viewed 300,000 AFY as more than a reasonable amount; Southern Nevada had no significant agricultural or industrial users, and groundwater seemed plentiful.[2]

These conditions changed significantly over time. By 1940, local resource managers began expressing concerns about limited groundwater supplies, water waste and declining groundwater levels. While the Colorado River Compact and subsequent construction of Hoover Dam in 1936 made Colorado River water a viable future resource, the lack of infrastructure and sufficient funding for capital improvements precluded any immediate use to support development in the growing region.

In 1947, the Nevada Legislature created the Las Vegas Valley Water District (LVVWD) to help manage local water supplies. The LVVWD acquired the assets of the Las Vegas Land and Water Company and began operations in 1954 as the municipal water purveyor for Las Vegas and unincorporated Clark County.

Shortly thereafter, LVVWD entered into agreements with what is now known as Basic Water Company. (BWC) for expansion of BWC's small industrial water line to deliver Colorado River water to the LVVWD service area.

Given the astonishing pace of growth that occurred over the next several years and the limits of the existing pipeline, LVVWD initiated formal engineering studies for new facilities to import additional Colorado River water into the Las Vegas Valley from Lake Mead. This effort ultimately resulted in the construction of the Alfred Merritt Smith Water Treatment Facility and associated intake, pumping and transmission facilities (collectively referred to as the Southern Nevada Water System or SNWS), which became operational in 1971. The SNWS was first expanded in 1982 (and again in the years to follow) in response to increasing demands.

By the latter part of the 20th century, water planners estimated that the region would soon reach the limits of its Colorado River apportionment.[3] In 1989, as a result of profound uncertainty created by population growth and future resource availability, the LVVWD filed applications for unappropriated groundwater in eastern Nevada and began storing its remaining unused Colorado River water for future use (see Chapter 2). During this time, the community also implemented its first significant conservation effort—Operation Desert Lawn. The program resulted in ordinances by the local municipalities restricting landscape irrigation during the hottest times of the day.

CREATION OF SNWA

By the end of the 1980s, resource challenges had reached a critical point; with the new decade, local leaders began to aggressively explore different options for extending and managing water resources, while meeting the ongoing demands of the community.

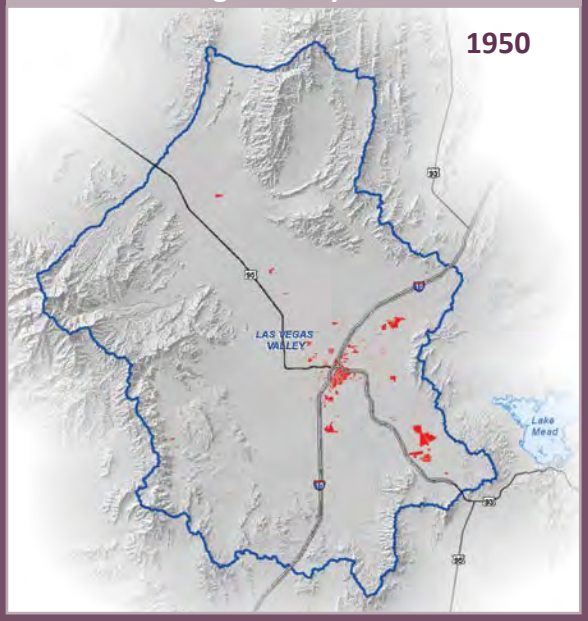
A Century of Change

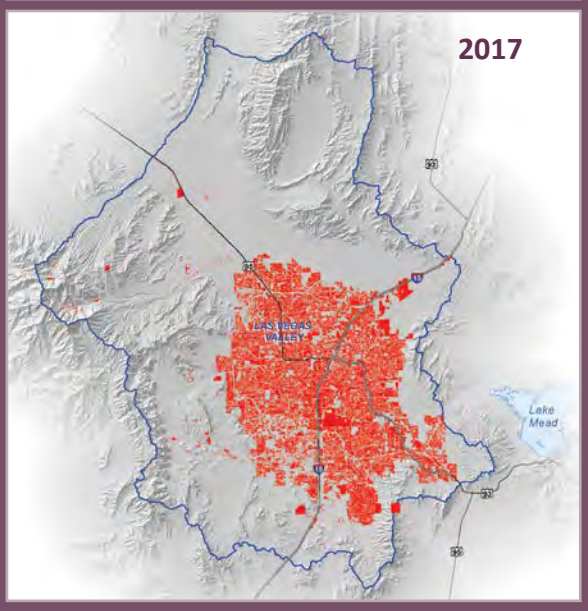
With the birth of Las Vegas in 1905 as a way station for the San Pedro, Los Angeles and Salt Lake Railroad, Southern Nevada began to attract a large number of residents and businesses.

From an estimated population of more than 40,000 in 1950 to approximately 2.2 million in 2017, the Southern Nevada region has experienced change faster than almost any other region in the nation during this same time period. Population density in the Las Vegas area is the highest in the interior western U.S.[4]

Today, Southern Nevada is home to 73 percent of Nevada's total population. The region uses less than five percent of all water available for use in the state.

Las Vegas Valley Land Use





One of the most significant events to occur during this time was the formation of the Southern Nevada Water Authority (SNWA) in 1991 through a cooperative agreement among seven water and wastewater agencies:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

Today, these seven agencies provide water and wastewater service to nearly 2.2 million residents in the cities of Boulder City, Henderson, Las Vegas and North Las Vegas, and portions of unincorporated Clark County (Figure 1). Since its inception, SNWA has worked to acquire and manage water supplies for current and future use; construct and operate regional water facilities; and promote conservation.

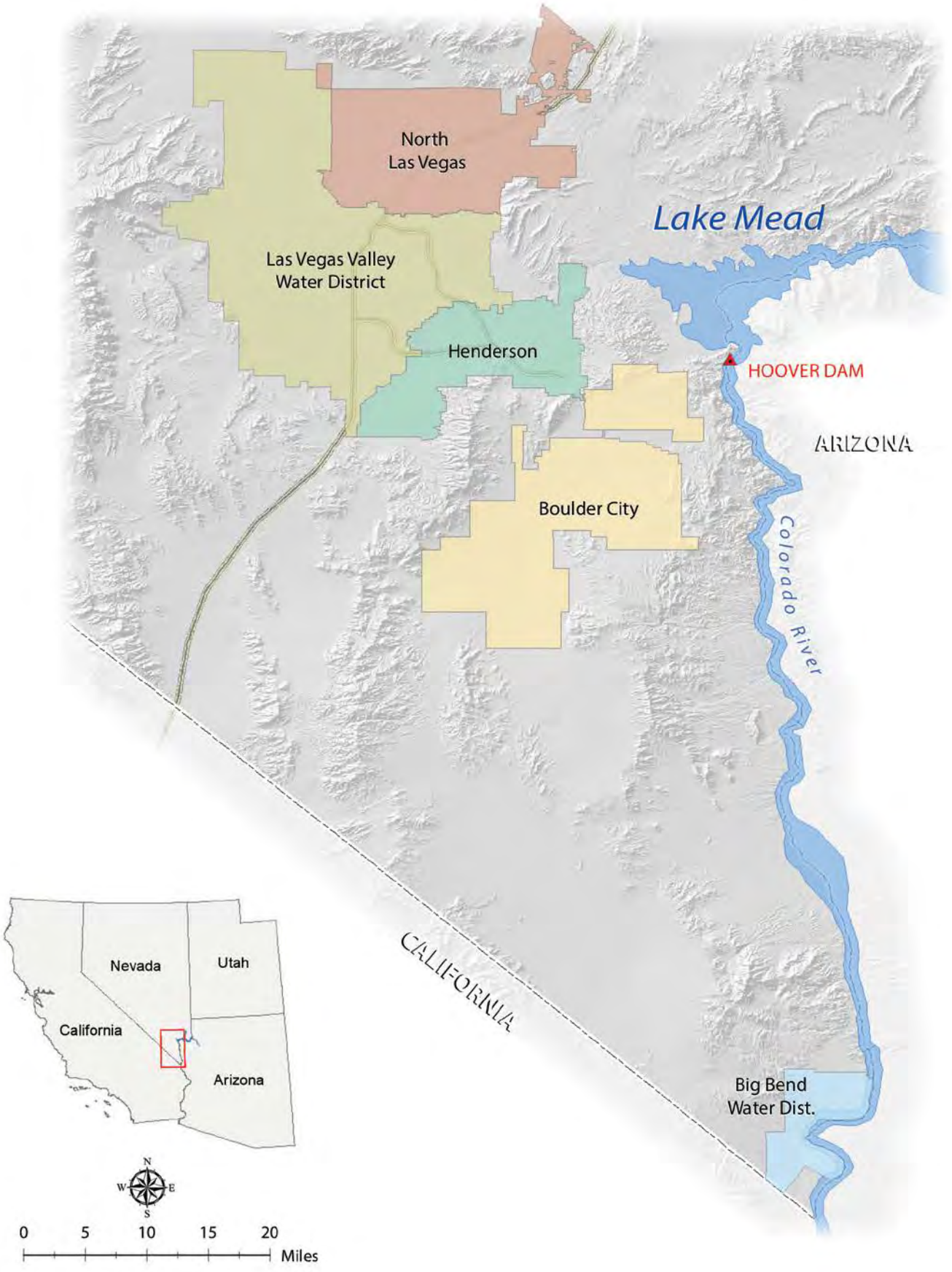
Water Supply Acquisition and Management

Since 1991, SNWA has worked diligently to develop and manage a flexible portfolio of diverse water resource options resulting from years of in-state, interstate and international collaborations. These resources include groundwater and surface water rights in the state of Nevada, Colorado River water, as well as temporary resources that are stored in the form of storage credits. A detailed summary of the SNWA Water Resource Portfolio is provided in Chapter 3.

Construction and Operation of Regional Water Facilities

To meet the community's current and long-term water resource needs, SNWA is responsible for constructing and operating regional water facilities, including the SNWS, which was expanded in 2002 to include the River Mountains Water Treatment Facility. The SNWA has completed a number of improvements and expansions to these facilities over the years to increase capacity to 900 Million Gallons per Day (MGD). Pumping facilities and state-of-the-art treatment and laboratory facilities were also constructed and updated to ensure the availability of high-quality reliable water supplies. These efforts were phased, coming online just in time to meet demands.

FIGURE 1 **SNWA Purveyor Service Areas**



The SNWA is responsible for managing Southern Nevada's long-term water resources, constructing and operating facilities and encouraging water conservation.

Planning for the Future

The SNWA's 2018 Plan is based on an integrated resource planning process that involved public stakeholders.

In 1996, the SNWA Cooperative Agreement was amended to require adoption of a Water Resource Plan. The SNWA's first Water Resource Plan was adopted in 1996;[6] the SNWA has reviewed its plan annually since then, adopting revisions as needed.

The plan reflects changing developments in Southern Nevada's overall water resource picture. Since the plan's inception, those developments have come principally from water demand changes as well as from landmark changes in rules, agreements or other factors affecting the region's water supplies.

In 2014, SNWA's 21-member Integrated Resource Planning Advisory Committee was asked to address issues related to the Colorado River drought, the effects of climate change, and the effects of declining water reservoir levels on the reliability of Southern Nevada's municipal water system. The committee was formed in 2012 to assist SNWA with its long-term planning efforts and was comprised of citizens representing diverse areas of the community. Phase 1 and 2 committee recommendations were presented to the SNWA Board of Directors in September 2013 and December 2014, respectively.

As discussed in Chapter 2, SNWA recently put its new raw water intake (Intake No. 3) into production and is working to construct a new Low Lake Level Pumping Station at Lake Mead. Together, these facilities will preserve access to existing Colorado River water supplies. These efforts are in response to extraordinary drought conditions in the Colorado River Basin and to offset risk associated with future water level declines.

Water Conservation

The SNWA and its member agencies have worked diligently over the years to maximize the availability of existing water supplies and reduce overall water demands. The community's first water conservation plan was adopted in 1995;[5] since then, the community has consistently set and achieved aggressive water conservation goals. As of 2018, the community is working to achieve its water conservation goal of 116 gallons per capita per day (GPCD) by 2035; a new conservation goal will be evaluated once the current goal has been achieved.

To promote conservation efforts, SNWA developed and implements a comprehensive water conservation program consisting of regulation, pricing, education and incentives designed to work together to improve water efficiency and reduce demands. The SNWA member agencies also implemented a number of water use and development ordinances, which have since become a permanent part of the community's overall conservation effort. Information on Southern Nevada's conservation efforts is provided in Chapter 3.

2018 Water Resource Plan and Water Budget

The SNWA's 2018 Plan provides a comprehensive overview of water resources and demands in Southern Nevada, and discusses factors that will influence resource availability and use over a 50-year planning horizon. The plan does not intend to specifically address all aspects of water resource management and development; rather, it serves as a companion to other detailed planning documents, including:

- SNWA Major Construction and Capital Plan
- SNWA Water Conservation Plan
- Regional Water Quality Plan for the Las Vegas Valley Watershed
- Annual Operating Plan for the Las Vegas Valley Watershed

- SNWA Financial Budget and Comprehensive Annual Financial Report

- SNWS Operating Plan

Integrated Resource Planning

As part of its overall water resource planning efforts, the SNWA has completed a number of integrated water resource planning processes. Integrated resource planning applies important concepts to traditional resource and facility planning, including involvement of the public early in the planning process as well as frequent reassessment, particularly as conditions change. These efforts have helped identify the appropriate combination of resources, facilities, conservation programs and funding formulas needed to meet current and future water demands in Southern Nevada.

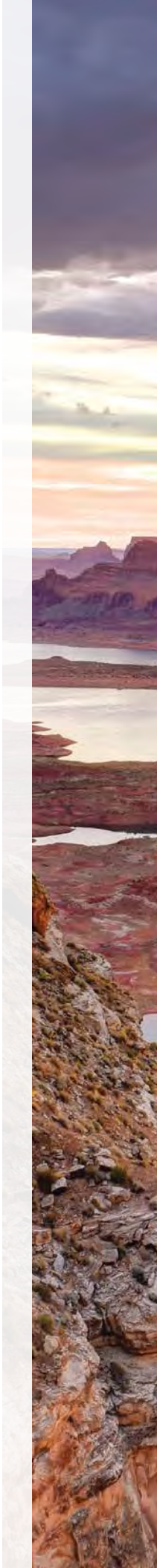
Recommendations resulting from these integrated resource planning processes are presented to the SNWA Board of Directors for consideration and incorporated into overall water resource planning efforts as approved. The 2018 Plan incorporates the recommendations from SNWA's most recent Integrated Resource Planning Advisory Committee, which were approved by the SNWA Board of Directors in December 2014.

CHAPTER SUMMARY

The SNWA Water Resource Plan and Water Budget are important tools designed to help SNWA anticipate and plan for future water supply and related facility needs, which have changed significantly over the years.

Since its formation in 1991, the SNWA has worked closely with its member agencies to meet the region's long-term water demands by acquiring and managing current and future water supplies; constructing and operating necessary facilities; and promoting conservation. In addition, SNWA has developed partnerships with other Colorado River Basin States (Basin States), working collaboratively to maximize opportunities for the flexible use of Colorado River resources.

These efforts will continue to be of paramount importance in the years to come, particularly as climate change and drought are anticipated to reduce the availability of supplies, and as economic expansion continues in Southern Nevada. These challenges, as well as SNWA's associated response efforts, are discussed in Chapter 2. The balance of this document provides a comprehensive overview of the SNWA Water Resource Portfolio (Chapter 3); a detailed discussion of how SNWA plans to meet current and future regional water demands (Chapter 4); a discussion on SNWA environmental initiatives underway to support water resource development and management efforts (Chapter 5); and a water budget that describes SNWA member agency historical water uses and near-term forecasted demands (Chapter 6).



ENDNOTES

1 "Water: A History of Las Vegas, Volume 1," 1975, Florence Lee Jones and John F. Cahlan, p.53.

2 "The Hoover Dam Documents," 1948, Ray Lyman Wilbur and Northcutt Ely.

3 "WRMI Process—Water Supply Planning for the Las Vegas Region," January 1991, published May 1992, prepared for Las Vegas Region Water Utilities by Water Resources Management, Inc.

4 Metropolitan Statistical Area Distance Profiles 2010, U.S. Census Bureau.

5 "Memorandum of Understanding Regarding Southern Nevada Water Authority's Water Conservation/Efficiency Programs," January 26, 1995, amended March 18, 1999, SNWA.

6 "Southern Nevada Water Authority 1991 Cooperative Agreement," between Big Bend Water District, City of Boulder City, City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Water Reclamation District (previously Clark County Sanitation District), and Las Vegas Valley Water District. Amended 1994 and 1996.

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 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).

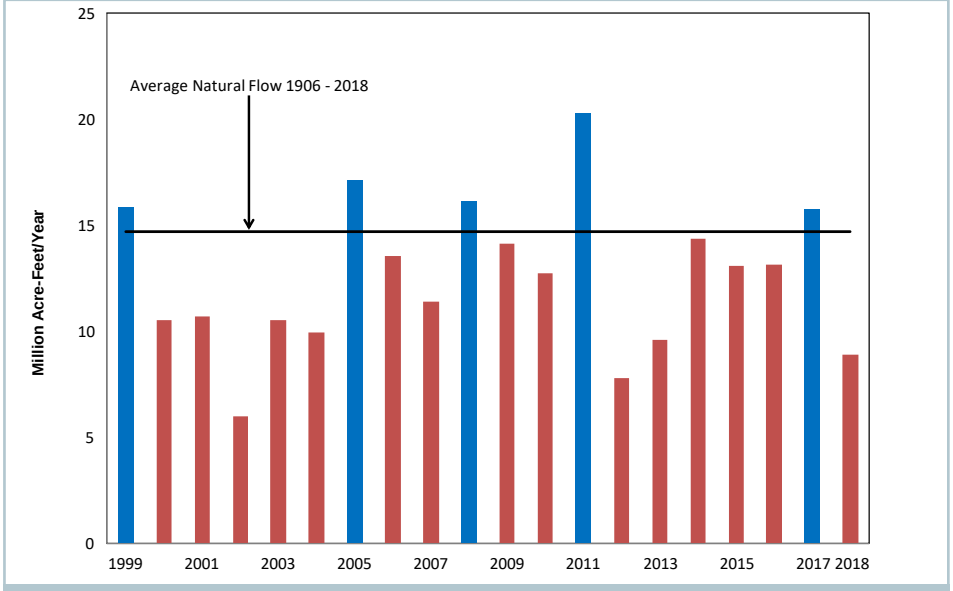


FIGURE 2.1 **Annual Colorado River Natural Flow 1999–2018**[1]

Between 2000 and 2018, overall snowfall and runoff into the basin were well below normal, representing the lowest 19-year average on record. These conditions have resulted in significant water level declines at major system reservoirs. As of late 2018, the combined water storage in the Colorado River's two primary reservoirs (Lake Mead and Lake Powell) was at just 42 percent of capacity.[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 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 2018 indicate an approximate 57 to 70 percent probability of shortage in years 2020-2023. There is a high probability (ranging from approximately 60 to 70 percent on average) 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 approximately 135 feet between 2000 and late 2018. In 2016, the lake's elevation reached its lowest point since it began filling in the 1930s (Figure 2.3).[5] As of late 2018, Lake Mead's water level was at approximately 1,079 feet. This minor improvement was due to slightly above average runoff during 2017, as well as benefits realized from interstate collaboration (see page 16). Based on current and forecasted conditions, however, there remains a high probability that Lake Mead water levels will continue to

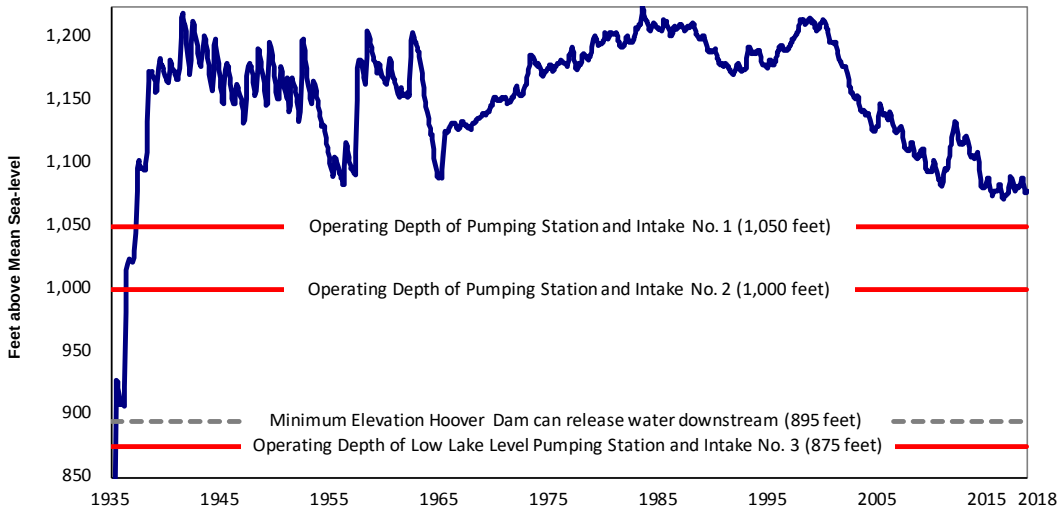


FIGURE 2.3 **Historical Lake Mead Elevations**

decline, potentially reaching an elevation of 1,000 feet or lower within the next decade.

The SNWA has a combined water treatment and transmission capacity of 900 MGD, consisting of raw water intakes and associated pumping facilities. These facilities are limited in their operating range relative to Lake Mead elevation.

The SNWA began exclusive operation of its new Intake No. 3 in late 2015. The intake pulls water from the coolest, clearest water in Lake Mead and allows for continued access to Colorado River supplies to an operating depth of 860 feet. Intake No. 3 works in conjunction with SNWA's pumping stations No. 1 and No. 2, which are expected to remain operational to a Lake Mead elevation of 1,050 feet and 1,000 feet, respectively.

A new Low Lake Level Pumping Station is needed and 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 early 20th century, observations indicate that global mean annual air temperatures have warmed 1.8 degrees Fahrenheit.[6]

Consistent with global trends, warming has also occurred in the southwestern United States. While climate change models project 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). Nevada's Clark County is projected to warm between 5-10 degrees Fahrenheit by the end of the century.[7]

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 water supply, while other areas experience greater frequency and severity of flood events.[8]

Climate Change Assessments

In 2014 and 2017, two important climate change studies were released: The Intergovernmental Panel on Climate Change's Climate Change 2014 Impacts, Adaptation, and Vulnerability report[9] and the U.S. Global Change Research Program's Climate Science Special Report.[10] Each of these studies concludes that climate change is occurring and is expected to significantly affect water resources.

According to the Climate Science Special Report, future droughts in the western U.S., which includes the Colorado River Basin, are projected to be warmer, more frequent and longer lasting than in the instrumental record.

Colorado River Basin states continue to work together to improve the accuracy of hydrological forecasts and projections, as well as enhance the performance of predictive tools and better understand uncertainty related to future Colorado River conditions.

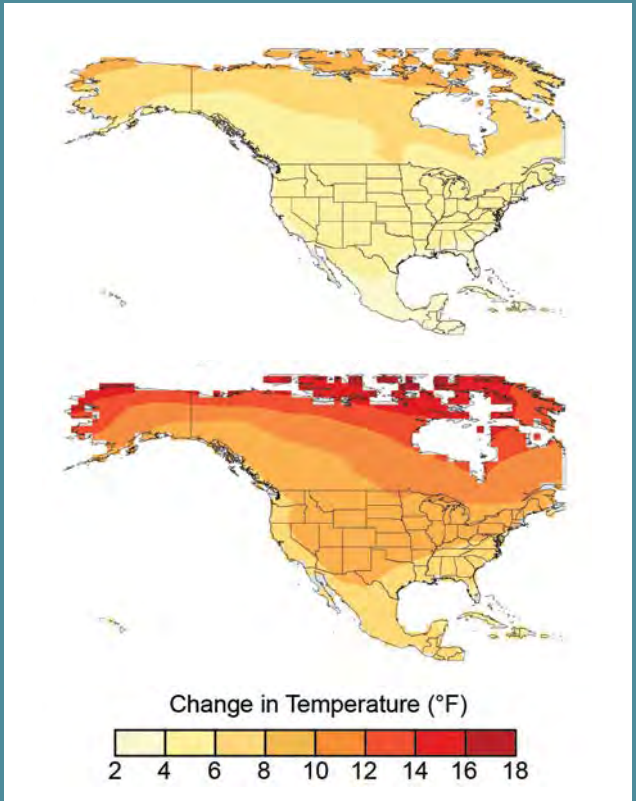


FIGURE 2.4 **CLIMATE CHANGE**
Range of possible future warming in North America 1976 – 2099 under high and low GHG emission scenarios.
(2014) National Climate Assessment.

From a resource planning perspective, direct climate change impacts will revolve around water quantity, particularly the form and distribution of precipitation, and increasing water demands. 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.

To help inform future decision-making efforts in the Colorado River Basin, the U.S. 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),[11] 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.[12] 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.[13]

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).[14] For years following the downturn, gaming and tourism revenues declined followed by a record spike in unemployment. Most new residential and commer-

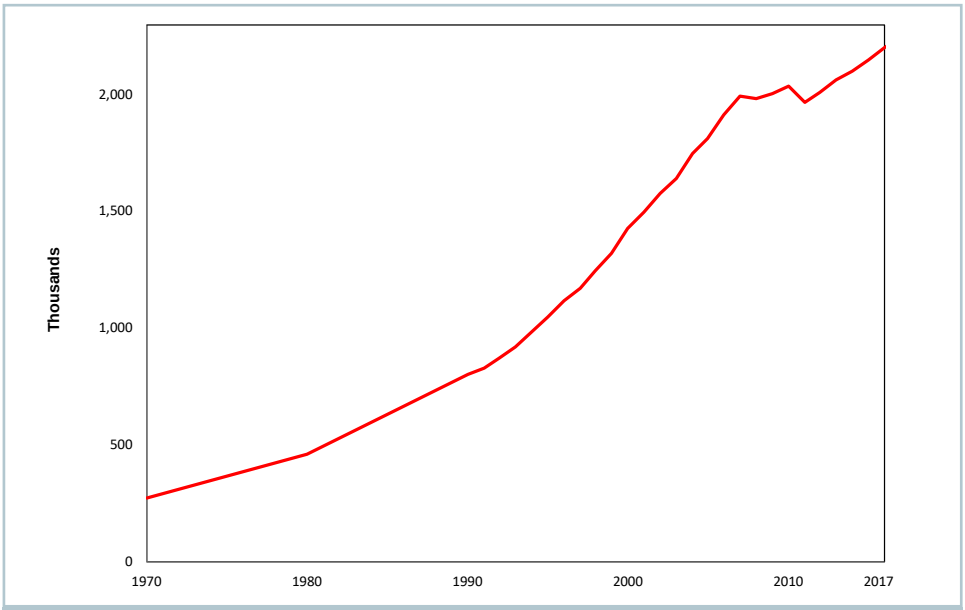


FIGURE 2.5 **Historical Clark County Population**

cial development projects came to a halt, and home foreclosures flooded the real estate market.

However, economic conditions have improved steadily in the region over the past six years. According to the U.S. Bureau of Economic Analysis, the Las Vegas metropolitan area's economic output rose an average of three percent per year between 2012 and 2017.[15] Building permits also are on the rise. According to the Center for Business and Economic Research at the University of Nevada, Las Vegas, the number of new housing permits that are likely to generate new water demands are projected to increase by 10.4 percent in 2018.[16]

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.[17] While the region's economy has recovered and is growing, 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 growth 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, other steps are considered long-term continuous efforts that will remain a priority for many years to come.

Adaptive Management in Action

Over the years, SNWA has taken 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 by approximately 85,000 AFY (approximately 28 billion gallons), between 2002 and 2017 despite the addition of nearly 660,000 new residents.
- Stored nearly eight times Nevada's 2017 Colorado River consumptive use through increased water banking, storage and recharge efforts.
- Completed new Intake No. 3 and began constructing a new Low Lake Level Pumping Station to ensure continued delivery of Colorado River water supplies under low reservoir conditions.
- Initiated legal and environmental permitting associated with the development of in-state groundwater resources.
- Acquired and developed permanent water resources in Clark County through resource leases and purchases.

Low Level Pumping Station 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.

The SNWA authorized construction of a new raw water intake (Intake No. 3) in 2005 and put the new intake into service in 2015. 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. The new pumping station is expected to be complete and operational in 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 on the Colorado River 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. By the end of 2017, Southern Nevada's use of Colorado River resources is well below any defined entitlement reduction that could be imposed under the current Interim Guidelines.

Interstate Collaboration

The Colorado River Basin states are collaboratively working with U.S. federal partners and Mexico to augment water supply, improve system efficiency, protect power generation and access to water supplies. These efforts range in nature from contributing funds to a cloud seeding program designed to increase the potential yield of snowfall in the Colorado River Basin, to system efficiency and conservation efforts that have mutual benefit to Colorado River Basin water users.

In 2014, the SNWA entered into two agreements (discussed below) to help mitigate the impacts of ongoing drought and bolster reservoir elevations. These efforts are intended to protect against critical reservoir elevations that threaten hydropower generation at Glen Canyon and Hoover dams, and access to water supplies for millions of lower basin water users. These programs benefit SNWA by reducing the near-term risk of losing access to its primary water supply as the organization works to complete development of its new Low Lake Level Pumping Station. At the end of 2017, collaboration efforts have reduced Lake Mead's water level decline by an estimated 25 feet.

Pilot System Conservation Agreement. The SNWA, U.S. Bureau of Reclamation, philanthropic organizations and other Colorado River water users have committed to fund up to $36 million between 2015 and 2019 for conservation projects that benefit the Colorado River system.[18] In accordance with a 2014 agreement, as amended, 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 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, U.S. Department of the Interior and other lower basin

water users and states set a goal of developing 1.5 to 3.0 million acre-feet of water in Lake Mead before 2020 to serve as a "protection volume". This water is intended to mitigate the impacts of ongoing drought and help to stabilize Lake Mead water levels.

As part of a 2014 memorandum of understanding the parties agreed to use their best efforts to create a total of 745,000 acre-feet of protection volume water between 2014 and 2017.[19] The SNWA's commitment to the program was 45,000 acre-feet. SNWA met its commitment by foregoing off-stream banking of its unused apportionment.

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 work groups 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.[20] 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 2017, 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 has received funding through WaterSMART grant from the Bureau of Reclamation to evaluate potential changes in Lake Mead water quality using SNWA's advanced Lake Mead model.[21] The Lake Mead study considered potential impacts of low lake elevations and increasing air temperatures due to climate change on a suite of water quality measures.

The SNWA is also a founding member of the Water Utility Climate Alliance (WUCA), which is comprised of 12 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.[22]

Supply and Demand Forecasting

As in prior years, SNWA has taken a scenario-based planning approach with its 2018 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 SUMMARY

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. Efforts include:

- Continue setting and achieving water conservation goals through aggressive water conservation efforts;
- Develop new 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, 2018

ENDNOTES

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SNWA WATER RESOURCE PORTFOLIO

THIS CHAPTER DISCUSSES THE DIVERSE SET OF WATER RESOURCE OPTIONS ACQUIRED BY THE SNWA TO RELIABLY MEET THE COMMUNITY'S CURRENT AND FUTURE WATER RESOURCE NEEDS.

INTRODUCTION

Since 1991, SNWA has worked to establish and manage a flexible portfolio of water resources, an approach commonly used in resource planning. Having a portfolio of resources allows SNWA to assess its overall water resource options and to make appropriate decisions regarding which resources to develop and use when necessary. Key factors considered in determining acquisition, priority of development, and use include the availability, accessibility, cost and need of the resource. Water supply diversification is also an important consideration. Having a portfolio of resource options helps to offset risks typically associated with dependence on any single resource.

The SNWA's water resource portfolio, along with associated facility planning and permitting efforts, provides SNWA flexibility in adapting to changing supply and demand conditions, and helps ensure that community water demands can be met. Resources in the portfolio are described in consumptive use volumes and are organized into three categories:

- Permanent Resources
- Temporary Resources
- Future Resources

PERMANENT RESOURCES

For the purpose of this plan, "Permanent Resources" are resources anticipated to be available for use over the 50-year planning horizon. These resources make up a base of supplies and can be used during any Colorado River operating condition, including shortage (subject to certain restrictions).

Permanent resources include Colorado River supplies (including return-flow credits); Tributary Conservation Intentionally Created Surplus (ICS); permitted groundwater rights in the Las Vegas Valley; and reclaimed water. Descriptions of these resources and details regarding their availability are discussed in the following section.

Colorado River—Nevada Basic Apportionment

Nevada's 300,000 AFY Colorado River apportionment continues to be Southern Nevada's largest and most critical permanent resource. Nevada's right to this water was established under the 1922 Colorado River Compact and the Boulder Canyon Project Act (BCPA), which together set forth where and how Colorado River water is used.

SNWA Contract. Section 5 of the BCPA requires entities wishing to divert Colorado River water within the states of Arizona, California and Nevada to have a contract with the Secretary of the Interior for that water. Early on, the agencies that would form the SNWA contracted for most of Nevada's Colorado River allocation.

With the creation of the SNWA in 1991, these agencies agreed to collaboratively manage Southern Nevada's current and future water resources, representing a significant shift in the overall management of the region's water supply. In the years that followed, SNWA determined that additional Colorado River water was available and contracted with the Secretary of the Interior in 1992 and 1994 to acquire these resources.[1] SNWA's total estimated Colorado River entitlement is 272,205 AFY of Nevada's 300,000 AFY allocation. Nevada's remaining apportionment is contracted to other users.[2] SNWA also holds contracts for any surplus Colorado River water available to Nevada.

Unused Apportionment. As part of its 1992 Colorado River contract, the SNWA has a right to the unused apportionment of other Nevada Colorado River contract holders. The SNWA anticipates some of this water will be available for use in the planning horizon, and plans to utilize this water if and when it is available.

SNWA may also choose to leave a portion of Nevada's unused allocation (the result of conservation efforts) in Lake Mead to help alleviate the impacts of drought conditions and avoid critical Lake Mead elevations.

Return-Flow Credits. The BCPA defines all Colorado River apportionments in terms of "consumptive use." Consumptive use is defined as water diversions minus any water that is returned to the Colorado River. These returns are also referred to as "return-flow credits." With return-flow credits, Nevada can divert more than 300,000 AFY, as long as there are sufficient flows returned to the Colorado River to ensure the consumptive or "net use" is no greater than 300,000 AFY.[3]

Return-flow credits constitute a significant portion of Southern Nevada's permanent Colorado River resource, expanding SNWA's Colorado River supply by approximately 75 percent. Nevada's Colorado River return-flows consist mostly of highly-treated wastewater that is returned to Lake Mead via the Las Vegas Wash.

Flood Control Surplus. If Lake Mead is full or nearly full, the Secretary of the Interior can declare a flood control surplus. This allows lower basin states to use Colorado River water, in excess of their apportionment, that would have been released to control potential flooding along the Colorado River system.[4]

Based on current Lake Mead water levels and climate variability in the Colorado River Basin, SNWA does not assume that flood control surplus water will be available during the planning horizon. However, SNWA will utilize this resource as a priority, when it is available.

Domestic Surplus. As discussed in Chapter 2, the Interim Guidelines defined both surpluses and shortages, and detailed provisions for water use during each condition. Under a "Domestic Surplus," SNWA is allowed to consumptively use up to 400,000 AFY of Colorado River water when Lake Mead is above 1,145 feet. The 2018 Plan does not assume availability or use of domestic surplus water during the planning horizon. However, SNWA will utilize this resource as a priority, when it is available.

Intentionally Created Surplus

In 2007, as part of the Interim Guidelines, SNWA entered into a series of agreements that ensure the availability and delivery of water resources developed under provisions for ICS.[5] As discussed below, Tributary Conservation ICS and Imported ICS enable SNWA to develop some of its surface and groundwater rights that are located in Nevada, near the Colorado River. The SNWA may develop these rights as needed by allowing them to flow into Lake Mead in exchange for Tributary Conservation ICS and Imported ICS credits.

Tributary Conservation and Imported ICS credits can be used during the year created and under any operating condition, including shortage (taken as Developed Shortage Supply or "DSS" during a declared shortage).[6] As required by the Interim Guidelines, these resources are subject to a one-time deduction of five percent for the benefit of Lake Mead system storage. As discussed in the "Temporary Resources" section on the following pages, water that is not used in the year it is created is converted to Extraordinary Conservation ICS. When needed, the credits will be withdrawn as Colorado River water through SNWA facilities and returned to the system for return-flow credits.

Tributary Conservation ICS. The SNWA is allowed to develop the portion of its Muddy and Virgin River surface water rights that have a priority date that precedes the BCPA (pre-1929 rights) as Tributary Conservation ICS. The SNWA can develop up to 50,000 AFY of Tributary Conservation ICS credits. To date, approximately 14,700 AFY of permanent rights have been acquired. In addition to its permanent rights, SNWA has acquired approximately 18,500 AFY of leased rights, with remaining terms up to nine years. The SNWA anticipates acquiring and developing a total of 40,000 AFY of Tributary Conservation ICS over the planning horizon.

Imported ICS. Under the Interim Guidelines, up to 15,000 AFY of Imported ICS can be created in an entitlement holder's state by introducing non-Colorado River water into the mainstream of the Colorado River.

While SNWA has 9,000 AFY of permitted non-Colorado River groundwater rights in Coyote Spring Valley, these and other groundwater rights within the Lower White River Flow System (including Garnet Valley and Hidden Valley resources discussed on page 27) are the subject of an ongoing process initiated by the State Engineer in June 2018 to evaluate the amount of water that can be pumped from the system sustainably. For the 2018 Plan, SNWA assumes no use of Coyote Spring Valley rights.

Las Vegas Valley Groundwater Rights

All surface water and groundwater rights in the state of Nevada are administered by the Nevada State Engineer and fall under the purview of Nevada Water Law.[7]

Of the seven SNWA member agencies, the LVVWD and North Las Vegas have permanent groundwater rights totaling 40,760 and 6,201 AFY, respectively. These rights are among the most senior groundwater rights in the Las Vegas Valley. As such, they are protected even though new rights were granted to other users. Groundwater remains a critical component of SNWA's Resource Portfolio.

Water Reuse

The term water reuse generally means to recycle wastewater to support a secondary use. In the SNWA service area, nearly all water used indoors is recycled for either direct or indirect reuse. Direct reuse involves capturing, treating and reusing wastewater flows for non-potable uses such as golf course and park irrigation, and other uses. Indirect reuse consists of recycling water by way of treatment and release to the Colorado River for return-flow credits.

Boulder City, City of Las Vegas, Clark County Water Reclamation District, City of Henderson and City of North Las Vegas each operate wastewater treatment facilities in the Las Vegas Valley that contribute to the region's direct and/or indirect reuse. For planning purposes and consistent with the SNWA Cooperative Agreement, the 2018 Plan assumes 21,800 AFY of water will be directly reused over the planning horizon.

As shown in Figure 3.1, approximately 40 percent of water used in the SNWA service area results in highly-treated wastewater. Of that, approximately 99 percent is recycled.

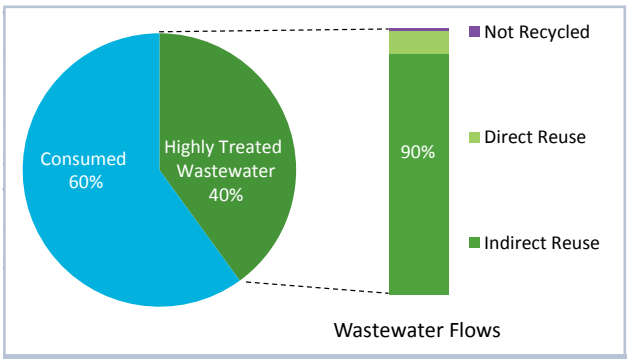


FIGURE 3.1 **SNWA Water Use and Recycling**

The Colorado River Basin

Colorado River operations and water use are governed by a series of contracts, regulatory guidelines, federal laws, compacts, a treaty with Mexico, court decisions and decrees—collectively known as the "Law of the River." The 1922 Colorado River Compact divided the Colorado River Basin into two divisions—the Upper Division and the Lower Division, allocating 7.5 million acre-feet per year (MAFY) to each. As part of the Boulder Canyon Project Act and the 1948 Upper Colorado River Basin Compact, the Upper and Lower Divisions divided their respective share amongst individual states within each division. In addition, 1.5 MAFY was allocated to Mexico as part of a 1944 treaty.[8]

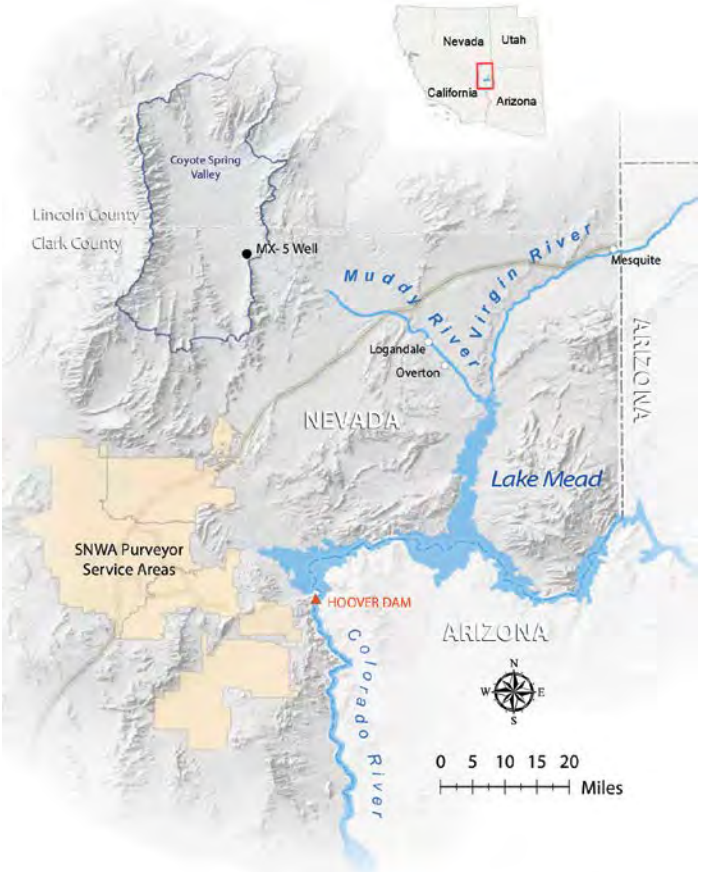
The Compact was forged in a time of abundance, during one of the wettest periods in recorded history. More recent reviews, modeling and studies of Colorado River flows have determined an imbalance in long-term Colorado River resources and future demands. State and federal partners agree that there is a strong potential for significant supply and demand challenges in coming decades, and are working together to offset potential water supply reductions.

Intentionally Created Surplus

The Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (Interim Guidelines) were adopted in 2007 by the Secretary of the Interior. Among other things, the Interim Guidelines established requirements for the creation, delivery, and accounting for a new form of surplus called Intentionally Created Surplus.

ICS was instituted to encourage the efficient use and management of Colorado River water and to increase the water supply in Colorado River system reservoirs. The creation of ICS helps to reduce the likelihood, magnitude and duration of shortages in the Lower Basin.

Efforts to help stabilize Lake Mead water levels are of key importance to the SNWA – the agency has made significant investments in new intake and pumping facilities that will allow for reliable access to community water supplies in the event of low lake level conditions (below 1,000 feet).



Map of Virgin/Muddy Rivers & Coyote Spring

While direct reuse of Colorado River water may have advantages over indirect reuse in terms of lower pumping cost, additional direct reuse in the Las Vegas Valley does not extend the region's Colorado River supply. This is because an increase in direct reuse will reduce the amount of water available for indirect reuse through return-flow credits by a similar amount.

In 2017, SNWA adopted a policy to address water use outside the Las Vegas Valley (Appendix 4).[9] Among other things, the policy prioritizes the return of treated wastewater to Lake Mead for return-flow credits where feasible, and implementation of reuse to achieve full beneficial use of SNWA water resources if returning treated wastewater to Lake Mead is not feasible. This is consistent with SNWA's approach for water reuse in the Las Vegas Valley.

Reuse of In-State Groundwater Resources

The water resources described in this chapter have generally been quantified and discussed based on consumptive use volumes. Water accounting for return-flow credits, which extends SNWA's diversions of Colorado River water, includes provisions for the reuse of imported in-state groundwater resources. Under these provisions, in-state groundwater resources are similarly extended by approximately 75 percent.

TEMPORARY RESOURCES

Beginning in the early 1990s and continuing today, SNWA has worked closely with other basin states to maximize opportunities for flexible use of Colorado River water. Through local and interstate arrangements, SNWA has acquired a number of temporary resources that serve as an important management tool—these resources can be used to meet potential short-term gaps between supply and demand, serving as a bridge to meet demands while other future resources are being developed. In some cases, temporary resources can be used to offset reductions in permanent supplies due to shortages.

For the purpose of this plan, "Temporary Resources" are defined as banked resources. As part of its overall water resource strategy, SNWA reserves water in years when Nevada's Colorado River allocation exceeds the community's demands. These resources are "banked" for future use in the form of storage credits. The volume of storage credits can change over time based on continued storage and use of supplies. As discussed below, SNWA stores banked resources locally, as well as through banking agreements with other states.

Southern Nevada Water Bank

As of 2017, SNWA has approximately 335,000 acre-feet of water stored in the Southern Nevada Water Bank for future use through an agreement with LVVWD. SNWA may recover water banked under this agreement in any water supply condition. This plan assumes a maximum recovery rate of 20,000 AFY.[10]

California Water Bank

Between 2004 and 2012, SNWA entered into various agreements that allow it to store Nevada's unused Colorado River water in California. As of 2017, Nevada has banked more than 330,000 acre-feet of water in California. This plan assumes a maximum recovery up to 30,000 AFY during normal and shortage conditions, subject to agreement terms.[11]

Arizona Water Bank

In 2013, SNWA approved an amendment to the 2001 water banking agreement with the Arizona Water Banking Authority.[12] Based on the amended agreement, SNWA stored approximately 601,000 acre-feet of Colorado River water underground in Arizona's aquifers for SNWA's future use as of 2017. Additional water can be banked on a pay-as-you-go basis up to 1.25 million acre-feet.

For SNWA to recover this stored water, Arizona will utilize the banked water and forgo use of a like amount of Colorado River water. The SNWA will then divert the water from facilities at Lake Mead. SNWA can recover up to 40,000 AFY during any water supply condition and may recover up to 60,000 AFY during a declared shortage. This plan assumes a maximum recovery up to 40,000 AFY during normal and shortage conditions.

Intentionally Created Surplus

The SNWA has participated in a number of efforts to expand its portfolio of temporary resources under provisions specified in the Interim Guidelines for ICS.

As discussed earlier in this chapter, the Interim Guidelines created several forms of ICS: Tributary Conservation ICS and Imported ICS (discussed under "Permanent Resources"), as well as System Efficiency ICS and Extraordinary Conservation ICS. In 2012, an additional form of ICS was created as part of an international pilot program, referenced here as Bi-National ICS.

Provisions for Bi-National ICS were extended through 2026 with the approval of a new agreement between the U.S. and Mexico in late 2017.

System Efficiency ICS. In 2007, SNWA collaborated with the U.S. Department of the Interior and other project partners to fund construction of the Warren H. Brock Reservoir. This System Efficiency ICS project provides Southern Nevada with 400,000 acre-feet of ICS credits; no more than 40,000 acre-feet are available for consumptive use each year through 2036. These credits are stored in Lake Mead, helping to bolster Lake Mead water levels. System Efficiency ICS can not be used under a Colorado River shortage condition.

In 2009, Nevada also collaborated with municipal water agencies in California, Arizona and the U.S. Bureau of Reclamation in a pilot operation of the Yuma Desalting Plant. The plant was constructed in 1992 to treat brackish agricultural drainage water in the United States for delivery to Mexico as part of its treaty obligation. Flood damage in 1993 caused the facility to cease operations.

As part of the 2009 collaborations, the facility was operated at one-third capacity to collect data on operational viability for long-term use. In exchange for funding the pilot test, the states received System Efficiency ICS. SNWA's share was 3,050 acre-feet. These resources are temporarily stored in Lake Mead as System Efficiency ICS and can be used during normal operating conditions.

Extraordinary Conservation ICS. Tributary Conservation and Imported ICS credits are converted to Extraordinary Conservation ICS credits if they are not used in the year they are created. Under the Interim Guidelines, the SNWA can accumulate up to 300,000 acre-feet of credits. These ICS credits are banked in Lake Mead and are reduced by 3 percent each year to account for evaporation losses.

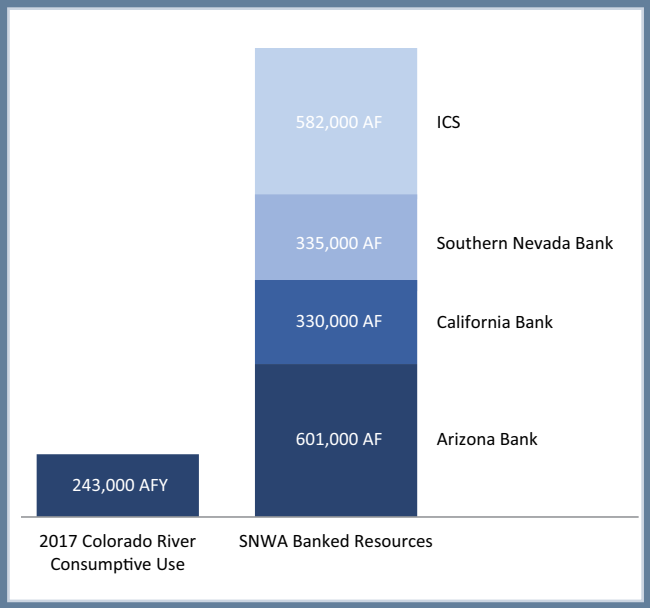
Unlike Tributary Conservation and Imported ICS, Extraordinary Conservation ICS is not available during declared shortages. As of 2017, SNWA has stored approximately 155,502 acre-feet of Extraordinary Conservation ICS credits. Due to restrictions during shortage, SNWA does not assume use of this resource during the planning horizon. However, the SNWA will utilize this resource as needed if and when it is available.

Recharge & Banking

The LVVWD began storing or "banking" water in the Las Vegas Valley in the late 1980s. In Southern Nevada, banking is accomplished through artificial recharge or in-lieu recharge.[13] Artificial recharge involves direct injection of treated unused Colorado River water into the local groundwater aquifer; in-lieu recharge is accomplished by not pumping non-revocable groundwater rights to acquire storage credits that are available for future use.

Through various programs and agreements, SNWA has expanded banking efforts to include storage in the Arizona Water Bank and California Water Bank, and in Lake Mead in the form of ICS. Banked resources serve as an important management tool. They can be used to help meet potential short-term gaps between supply and demand, and serve as a bridge to help meet demands while other long-term resources are being developed. If needed, some banked supplies can be used to help meet demands during a declared shortage.

As of 2017, SNWA has accrued more than 1.8 million acre-feet of storage credits. This amount is nearly eight times Nevada's 2017 Colorado River consumptive use.



Bi-National ICS. The United States and Mexico finalized Minute 323 to the 1944 U.S./Mexico water treaty in September 2017. Minute 323 extends and modifies key provisions of historic Minute 319, which enhanced Colorado River system sustainability by quantifying water deliveries to Mexico under both high- and low-reservoir conditions. In addition, Minute 323 contains Mexico's commitment to a Water Scarcity Plan requiring Mexico to store additional water in the United States as Lake Mead elevations drop. Implementation of the Water Scarcity Plan is contingent upon finalization of a lower basin drought contingency plan by which Arizona, California, and Nevada would store additional water in Lake Mead.

Effective through the year 2026, Minute 323 authorizes Mexico to defer its Colorado River water deliveries and to store water in the United States for later delivery to Mexico. The agreement will help maintain Lake Mead water levels, delay potential shortages, and create additional certainty for all water users, particularly during shortages.

Like Minute 319, Minute 323 allows for the SNWA to invest in conservation and infrastructure projects in Mexico in exchange for Bi-National ICS credits. Through Minutes 319 and 323 and the accompanying domestic agreements, SNWA has agreed to fund projects yielding a minimum of 51,025 and a maximum of 78,300 acre-feet of Bi-National ICS credits. As of late 2017, SNWA has accrued 23,750 acre-feet of Bi-National ICS credits.

FUTURE RESOURCES

For the purpose of this plan, "Future Resources" are defined as those resources expected to be available to SNWA at some point during the planning horizon. In some instances, water resources are quantified subject to water right permitting, while the availability and development of others requires further research and analysis.

Water resource conditions have changed significantly over the years for many of the western states, including Nevada. During that time, SNWA has worked to implement water resource strategies that maximize use of permanent and temporary resources, delaying the development of costly facilities that may not be needed in the future.

Development of the Future Resources discussed below will require additional environmental permitting as well as project design and construction of water delivery infrastructure. In some cases, litigation will be necessary. For planning purposes, SNWA estimates a 10-year lead time is needed from project authorization by its Board of Directors to first water delivery.

Desalination

The SNWA is engaged with other Colorado River Basin states and water users, the U.S. Bureau of Reclamation and the country of Mexico to actively explore and investigate potential seawater and brackish water desalination projects in the state of California and in the country of Mexico. One example includes ongoing exploration for operation of the Yuma Desalting Plant to treat brackish water. Other projects are being considered by a Binational Projects Work Group. These include opportunities for seawater desalination and wastewater reuse facilities in Mexico. The latter are noted as areas of interest under Minute 323.

In-State Groundwater

The SNWA has a number of groundwater permits and applications in southern and eastern Nevada based on applications filed by the LVVWD in 1989. Many of these applications have been permitted by the Nevada State Engineer in accordance with Nevada Water Law, while others require further review and analysis. Figure 3.2. depicts the hydrographic areas associated with these permits/applications. Below is a summary of each resource and its current standing.

Garnet and Hidden Valleys. The SNWA has permitted rights to 2,200 AFY of groundwater in Garnet and Hidden valleys. The majority of these rights have been leased to dry-cooled power plants located in Garnet Valley. The remaining resources are anticipated to be developed as needed within these valleys.[14] These rights are subject to the ongoing process described on page 22.

Three Lakes Valley (North and South) and Tikaboo Valley (North and South). Between 2003 and 2006, the Nevada State Engineer issued a series of rulings granting SNWA rights to 10,605 AFY of groundwater in these basins. The SNWA is working to develop options for delivery of 8,018 AFY of the groundwater rights from Three Lakes Valley North and South and Tikaboo Valley South into the northwest portion of the Las Vegas Valley.

Delamar, Dry Lake, Cave and Spring Valleys. In 2012, the Nevada State Engineer issued a ruling on SNWA's groundwater applications in Delamar, Dry Lake, Cave and Spring valleys. The ruling granted SNWA 61,127 AFY from Spring Valley and 22,861 AFY from Delamar, Dry Lake and Cave valleys.

The rulings were appealed. A District Court order affirmed several aspects of the rulings, but remanded the matter back to the Nevada State Engineer for

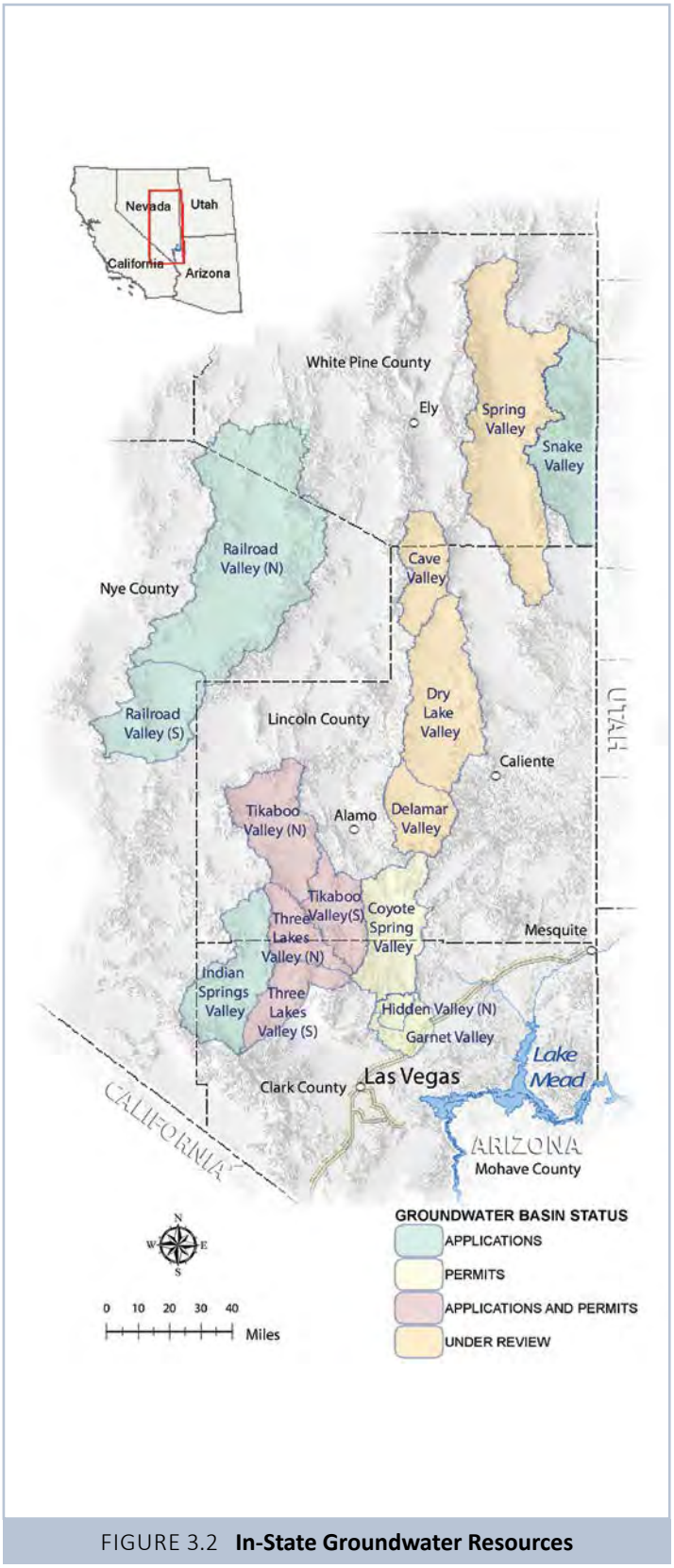


FIGURE 3.2 **In-State Groundwater Resources**

Nevada Water Law

Nevada water law is considered one of the most comprehensive water laws in the West.[15]

Unlike Colorado River water, which is managed by the U.S. Bureau of Reclamation, groundwater and surface water in Nevada (excluding the Colorado River) is administered and managed by the state. Nevada's first water law was passed in 1866 and has been amended many times since then.

The Nevada Division of Water Resources, also known as the Office of the State Engineer, regulates these supplies. The Office was created in 1903 to protect existing water rights and to bring about a better method for utilizing the state's water resources.

Today, Nevada water law serves the people of the state by providing the rules for acquiring and maintaining a water right, as well as guidelines for the State Engineer in managing the state's valuable water resources. Nevada water law follows the doctrine of prior appropriation, or "first in time, first in right"—meaning the first person to file on a water resource for beneficial use is typically considered first for a permanent right to water, subject to the Nevada State Engineer's determination of available appropriated water.

additional consideration on three primary issues. Under narrow and unprecedented requirements, the remand order specifically directed the State Engineer to recalculate the volume of water available for permitting and reconsider aspects of SNWA's monitoring, management and mitigation plan. Following a hearing in 2017, the State Engineer issued a 2018 ruling denying SNWA's applications.

The 2018 ruling makes it clear that water is available for appropriation in these basins, but the scope of the District Court remand order prevented the State Engineer from granting rights. The State Engineer did, however, approve SNWA's monitoring, management and mitigation plan, subject to the potential reinstatement of an award of the disputed groundwater rights. These resources are subject to ongoing litigation, and the SNWA and several protestants have filed petitions for judicial review of the 2018 ruling.

In the meantime, the SNWA continues to perform hydrologic and biologic monitoring to satisfy reporting requirements as set forth in the 2012 State Engineer approved monitoring plans. Additionally, SNWA holds groundwater rights to more than 8,000 AFY in Spring Valley that were acquired through the acquisition of its Great Basin Ranch Holdings (See Chapter 5).

Snake Valley. The SNWA currently holds applications for approximately 50,678 AFY in Snake Valley. The Lincoln County Conservation, Recreation, and Development Act of 2004 require the states of Nevada and Utah to reach an agreement regarding the division of water resources in Snake Valley, which is located in portions of both states. To date, an agreement has not been signed by Utah and SNWA's applications remain pending before the Nevada State Engineer. The SNWA intends to pursue development of these resources when needed to supply future demands.

Railroad Valley The SNWA holds applications filed in 1989 for 111,496 AFY of groundwater in Railroad Valley North and South. The SNWA intends to pursue development of these resources when needed to supply future demands.

Virgin River/Colorado River Augmentation

The SNWA was permitted 113,000 AFY of Virgin River water rights in 1994. Under an agreement, SNWA transferred 5,000 AFY to the Virgin Valley Water District. In accordance with the 2007 Seven States' Agreement, the SNWA has agreed to suspend development of these Virgin River surface water rights in exchange for agreement with the other Colorado River Basin states to cooperatively pursue the development of 75,000 AFY of

permanent water supplies to augment the Colorado River for Nevada.[16]

Transfers/Exchanges

In concept, water transfers involve moving water resources from willing sellers to willing buyers. There are a variety of ways in which this can occur: interbasin, intrastate and interstate transfers.

Full-scale transfers and exchanges among Colorado River users could involve transfers/exchanges associated with participation in desalination or agricultural fallowing projects. While Colorado River transfers and exchanges are an important future resource for Southern Nevada, they will require considerable discussion, agreements and potential regulations to implement. The SNWA continues to collaborate with other Colorado River users to evaluate the potential for future transfer and exchange projects.

WATER CONSERVATION

Water conservation is a resource. However, unlike typical "wet" resources, which are acquired and conveyed to meet demands, conservation reduces existing and future demands, and extends available supplies.

The SNWA's comprehensive five-year water conservation plan details the community's water conservation goals and progress towards those goals over time.[17] It also includes a complete description of water conservation programs and projected water savings. The following provides a brief overview of how conservation is measured and implemented in Southern Nevada.

Measuring Water Conservation and Use

Gallons Per Capita Per Day (GPCD) is a metric used by many communities to measure water uses. It is also an effective tool to measure efficiency over time. GPCD varies across communities due to several factors, including differences in climate, demographics, water-use accounting practices and economic conditions.

In the 2018 Plan, GPCD is calculated by dividing total water "consumed" (all sources) by total resident population served per day (water consumed/resident population/365 days = GPCD). Not all water that is delivered is consumed. This is because SNWA recycles nearly all indoor water use, either through return-flow credits or direct reuse.

Conservation Goals

Since its inception in 1991, SNWA and its member agencies have worked collaboratively to set and achieve aggressive water conservation goals. These efforts produced

Consumptive vs. Non-Consumptive Uses

Approximately 60 percent of all water delivered by SNWA is consumed, primarily for landscape irrigation and cooling. Unlike water used indoors, water used outdoors and for cooling is lost to the system as it cannot be treated and reused. As a result, outdoor uses continue to be a primary focus area for future conservation gains. Since 66 percent of all metered uses are by residential and common area use (Figure 3.3), this is the principal water use sector that is targeted for conservation actions.

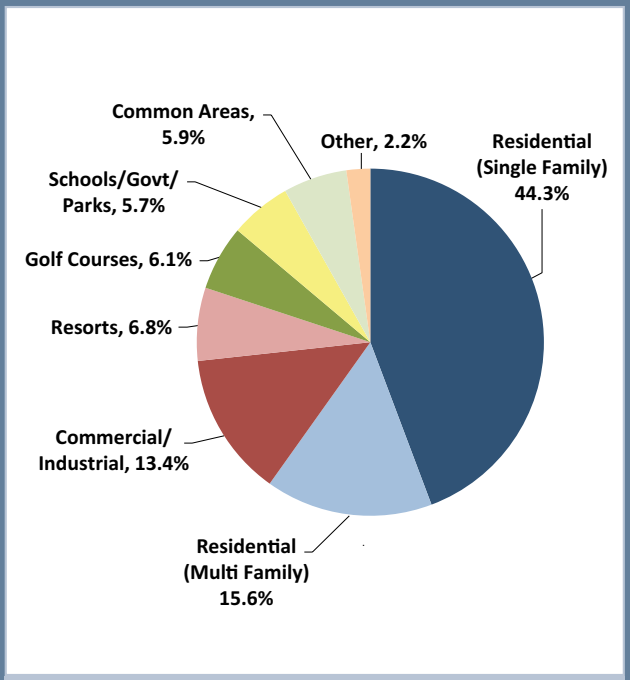


FIGURE 3.3 **Municipal Metered Use (2017)**

significant decreases in per person water use as shown in Figure 3.4. The community is working to achieve its water conservation goal of 116 GPCD by 2035. As recommended by SNWA's 2014 Integrated Resource Planning Advisory Committee, a new conservation goal will be evaluated after the current goal has been achieved.

While future conservation gains are expected to occur over the planning horizon, these gains are likely to be realized more slowly than in previous years as higher levels of efficiency—over and above what has already occurred—become more difficult to achieve. In the long-term, there also is anticipated to be upward pressure on water use as a result of warming due to climate change.

As shown in Figure 3.4, Southern Nevada experienced a slight increase in GPCD water use in 2017, with hot and dry weather conditions being a likely contributor. According to the National Weather Service, 2017 marked the hottest year on record in the Las Vegas Valley with 86 days reaching or exceeding 100°F. Annual precipitation was well below normal and the region experienced the driest fall on record (109 consecutive days with no precipitation). Likewise, for the first time on record, winter low temperatures did not reach freezing. [18]

To draw higher levels of participation from area residents and businesses, and to support continued water conservation gains, the SNWA made changes to several of its conservation incentive programs. For example, the rebate for SNWA's Water Smart Landscapes program was increased from $2.00 to $3.00 per square foot of turf removed and replaced with water efficient landscaping. A full description of SNWA programs and conditions are available online at SNWA.com.

Conservation Tools

The SNWA operates one of the largest and most comprehensive water conservation programs in the nation. This program includes a combination of education, incentives, regulation and water pricing. Because the biggest potential for water savings comes from reductions in consumptive water demands, primarily in the form of outdoor water uses such as landscape irrigation, the majority of conservation tools are designed to achieve results in these areas.

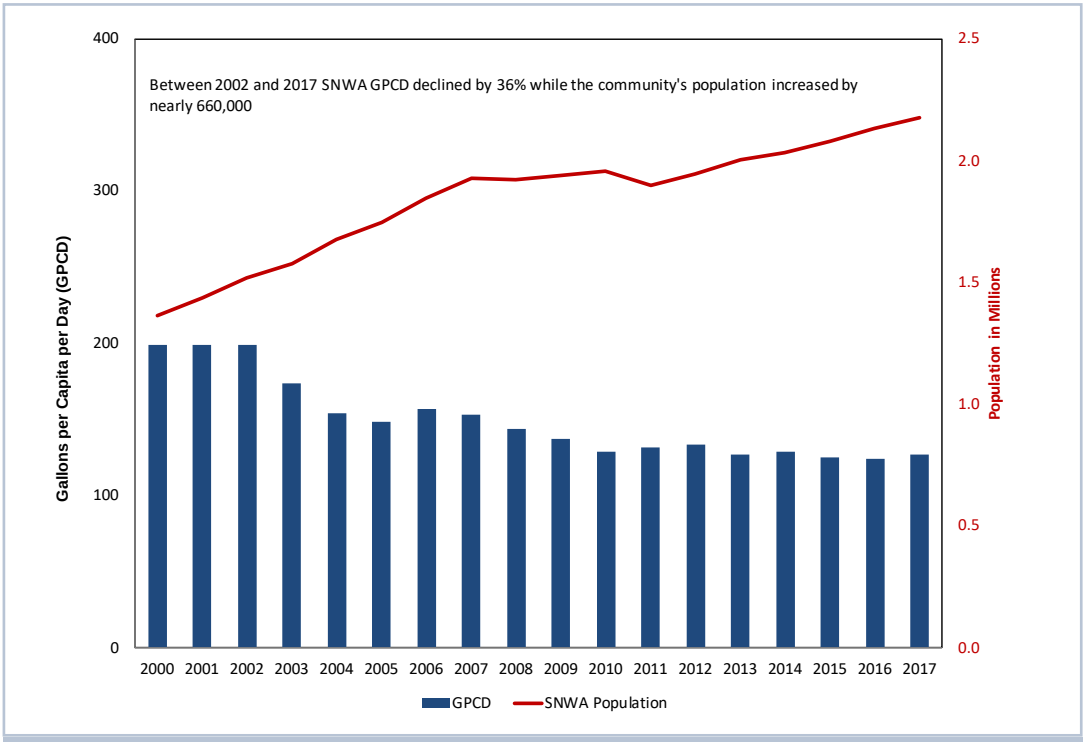


FIGURE 3.4 **Population & Per Capita Water Use**

- Education: Education is an integral element of SNWA's water conservation strategy. It includes both formal and informal education, from tips and tutorials to improve efficiency, to class offerings on water-smart landscaping practices for both resident and landscape professionals.
- Incentives: The SNWA operates one of the largest incentive programs in the nation. Since 2000, SNWA has invested more than $225 million in incentive programs, reducing demand by more than 14 billion gallons annually.
- Regulation: Through collaboration, SNWA member agencies and Clark County have adopted a suite of land use codes, ordinances and water use policies to ensure more efficient use of water in Southern Nevada. These include time-of-day and day-of-week watering restrictions, water waste restrictions and limitations on the installation of new turf in residential and commercial development.
- Water Pricing: SNWA member agencies implement conservation rate structures that charge higher rates for water as use increases. These rate structures encourage efficiency, without jeopardizing water affordability for essential uses.

CHAPTER SUMMARY

A number of factors can influence the timing, use and availability of water resources. Having a diverse portfolio of resources allows SNWA to assess its overall water resource options and make appropriate decisions regarding which resources to bring online when necessary. This approach provides flexibility in adapting to changing supply and demand conditions, and helps ensure that community water demands can be met reliably.

The SNWA Water Resource Portfolio includes a mix of permanent, temporary and future resources that will be used in tandem with continued conservation efforts to meet demands over the 50-year planning horizon. Some of these resources can be used under any Colorado River operating condition, while others are subject to limitations (such as staged pumping or restrictions during shortage).

SNWA continues to make water conservation a priority and the community is currently working to achieve its 116 GPCD conservation goal by 2035. Additional targets will be evaluated once the current goal is realized. The SNWA has taken a number of steps to increase conservation gains, including increases to its conservation rebate and incentive programs.

With ongoing support from the community, conservation will maximize the use and availability of existing supplies, help protect Lake Mead water levels from continued decline, delay the need for new resources and facilities, and provide opportunities to increase temporary storage reserves.

Likewise, the SNWA continues to work with other Colorado River water users to pursue flexible use of Colorado River supplies, including augmentation and storage projects that are designed to increase supplies and bolster Lake Mead water levels. Together, these actions will provide flexibility in meeting demands as described in Chapter 4.

ENDNOTES

1 "Contract with the Southern Nevada Water Authority, Nevada for the Delivery of Colorado River Water," effective March 2, 1992; between Secretary of Interior, Colorado River Commission and Southern Nevada Water Authority." The contract was amended in 1994: "Amended and Restated Contract with the Southern Nevada Water Authority, Nevada for the Delivery of Colorado River Water," effective November 17, 1994.

2 Nevada Colorado River consumptive use entitlement available for SNWA and the SNWA purveyor members is estimated to be 272,205 acre-feet/year with 27,795 acre-feet/year estimated to be allocated to Nevada non-SNWA contractors. "Listing of Individual Water Entitlements in the State of Nevada," listing as of February 2018, U.S. Bureau of Reclamation, http://www.usbr. gov/lc/region/g4000/contracts/entitlements/NVentitlements.pdf.

3 Nevada receives credits for Colorado River return flows from the Las Vegas Wash based upon a procedure originally agreed to by the U.S. Bureau of Reclamation (BOR) and the Colorado River Commission of Nevada in 1984. This procedure has been updated periodically through consultation with the BOR, SNWA and Colorado River Commission of Nevada; the most recent update in 2007 allows full consumptive use of groundwater imported to the Las Vegas Valley.

4 The 1964 Supreme Court Decree in Arizona v. California defines "surplus" as follows: "If sufficient mainstream water is available for release as determined by the Secretary, to satisfy annual consumptive use [in the lower Division states of Arizona, California and Nevada] in excess of 7,500,000 acre-feet, such excess consumptive use is surplus."

5 According to Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations of Lake Powell and Lake Mead (Interim Guidelines), Lower Basin States of Arizona, California and Nevada can create credits for Colorado River or non-Colorado River water that has been conserved by users in the Lower Basin (known as intentionally created surplus or ICS). ICS credits can be used in the year they are created or be stored in Lake Mead and made available for release from Lake Mead at a later time, subject to Operating (Shortage) conditions at the time of release.

6 "Developed Shortage Supply ("DSS")" shall mean water available for use by a contractor under the terms and conditions of a Delivery Agreement and Section 4 of Interim Guidelines in a Shortage Condition, under Article III(B)(3) of the Consolidated Decree. During a year when the Secretary has determined a shortage condition, the Secretary shall deliver DDS available in a contractor's DSS Account at the request of the contractor, subject to the provisions of Interim Guidelines' Section 4.C.

7 Nevada Revised Statutes, Chapters 532, 533, and 534.

8 The 1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande. The treaty guarantees Mexico the delivery of 1.5 million AFY of Colorado River water plus 200,000 AFY of any surplus Colorado River water. In 1974, an international agreement interpreting the 1944 Treaty guaranteed Mexico water of the same quality as that being used in the United States.

9 "Policy Regarding Out-of-Valley Water Reuse." 2017, SNWA.

10 "Cooperative Agreement for the Banking of Water in the Las Vegas Valley Groundwater Basin between the Southern Nevada Water Authority and the Las Vegas Valley Water District," effective February 21, 2006. The artificial recharge program in the Las Vegas Valley was initiated in 1987 by the Las Vegas Valley Water District.

11 "Second Amended Operational Agreement among the Metropolitan Water District of Southern California (Metropolitan), Colorado River Commission of Nevada and the Southern Nevada Water Authority (SNWA)," effective October 24, 2012 and "Storage and Interstate Release Agreement among the United States of America, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, and the Colorado River Commission of Nevada," effective October 27, 2004. The amount of developed and released water stored in Metropolitan's SNWA Interstate Account to SNWA depends on timing of SNWA's request and Colorado River operating conditions at the time of such request.

12 "Third Amended and Restated Agreement for Interstate Water Banking among the Arizona Water Banking Authority and the Southern Nevada Water Authority and the Colorado River Commission of Nevada," effective May 20, 2013 and "Storage and Interstate Release Agreement among the United States of America, the Arizona Water Banking Authority, the Southern Nevada Water Authority, and the Colorado River Commission of Nevada," effective December 18, 2002.

13 "In-Lieu Recharge Order," Order No. 1176, December 10, 2004, State of Nevada, Office of the Nevada State Engineer.

14 SNWA has 2,200 AFY of groundwater permits in Garnet and Hidden valleys as a combined duty. SNWA is currently leasing a maximum of 1,450 AFY, not to exceed 13,000 acre-feet over any ten year rolling period, for power generation in Garnet Valley. The leases therefore commit 1,300 AFY over a ten year rolling period. In addition, the City of North Las Vegas is permitted to divert 300 AFY from their wells in Garnet Valley, and the remaining 600 AFY is available for future uses.

15 Nevada Revised Statutes, Chapters 532, 533 and 534.

16 "Agreement Concerning Colorado River Management and Operations," effective April 23, 2007; between Arizona Department of Water Resources, Colorado River Board of California, Colorado Water Conservation Board, Governor's Representative for the State of Colorado, Colorado River Commission of Nevada, Southern Nevada Water Authority, New Mexico Interstate Stream Commission, Utah Division of Water Resources, Utah Interstate Streams Commissioner, and Wyoming State Engineer.

17 "Southern Nevada Water Authority Water Conservation Plan, 2014-2018," 2014, SNWA.

18 "Las Vegas breaks records during hot, dry 2017." Las Vegas Review Journal, January 3, 2018.

MEETING FUTURE DEMANDS

THIS CHAPTER ADDRESSES HOW SNWA PLANS TO RELIABLY MEET PROJECTED WATER DEMANDS UNDER A RANGE OF SUPPLY AND DEMAND CONDITIONS.

INTRODUCTION

As described in the preceding chapters, water supply conditions and demands can be influenced by a number of factors that can change in unpredictable ways, including changes associated with economic conditions, water conservation progress and climate variability. As SNWA prepared its 2018 Plan, the organization considered two overriding issues related to water supply and demands:

- The potential impact of continued drought and climate change on water resource availability, particularly for Colorado River supplies; and
- The potential impact of economic conditions, climate change and water use patterns on long-term water demands.

To address these uncertainties, SNWA developed a series of planning scenarios that represent Southern Nevada's future water resource needs under variable supply and demand conditions. This approach helps inform water resource planning and water resource development efforts, and demonstrates how the SNWA plans to meet future needs, even if conditions change significantly over time.

As described in the sections below, all of the planning scenarios presented in this chapter demonstrate SNWA's ability to meet the community's long-term projected water needs through adaptive use of its Water Resource Portfolio.

SUPPLY AND DEMAND

Water resource planning is based on two key factors: supply and demand. Supply refers to the amount of water that is available or that is expected to be available for use. Demand refers to the amount of water expected to be needed in a given year.

Water demand projections are based on population forecasts and include assumptions about future water use, such as expected achievements toward water conservation goals. Precise accuracy from year to year rarely occurs in projecting demands, particularly during periods of significant social and economic changes. While making assumptions is a necessary part of the planning process, assumptions are unlikely to materialize exactly as projected. Likewise, climate variations, policy changes and/or the implementation of new regulations can also influence water resource availability over time.

The scenarios presented in this chapter address these uncertainties by considering a wide-range of supply and demand possibilities. Rather than considering a single forecast, the scenarios bracket the range of reasonable conditions that may be experienced over the 50-year planning horizon. Key factors evaluated include possible shortages of Colorado River supplies, as well as variation in future demands. This is a conservative approach that reflects the uncertainties presented in the current planning environment.

The following describes the water demand projections and water supply conditions that were considered as part of scenario development.

Water Demand Projections

The planning scenarios developed as part of this plan include two water demand projections: an upper water demand projection and a lower water demand projection. The lower water demand projection (Figures 4.1 and 4.3) was derived from a population forecast and expected conservation achievements. The Clark County population forecast was obtained from the University of Nevada Las Vegas Center for Business and Economic Research (CBER). This forecast is also used in local transportation planning by the Regional Transportation Commission and is accepted by the Southern Nevada Regional Planning Coalition for use in regional planning. The forecast is based upon CBER's working knowledge of the economy and the nationally recognized Regional Economic Model Incorporated (REMI).

The lower water demand projection was derived using the 2018 CBER population forecast through 2060 and trending through the year 2069. The historical share of

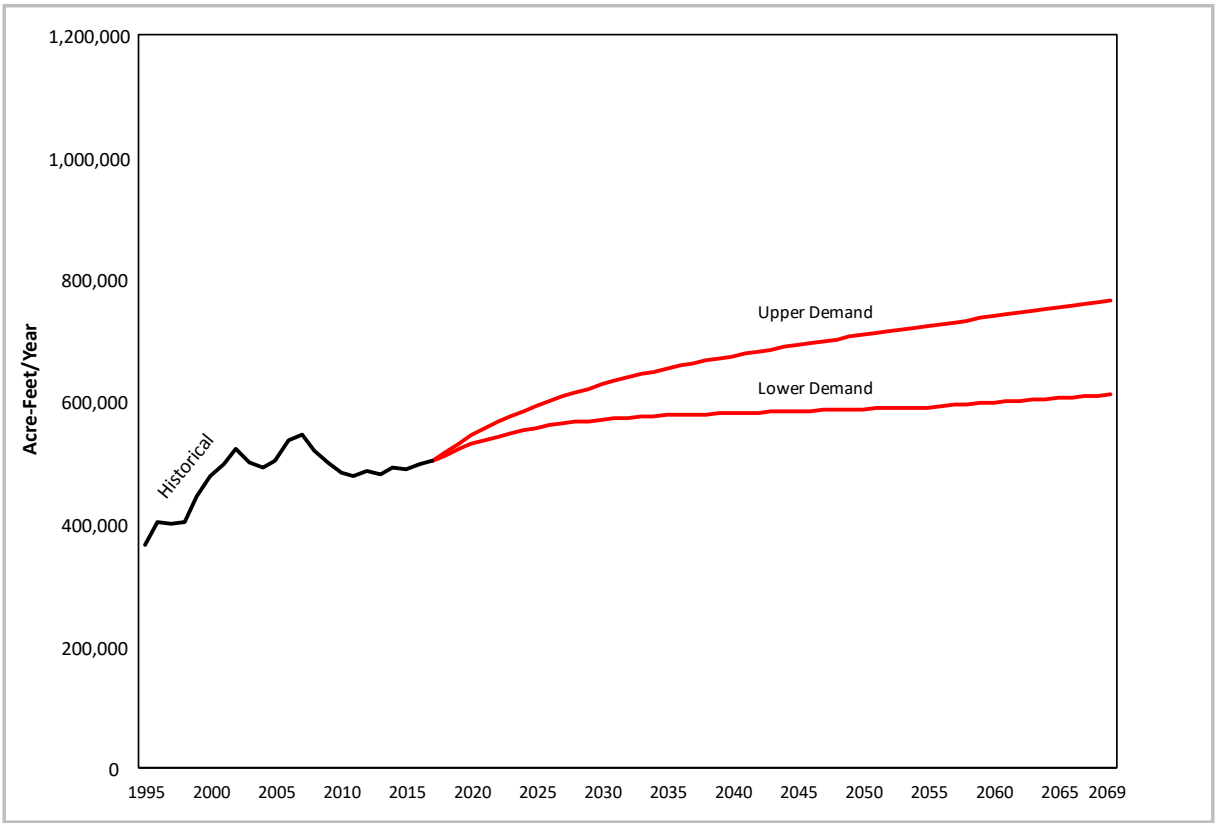


FIGURE 4.1 **SNWA Historical and Projected SNWA Water Demand**

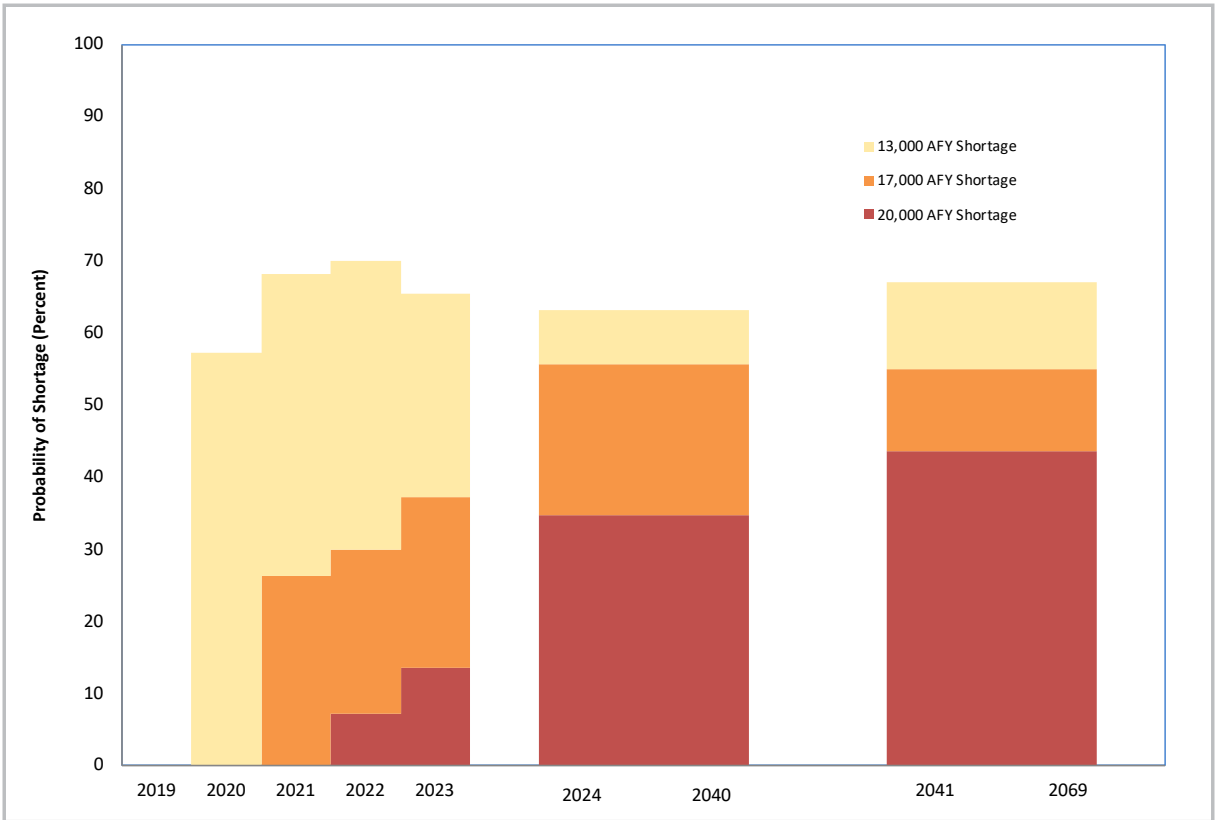


FIGURE 4.2 **Probability of Colorado River Shortage Declarations**[1]

Clark County population attributable to the SNWA service area was multiplied by 2017 water-use levels and reduced over time to represent expected achievement of the community's water conservation goal of 116 GPCD by 2035. The projection assumes a further reduction in total demand (111 GPCD) by 2055 to reflect the potential for additional conservation once the current goal has been met.

The upper demand projection was developed for planning purposes to reflect increased uncertainties related to possible changes in demands that are associated with the economy, climate, population and water use variability. The upper demand projection represents a 15 percent increase over the lower projection at the midpoint of the planning horizon (2038), increasing to 25 percent in the latter part of the planning horizon (2069). The SNWA also considered one variant of the upper demand projection that includes assumptions about additional levels of conservation.

YEAR	2018	2035	2069
LOWER DEMAND	512	577	611
UPPER DEMAND	517	653	765

FIGURE 4.3
SNWA Demand Projection, in thousands (AFY)

Water Supply Conditions

The water supply conditions considered in the planning scenarios represent three Colorado River water-supply conditions: Normal Supply, Shortage and Increased Shortage (Figure 4.4). These supply conditions were developed to reflect current and likely conditions in the Colorado River Basin, as well as the potential for more significant water resource shortages than are currently prescribed by the Interim Guidelines.

NORMAL SUPPLY	Nevada receives its full apportionment of 300,000 AFY
SHORTAGE	Nevada apportionment is incrementally reduced to a maximum shortage of 20,000 AFY according to the Interim Guidelines
INCREASED SHORTAGE	Nevada apportionment is reduced by 40,000 AFY, double the maximum shortage level established in the Interim Guidelines

FIGURE 4.4 **Water Supply Conditions**

Under the Interim Guidelines, shortage volumes are defined for Lake Mead elevations between 1,075 and 1,025 feet. The U.S. Secretary of the Interior will consult with Colorado River Basin States to determine what additional measures are needed if Lake Mead drops below elevation 1,025 feet. If this were to occur, future negotiations and consultation with the U.S. Secretary of the Interior may establish additional shortage volumes. As a result, Nevada may be required to bear shortages greater than 20,000 AFY (currently Nevada's maximum shortage volume under the Interim Guidelines).

Colorado River modeling performed by the Bureau of Reclamation in 2018 projects an approximate 57–70 percent probability of a Colorado River shortage in the years 2020 to 2023. The probability of shortage ranges between approximately 60–70 percent in the years following. (Figure 4.2)[1]

SUPPLY AND DEMAND SCENARIOS

Figure 4.5 summarizes the water resources planned for development and use as part of the SNWA's water resource portfolio. These resources were combined with the Supply and Demand Scenarios (Figures 4.6 – 4.10) to depict the volume and type of resources planned for use to meet the range of possible future demand projections under the three supply conditions. All planning scenarios consider combinations of permanent, temporary and future resources as described in Chapter 3. Having a portfolio of resource options provides flexibility to adjust the use of some resources if development of other resources is delayed or revised, or if changes to demands occur. Likewise, if other options become a reality sooner rather than later, the priority and use of resources may change.

As previously described, some permanent and temporary resources are subject to restrictions for use during declared shortage, while other resources will require the development of facilities for use. Ultimately, the timing and need for resources will depend significantly on how supply and demand conditions materialize over the long-term planning horizon. For planning purposes, it is important to note that an estimated 10-year lead time is needed to secure remaining state and federal permits, and to design and construct facilities associated with in-state groundwater resources. Other future resources are likely to require lead time as well for the development of facilities and/or agreements for use.

FIGURE 4.5 **SNWA Water Resource Portfolio**

	SUPPLY	CONSUMPTIVE USE	DIVERSION EQUIVALENT [2]	AVAILABLE IN SHORTAGE?
PERMANENT	Colorado River (SNWA)	272,205 AFY	476,359 AFY	Yes. Subject to shortage reductions
	Nevada Unused Colorado River (Non-SNWA)	21,067 (2017) to 0 AFY in 2031	36,867 (2017) to 0 AFY in 2031	Yes. Subject to availability
	Tributary Conservation/Imported ICS	40,000 AFY	70,000 AFY	Yes
	Las Vegas Valley Groundwater Rights	46,961 AFY	Not applicable	Yes
	Direct Reuse	21,800 AFY	Not applicable	Yes
TEMPORARY	Southern Nevada Groundwater Bank	335,410 AF (20,000 AFY max.)	Up to 586,968 AF (35,000 AFY max.)	Yes
	Interstate Banks (Arizona and California)	931,266 AF (70,000 AFY max.)	1,629,716 AF (122,500 AFY max.)	Yes
	Intentionally Created Surplus (storage in Lake Mead)	582,302 AF	1,019,029 AF	No
FUTURE	Desalination	To be determined	To be determined	To be determined
	Garnet and Hidden Valleys Groundwater	2,200 AFY	Not applicable	Yes
	Delamar, Dry Lake, Cave and Spring Valleys Groundwater	91,988 AFY	160,979 AFY	Yes
	Tikaboo and Three Lakes Valley North and South Groundwater	10,605 AFY	18,559 AFY	Yes
	Virgin River/Colorado River Augmentation	Up to 108,000 AFY	Up to 189,000 AFY	To be determined
	Snake and Railroad Valleys Groundwater	To be determined	To be determined	Yes
	Transfers/Exchanges	To be determined	To be determined	To be determined

Water supplies are described in Chapter 3.

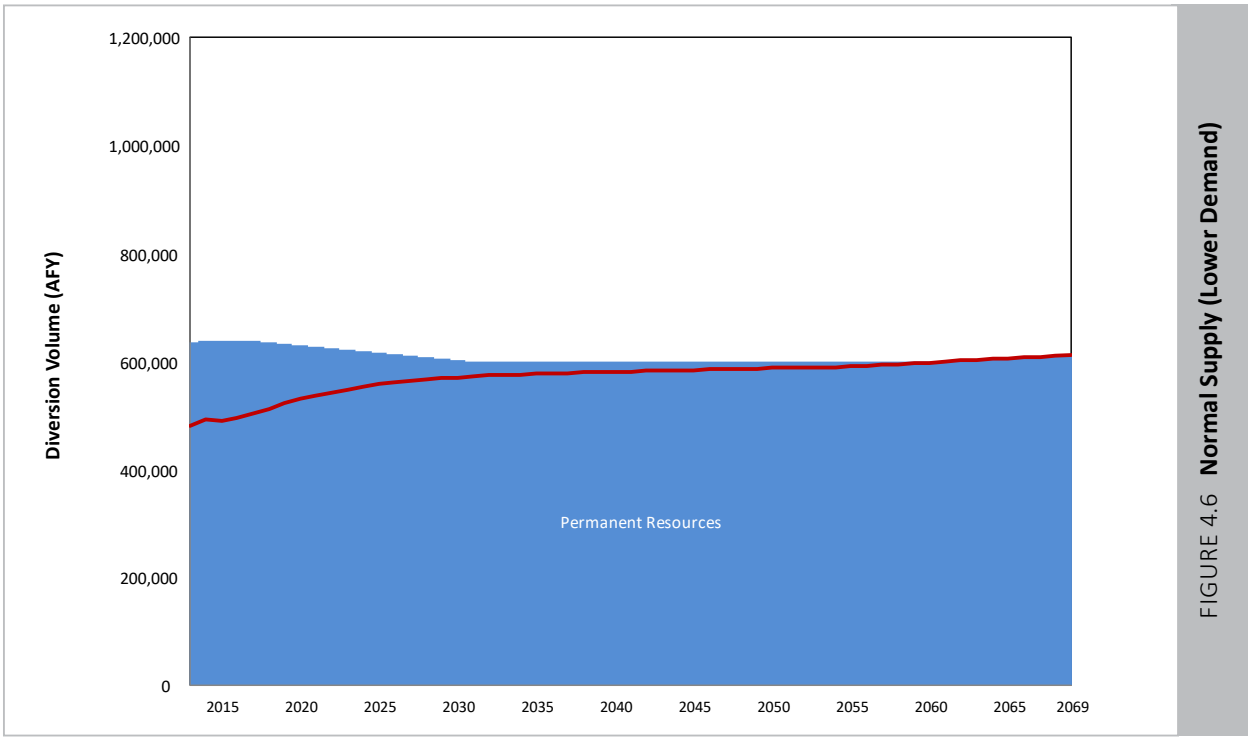


FIGURE 4.6 **Normal Supply (Lower Demand)**

Normal Supply Scenario (Lower Demand)

Figure 4.6 assumes full availability of Southern Nevada's 300,000 AFY Colorado River allocation. Under this scenario, permanent water resources are sufficient to meet water demands through the 50-year planning horizon.

This scenario also assumes continued banking of unused Colorado River supplies to the extent these resources are available. Given the high probability of Colorado River shortages, this scenario is unlikely to represent actual future supply conditions.

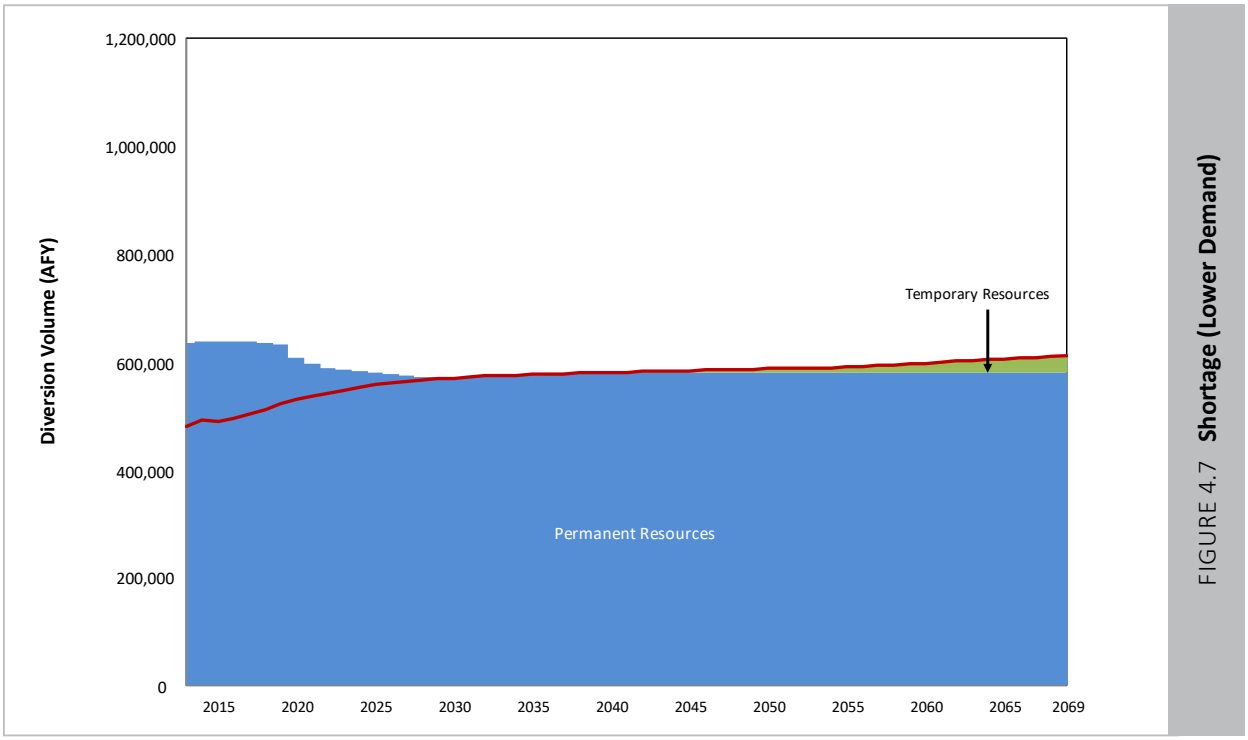


FIGURE 4.7 **Shortage (Lower Demand)**

Shortage Scenarios (Lower Demand)

Figure 4.7 assumes a staged reduction of Colorado River water up to 20,000 AFY based on a shortage declaration (reduction of 13,000 AFY in 2020, 17,000 AFY in 2021 and 20,000 AFY thereafter). Under this scenario, permanent and temporary water resources are sufficient to meet water demands through the 50-year planning horizon.

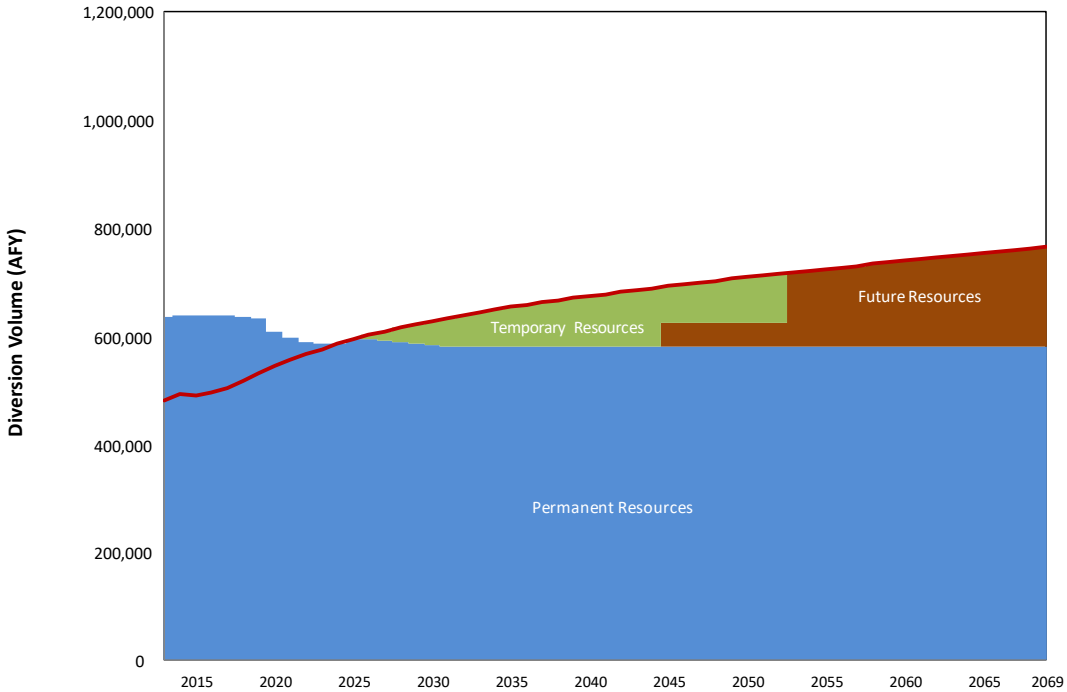


FIGURE 4.8 **Shortage (Upper Demand)**

Shortage Scenario (Upper Demand)

Figure 4.8 assumes a staged reduction of Colorado River water up to 20,000 AFY based on a shortage declaration (reduction of 13,000 AFY in 2020, 17,000 in 2021 and 20,000 AFY thereafter). Under this scenario, permanent and temporary water resources are sufficient to meet water demands through 2044 before future resources are needed. In 2069, the need for future resources is estimated at 106,000 AFY (consumptive use volume).

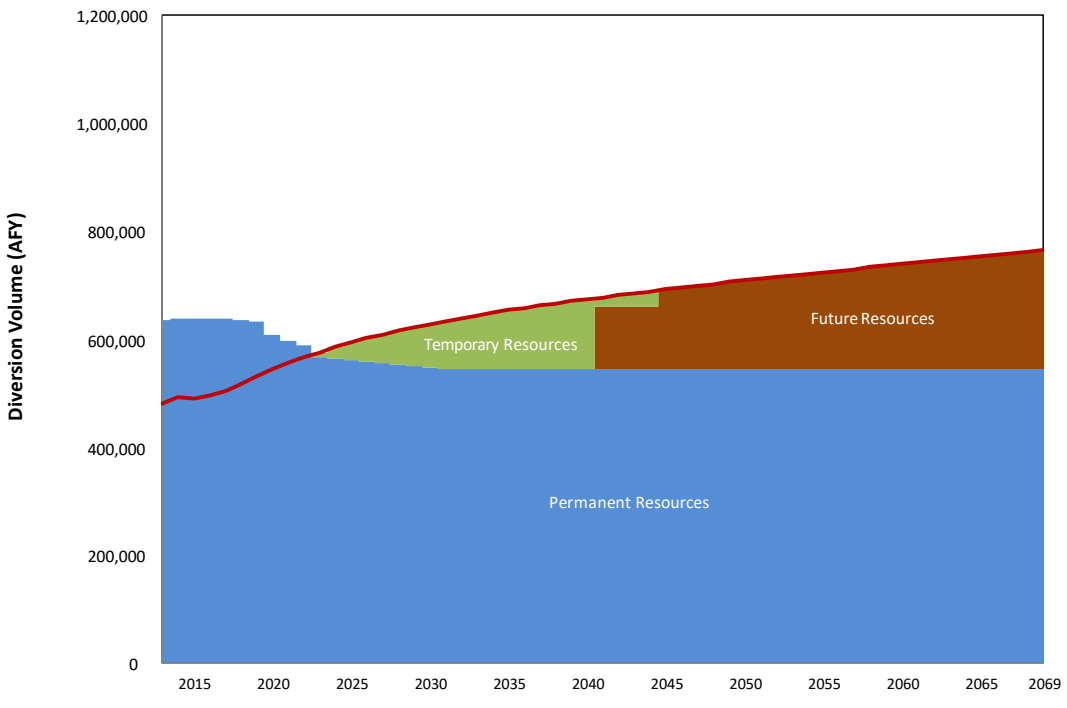


FIGURE 4.9 **Increased Shortage (Upper Demand)**

Increased Shortage Scenario (Upper Demand)

Figure 4.9 assumes a staged Colorado River shortage in years 2020–2022 and an increased shortage of 40,000 AFY thereafter. Under this scenario, SNWA's permanent and temporary water resources are sufficient to meet water demands through 2040 before future resources are needed. In 2069, the need for future resources is estimated at 126,000 AFY. (consumptive use volume), demonstrating the need for a combination of future resources to meet projected demands.

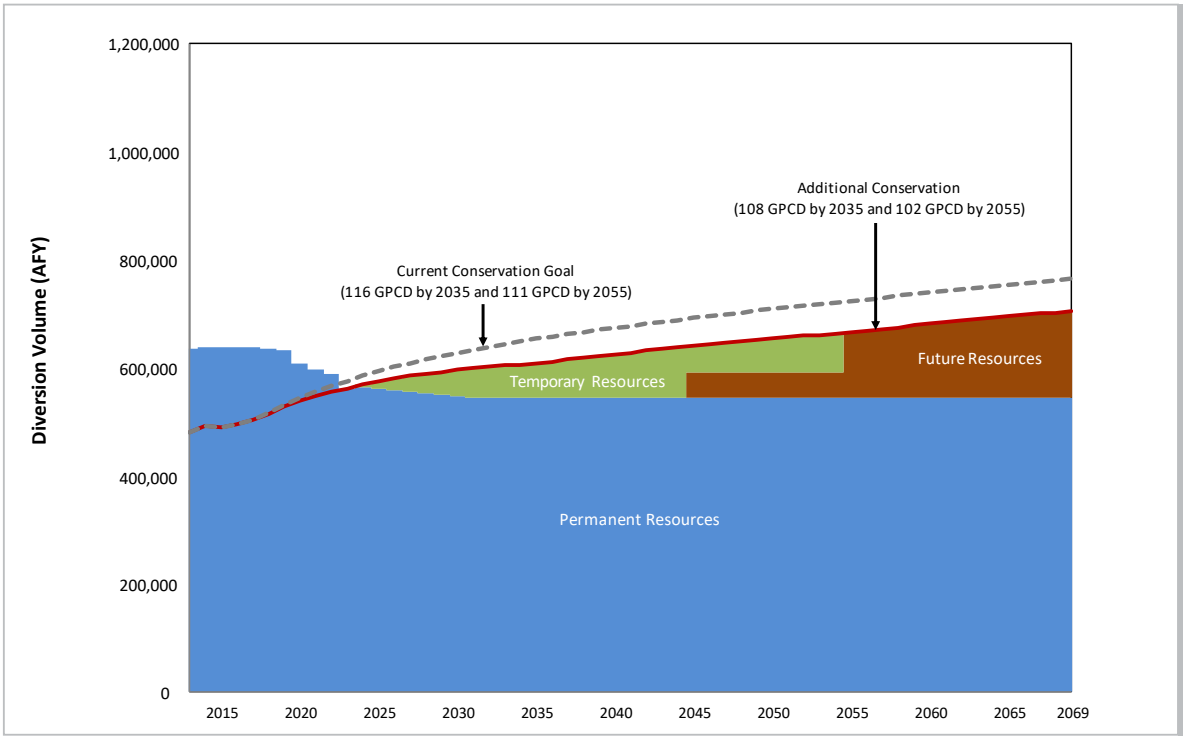


FIGURE 4.10 **Increased Shortage (Upper Demand)**

Additional Conservation Scenario

Figure 4.10 illustrates the timing and need for additional resources with the implementation of additional conservation. This scenario assumes future water use at 108 GPCD by 2035 and 102 GPCD by 2055. The scenario also assumes a staged Colorado River shortage in years 2020–2022 and an increased shortage of 40,000 AFY thereafter. Under this scenario, permanent and temporary water resources are sufficient to meet water demands through 2044 before future resources are needed. In 2069, the need for future resources is estimated at 91,000 AFY (consumptive use volume).

CHAPTER SUMMARY

Water supply and demand conditions are influenced by a number of factors, including economic conditions, water use patterns, conservation progress and climate variability. To account for these variables, SNWA's 2018 Plan considers several water supply and demand scenarios that bracket the range of plausible conditions to be experienced over the 50-year planning horizon.

The scenarios assume that Southern Nevada will continue to make progress towards its current water conservation goal, as well as achieve increased levels of efficiency over the long-term planning horizon. Likewise, the scenarios assume that unused Nevada Colorado River water will continue to be stored for future use and that this and other temporary resources will be used to meet demands until future resources are needed and developed.

Modeling efforts performed by the U.S. Bureau of Reclamation indicate a high probability of future shortage associated with Colorado River supplies (approximately 57–70 percent, beginning in 2020). The current maximum level of shortage prescribed to Nevada is 20,000 AFY; however, this level could potentially increase if Lake Mead water levels fall below an elevation of 1,025 feet.

The SNWA is not currently using its full Colorado River allocation and near-term shortage declarations are not anticipated to impact current customer use. Additionally, and as illustrated in the planning scenarios, SNWA is prepared to meet long-term demands and future shortages by adaptively managing its resource portfolio and by bringing future resources online when needed.

Subject to necessary authorizations, the amount of resources available for use as described in the SNWA Water Resource Portfolio is more than sufficient to meet the range of projected demands through the planning horizon. Maintaining this portfolio provides flexibility and enables SNWA to use an appropriate mix of resources as needed to meet demands. Through this and other adaptive management strategies, SNWA is better prepared to address factors that can influence resource availability over time such as permitting, policy changes, climate variability and/or new regulations.

As part of its long-term water planning efforts, the SNWA will:

- Continue to assess factors influencing water demands and the outlook for future demands;
- Continue to assess its overall water resource options and make informed decisions on which resources to use when needed;
- Consider the factors of availability, accessibility, cost, need and supply diversification when determining priority of resources for use;
- Maintain a diverse water resource portfolio to ensure future resources are available to meet projected long-term demands and to replace temporary supplies such as banked resources; and
- Work proactively with other Colorado River water users on efforts that increase Lake Mead's elevation in order to reduce the likelihood and severity of shortages.

ENDNOTES

1 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 2018 CRSS results, applying historical Colorado River flows, provided by U.S. Bureau of Reclamation to Southern Nevada Water Authority, August, 2018.

2 Water supplies are described in Chapter 3. For this plan, SNWA estimates diversion volumes by multiplying the corresponding consumptive use volume by a factor of 1.75, which incorporates the estimated return-flow credit ratio, where applicable. This factor is also applied in this plan to estimate full consumptive use of future in-state water resources.

PROTECTING THE ENVIRONMENT

THE SNWA'S ENVIRONMENTAL STEWARDSHIP EFFORTS HELP CONSERVE AND PRESERVE NATURAL RESOURCES FOR FUTURE GENERATIONS WHILE MINIMIZING CONFLICTS WITH WATER RESOURCE MANAGEMENT.

The SNWA works cooperatively with federal, state and local agencies as part of its long-term water resource management and planning efforts. This work helps to ensure avoidance, mitigation or minimization of impacts during development and delivery of water resources, including the construction, operation and maintenance of regional water facilities. In addition to the organization's proactive efforts, SNWA adheres to strict environmental laws and regulations that govern its use and development of resources and facilities. These include the Endangered Species Act, National Environmental Policy Act (NEPA) and Clean Water Act.

By complying with environmental laws and regulations, working cooperatively with others, and by implementing the latest best management practices, SNWA minimizes its footprint and protects valuable environmental resources for generations to come.

The SNWA participates in several environmental programs that contribute to species recovery and habitat conservation and protection in areas where its facilities or resources are located. The following summarizes specific activities that are currently planned or underway:

COLORADO RIVER

Human alterations on the Colorado River, including changes to riparian, wetland and aquatic habitats, have affected the river's ecosystem, both in the United States and in Mexico. Today, there are several native fish, birds and other wildlife species listed as threatened or endangered under the ESA.

Lower Colorado River Multi-Species Conservation Program

Environmental issues are being addressed cooperatively by Colorado River water users, primarily through the Lower Colorado River Multi-Species Conservation Program (LCRMSCP).

Finalized in 2005, the LCRMSCP provides ESA coverage for federal and non-federal operations in the Lower Colorado River under a Biological Opinion and a Habitat Conservation Plan.[1]

The SNWA is a non-federal partner in the LCRMSCP, which is being implemented by the Bureau of Reclamation over a 50-year period. The program area extends more than 400 miles along the lower Colorado River, from Lake Mead to the southernmost point of the U.S./Mexico border. Lakes Mead, Mohave and Havasu, as well as the historical 100-year floodplain along the main stem of the lower Colorado River, are all included. The program area also supports implementation of conservation activities in the lower Muddy, Virgin, Bill Williams and Gila rivers. The plan will benefit at least 26 species, most of which are state or federally listed endangered, threatened or sensitive species.

Some of the LCRMSCP projects being conducted in Nevada include razorback sucker studies on Lake Mead, southwestern willow flycatcher surveys and habitat protection at the Big Bend Conservation Area.

In 2005, SNWA purchased the 15-acre Big Bend Conservation Area site along the Colorado River to protect backwater habitat for native fish. In 2008, the LCRMSCP and the U.S. Fish and Wildlife Service (USFWS) funded wildlife habitat improvements on the property. The SNWA continues to maintain the property and habitat.

By taking a proactive role in the health of the river and its native species, SNWA and other Colorado River users are working to help ensure the long-term sustainability of this critical resource.

Colorado River Basin Water Supply and Demand Study

An Environmental and Recreational Flows Workgroup was one of three workgroups established following completion of the Colorado River Basin Water Supply

and Demand Study.[2] The SNWA is a member of this workgroup, which identified opportunities that would provide multiple benefits to improve flow and water-dependent ecological systems, power generation and recreation.

Binational Collaboration

Through interpretive minutes to the 1944 Treaty for the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, the United States and Mexico have established a framework for cooperation on environmental issues in Mexico. This includes studies related to the riparian and estuarine ecology of the Colorado River limitrophe and delta.

The SNWA is a member of the Environmental Work Group that was established in 2010. The work group provides a forum where the two countries can explore and evaluate potential areas of cooperation. SNWA continues to collaborate with the work group to consider opportunities for environmental improvements such as those identified in minutes 319 and 323 regarding environmental flow deliveries in the limitrophe and delta.

Adaptive Management Work Group

The SNWA participates in the Adaptive Management Work Group (AMWG) for the operations of Glen Canyon Dam. This multi-agency work group helps balance the needs and interests of the endangered humpback chub, recreational interests, Native American perspectives, hydropower generation, water deliveries and downstream water quality. Active participation in the AMWG and its subcommittees helps ensure SNWA's interests in protecting water deliveries, downstream water quality and the endangered humpback chub are adequately addressed.

MUDDY RIVER

The Muddy River and its tributaries and springs provide habitat for a unique array of rare species, including the federally endangered Moapa dace (*Moapa coriacea*), southwestern willow flycatcher (*Empidonax trailii extimus*), and Yuma Ridgway's rail (*Rallus obsoletus yumanensis*) (formerly Yuma clapper rail), and the federally threatened western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). It is also habitat for the Virgin River chub (*Gila seminuda*), which although not listed on the Muddy River is listed as endangered on the Virgin River.

The SNWA has conducted and supported environmental studies on the Muddy River since 2004, including population and habitat surveys for these and other native, sensitive species. The SNWA is also working with federal and state agencies, environmental organizations and local stakeholders to implement conservation and recovery actions.

Warm Springs Natural Area

Located approximately 7 miles northwest of the town of Moapa, the Warm Springs Natural Area contains more than two dozen warm water springs that form the headwaters of the Muddy River. The springs and river provide habitat for the federally endangered Moapa dace, a small fish that is endemic to the area. The river and surrounding riparian areas also provide habitat for 27 other listed and sensitive species, including fish, birds, bats, invertebrates and amphibians.

In 2007, SNWA purchased the former 1,220-acre "Warm Springs Ranch," using funding secured under the Southern Nevada Public Lands Management Act. Working with federal, state and local stakeholders, SNWA completed a Stewardship Plan for the Warm Springs Natural Area in 2011.[3] The Stewardship Plan provides a framework for use and management of the property that preserves the integrity of natural resources and allows for management of water resources.

Since acquisition of the property, SNWA has focused on restoration of aquatic fish habitat, control and eradication of invasive species, fire prevention and general property maintenance. A public use trail system with interpretive signage also was developed to allow for low-impact public use of the property. These conservation actions help to provide mitigation benefits for water development. The Warm Springs Natural Area is now open to the public six days a week, from Labor Day to Memorial Day. For more information, visit warmspringsnv.org.

VIRGIN RIVER

The Virgin River is one of the largest riparian corridors in the desert southwest; within Nevada, the lower Virgin River is home to the federally

endangered woundfin (Plagopterus argetissimus), Virgin River chub, southwestern willow flycatcher, and Ridgway's rail and the federally threatened western yellow-billed cuckoo. Since 1993, SNWA has conducted and supported environmental studies on the Virgin River, including population and habitat surveys for these species.

In addition, the SNWA participates on the Lower Virgin River Recovery Implementation Team, which is working to develop a conservation action plan for the woundfin and Virgin River chub.

CLARK COUNTY

The SNWA participates in a number of environmental initiatives in Clark County to help protect and restore the environment, including the Clark County Multiple Species Habitat Conservation Plan and Las Vegas Wash Comprehensive Adaptive Management Plan. These efforts directly affect the SNWA's ability to operate facilities in Clark County and deliver high quality water to the community.

Clark County Multiple Species Habitat Conservation Plan

The Clark County Multiple Species Habitat Conservation Plan (MSHCP)[4] was approved in 2001, and provides ESA coverage for 78 species, including the threatened desert tortoise (*Gopherus agassizii*). The key purpose of the MSHCP is to achieve a balance between the conservation and recovery of listed and sensitive species in Clark County and the orderly beneficial use of land to meet the needs of the growing population in Clark County. The SNWA actively participates in the MSHCP, which provides ESA coverage for its projects and facilities located on non-federal lands within the county.

Las Vegas Wash

The Las Vegas Wash is the primary channel through which the SNWA member agencies return water to Lake Mead for return-flow credits. These flows account for less than two percent of the water in Lake Mead and consist of urban runoff, shallow groundwater, storm-water and highly treated wastewater from the valley's four water reclamation facilities. Decades ago, the flows of the Wash created more than 2,000 acres of wetlands, but by the 1990s, only about 200 acres of wetlands remained. The dramatic loss of vegetation reduced both the Wash's ability to support wildlife and serve as a natural water filter.

In 1998 at the request of its citizen's advisory committee, SNWA reached out to the community in an effort to develop solutions to the problems affecting the Wash. This led to the formation of the Las Vegas Wash Coordination Committee (LVWCC), a panel representing more than two dozen local, state and federal agencies, businesses, an environmental group, the University of Nevada Las Vegas and private citizens. The committee quickly developed a Comprehensive Adaptive Management Plan for the Wash.[5]

Over nearly 20 years of working together, the LVWCC and its member agencies have taken significant strides toward improving the Las Vegas Wash. Early efforts focused on reducing the channelization of the Wash, reducing erosion and increasing the number of wetlands. Accomplishments to date include:

- Completed construction of 21 identified erosion control structures or weirs.
- Stabilized more than 13 miles of the Wash's banks

Mature Vegetation Along the Wash

Dace on the Rise

The Moapa dace is endemic to the Muddy River.

The Moapa dace only occurs in the warm springs, tributaries and upper main stem of the Muddy River, and was listed as an endangered species in 1967. The USFWS recovery plan for the Moapa dace set a goal to delist the fish when the adult population reaches 6,000 in five spring systems for five consecutive years.[6]

The SNWA has worked with its partners to implement a number of activities to benefit the Moapa dace, including installation of non-native fish barriers, eradication of invasive fish species, restoring natural stream flow dynamics and riparian vegetation, and improving connectivity between springs and streams. These actions have helped the overall Moapa dace population to increase substantially. The population increased from a low of 459 individuals in 2008 to more than 1,500 in 2018.

- Removed more than 550 acres of non-native tamarisk
- Revegetated more than 500 acres with native plants
- Removed more than 500,000 pounds of trash from adjacent areas
- Organized more than 15,000 volunteers
- Completed extensive wildlife and water quality monitoring programs
- Built or improved more than two miles of trails
- Implemented an invasive species management program

Today, the Wash carries about 200 million gallons of water a day to Lake Mead. The efforts to stabilize the Wash have resulted in a greater than 60 percent reduction in the amount of total suspended solids in the water, and the removal of the Wash from Nevada Division of Environmental Protection's list of impaired waters.

NORTHERN NEVADA GROUNDWATER RESOURCES

As described in Chapter 3, In-State Groundwater is a future resource in SNWA's water resource portfolio. The SNWA is working to complete the environmental compliance and permitting that will allow these resources to be developed and conveyed to Southern Nevada when they are needed.

In 2006 and 2008, SNWA and U.S. Department of the Interior agencies, including the Bureau of Indian Affairs, Bureau of Land Management (BLM), USFWS and the National Park Service, entered into stipulations for withdrawal of protests for water right applications in Spring, Delamar, Dry Lake and Cave valleys.

Technical teams representing the agencies developed biological and hydrological monitoring plans pursuant to the obligations of the stipulated agreements. Hydrologic monitoring is ongoing, in accordance with the Hydrologic Monitoring and Mitigation Plan for Spring Valley[7] and the Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake and Cave valleys.[8]

Two years of baseline biologic monitoring were conducted in 2009 and 2010.[9] in accordance with the Biological Monitoring Plan for Spring Valley with ongoing biological monitoring focusing on specific species and small studies to further understand the ecosystems and biota.

Groundwater Development Project

After completion of an Environmental Impact Statement[10] and Record of Decision[11] the BLM issued a right-of-way to SNWA for the Clark, Lincoln and White Pine Counties Groundwater Development Project in 2013.

The right-of-way grant is for the first phase of the Groundwater Development Project; additional tiered NEPA compliance and rights-of-way will be necessary when specific well sites and collector pipeline routes are identified.

Great Basin Ranch

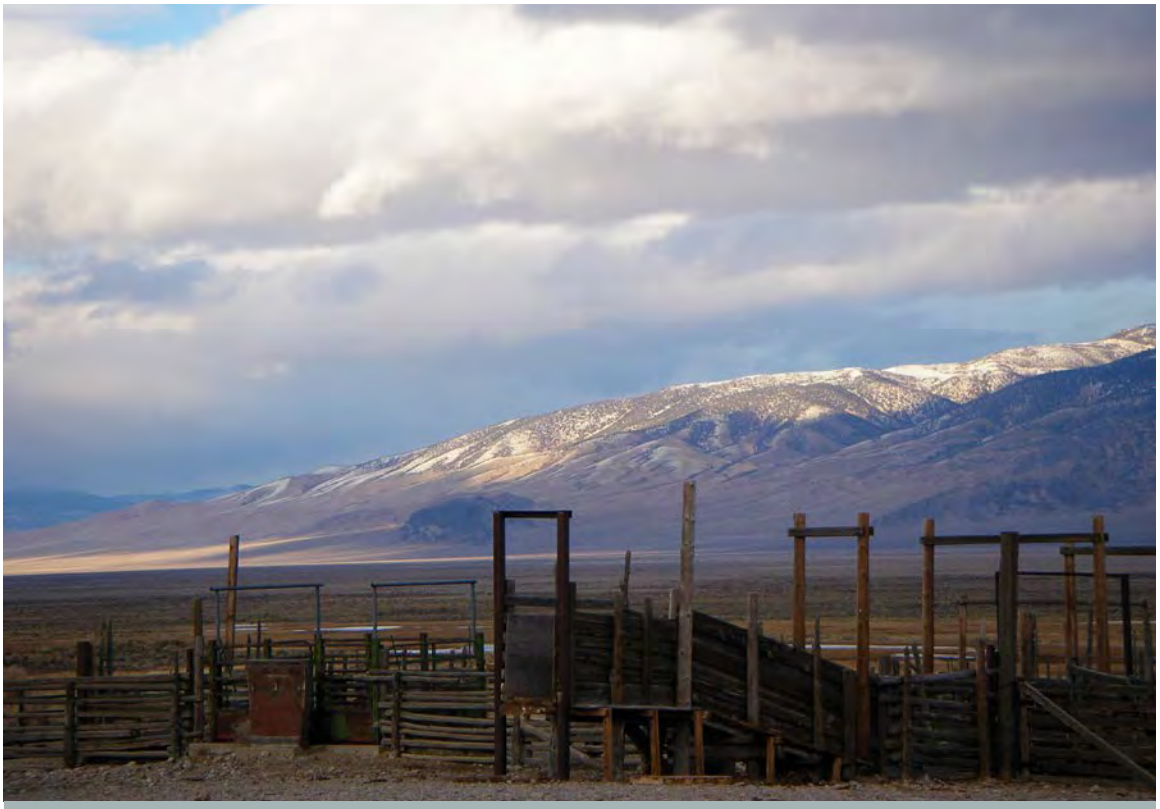
Beginning in 2006, SNWA began acquiring ranch properties in Spring Valley from landowners who approached SNWA desiring to sell their properties. Since then, the SNWA has continued to operate the properties, collectively named the Great Basin Ranch, to ensure water rights associated with the properties are maintained in good standing through beneficial use and to ensure land resources remain productive. The land and water rights associated with Great Basin Ranch provide SNWA with an opportunity to integrate adaptive management with environmental mitigation during future development activities.

The seven properties acquired by the SNWA include the El Tejon, Robison, Huntsman, Harbecke, Wahoo, Phillips and Bransford ranches. As part of its ranch purchases, the SNWA has:[12]

- More than 23,000 acres of private land
- More than 56,000 AFY of surface water rights
- More than 11,000 acre-feet of groundwater rights
- On average, 8,900 head of livestock (depending upon time of year and season)

The SNWA also holds roughly 900,000 acres in grazing allotment permits from the BLM and the U.S. Forest Service. There are a total of 15 grazing allotments that span Spring, Dry Lake, Cave, Lake, Tippett, Hamlin, Pahroc, Steptoe and Patterson valleys. SNWA-owned cattle and sheep graze these allotments under a program designed to maintain rangeland health standards.

The Great Basin Ranch provides opportunities for SNWA to better understand and manage hydrologic and biological resources of Spring Valley while continuing the historic agricultural and livestock operations. The SNWA accomplishes this by employing best management practices, such



Great Basin Ranch

as adaptive grazing, water- and energy-efficient agricultural technologies, GPS tracking of livestock and invasive weed-control treatments. Technical staff and contractors perform range monitoring and rangeland-condition analyses, among a variety of monitoring and reporting programs. Through these management efforts, the SNWA is creating a sustainable ranch operation.

SUSTAINABILITY

Sustainability transcends resource boundaries, but it is inseparably linked to the conservation of vital resources such as water and energy. This concept forms the framework for SNWA's sustainability initiatives, which focus on four main areas:

- Water
- Energy
- Environment
- Personal responsibility

As a water provider and educator in one of the region's driest communities, living a conservation ethic is an essential part the organization's work practices. The SNWA strives to provide sufficient water to the community while promoting conservation, utilizing reliable, renewable water resources and maintaining water quality with minimal impact on the environment.

The SNWA has undertaken a broad range of initiatives to help ensure conservation and preservation of water resources. The SNWA's Water Smart Landscape program has averted more than 463,000 metric tons of carbon dioxide discharge (more than 1 billion pounds). On an annual basis, program participants reduce our carbon dioxide footprint by more than 40,000 metric tons. SNWA's chemical reduction program has increased non-chemical water treatment methods and reduced our carbon footprint by 309 metric tons of carbon equivalent.

As the state's largest energy user, the SNWA strives to reduce energy consumption and reduce environmental pollution through efficient energy use and incorporating use of renewable resources such as solar energy and hydropower. The SNWA has voluntarily committed to meeting 25 percent of its energy needs through renewable resources by 2025, which parallels Nevada's Renewable Energy Portfolio Standards. The SNWA's current energy portfolio consists of approximately 18 percent derived from renewable resources.

The SNWA's solar and small hydropower facilities generate more than 44 million kilowatt hours of clean energy, enough to power nearly 3,500 average Southern Nevada homes annually. The SNWA's fleet is nearing its goal of becoming 100 percent alternative fueled, replacing standard-fueled vehicles with alternative-fueled models when appropriate.

The SNWA continues to identify ways to minimize the environmental impacts of operations and create a greener way of working. Reducing, reusing and recycling are key components of waste reduction efforts. SNWA facilities are designed to be environmentally conscious, including certification under U.S. Leadership in Energy and Environmental Design green building program.

CHAPTER SUMMARY

The SNWA adheres to strict environmental laws and regulations that govern its use and development of resources and facilities. In addition, the SNWA proactively integrates environmental stewardship into facility operations and resource management. To support its long-term water resource planning and development efforts, the SNWA will:

- Continue its environmental planning, monitoring and mitigation efforts to minimize its footprint and protect community water supplies;
- Participate in environmental programs to enhance regulatory certainty for the flexible and adaptive use of resources;
- Work with partners to conserve habitat and work towards the recovery of threatened and endangered species, as well as reducing the likelihood of additional species listings; and
- Meet the community's current and long-term water resource needs while promoting conservation, utilizing reliable, renewable water resources and maintaining water quality with minimal impact on the environment.

ENDNOTES

1 Lower Colorado River Multi-Species Conservation Program, 2004. Lower Colorado River Multi-Species Conservation Program, Volume II: Habitat Conservation Plan. December 17, 2004.

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

3 SNWA, 2011. "Warm Springs Natural Area Stewardship Plan," June 2011, SNWA.

4 Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada, September, 2000, Clark County Department of Comprehensive Planning and U.S. Fish and Wildlife Service.

5 "Las Vegas Wash Comprehensive Adaptive Management Plan," December 1999, Las Vegas Wash Coordination Committee.

6 "Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem," May 16, 1996, U.S. Fish and Wildlife Service Region 1, Portland, Oregon.

7 "Hydrologic Monitoring and Mitigation Plan for Spring Valley (Hydrographic Area 184)," 2011 SNWA (Doc. No. WRD-ED-0012).

8 "Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys," 2011, SNWA (Doc. No. WRD-ED-0011).

9 Biological Monitoring Plan for the Spring Valley Stipulation, 2011 Biological Working Group.

10 Biological Monitoring Plan for Delamar, Dry Lake, and Cave Valley Stipulation, January, 2011, Biological Resource Team.

11 "Clark, Lincoln, and White Pine Counties Groundwater Development Project Record of Decision," 2012, U.S. Bureau of Land Management.

12 Supplemental rights are included in groundwater and surface water totals. These rights are subordinate to primary, stand alone rights and have restrictions on use that primary rights do not.

Water Smart Landscape

SNWA WATER BUDGET

THIS SECTION SUMMARIZES THE DISTRIBUTION OF AVAILABLE RESOURCES AND FORECASTED DEMANDS BY SNWA MEMBER AGENCY OVER THE SHORT-TERM PLANNING HORIZON.

INTRODUCTION

This Water Budget was prepared with technical input from SNWA's member agencies. The Water Budget differs from the Water Resource Plan (Chapters 1-5) by presenting a more detailed accounting of water resources available to individual SNWA member agencies over the short-term (4-year) planning horizon. It also includes a forecast of water demands by SNWA purveyor member for each of their respective service areas.

Collectively, SNWA's member agencies provide potable water, wastewater treatment service and reuse water to nearly 2.2 million residents in Southern Nevada. As detailed below, "Purveyor Members" (*) are responsible for delivering potable water supplies and "Wastewater Purveyors" (†) are responsible for treating wastewater for direct and/or indirect water reuse:

- Big Bend Water District (BBWD)*
- City of Boulder City (BC)*†
- City of Henderson (COH)*†
- City of Las Vegas (LV)†
- City of North Las Vegas (NLV)*†
- Clark County Water Reclamation District (CCWRD)†
- Las Vegas Valley Water District (LVVWD)*

The Water Budget includes eight primary tables and four supplementary tables that detail various aspects of water supply and demand, providing both historical (actual) water demand, water resources and facility use data, as well as short-term forecasts.

WATER BUDGET TABLES

Table 1: Provides a summary of actual and forecasted water use by each SNWA member agency. Water use includes delivery of potable water supplies (groundwater, Colorado River and recovery of artificial recharge), as well as non-potable supplies (direct reuse). The total water delivery forecast for all SNWA member agencies ranges between approximately 515,000 and 547,000 AFY over the short-term planning horizon. This falls within the projected upper and lower demand range as described in Chapter 4.

Table 2: Provides a summary of resources available to SNWA member agencies under normal Colorado River operating conditions and is based on various agreements and/or permits. Total resources include approximately 536,000 AFY of potable and non-potable supplies. Short-term resources (such as unused Nevada Colorado River water, banked water and intentionally created surpluses) are identified in Table 2, but these resources are not allocated by SNWA member agency.

Table 3: Provides a summary of actual and forecast facility usage by SNWA member agency for diversion of Colorado River water and groundwater production by facility. For the short-term planning horizon, the total forecasted Colorado River facility uses for all SNWA purveyor diversions range from approximately 459,000 to 490,000 AFY; total forecasted groundwater facility uses is approximately 46,000 AFY for the same timeframe.

Table 4: Provides a summary of actual and forecast facility usage by facility, by SNWA member agency as well as by other Colorado River and groundwater users. Facilities include Colorado River facilities—BBWD system, SNWS, BWC system and U.S. Bureau of Reclamation (USBR) raw water system—and groundwater facilities (groundwater recovery and artificial recharge wells). For the short-term planning horizon, total forecasted Colorado River diversions range between approximately 465,000 and 496,000 AFY. The short-term forecast for groundwater and artificial recharge recovery facilities is approximately 75,000 AFY. This includes use by LVVWD, NLV, Nellis

AFB and private/permitted wells across the Las Vegas Valley groundwater basin.

Table 5: Provides a summary of actual and forecasted potable water use by SNWA water purveyor, including Colorado River water, groundwater and artificial recharge, as provided under various water supply agreements and/or permits. The total forecasted potable water usage for all SNWA purveyors ranges from approximately 500,000 to 531,000 AFY over the short-term planning horizon. As needed, short-term resources identified in Table 2 will be used to meet demands through 2021.

Table 6: Provides a summary of actual and forecasted wastewater supplies, as well as reuse of highly-treated wastewater effluent. Various types of use include direct reuse, disposal to groundwater and returns to surface water. The vast majority of reuse in Southern Nevada occurs through indirect reuse, where highly treated effluent is returned to the Colorado River for return-flow credits. This expands the availability and use of SNWA's Colorado River supplies. The forecasted return to surface water during the short-term planning horizon ranges from approximately 197,000 to 211,000 AFY. Surface water returns are different than return-flow credits which are discussed in Table 8.

Table 7: Provides a summary of actual and forecasted reuse amounts by SNWA member agency over the short-term planning horizon. This table identifies reuse limits or "thresholds" established under the SNWA Cooperative Agreement and describes how they are managed.

Table 8: Provides a summary of actual and forecasted Colorado River diversions by SNWA purveyor member and other Nevada contract holders, as well as the actual and forecasted amount of return-flow credits. These forecasts are used to show the projected consumptive use of Colorado River resources over the short-term planning horizon. With no artificial recharge the forecasted consumptive use of Colorado River supplies during the short-term planning horizon ranges from approximately 242,000 to 258,000 AFY.

Supplementary Tables A-D: These tables provide detailed calculations used to project return-flow credits and system loss.

CHAPTER SUMMARY

The 2018 Water Budget projects consumptive use of Nevada's Colorado River allocation to range between approximately 242,000 and 258,000 AFY during the short-term planning horizon (2018-2021). SNWA plans to store the balance of available resources for future use as temporary resources (see Chapter 4) and/or leave a portion of this available resource in Lake Mead to help bolster Lake Mead water levels from continued declines associated with ongoing drought:

- 2018 plans include storing up to 13,500 AF of Nevada's unused Colorado River apportionment in the Arizona Water Bank.
- The balance of Nevada's unused apportionment will remain in Lake Mead, helping to reduce the magnitude of lake level declines.
- For 2018-2021, SNWA plans to store approximately 32,000 AFY in Lake Mead through the creation of Tributary Conservation ICS.

The actual amount of water stored from year to year may change depending upon the water use and resource availability. While a shortage declaration may affect the availability of Colorado River water for storage and future recovery, it is not expected to impact SNWA's ability to meet near-term forecasted demands.

Even with an imposed shortage, forecasted Colorado River water use through 2021 is well below the largest shortage reduction that could be imposed under the existing guidelines (staged consumptive use reductions range from 13,000 to 20,000 AFY). As detailed in the 2018 Plan, SNWA has sufficient resources to meet the region's short- and long-term water resource needs under a wide range of supply and demand conditions, including shortage. If needed, SNWA will use temporary or banked resources to meet customer demands or for operational flexibility

SNWA member agencies are expected to continue the utilization of reuse supplies for direct, non-potable applications. The estimated amount of direct reuse ranges from approximately 14,900 to 16,300 AFY during the short-term planning horizon. The 1991 SNWA Cooperative Agreement allows for up to 21,800 AFY of direct reuse.

Las Vegas Valley and Lake Mead

Table 1: Customer Water Use, AFY (a)

POTABLE CUSTOMER USE	2016	2017	2018	2019	2020	2021
Groundwater (b)						
LVVWD	40,756	40,859	40,760	40,760	40,760	40,760
NLV	1,835	2,246	5,235	5,250	5,250	5,250
Total	**42,591**	**43,105**	**45,995**	**46,010**	**46,010**	**46,010**
Colorado River						
Deliveries						
BBWD	3,884	4,043	4,008	4,250	4,425	4,478
BC (c)	10,650	10,527	10,696	10,736	10,736	10,744
COH (c)	79,045	84,556	86,210	86,790	88,731	90,594
LVVWD	292,584	302,453	301,278	308,333	314,932	319,877
NLV	50,602	52,256	51,706	54,047	56,953	59,251
Total	436,765	453,835	453,898	464,156	475,777	484,944
AR Recovery						
BBWD	0	0	0	0	0	0
BC	0	0	0	0	0	0
COH	0	0	0	0	0	0
LVVWD	0	0	0	0	0	0
NLV	0	0	0	0	0	0
Total	0	0	0	0	0	0
Colorado River Use (Deliveries + AR Recovery)						
BBWD	3,884	4,043	4,008	4,250	4,425	4,478
BC (c)	10,650	10,527	10,696	10,736	10,736	10,744
COH (c)	79,045	84,556	86,210	86,790	88,731	90,594
LVVWD	292,584	302,453	301,278	308,333	314,932	319,877
NLV	50,602	52,256	51,706	54,047	56,953	59,251
Total	**436,765**	**453,835**	**453,898**	**464,156**	**475,777**	**484,944**
Total Potable Customer Use (All Sources)						
BBWD	3,884	4,043	4,008	4,250	4,425	4,478
BC (c)	10,650	10,527	10,696	10,736	10,736	10,744
COH (c)	79,045	84,556	86,210	86,790	88,731	90,594
LVVWD	333,340	343,312	342,038	349,093	355,692	360,637
NLV	52,437	54,502	56,941	59,297	62,203	64,501
Total Potable Customer Use	**479,356**	**496,940**	**499,893**	**510,166**	**521,787**	**530,954**
NON-POTABLE CUSTOMER USE						
Direct Reuse						
BC	680	278	736	552	559	559
CCWRD - LVV (d)	3,984	3,363	3,000	3,000	3,000	3,000
CCWRD - Laughlin	0	0	0	0	0	0
COH	7,638	7,041	7,000	7,000	7,000	7,000
LV (d)	4,392	4,235	4,200	4,200	4,200	4,200
NLV	0	0	0	1,500	1,500	1,500
Total Non-Potable Customer Use	**16,694**	**14,917**	**14,936**	**16,252**	**16,259**	**16,259**
TOTAL CUSTOMER USE (ALL SOURCES)						
BBWD	3,884	4,043	4,008	4,250	4,425	4,478
BC (c)	11,330	10,805	11,432	11,288	11,295	11,303
CCWRD: LVV (d)	3,984	3,363	3,000	3,000	3,000	3,000
CCWRD: Laughlin	0	0	0	0	0	0
COH (c)	86,683	91,597	93,210	93,790	95,731	97,594
LV (d)	4,392	4,235	4,200	4,200	4,200	4,200
LVVWD	333,340	343,312	342,038	349,093	355,692	360,637
NLV	52,437	54,502	56,941	60,797	63,703	66,001
Total	**496,050**	**511,857**	**514,829**	**526,418**	**538,046**	**547,213**

NOTES

(a) Source (2016-2021): SNWA member agencies (Customer).

(b) Groundwater production includes applicable in-lieu recovery.

(c) A portion of water usage is met with raw water.

(d) CCWRD and LV provide sewer service to their respective service areas; both are located in the LVVWD service area.

Table 2: Available Resources, AFY

	SNWS Delivery Contract (a)	SNWA Delivery Contract (b)	SNWA Delivery Contract (c)	Other Delivery Contracts (d)	Total Colorado River Water	Ground-water	Total Potable Resource	Total Non-Potable Resource (e)	Total Long-Term Resource (f)	Total Short-Term Resource
BBWD	0	5,352	0.0	10,000	15,352.0	0	15,352.0	0	15,352.0	
BC	8,918	3,948	0.0	5,876	18,742.0	0	18,742.0	0	18,742.0	
CCWRD (h) (i)	0	0	0.0	0	0.0	0	0.0	11,100	11,100.0	
COH	27,021	19,858	2,137.5	15,878	64,894.5	0	64,894.5	7,500	72,394.5	
LV (h)	0	0	0.0	0	0.0	0	0.0	2,000	2,000.0	
LVVWD	232,426	78,799	362.5	15,407	326,994.5	40,760	367,754.5	0	367,754.5	
NLV	26,635	15,043	0.0	0	41,678.0	6,201	47,879.0	1,200	49,079.0	
Total	**295,000**	**123,000**	**2,500**	**47,161**	**467,661**	**46,961**	**514,622**	**21,800**	**536,422**	(g)

NOTES

(a) Contract 7-07-03-W0004 between SNWA and the Department of the Interior ("Federal SNWS Water Delivery Contract" or "SNWS Delivery Contract"). Quantities for individual purveyors are outlined in Section 8(b) of the SNWA Cooperative Agreement.

(b) In Contract 2-07-30-W0266 between SNWA and the Department of the Interior ("SNWA Water Delivery Contract"), Sections 4(a)(1) and (2) give SNWA the right to use any remaining, uncontracted Nevada apportionment and water available because of reduction, expiration or termination of individual entitlements within Nevada. Section 8(c) of the SNWA Cooperative Agreement (amended January 1, 1996) apportions among the purveyors 123,000 AFY of Colorado River water made available to SNWA under Sections 4(a)(1) and (2).

(c) Allocated 2,500 AFY pursuant to Section 8(d) of the SNWA Cooperative Agreement and the November 17, 1994 Water Supply Agreement.

(d) Other delivery contracts: 2-07-30-W0269 (BBWD), 14-06-300-978 (BC), 0-07-30-W0246 (COH) and 14-06-300-2130 (LVVWD).

(e) Maximum 21,800 AFY reuse per SNWA Cooperative Agreement; safeguards return-flows to the Colorado River for return-flow credit. If reuse is greater than quantities outlined in the agreement and if the excess reuse results in a reduction of return-flow credits (which in turn reduces other purveyors' Colorado River water supplies), then the excess reuse quantity is reduced from the potable purveyor in whose service area the reuse provider resides.

(f) Expected to be available in perpetuity.

(g) Short-term resource includes: unused Colorado River apportionments, Intentionally Created Surplus stored in Lake Mead and banked water. It may include flood control and domestic surpluses of Colorado River water made available to Nevada on a year-by-year basis by the Secretary of the Interior. Short-term resources have not been allocated by SNWA member agency. As shown in Table 8, Nevada Colorado River consumptive use is sufficient to meet demands through 2021. Tables 5 and 7 provide additional details on forecasted use of potable and non-potabe water resources by SNWA member agency. When needed, water supplies will be allocated to the SNWA member agencies pursuant to 8(g) of the 1995 Amended Cooperative Agreement.

(h) CCWRD-LVV and LV sewer service areas are within the LVVWD water service area. If reuse demands for CCWRD-LVV or LV are greater than the reuse in the SNWA Cooperative Agreement and if they reduce return-flow credits (which in turn reduces other purveyors' Colorado River water supplies), then the excess reuse quantity is subtracted from LVVWD's potable water resource.

(i) Maximum reuse for CCWRD includes reuse for CCWRD in Laughlin and in the LVV.

Table 3: Customer Facility Use, AFY (a)

COLORADO RIVER FACILITY USE (b)	2016	2017	2018	2019	2020	2021
BBWD System	3,884	4,043	4,008	4,250	4,425	4,478
BC						
SNWS	10,650	10,527	10,696	10,736	10,736	10,744
USBR System (Raw Water)	0	0	0	0	0	0
Total	**10,650**	**10,527**	**10,696**	**10,736**	**10,736**	**10,744**
COH						
SNWS	66,057	71,167	75,664	73,790	75,731	77,594
BWC System						
Potable	10,763	9,805	7,672	10,000	10,000	10,000
Raw	2,225	3,584	2,874	3,000	3,000	3,000
Total	12,988	13,389	10,546	13,000	13,000	13,000
Total	**79,045**	**84,556**	**86,210**	**86,790**	**88,731**	**90,594**
LVVWD (SNWS)						
Customer Use (No AR Recovery)	292,584	302,453	301,278	308,333	314,932	319,877
AR						
Current Year Banking Operations (c)	0	0	0	0	0	0
Other (d)	0	0	0	0	0	0
Total AR	0	0	0	0	0	0
Total	**292,584**	**302,453**	**301,278**	**308,333**	**314,932**	**319,877**
NLV (SNWS)						
Customer Use (No AR Recovery)	50,602	52,256	51,706	54,047	56,953	59,251
AR	0	0	0	0	0	0
Total	**50,602**	**52,256**	**51,706**	**54,047**	**56,953**	**59,251**
Total Colorado River Customer Facility Use (b)	**436,765**	**453,835**	**453,898**	**464,156**	**475,777**	**484,944**
AR	0	0	0	0	0	0
Total	436,765	453,835	453,898	464,156	475,777	484,944
SNWS System Loss (e)	7,888	4,988	5,022	5,109	5,239	5,343
Total Colorado River Customer Facility Use	**444,653**	**458,823**	**458,920**	**469,265**	**481,016**	**490,287**
GROUNDWATER FACILITY USE (f)						
LVVWD						
Groundwater Production (g)	40,756	40,859	40,760	40,760	40,760	40,760
AR Pumpage (AR Recovery)						
Banking Operations	0	0	0	0	0	0
Recovery for Customers	0	0	0	0	0	0
Total AR Pumpage	0	0	0	0	0	0
Total	**40,756**	**40,859**	**40,760**	**40,760**	**40,760**	**40,760**
NLV						
Groundwater Production (g)	1,835	2,246	5,235	5,250	5,250	5,250
Total AR Pumpage	0	0	0	0	0	0
Total	1,835	2,246	5,235	5,250	5,250	5,250
Total Groundwater Customer Facility Use	**42,591**	**43,105**	**45,995**	**46,010**	**46,010**	**46,010**

NOTES

(a) Source (2016-2021): SNWA member agencies.

(b) Includes AR, but no AR recovery.

(c) Recharge recovered during current year for system management.

(d) Recharge for SNWA customers and Las Vegas Valley Groundwater Management Program.

(e) SNWS system loss, see Supplementary Table D.

(f) Includes AR recovery.

(g) Groundwater production includes applicable in-lieu recovery. LVVWD and NLV do not plan to recover in-lieu groundwater.

Table 4: Usage by Facility, AFY (a)

COLORADO RIVER FACILITIES USE (b)	2016	2017	2018	2019	2020	2021
BBWD System	3,884	4,043	4,008	4,250	4,425	4,478
BWC System						
COH	12,988	13,389	10,546	13,000	13,000	13,000
BWC Complex (b)	4,982	4,451	4,717	4,717	4,717	4,717
Total	17,970	17,840	15,263	17,717	17,717	17,717
BWC System Loss (c)	-576	-768	119	138	138	138
Total BWC	17,394	17,072	15,382	17,855	17,855	17,855
SNWS						
BC	10,650	10,527	10,696	10,736	10,736	10,744
COH	66,057	71,167	75,664	73,790	75,731	77,594
LVVWD	292,584	302,453	301,278	308,333	314,932	319,877
Nellis AFB (b)	1,269	1,159	1,214	1,214	1,214	1,214
NLV	50,602	52,256	51,706	54,047	56,953	59,251
Total	421,162	437,562	440,558	448,120	459,566	468,680
SNWS System Loss (c)	7,888	4,988	5,022	5,109	5,239	5,343
Total SNWS	429,050	442,550	445,580	453,229	464,805	474,023
USBR System (Raw Water)						
BC	0	0	0	0	0	0
Total Colorado River Diversions	**450,328**	**463,665**	**464,970**	**475,334**	**487,085**	**496,356**
GROUNDWATER FACILITIES USAGE (d)						
SNWA Customers						
Groundwater Production						
LVVWD	40,756	40,859	40,760	40,760	40,760	40,760
NLV	1,835	2,246	5,235	5,250	5,250	5,250
Total	42,591	43,105	45,995	46,010	46,010	46,010
AR Production (AR Recovery)						
LVVWD	0	0	0	0	0	0
NLV	0	0	0	0	0	0
Total	0	0	0	0	0	0
Total SNWA Customer Pumpage	**42,591**	**43,105**	**45,995**	**46,010**	**46,010**	**46,010**
Other LVV Production						
Nellis AFB (e)	473	522	498	498	498	498
Private/Permitted Wells (e)	28,218	28,801	28,510	28,510	28,510	28,510
Total	28,691	29,323	29,008	29,008	29,008	29,008
Total Groundwater Production	**71,282**	**72,428**	**75,003**	**75,018**	**75,018**	**75,018**
Total Groundwater Production/AR Recovery	**71,282**	**72,428**	**75,003**	**75,018**	**75,018**	**75,018**

NOTES

(a) Source (2016-2021): SNWA member agencies.

(b) Source (2016-2017): Colorado River Commission. Source (2018+): Average 2016-2017.

(c) SNWS and BWC system loss, see Supplementary D.

(d) Total production includes direct customer usage and AR/in-lieu recovery.

(e) Source (2016-2017): Nevada Division of Water Resources. Source (2018+): Average 2016-2017.

Table 5: SNWA Customer Use by Source
(Potable Includes Artificial Recharge), AFY

USE BY SOURCE - POTABLE	2016	2017	2018	2019	2020	2021	Available
BBWD							
Groundwater Rights	0	0	0	0	0	0	0
Federal Delivery Contract (a)	0	0	0	0	0	0	0
SNWA Delivery Contract (b)	0	0	0	0	0	0	5,352
Other Contracts (c)	3,884	4,043	4,008	4,250	4,425	4,478	10,000
Short-Term Resource	0	0	0	0	0	0	(d)
Total	3,884	4,043	4,008	4,250	4,425	4,478	
BC							
Groundwater Rights	0	0	0	0	0	0	0
Federal Delivery Contract (a)	4,774	4,651	4,820	4,860	4,860	4,868	8,918
SNWA Delivery Contract (b)	0	0	0	0	0	0	3,948
Other Contracts (c)	5,876	5,876	5,876	5,876	5,876	5,876	5,876
Short-Term Resource	0	0	0	0	0	0	(d)
Total	10,650	10,527	10,696	10,736	10,736	10,744	
COH							
Groundwater Rights	0	0	0	0	0	0	0
Federal Delivery Contract (a)	27,021	27,021	27,021	27,021	27,021	27,021	27,021
SNWA Delivery Contract (b)	19,858	19,858	19,858	19,858	19,858	19,858	19,858
SNWA Delivery Contract (e)	2,138	2,138	2,138	2,138	2,138	2,138	2,137.5
Other Contracts (c)	15,878	15,878	15,878	15,878	15,878	15,878	15,878
Short-Term Resource	14,151	19,662	21,316	21,896	23,837	25,700	(d)
Total	79,045	84,556	86,210	86,790	88,731	90,594	
LVVWD (f)							
Groundwater Rights	40,756	40,760	40,760	40,760	40,760	40,760	40,760
Federal Delivery Contract (a)	232,426	232,426	232,426	232,426	232,426	232,426	232,426
SNWA Delivery Contract (b)	44,751	54,620	53,445	60,500	67,099	72,044	78,799
SNWA Delivery Contract (e)	0	0	0	0	0	0	362.5
Other Contracts (c)	15,407	15,407	15,407	15,407	15,407	15,407	15,407
Short-Term Resource	0	99	0	0	0	0	(d)
Total	333,340	343,312	342,038	349,093	355,692	360,637	
NLV (f)							
Groundwater Rights	1,835	2,246	5,235	5,250	5,250	5,250	6,201
Federal Delivery Contract (a)	26,635	26,635	26,635	26,635	26,635	26,635	26,635
SNWA Delivery Contract (b)	15,043	15,043	15,043	15,043	15,043	15,043	15,043
Other Contracts (c)	0	0	0	0	0	0	0
Short-Term Resource	8,924	10,578	10,028	12,369	15,275	17,573	(d)
Total	52,437	54,502	56,941	59,297	62,203	64,501	
TOTAL USE BY SOURCE - POTABLE							
Groundwater Rights	42,591	43,006	45,995	46,010	46,010	46,010	46,961
Colorado River Water (Includes AR)							
Federal Delivery Contract (a)	290,856	290,733	290,902	290,942	290,942	290,950	295,000
SNWA Delivery Contract (b)	79,652	89,521	88,346	95,401	102,000	106,945	123,000
SNWA Delivery Contract (e)	2,138	2,138	2,138	2,138	2,138	2,138	2,500
Other Contracts (c)	41,045	41,204	41,169	41,411	41,586	41,639	47,161
Short-Term Resource	23,075	30,339	31,344	34,265	39,112	43,273	(d)
Total	436,765	453,934	453,898	464,156	475,777	484,944	
Total Potable Use	**479,356**	**496,940**	**499,893**	**510,166**	**521,787**	**530,954**	

NOTES

(a) Section 8(b) water in the SNWA Cooperative Agreement (295,000 AFY).

(b) Section 8(c) water in the SNWA Cooperative Agreement. This estimate corresponds with Table 2.

(c) Other contracts as described in Table 2.

(d) Includes Section 8(b) or 8(c) water that is unused by another individual SNWA purveyor and "short-term resource" described in Table 2.

(e) Section 8(d) water in the SNWA Cooperative Agreement.

Table 6: Wastewater and Uses of Wastewater, AFY (a)

WASTEWATER EFFLUENT	2016	2017	2018	2019	2020	2021
LVV						
BWC Discharge (b)	4,429	3,444	3,937	3,937	3,937	3,937
LV (c)	50,046	49,364	50,391	51,279	52,184	53,106
CCWRD - LVV	104,772	108,150	110,700	113,400	116,200	119,100
COH	24,674	24,715	25,629	26,189	26,721	27,226
NLV	19,207	19,769	20,164	22,068	22,479	22,898
Total	203,128	205,442	210,821	216,873	221,521	226,267
BC	1,213	1,162	1,104	1,113	1,122	1,122
CCWRD - Laughlin	2,097	2,035	2,260	2,320	2,370	2,430
Total Wastewater Effluent	**206,438**	**208,639**	**214,185**	**220,306**	**225,013**	**229,819**
USES OF WASTEWATER EFFLUENT						
LVV						
Direct Reuse (Reclaimed Water)						
LV	4,392	4,235	4,200	4,200	4,200	4,200
CCWRD - LVV	3,984	3,363	3,000	3,000	3,000	3,000
COH	7,638	7,041	7,000	7,000	7,000	7,000
NLV	0	0	0	1,500	1,500	1,500
Total	16,014	14,639	14,200	15,700	15,700	15,700
Disposal to Groundwater						
LV	0	0	0	0	0	0
CCWRD - LVV	0	0	0	0	0	0
COH	1,673	1,779	1,500	1,500	1,500	1,500
NLV	0	0	0	0	0	0
Total	1,673	1,779	1,500	1,500	1,500	1,500
Returns to Surface Water						
BWC Discharge	4,429	3,444	3,937	3,937	3,937	3,937
LV (c)	45,654	45,129	46,191	47,079	47,984	48,906
CCWRD - LVV	100,788	104,787	107,700	110,400	113,200	116,100
COH	15,363	15,895	17,129	17,689	18,221	18,726
NLV	19,207	19,769	20,164	20,568	20,979	21,398
Total	185,441	189,024	195,121	199,673	204,321	209,067
BC						
Direct Reuse (Reclaimed Water)	680	278	736	552	559	559
Disposal to Groundwater	533	884	368	561	563	563
Returns to Surface Water	0	0	0	0	0	0
Total	1,213	1,162	1,104	1,113	1,122	1,122
CCWRD - Laughlin						
Direct Reuse (Reclaimed Water)	0	0	0	0	0	0
Disposal to Groundwater	0	0	0	0	0	0
Returns to Surface Water	2,097	2,035	2,260	2,320	2,370	2,430
Total	2,097	2,035	2,260	2,320	2,370	2,430
Total Direct Reuse (Reclaimed Water)	**16,694**	**14,917**	**14,936**	**16,252**	**16,259**	**16,259**
Total Disposal to Groundwater	**2,206**	**2,663**	**1,868**	**2,061**	**2,063**	**2,063**
Total Returns to Surface Water	**187,538**	**191,059**	**197,381**	**201,993**	**206,691**	**211,497**
WASTEWATER FOR REUSE (DIRECT AND INDIRECT)						
LVV						
BWC Discharge	4,429	3,444	3,937	3,937	3,937	3,937
LV (c)	50,046	49,364	50,391	51,279	52,184	53,106
CCWRD - LVV	104,772	108,150	110,700	113,400	116,200	119,100
COH	23,001	22,936	24,129	24,689	25,221	25,726
NLV	19,207	19,769	20,164	22,068	22,479	22,898
Total	**201,455**	**203,663**	**209,321**	**215,373**	**220,021**	**224,767**

NOTES

(a) Source (2016-2021): SNWA customers.

(b) Source (2016-2017): Colorado River Commission. Source (2018+): Average 2016-2017.

(c) Las Vegas flows exclude dewatering flows to Las Vegas Wash at the Water Pollution Control Facility.

Table 7: Wastewater Reuse and Reuse Threshold, AFY (a)

REUSE BY SNWA PURVEYOR (a)	2016	2017	2018	2019	2020	2021	Section 9 Threshold	
BC	---	---	---	---	---	---	(b)	
LV (c)	4,392	4,235	4,200	4,200	4,200	4,200	2,000	
CCWRD								
LVV (c)	3,984	3,363	3,000	3,000	3,000	3,000	10,550	(e)
Laughlin (d)	0	0	0	0	0	0	550	(e)
Total	3,984	3,363	3,000	3,000	3,000	3,000	11,100	
COH	7,638	7,041	7,000	7,000	7,000	7,000	7,500	
NLV	0	0	0	1,500	1,500	1,500	1,200	
REUSE GREATER THAN SECTION 9 THRESHOLD (f)								
BC	---	---	---	---	---	---	(b)	
LV	2,392	2,235	2,200	2,200	2,200	2,200		
CCWRD								
LVV	0	0	0	0	0	0		
Laughlin	0	0	0	0	0	0		
Total	0	0	0	0	0	0		
COH	138	0	0	0	0	0		
NLV	0	0	0	300	300	300		

If a purveyor reuses more than its reuse threshold, then its corresponding potable supply of 8(c) water (purveyor portion of 123,000 AFY) is reduced by an amount that will assure deliveries to other purveyors will not be less (g). Even though the reuse of some purveyors is projected to be greater than the quantified threshold, there is also projected to be potable water available such that all projected demands will be met. Therefore, no purveyor's potable supply has been reduced in the accompanying tables.

NOTES

(a) Source (2016-2021): SNWA member agencies.

(b) Not applicable to BC (Section 9c of SNWA Cooperative Agreement).

(c) LVVWD is the water provider in the LVVWD service area, and LV and CCWRD are the sewer services and reuse providers. If LV and CCWRD combined reuse is greater than its combined threshold, and the other purveyors' deliveries are less as a result, then LVVWD's Section 8(c) potable resource is reduced correspondingly.

(d) BBWD is the potable water provider in the Laughlin area, and CCWRD is the sewer services and reuse provider. If CCWRD reuse is greater than its threshold, and other purveyors' deliveries are less as a result, then BBWD's Section 8(c) potable resource is reduced correspondingly.

(e) There are no individual thresholds for CCWRD-LVV and CCWRD-Laughlin in the SNWA Cooperative Agreement. Thresholds in this table are used for planning purposes to determine whether the amount over the threshold comes out of LVVWD or BBWD.

(f) Source: Section 9 of the SNWA Cooperative Agreement.

(g) Source: Section 9(b) of the SNWA Cooperative Agreement states: "If in any year a Member uses or authorizes the use of Reuse Water in excess of the amount specified in sub article 9(a) [refers to the purveyor portions of 21,800 AFY], then the allocation made by or pursuant to sub article 8(c) [123,000] to the Purveyor Members that serves such Member shall be reduced by an amount that will assure that deliveries to the other Purveyor Members of water (i) allocated to such other Purveyor Members pursuant to this Agreement, or (ii) to which such other Purveyor Members have a right pursuant to separate contracts with the United States will not be less than they would have been in the absence of such excess use of Reuse Water." In other words, if excess reuse causes a reduction in return-flow credits, which in turn causes a reduction in other purveyor's Colorado River supplies, the excess reuse quantity is subtracted from the potable purveyors in whose service area the reuse provider resides.

(h) Policy Regarding Out-of-Valley Water Use (see Appendix 4), adopted by SNWA Board of Directors in May 2017. Sets forth guiding principles for the efficient and beneficial use of water resources outside the areas currently served by SNWA member agency wastewater systems.

Table 8: Nevada Colorado River Diversions, Return-Flow Credits and Consumptive Use, AFY (a)

COLORADO RIVER	2016	2017	2018	2019	2020	2021	Available Resource
SNWA Customer Use (a) (b)							
BBWD	3,884	4,043	4,008	4,250	4,425	4,478	
BC	10,650	10,527	10,696	10,736	10,736	10,744	
COH	79,045	84,556	86,210	86,790	88,731	90,594	
LVVWD	292,584	302,453	301,278	308,333	314,932	319,877	
NLV	50,602	52,256	51,706	54,047	56,953	59,251	
Total	436,765	453,835	453,898	464,156	475,777	484,944	
SNWA Net AR (a) (c) (d)							
LVVWD	0	0	0	0	0	0	
NLV	0	0	0	0	0	0	
Total	0	0	0	0	0	0	
SNWA Customer Colorado River Use							
BBWD	3,884	4,043	4,008	4,250	4,425	4,478	
BC	10,650	10,527	10,696	10,736	10,736	10,744	
COH	79,045	84,556	86,210	86,790	88,731	90,594	
LVVWD	292,584	302,453	301,278	308,333	314,932	319,877	
NLV	50,602	52,256	51,706	54,047	56,953	59,251	
Total Use	436,765	453,835	453,898	464,156	475,777	484,944	
Total System Loss (e)	7,312	4,220	5,141	5,247	5,377	5,481	
Total	**444,077**	**458,055**	**459,039**	**469,403**	**481,154**	**490,425**	
Other Colorado River Users (f) (g)							
BWC Complex	4,982	4,451	4,717	4,717	4,717	4,717	8,208
FMIR	4,998	4,643	4,821	4,821	4,821	4,821	12,534
Nellis AFB	1,269	1,159	1,214	1,214	1,214	1,214	4,000
LMNRA at Lake Mead	348	335	342	342	342	342	2,000
LMNRA at Lake Mohave	163	151	157	157	157	157	
Pabco	914	914	914	914	914	914	928
Secretarial Reservation	61	68	65	65	65	65	300
Nevada Division of Wildlife	622	495	559	559	559	559	(h)
Small Water Users	0	0	0	0	0	0	
Total	13,357	12,216	12,789	12,789	12,789	12,789	
Total Nevada Colorado River Diversions	**457,434**	**470,271**	**471,828**	**482,192**	**493,943**	**503,214**	
NEVADA RETURN-FLOW CREDITS							
LVV (f) (i)	214,727	222,768	225,011	230,118	235,403	240,655	
Laughlin (a) (f)	2,097	2,035	2,260	2,320	2,370	2,430	
Secretarial Reservation (f) (g)	22	25	24	24	24	24	
Nevada Division of Wildlife (f) (g)	613	486	550	550	550	550	
Unmeasured Returns (f) (g)	1,649	1,532	1,607	1,607	1,607	1,607	
Total	219,108	226,846	229,452	234,619	239,954	245,266	
NEVADA CONSUMPTIVE USE							
Consumptive Use with AR (j)	238,326	243,425	242,376	247,573	253,989	257,948	
Net AR (c)	0	0	0	0	0	0	
Consumptive Use with No AR (k)	238,326	243,425	242,376	247,573	253,989	257,948	

NOTES

(a) Source: SNWA member agencies, see Table 1 and Table 3.

(b) Includes AR recovery for Customers.

(c) AR less recovery, excludes in-lieu recharge.

(d) Includes recharge for carryover banking operations.

(e) Source (2018+): Supplementary Table D.

(f) Source (2016-2017): USBR.

(g) Source (2018+): Average 2016 to 2017.

(h) Available resource assumed as consumptive use of 25 AFY.

(i) Source (2018+): Supplementary Table A, line 18.

(j) Excludes interstate banking.

(k) May be subject to final USBR accounting.

Supplementary A: Return-Flow Credit (USBR Method) and Nevada Consumptive Use Adjusted for Intentionally Created Surplus and Interstate Banking

	TOTAL COLORADO RIVER DELIVERIES ABOVE HOOVER DAM	2016	2017	2018	2019	2020	2021
1.	Total Colorado River Water Diverted Above Hoover Dam	448,389	461,434	462,842	472,964	484,540	493,758
2.	Gauged Flow of Las Vegas Wash Below Lake Las Vegas	224,874	229,560	231,259	236,366	241,651	246,903
3.	Precipitation Runoff (Estimated)	11,147	7,792	7,248	7,248	7,248	7,248
4.	Imported Groundwater and Surface Water	0	0	0	0	0	0
5.	2% of Imported Groundwater and Surface Water	0	0	0	0	0	0
6.	Effluent Reaching Lake Mead From LVV M&I Groundwater Pumping	0	0	0	0	0	0
7.	Total Las Vegas Wash Adjusted Gauge Flow (2-3-5-6)	213,727	221,768	224,011	229,118	234,403	239,655
8.	Total Other NV Flow to Lake Mead Above Hoover Dam	635	511	574	574	574	574
9.	Colorado River Bypassing Gauge, Less Phreatophyte Use	1,000	1,000	1,000	1,000	1,000	1,000
10.	Total Flow to Colorado River Above Hoover Dam (7+8+9)	215,362	223,279	225,585	230,692	235,977	241,229
11.	Consumptive Use Above Hoover Dam (1-10)	233,027	238,155	237,257	242,272	248,563	252,529
	BELOW HOOVER DAM						
12.	Total Colorado River Water Diverted Below Hoover Dam	9,045	8,837	8,986	9,228	9,403	9,456
13.	Total Flow to Colorado River Below Hoover Dam	3,746	3,567	3,867	3,927	3,977	4,037
14.	Consumptive Use Below Hoover Dam (12-13)	5,299	5,270	5,119	5,301	5,426	5,419
	SUMMARY						
15.	Total NV Colorado River Diversions (1+12)	457,434	470,271	471,828	482,192	493,943	503,214
16.	Total NV Return-Flow Credit (10+13)	219,108	226,846	229,452	234,619	239,954	245,266
17.	Total NV Consumptive Use Before Interstate Banking (15-16) (b)	238,326	243,425	242,376	247,573	253,989	257,948
18.	Total LVV RFC (7+9)	214,727	222,768	225,011	230,118	235,403	240,655
	NEVADA CONSUMPTIVE USE WITH ICS, INTERSTATE BANKING						
19.	NV Basic Apportionment	300,000	300,000	300,000	300,000	300,000	300,000
20.	ICS Creation (b)	23,823	30,802	32,000	32,000	32,000	32,000
21.	Overrun Payback	0	0	0	0	0	0
22.	ICS Delivery	0	0	0	0	0	0
23.	Yearly ICS Volume Banked in Lake Mead	(23,823)	(30,802)	(32,000)	(32,000)	(32,000)	(32,000)
24.	Total Available NV Colorado River Water (19+20-21+22+23)	300,000	300,000	300,000	300,000	300,000	300,000
25.	Total NV Colorado River Consumptive Use (c)	238,326	243,425	242,376	247,573	253,989	257,948
26.	NV Unused Apportionment	61,674	56,575	57,624	52,427	46,011	42,052
27.	NV Unused Apportionment to Banking and/ or MOU (d) (f)	(61,674)	(56,575)	TBD	TBD	TBD	TBD
28.	NV Underrun/(Overrun) (26+27) (c)	0	0	TBD	TBD	TBD	TBD

NOTES

(a) If LVV M&I groundwater rights exceed 47,340 AFY, then lines 6 and 9 above will be recalculated based on the USBR method as referenced in December 5, 2007 letter.

(b) Total Tributary Conservation and Imported ICS after 5% deduction for system benefit. Excludes Pilot System Conservation Agreement volume of 7,688 AF in 2016.

(c) May be subject to final USBR accounting. Some differences may be due to revisions, differences among various data sources and rounding.

(d) May include banking in LVV and interstate banking in California and Arizona.

(e) Under the 2014 Memorandum of Understanding (MOU) for Pilot Drought Response and by the end of 2016, SNWA created in excess of 45,000 AF of Protection Volume by reducing its off-stream storage of Colorado River water.

(f) SNWA's plan for 2018 anticipates interstate banking up to 13,500 AF in Arizona.

Supplementary B: Projection of Accrual and Gauge Flows (Used in Return-Flow Credit Calculation), AFY

ESTIMATE ACCRUALS	2013	2014	2015	2016	2017
a. Measured Wash Flow at Gauge (a)	215,007	217,997	223,913	224,874	229,560
b. Effluent to Wash (b)	(180,582)	(182,559)	(183,468)	(185,441)	(189,024)
c. Stormwater (a)	(8,106)	(3,808)	(6,704)	(11,147)	(7,792)
Total (Accruals) (c)	26,319	31,630	33,741	28,286	32,744
Ratio of Accruals/LVV Customer Use					
a. Accruals	26,319	31,630	33,741	28,286	32,744
b. Total LVV Customer Use (b)					
1. LVV Customer Use (d)	481,620	493,932	493,651	499,764	517,303
2. LVV Total System Loss	4,529	4,353	5,865	7,312	4,220
3. Total	486,149	498,285	499,516	507,076	521,523
c. Accruals / Total LVV Use (%)	5.41%	6.35%	6.75%	5.58%	6.28%

PROJECTED FUTURE ACCRUALS	2018	2019	2020	2021
a. Total LVV Use (b)				
1. LVV Use (d)	520,128	530,119	541,565	550,671
2. LVV Total System Loss	5,141	5,247	5,377	5,481
3. Total	525,269	535,366	546,942	556,152
5.50% * Total LVV Use (e)	28,890	29,445	30,082	30,588

PROJECTED FUTURE GAUGE FLOWS	2018	2019	2020	2021
a. Effluent to Wash (b)	195,121	199,673	204,321	209,067
b. Stormwater (Median 2008 - 2017)	7,248	7,248	7,248	7,248
c. Accruals	28,890	29,445	30,082	30,588
d. Estimated Wash Flows at Gauge	231,259	236,366	241,651	246,903
Measured and Estimated Gauge Flows	231,259	236,366	241,651	246,903

NOTES

(a) Source (2013-2017): Year-End Return-Flow Credit Data (CRC).

(b) From Appendix 3.

(c) Accruals, calculations and projections correspond with LVV Return-Flow Credit methodology adopted December 5, 2007.

(d) Includes AR recovery.

(e) Median corresponds with the period 2008 to 2017 and is intended to represent the gauge at Las Vegas Wash below Lake Las Vegas, established June 28, 2002.

Supplementary C: Las Vegas Valley Water Usage and Wastewater Flows (Used in Return-Flow Credit Calculation), AFY

LVV CUSTOMER USE	2013	2014	2015	2016	2017	2018	2019	2020	2021	Resources Available
Colorado River Diversion (No AR / AR Recovery)(a)										
SNWA Purveyors										
COH	75,864	79,916	78,386	79,045	84,556	86,210	86,790	88,731	90,594	
LVVWD	279,917	282,638	286,677	292,584	302,453	301,278	308,333	314,932	319,877	
NLV	45,292	46,325	47,240	50,602	52,256	51,706	54,047	56,953	59,251	
Total	401,073	408,879	412,303	422,231	439,265	439,194	449,170	460,616	469,722	
Other LVV Users										
BWC Complex (b)	5,366	6,188	5,253	4,982	4,451	4,717	4,717	4,717	4,717	
Nellis AFB (b)	1,084	1,101	895	1,269	1,159	1,214	1,214	1,214	1,214	
Total	6,450	7,289	6,148	6,251	5,610	5,931	5,931	5,931	5,931	
Total System Loss	4,529	4,353	5,865	7,312	4,220	5,141	5,247	5,377	5,481	
Total	**412,052**	**420,521**	**424,316**	**435,794**	**449,095**	**450,266**	**460,348**	**471,924**	**481,134**	
AR / In-Lieu Recovery (c)										
SNWA Purveyors										
LVVWD	0	0	0	0	0	0	0	0	0	
NLV	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	
Groundwater Use										
SNWA Purveyors (a)										
LVVWD	44,199	44,550	40,523	40,756	40,859	40,760	40,760	40,760	40,760	40,760
NLV	4,459	4,793	5,283	1,835	2,246	5,235	5,250	5,250	5,250	6,201
Total	48,658	49,343	45,806	42,591	43,105	45,995	46,010	46,010	46,010	46,961
Other LVV Users										
Nellis AFB (b)	793	786	802	473	522	498	498	498	498	4,946
Private Wells (d)	24,646	27,635	28,592	28,218	28,801	28,510	28,510	28,510	28,510	
Total	25,439	28,421	29,394	28,691	29,323	29,008	29,008	29,008	29,008	
Total	**74,097**	**77,764**	**75,200**	**71,282**	**72,428**	**75,003**	**75,018**	**75,018**	**75,018**	
LVV Total Use (e)	486,149	498,285	499,516	507,076	521,523	525,269	535,366	546,942	556,152	
LVV Total Use (f)	**481,620**	**493,932**	**493,651**	**499,764**	**517,303**	**520,128**	**530,119**	**541,565**	**550,671**	
LVV WASTEWATER FLOW TO LAS VEGAS WASH										
Effluent	196,437	200,337	199,279	201,455	203,663	209,321	215,373	220,021	224,767	
Direct Reuse	15,855	17,778	15,811	16,014	14,639	14,200	15,700	15,700	15,700	
Effluent to Wash	180,582	182,559	183,468	185,441	189,024	195,121	199,673	204,321	209,067	

NOTES

(a) Source (2013 - 2017): Actual; Source (2018+): SNWA member agencies.

(b) Source (2013 - 2017): Actual; Source (2018+): Table 8.

(c) Includes recovery for banking operations and for purveyor members.

(d) Source (2013 - 2017): Nevada Division of Water Resources. Source (2018+): Table 4.

Supplementary D: Colorado River Usage (Customer + Artificial Recharge) by System and Estimates of SNWS System Loss, AFY

COLORADO RIVER DELIVERIES BY SYSTEM	2013	2014	2015	2016	2017	2018	2019	2020	2021
BBWD	4,134	4,078	3,854	3,884	4,043	4,008	4,250	4,425	4,478
BC									
SNWS	10,354	10,818	10,339	10,650	10,527	10,696	10,736	10,736	10,744
USBR System	-	-	-	-	-	-	-	-	-
Total	10,354	10,818	10,339	10,650	10,527	10,696	10,736	10,736	10,744
COH									
SNWS	60,234	64,979	65,242	66,057	71,167	75,664	73,790	75,731	77,594
BWC System	15,630	14,937	13,144	12,988	13,389	10,546	13,000	13,000	13,000
Total	75,864	79,916	78,386	79,045	84,556	86,210	86,790	88,731	90,594
LVVWD (SNWS)	279,917	282,638	286,677	292,584	302,453	301,278	308,333	314,932	319,877
NLV	45,292	46,325	47,240	50,602	52,256	51,706	54,047	56,953	59,251
Systems with Multiple Users									
BWC System:									
COH	15,630	14,937	13,144	12,988	13,389	10,546	13,000	13,000	13,000
BWC Complex	5,366	6,188	5,253	4,982	4,451	4,717	4,717	4,717	4,717
Total	20,996	21,125	18,397	17,970	17,840	15,263	17,717	17,717	17,717
SNWS (At Turnouts)									
BC	10,354	10,818	10,339	10,650	10,527	10,696	10,736	10,736	10,744
COH	60,234	64,979	65,242	66,057	71,167	75,664	73,790	75,731	77,594
LVVWD	279,917	282,638	286,677	292,584	302,453	301,278	308,333	314,932	319,877
Nellis AFB	1,084	1,101	895	1,269	1,159	1,214	1,214	1,214	1,214
NLV	45,292	46,325	47,240	50,602	52,256	51,706	54,047	56,953	59,251
Total	396,881	405,861	410,393	421,162	437,562	440,558	448,120	459,566	468,680
Estimate of BWC System Loss									
BWC Diversions at Intake (b)	21,146	21,302	18,651	17,394	17,072				
BWC Deliveries at Turnout	20,996	21,125	18,397	17,970	17,840				
Loss (Intake-Turnout) (c)	150	177	254	-576	-768				
Loss Percentage (%)	0.71%	0.84%	1.38%	(c)	(c)				
Median Reasonable Loss % (c)(d)					0.78%				
Replace Unreasonable Loss, Project:									
0.78% * BWC Diversion at Turnout (d)						119	138	138	138
Estimate of SNWS System Loss									
SNWS Diversions at Intake (e)	401,260	410,037	416,004	429,050	442,550				
SNWS Deliveries at Turnout	396,881	405,861	410,393	421,162	437,562				
Loss (Intake-Turnout) (c)	4,379	4,176	5,611	7,888	4,988				
Loss Percentage (%)	1.10%	1.03%	1.37%	1.87%	1.14%				
Median Reasonable Loss % (c)(d)					1.14%				
Replace Unreasonable Loss, Project:									
1.14% * SNWS Deliveries at Turnout (d)	4,379	4,176	5,611	7,888	4,988	5,022	5,109	5,239	5,343
Estimate of Total System Loss	**4,529**	**4,353**	**5,865**	**7,312**	**4,220**	**5,141**	**5,247**	**5,377**	**5,481**

NOTES

(a) Includes AR, but no AR recovery. AR is part of the Colorado River diversion. AR recovery is not.

(b) Source: "Colorado River Accounting and Water Use Report: Arizona, California, and Nevada," USBR.

(c) Loss figures are sometimes negative or very small due to meter imprecision and other factors.

(d) Median corresponds with the period of 2013-2017.

(e) Source: "Colorado River Water Diverted for Use in Southern Nevada, "Colorado River Commission.

APPENDIX 1

ACRONYM LIST

AMWG	Adaptive Management Work Group
AFB	Air Force Base (Nellis)
AFY	Acre-feet (of water) per year
AR	Artificial recharge
BC	City of Boulder City
BCPA	Boulder Canyon Project Act
BBWD	Big Bend Water District
BLM	U.S. Bureau of Land Management
BOR	U.S. Bureau of Reclamation
BWC	Basic Water Company (formerly Basic Management Inc.)
CBER	Center for Business and Economic Research
CCWRD	Clark County Water Reclamation District
COH	City of Henderson
DSS	Developed Shortage Supply
ESA	Endangered Species Act
FMIR	Fort Mojave Indian Reservation
GHG	Greenhouse gases
GPCD	Gallons (of water) per capita per day
ICS	Intentionally Created Surplus
IRPAC	Integrated Resource Planning Advisory Committee
LCRMSCP	Lower Colorado River Multi-Species Conservation Program
LM	Lake Mead
LMNRA	Lake Mead National Recreation Area
LV	City of Las Vegas
LVV	Las Vegas Valley
LVWCC	Las Vegas Wash Coordination Committee
LVVWD	Las Vegas Valley Water District
MGD	Million gallons (of water) per day
MSCP	Multiple Species Conservation Plan
MOU	Memorandum of Understanding
M&I	Municipal and industrial
NEPA	National Environmental Policy Act
NLV	North Las Vegas
SNWA	Southern Nevada Water Authority
SNWS	Southern Nevada Water System
USFWS	U.S. Fish and Wildlife Service
WUCA	Western Utility Climate Alliance

APPENDIX 2

CLARK COUNTY POPULATION FORECAST AND ASSUMPTIONS USED IN 2018 WATER RESOURCE PLAN DEMAND PROJECTIONS

Year	Lower Demand Population	Upper Demand Population
2018	2,296,000	2,316,000
2019	2,344,000	2,384,000
2020	2,389,000	2,450,000
2021	2,423,000	2,505,000
2022	2,452,000	2,554,000
2023	2,481,000	2,604,000
2024	2,507,000	2,651,000
2025	2,530,000	2,694,000
2026	2,550,000	2,735,000
2027	2,568,000	2,773,000
2028	2,585,000	2,809,000
2029	2,600,000	2,844,000
2030	2,615,000	2,878,000
2031	2,628,000	2,910,000
2032	2,640,000	2,941,000
2033	2,651,000	2,970,000
2034	2,662,000	2,999,000
2035	2,672,000	3,026,000
2036	2,682,000	3,054,000
2037	2,692,000	3,081,000
2038	2,701,000	3,106,000
2039	2,710,000	3,131,000
2040	2,719,000	3,156,000
2041	2,728,000	3,181,000
2042	2,737,000	3,205,000
2043	2,747,000	3,230,000
2044	2,756,000	3,254,000
2045	2,766,000	3,279,000

Continued on next page

Year	Lower Demand Population	Upper Demand Population
2046	2,776,000	3,303,000
2047	2,786,000	3,327,000
2048	2,796,000	3,350,000
2049	2,806,000	3,374,000
2050	2,816,000	3,396,000
2051	2,825,000	3,418,000
2052	2,835,000	3,440,000
2053	2,844,000	3,461,000
2054	2,854,000	3,482,000
2055	2,863,000	3,502,000
2056	2,871,000	3,520,000
2057	2,879,000	3,538,000
2058	2,886,000	3,554,000
2059	2,894,000	3,572,000
2060	2,900,000	3,586,000
2061	2,907,000	3,601,000
2062	2,915,000	3,617,000
2063	2,922,200	3,631,000
2064	2,930,000	3,646,000
2065	2,937,000	3,660,000
2066	2,944,000	3,673,000
2067	2,952,000	3,686,000
2068	2,959,000	3,699,000
2069	2,967,000	3,711,000

Endnotes:

1 "Population Forecasts: Long-Term Projections for Clark County, Nevada 2018–2060," May 2018, Center for Business and Economic Research at the University of Nevada, Las Vegas (projected through 2069)."

2 "Adjusted "Clark County Nevada Population Forecast 2018–2060," May 2018, Center for Business and Economic Research, University of Nevada, Las Vegas (projected through 2069 with a 15 percent increase by 2038 and a 25 percent increase by 2069)."

APPENDIX 3

Year	Lower Demand (116 GPCD Conservation goal)	Upper Demand (116 GPCD Conservation goal)	Upper Demand (Add'l Conservation Scenario)
2018	512,000	517,000	515,000
2020	531,000	544,000	538,000
2025	557,000	593,000	575,000
2030	570,000	627,000	596,000
2035	577,000	653,000	607,000
2040	580,000	674,000	625,000
2045	584,000	692,000	640,000
2050	587,000	708,000	654,000
2055	590,000	722,000	665,000
2060	598,000	739,000	681,000
2065	605,000	754,000	695,000
2069	611,000	765,000	705,000

APPENDIX 4

POLICY REGARDING OUT-OF-VALLEY WATER USE

Managing Southern Nevada's water resources responsibly is critical to the continued vitality of the region. The ongoing risk of supply reductions underscores the need for responsible and sustainable management of Southern Nevada Water Authority (SNWA) water resources. This policy is designed to maximize the productivity of all SNWA water resources. To provide for the long-term sustainable development of resources and reduce demand impacts to Colorado River resources, the SNWA Board of Directors agrees to support the following principles for the use of Colorado River water and other SNWA water resources outside areas that are currently served by SNWA members' wastewater systems.

- Adoption of service rules and development codes by SNWS Purveyor Members that rely on industry best practices to minimize consumptive use of water resources.

- Returning treated wastewater to Lake Mead to receive return-flow credits should be accomplished whenever feasible.

- If returning treated wastewater to Lake Mead is not feasible, Colorado River water and other SNWA water resources should be reused either through direct or indirect reuse to achieve full beneficial use of recycled water similar to existing practices within the Las Vegas Valley.

- Wastewater will be treated to levels sufficient to allow the water to be reused.

- Implementation of localized, beneficial direct reuse within the development area for industrial and commercial uses, and school and community parks where feasible should displace the need for SNWA water resources.

- Implementation of aquifer storage and recovery programs, where possible.

- If returning treated wastewater to Lake Mead is not feasible, Colorado River water and other SNWA water resources should be reused either through direct or indirect reuse to achieve full beneficial use of recycled water similar to existing practices within the Las Vegas Valley.

- Limitation on the use of evaporative coolers.

Introduced and passed on May 18, 2017.

RESOLUTION IN SUPPORT OF APPLICATION FOR WATERSMART: WATER AND ENERGY EFFICIENCY GRANT FUNDING TO THE UNITED STATES BUREAU OF RECLAMATION

WHEREAS, the U.S. Bureau of Reclamation's (Reclamation) WaterSMART: Water and Energy Efficiency Grants Program is soliciting proposals for and may provide financial assistance to irrigation districts, water districts and other organizations to implement projects that result in quantifiable and sustained water savings and support broader water reliability benefits; and

WHEREAS, the WaterSMART: Water and Energy Efficiency Grant Program specifically allows for project proposals that conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability in the western United States; and

WHEREAS, the Southern Nevada Water Authority (Authority) has adopted a Water Resource Plan and a Conservation Plan, which outline specific water conservation strategies; and

WHEREAS, the Authority will benefit significantly from financial assistance to support water conservation efforts in Southern Nevada.

NOW, THEREFORE, BE IT RESOLVED that the Southern Nevada Water Authority Board of Directors agrees, authorizes and verifies:

1. That, if awarded, the Authority's General Manager, John J. Entsminger, has the authority to enter into a grant or cooperative agreement on behalf of the Authority with Reclamation for WaterSMART: Water and Energy Efficiency Grant Program funding.

2. That the Authority's application requesting $300,000 to support the Authority's Water Smart Landscape Rebate Program has been reviewed and approved by appropriate Authority staff and the Board supports its submission to Reclamation's WaterSMART: Water and Energy Efficiency Grant Program.

3. That the application includes a funding plan that outlines the Authority's ability to provide a matching contribution of up to $3,000,000 and that, if awarded, the Authority has the financial capability to provide the matching contribution, as specified in the funding plan.

4. That, if awarded, the Authority will work with Reclamation to meet established deadlines for entering into a grant or cooperative agreement.

Introduced and passed this 21st day of March, 2019.

Attest:

John J. Entsminger, Secretary

Southern Nevada Water Authority

Marilyn Kirkpatrick, Chair

Approved as to form:

Gregory J. Walch, General Counsel

RESOLUTION IN SUPPORT OF APPLICATION FOR WATERSMART: WATER AND ENERGY EFFICIENCY GRANT FUNDING TO THE UNITED STATES BUREAU OF RECLAMATION

WHEREAS, the U.S. Bureau of Reclamation's (Reclamation) WaterSMART: Water and Energy Efficiency Grants Program is soliciting proposals for and may provide financial assistance to irrigation districts, water districts and other organizations to implement projects that result in quantifiable and sustained water savings and support broader water reliability benefits; and

WHEREAS, the WaterSMART: Water and Energy Efficiency Grant Program specifically allows for project proposals that conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability in the western United States; and

WHEREAS, the Southern Nevada Water Authority (Authority) has adopted a Water Resource Plan and a Conservation Plan, which outline specific water conservation strategies; and

WHEREAS, the Authority will benefit significantly from financial assistance to support water conservation efforts in Southern Nevada.

NOW, THEREFORE, BE IT RESOLVED that the Southern Nevada Water Authority Board of Directors agrees, authorizes and verifies:

1. That, if awarded, the Authority's General Manager, John J. Entsminger, has the authority to enter into a grant or cooperative agreement on behalf of the Authority with Reclamation for WaterSMART: Water and Energy Efficiency Grant Program funding.

2. That the Authority's application requesting $1,500,000 to support the Authority's Water Smart Landscape Rebate Program has been reviewed and approved by appropriate Authority staff and the Board supports its submission to Reclamation's WaterSMART: Water and Energy Efficiency Grant Program.

3. That the application includes a funding plan that outlines the Authority's ability to provide a matching contribution of up to $25,000,000 and that, if awarded, the Authority has the financial capability to provide the matching contribution, as specified in the funding plan.

4. That, if awarded, the Authority will work with Reclamation to meet established deadlines for entering into a grant or cooperative agreement.

Introduced and passed this 21st day of March, 2019.

Attest:

John J. Entsminger, Secretary

Southern Nevada Water Authority

Marilyn Kirkpatrick, Chair

Approved as to form:

Scott Diddyment for

Gregory J. Walch, General Counsel