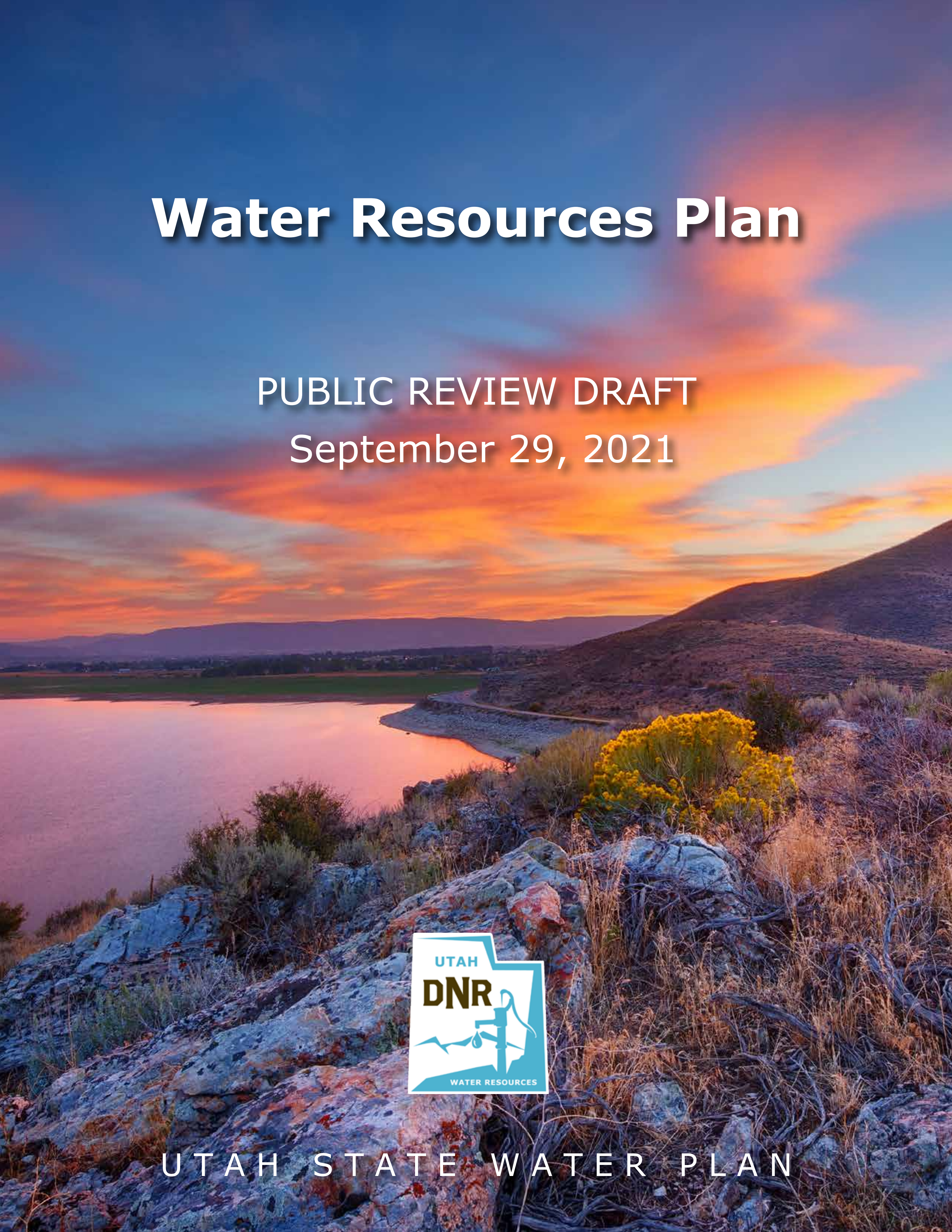

Water Resources Plan

PUBLIC REVIEW DRAFT

September 29, 2021

UTAH STATE WATER PLAN

Water Resources Plan

PUBLIC REVIEW DRAFT

September 29, 2021

By:

Utah Division of Water Resources

With valuable input from the State Water Plan Advisory Committee

U T A H   S T A T E   W A T E R   P L A N

Foreward

Friends,

2021 will go down as one for the books. In addition to a worldwide pandemic, wild weather events hit hard, including record-high temperatures, extreme drought, as well as flooding. In July, 99.94% of the state was in “extreme” and “exceptional” drought – the two worst categories according to the U.S Drought Monitor. The Great Salt Lake and Lake Powell both dropped below their previous record lows. Utah experienced some of the worst water supply conditions on record and relied on water stored in reservoirs, which underscores the importance of water planning.

This Water Resources Plan is a planning document that looks 50 years into the future and has been years in the making. Thank you for your patience, as the staff who worked on this plan put in a tremendous effort to produce a solid plan. We are grateful to the State Water Plan Advisory Committee that helped shape this plan through their input, reviews, and feedback.

This plan is not a “drought response plan.” Rather it provides a comprehensive look at Utah’s current water use and supply conditions and future demand scenarios. It focuses on three water management principles: reliable data, supply security, and healthy environment. It also prioritizes actions the Division of Water Resources will undertake in the next five years.

Water management is complicated and involves the coordination of multiple state agencies as well as local suppliers. A collaborative effort is underway to produce a more holistic “State Water Plan” rather than this division-specific Water Resources Plan. Contributing agencies include the Governor’s Office of Planning and Budget, Department of Agricultural and Food, Department of Environmental Quality (divisions of Drinking Water and Water Quality), and Department of Natural Resources (divisions of Water Resources, Water Rights, Wildlife and Forestry, Fire and State Lands). This coordinated action plan will include a comprehensive implementation strategy as the state continues to plan for rapid growth, climate change, and sound management of an uncertain natural resource.

A safe, reliable water supply is critical to Utah’s prosperity and quality of life. Climate scientists predict climate change will bring drier conditions and more extreme weather events, both of which we have seen in 2021. We look to science and data and continued collaboration as we prepare for the future.

Sincerely,

Brian Steed
Executive Director
Utah Department of Natural Resources

Acknowledgements

The Board of Water Resources acknowledges staff members of the Utah Division of Water Resources in the River Basin Planning Section for their dedication and valuable contribution to this document. River Basin Planning staff responsible for plan development include: Russell Barrus, Anny Baynard, Arthur Guo, Laura Haskell, Rachel Shilton, and Rick Webster. We also acknowledge other Division staff who have contributed to the plan through writing, editing, graphics, and reviewing.

Division staff prepared this plan under the leadership of Directors – Todd Adams and Eric Millis (retired); Deputy Director – Candice Hasenyager; and Assistant Directors – Todd Stonely and Joel Williams.

The board extends its gratitude to members of the Utah State Water Plan Advisory Committee (Advisory Committee) who provided invaluable insight and data, reviewed the document for accuracy, and lent their support. Participants serving on the Advisory Committee represent state and local government, industry, environmental concerns, business, academia, and the public. Participants include: Josh Palmer, Alan Matheson, Scott Baird, Kerry Gibson, Marcelle Shoop, Evan Curtis, Mark Thomas, Darren Hess, Scott Ericson, Warren Peterson, Peter Gessel, Jay Olsen, James Toledo, Shirlee Silversmith, Stephen Handy, Steven Burian, Mark Stratford, and Randy Crozier.

The Board also extends a special thanks to the other individuals who took time to attend the virtual open house in conjunction with this document. Many people provided the Division with valuable comments, all of which have been carefully considered and incorporated where appropriate. Without all these contributions, the product before you would be incomplete.

Preface

One of the major responsibilities of the Utah Division of Water Resources is comprehensive water planning. Over the years, the Division has prepared a series of documents under the title "Utah State Water Plan." This includes two statewide water plans, an individual water plan for each of the state's 11 river basin planning areas, and numerous special studies. The preparation of these plans involved several major data collection programs as well as inter-agency and public outreach efforts.

This document is the latest in the "Utah State Water Plan" series and the third statewide water plan. Although this plan can be viewed as a general guide to direct Utah's water-related planning and management into the future, it was specifically written to highlight actions that the Utah Division of Water Resources (Division) can take in the coming years to fulfill its mission to: plan, conserve, develop, and protect Utah's water resources. Unlike previous water plans, this plan was written in a more conversational tone to be accessible to the general public.

This plan summarizes key data obtained through the previous water planning documents, introduces new data where available, and addresses issues of importance to all future water planning efforts. Where possible, it identifies water use trends and makes projections of water use. It explores various means of meeting future water demands and identifies important issues that need to be considered when making water-related decisions. Water managers and planners will find the data, insights, and direction provided by this document valuable in their efforts. The general public will discover many useful facts and information helpful in understanding the complexities of Utah's water resources.

It should be noted that the municipal and industrial projections of water need contained in this plan are based on current and historical data reported to the state by various water users and models that attempt to predict future conditions as best as possible. These projections suggest that most areas of the state will have adequate water supplies to satisfy growth if Regional Water Conservation Goals are met. However, several areas will need to acquire additional water supplies – most notably Washington County and portions of the Wasatch Front. The Division acknowledges that the impacts of drought and climate change on future water supplies are difficult to predict. The unprecedented drought of 2021 highlights the challenge of forecasting the water supply that will be available in the future.

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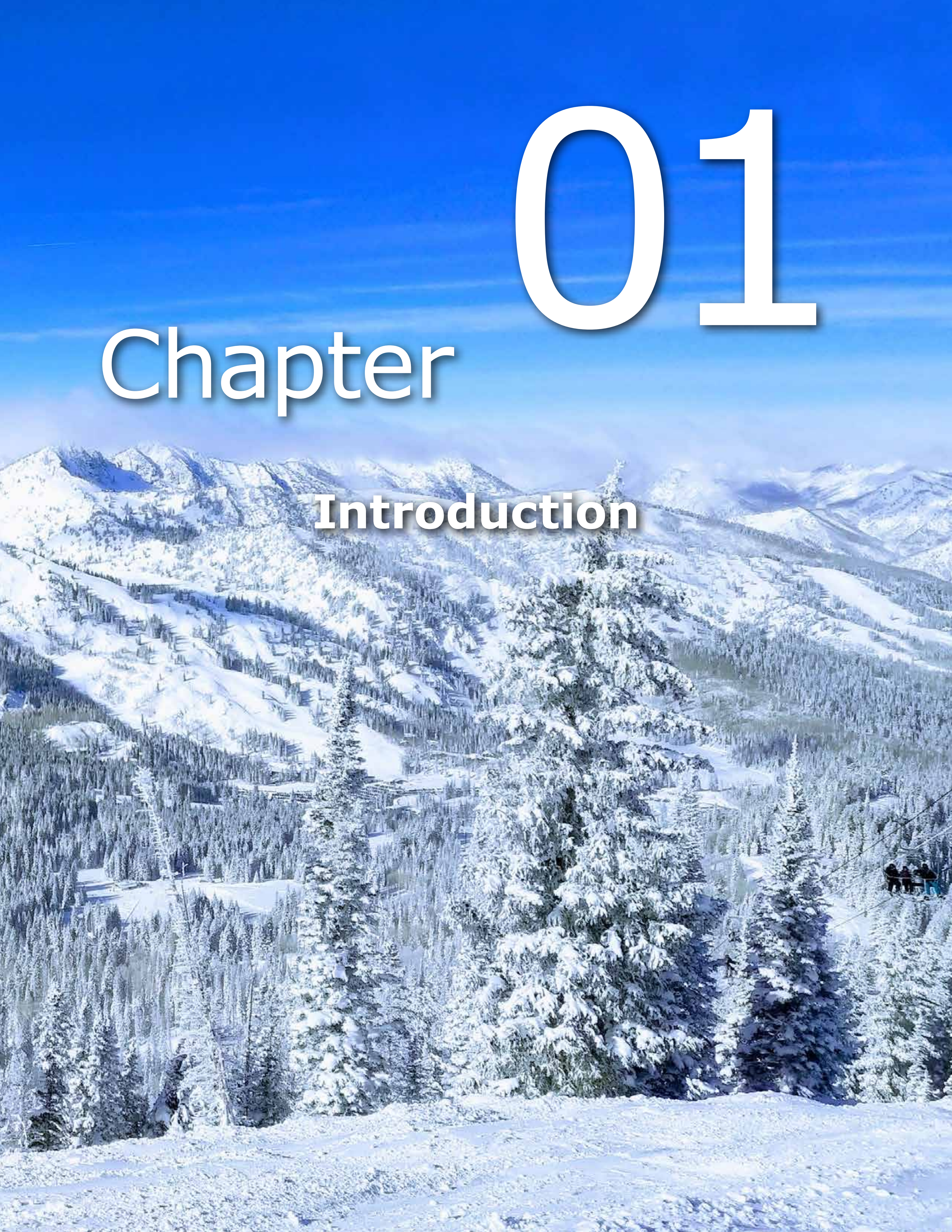
Appendices

(Available only online at: water.utah.gov/2021WaterPlan)

View of snow-covered Wasatch Mountains from Brighton Ski Resort
PC: Marcie McCartney

Chapter 01

Introduction



Gloria Falls, Little Cottonwood Canyon

Plan Focus

The Water Resources Plan focuses on the following three principles of water management:

- Reliable data is needed to make informed water management decisions.
- Securing a reliable water supply requires a comprehensive approach.
- Preserving the health of watersheds and the environment is an essential component of water management.

An Action Plan

Utahns and policy leaders understand and appreciate that clean, reliable water sources are vital to Utah's future. The Utah Division of Water Resources' (Division) mission is to plan, conserve, develop, and protect Utah's water resources. Our goal is to ensure Utah's citizens, environment, economy, and agriculture have water to thrive now and into the future. While finding that balance can be challenging, the Division is committed to working with agencies, organizations, and individuals to do what's best for Utah by providing balanced solutions through water conservation, development, agriculture conversion, optimization, and efficiency to meet Utah's water needs.

In the past, Utah's statewide water plans have been more of a status update. While this information is important, this plan is different. The Division assembled a State Water Plan Advisory Committee, consisting of diverse experts and stakeholders. This committee underscored the importance of developing an actionable plan. As a result, the 2021 *Water Resources Plan* focuses on goals the Division will strive to accomplish by 2026.

In 2017, a Recommended State Water Strategy was published that had extensive public involvement and collaboration with various special interest groups to provide water management recommendations for the next 50 years. The strategy provides additional information and recommendations that are not outlined in this plan. It's complementary to the work the Division has done to prepare and develop this plan.

Reliable Data

Reliable data about existing water supplies, current uses, future population, and future water demands is critical for policymakers and water managers to make informed decisions.

Chapter 2 discusses current water uses and ongoing efforts to improve this data. This chapter also addresses population projections, which continue to drive future water demands and the difficult water management decisions that need to be made.

Chapter 3 explains Utah's water supply and how it is measured and enhanced through cloud seeding projects. It also provides a broad overview of how these supplies are diverted and depleted for various uses according to estimates from the Division's Water Budget Model. This chapter also considers the impact of drought and climate change on the state's water supply.

Chapter 4 estimates future water demands using the Division's Water Demand Model and explains how water demands in the Jordan River, Utah Lake, and Weber River basins will exceed available supplies over the next 50 years. The model also highlights how water demands in the Kanab Creek/ Virgin River Basin, even using the most conservative projection scenario, will exceed existing supplies within the next 10 years, making it necessary to develop additional water resources.

Supply Security

Securing a reliable water supply for the future requires a comprehensive approach that includes water conservation, water development, conversion of agricultural water to municipal and industrial water uses as agricultural land transitions to urban uses, agricultural water use optimization, and a combination of other innovative water management strategies such as water reuse, aquifer storage and recovery, and water banking. State and federal water laws also play an essential role in water security as it provides order to one of the most complicated issues in the world – water.

Chapter 5 highlights the state's extensive water conservation efforts, programs, and partnerships. It highlights the recent development of Regional Water Conservation Goals and how they build upon the success of previous water conservation efforts and focuses on the importance of water education.

Chapter 6 details several water development projects that are planned for and/or legislatively directed to meet growing water demands, including the Lake Powell Pipeline and Bear River Development. It discusses agricultural land water conversions that occur as agricultural land transitions to urban uses and provides a range of potential conversion estimates that will help meet future water needs. Other innovative water management strategies such as water reuse and aquifer storage and recovery are also discussed.

Chapter 7 discusses the importance of optimizing water use in the agricultural sector to help secure Utah's water future. It summarizes several strategies, programs, and best management practices that are available to help improve overall water management in the agricultural sector. It also highlights the potential for water banking to provide increased flexibility.

Chapter 8 details the importance of the state's water rights system and other federal water laws. These laws form the foundation for how water is allocated and distributed and ensure the rights of water users, including tribal interests, are protected. This chapter also discusses issues related to two of the state's interstate streams (Bear River and Colorado River) as well as how water banking can provide enhanced opportunities to utilize available water.


Utah Lake
PC: Marcie McCartney

Healthy Environment

Preserving the health of watersheds and the environment must be an integral part of any water management project. Utah is fortunate to be located in a mountainous region that includes the pristine headwaters of numerous rivers and streams. However, as the state's population grows, preserving watershed health is becoming more and more challenging. As a result, finding balanced solutions that preserve and protect the environment is more critical than ever.


Deer in a field, Morgan County
PC: Marcie McCartney

Chapter 9 illustrates the importance of healthy watersheds and maintaining a balance as conditions change. It discusses the many water quality challenges facing Utah waters and the efforts underway to improve water quality and maintain beneficial uses. Preserving the Great Salt Lake is another example of the complex challenges that lay ahead. Water management decisions directly impact the health and viability of the lake and its ecosystem and need to be made carefully to avoid harming its integrity.


Dry Creek, Alpine
PC: Rob Hall

Goals

Improvements in each of the three focus areas (reliable data, supply security, and healthy environment) are necessary as our state's population continues to grow at a rapid rate. The identified goals focus on the actions that are within the Division's influence. The Division is confident that as we work to accomplish these goals, we will meet Utah's water needs. We recognize that greater strides can be reached in conjunction with actions by regional water providers, organizations, municipalities, businesses, policy leaders, and individuals.

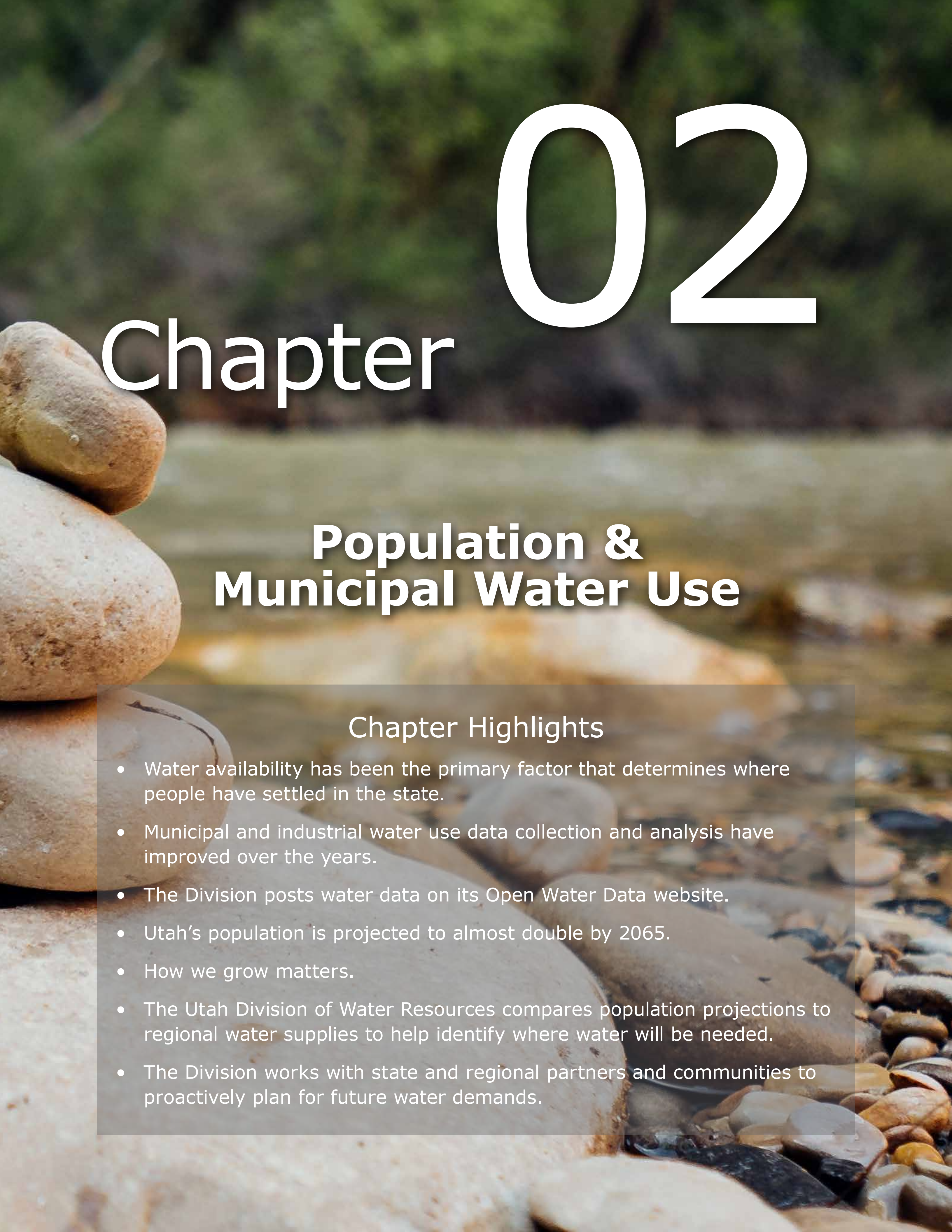
Table 1-1 List of Division Goals

Goals	Reliable Data	Supply Security	Healthy Environment
Increase water conservation efforts by engaging and educating the public, promoting tiered water rates, and working with water providers and suppliers to ensure water conservation plans meet regulatory requirements and include Regional Water Conservation Goals.	💧	💧	💧
Support efforts by water managers and retailers to double the number of installed secondary water meters using funds from the Board of Water Resources, the Utah Legislature, and local funds.	💧	💧	💧
Research and collaborate with stakeholders on ways to get more water to Great Salt Lake.	💧	💧	💧
Organize and host regular state water agency collaboration meetings.	💧	💧	💧
Identify areas that would benefit from weather modification (cloud seeding) enhancement.	💧	💧	💧
Collaborate with stakeholders to research and implement a pilot Demand Management program for water users that rely on the Colorado River.	💧	💧	💧
Analyze existing streamgage networks within the state and identify where additional monitoring is needed.	💧	💧	💧
Work to enhance and refine the methodology used to determine the amount of water depleted in the Water Budget model.	💧	💧	💧
Complete a comprehensive model of the Bear River.	💧	💧	💧

Kokanee Salmon spawning, Indian Creek
PC: Rob Hall

Goals	Reliable Data	Supply Security	Healthy Environment
Analyze existing weather station networks within the state and identify where additional stations are needed.	💧	💧	💧
Complete the National Environmental Policy Act process for the Lake Powell Pipeline.	💧	💧	💧
Work with water conservancy districts, water managers, and organizations to promote and increase water loss audits.	💧	💧	
Establish the Utah Watersheds Council and several local watershed councils.		💧	💧
Publish and present to the legislature a Statewide Water Marketing Strategy that includes pilot projects in different areas around the state.		💧	💧
Develop a program for integrating water use into land development planning.		💧	💧
Acquire right-of-way property for the proposed Bear River Development project.		💧	
Develop a policy to establish a process for consultation with federally recognized Indian Tribes to comply with Executive Order 2014/005.		💧	
Update Utah's Drought Response Plan.		💧	

Hikers use piles of rocks called cairns to help those who follow navigate unfamiliar or difficult terrain. Like hikers, water managers have the wisdom of previous generations to help guide them, but may need to chart a new course to meet future needs.



Chapter 02

Population & Municipal Water Use

Chapter Highlights

- Water availability has been the primary factor that determines where people have settled in the state.
- Municipal and industrial water use data collection and analysis have improved over the years.
- The Division posts water data on its Open Water Data website.
- Utah’s population is projected to almost double by 2065.
- How we grow matters.
- The Utah Division of Water Resources compares population projections to regional water supplies to help identify where water will be needed.
- The Division works with state and regional partners and communities to proactively plan for future water demands.


Farmer tending peach trees near Mapleton, Utah County
PC: Utah State Historical Society


Daybreak Community Gathering
PC: Cindy Costa


Officials inspecting the Washington-Fields Canal
PC: Washington County Water Conservancy District

Water Is Where You Live

Water availability imposes limitations on what people can do and where they live. Utah settlers first lived where perennial streams provided an abundant water supply. While subsequent settlers took up residence further from available water sources, settlements were still close enough that water could be transported to crops and gardens through canals and ditches. Available water supply has often dictated what kinds of crops and how much could be grown. Today, vast areas of the state still have few or no residents because water supplies are inadequate to meet even the most basic needs.

The Wasatch Mountains capture water in the form of snow, which supplies water to most Utahns living along the Wasatch Front. Water will not only continue to influence where people live within the state, but how people live.

How Utah Grows Matters

If we continue with traditional suburban development trends, Utah will not have the water needed to meet projected growth. Fortunately, steps are being taken to stretch the water supply. For example, it is becoming more common for planning commissions to approve higher density housing projects and adopting landscape ordinances that require native plants and water-wise landscaping. Smaller lot sizes use less water because outdoor space is reduced, and transitioning from turf-heavy landscapes to a balanced landscape of turf and native plants uses significantly less water.

Over the years, Utahns have learned to successfully manage the existing water supply by incorporating a variety of tools and techniques.

Powerful management tools like those described below help ensure adequate water supplies:

- Stream flows are altered by storing springtime peak flows in reservoirs for later use.
- Water supplies are moved from places of abundance to places of greater need for safe and reliable water sources.
- Surplus water is stored in aquifers for later withdrawal.
- Water stored in aquifers augments or replaces surface water when it is unavailable.

Ultimately, we are faced with the same dilemma as the early settlers – there is a finite supply of fresh water.

The Utah Division of Water Resources (Division) works with federal, state, regional, and local partners to plan for future water demands. The Division uses the most current data to model and project which areas of the state will need to take action to meet their future water demands. Data reliability is critical for accurate forecasting.

> ***"By failing to prepare, you are preparing to fail."***
>
> -Benjamin Franklin

Every New Utahn Needs Water

When planning for Utah's future needs, there are two main elements: water supply (what's available) and demand (what we use). The Division uses population projections from the Kem C. Gardner Policy Institute (Gardner Policy Institute) and assesses available water supplies and uses to help regions plan for the future.

Utah's historical and projected population growth results from a combination of four components:

- Birth rate
- Death rate
- Inbound migration – people who move into Utah
- Outbound migration – people who move out of Utah

Before 1940, these factors produced a fairly constant growth rate, increasing the state's average population between 4,000 to 9,000 people per year. The growing U.S. economy after World War II fueled a nationwide westward migration. Between 1950 and 1990, Utah experienced significant inbound migration, which resulted in a steepening of the population curve.

Over the past two decades, the state's overall growth rate has stabilized at an average of 2.2% per year. The Gardner Policy Institute projects that Utah's population will increase from approximately 3 million in 2015 to almost 6 million in 2065. This represents an annual average growth rate of 1.3%. Utah's growth rates are projected to continue to exceed national rates over the next 50 years.

Figure 2-1 shows the statewide population projections. Detailed statewide population projections are presented in Appendix C. Although the state's population is projected to nearly double by 2065, Figure 2-2 shows that not all areas will experience the same growth rate. Washington County's population is projected to increase 229% by 2065. Wasatch, Utah, and Juab counties will also experience rapid growth with a nearly 200% increase. More rural counties such as Beaver, Emery, Garfield, Millard, Piute, and Rich are projected to grow more slowly.

One of the more notable trends over the past century is that parts of Utah have transitioned from a rural, agricultural-based society and economy to a more urban society with a diverse economy. Figure 2-3 illustrates Utah's urban versus rural population trend.

Approximately 20% of Utah's population resided in rural areas of the state in 1940. That percentage declined to just below 7% by 2000 and is expected to decline to about 5% by 2060. Today, well over 90% of Utah's residents reside in an urban setting, or an area transitioning to urban – like the cities of Lehi and Herriman – and rely upon non-agricultural sectors of the state's economy for their income. This transition creates pressure to move water from agricultural use to municipal and industrial use.

Although Figure 2-3 shows a decline in the percentage of the state's population residing in rural areas, rural populations in most areas are not actually declining. Urban populations are growing faster than rural populations, and some areas that were formerly considered rural are rapidly becoming urban. This trend has decreased available agricultural lands in recent decades. As a result, careful urban planning is increasingly important to plan for the changing water needs of the growing population.

Figure 2-1 State of Utah Population Projections

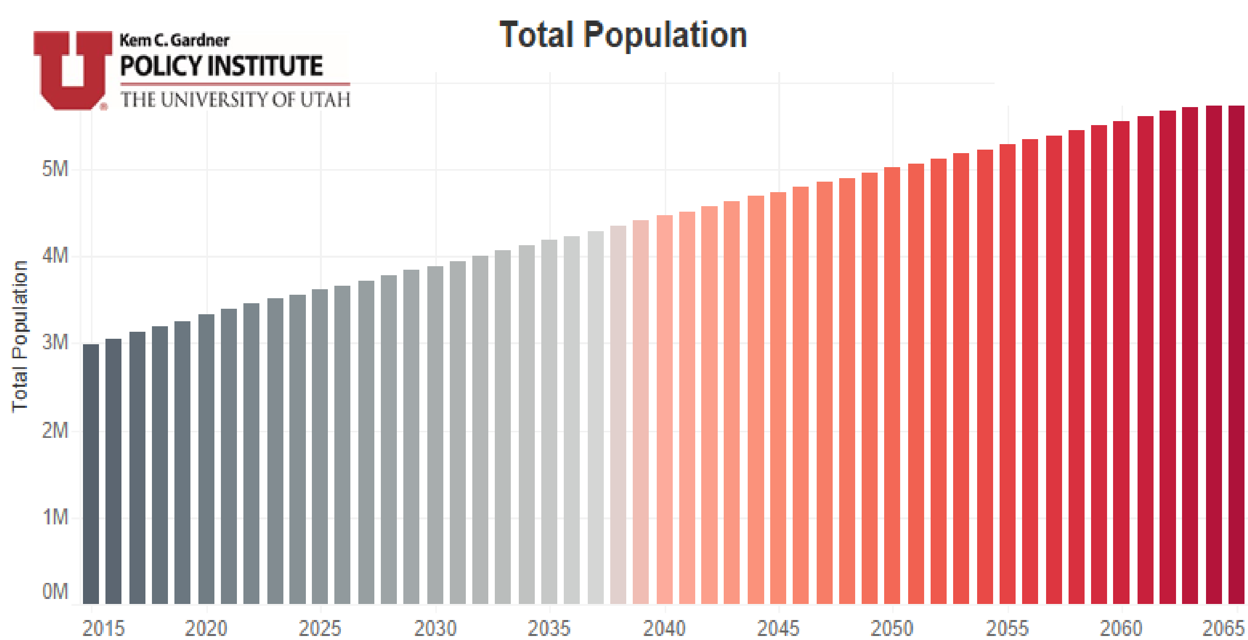
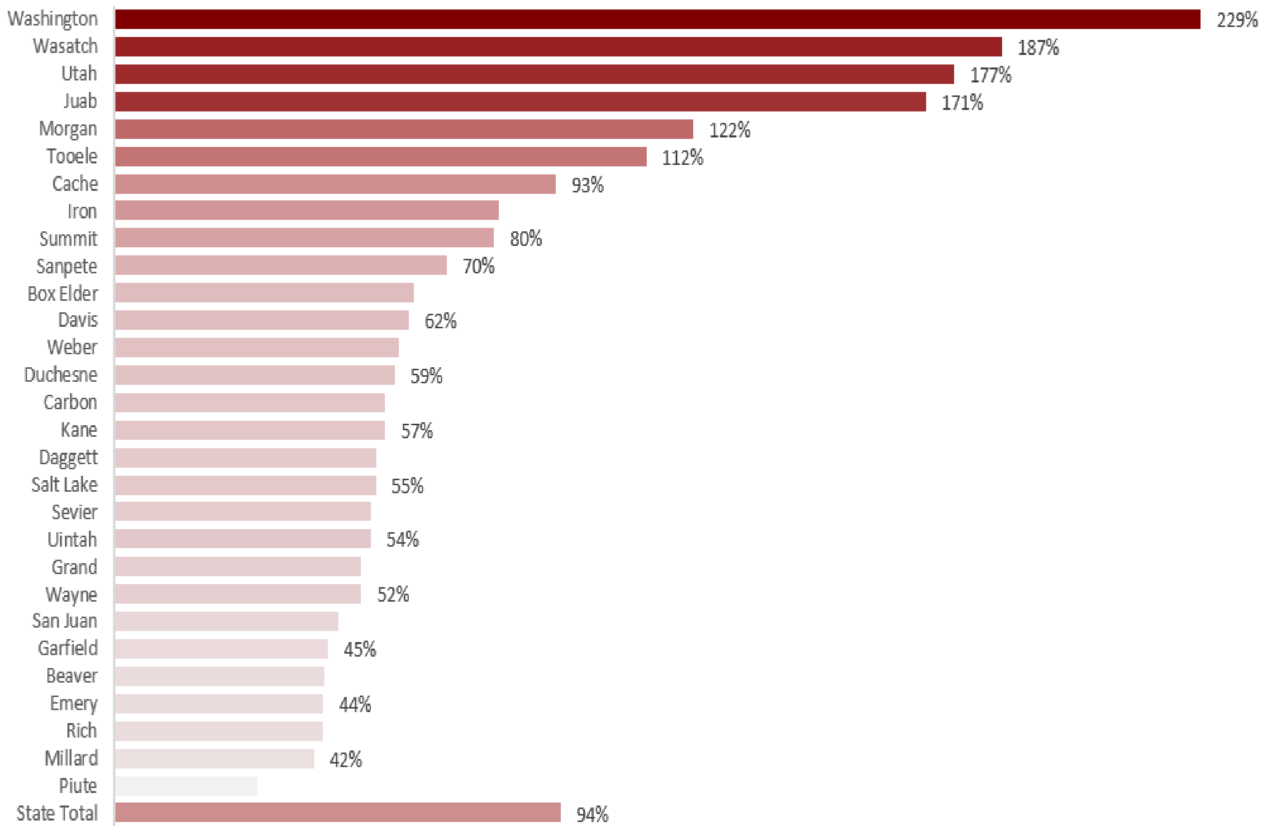
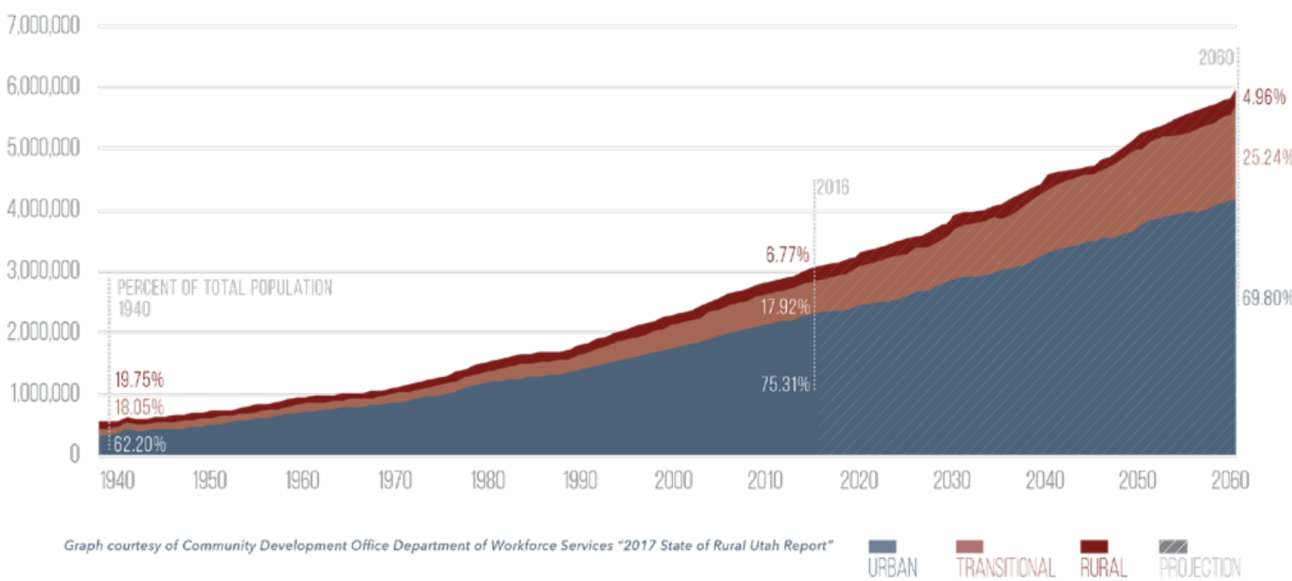


Figure 2-2 Projected Growth Rate by County (2015-2065)



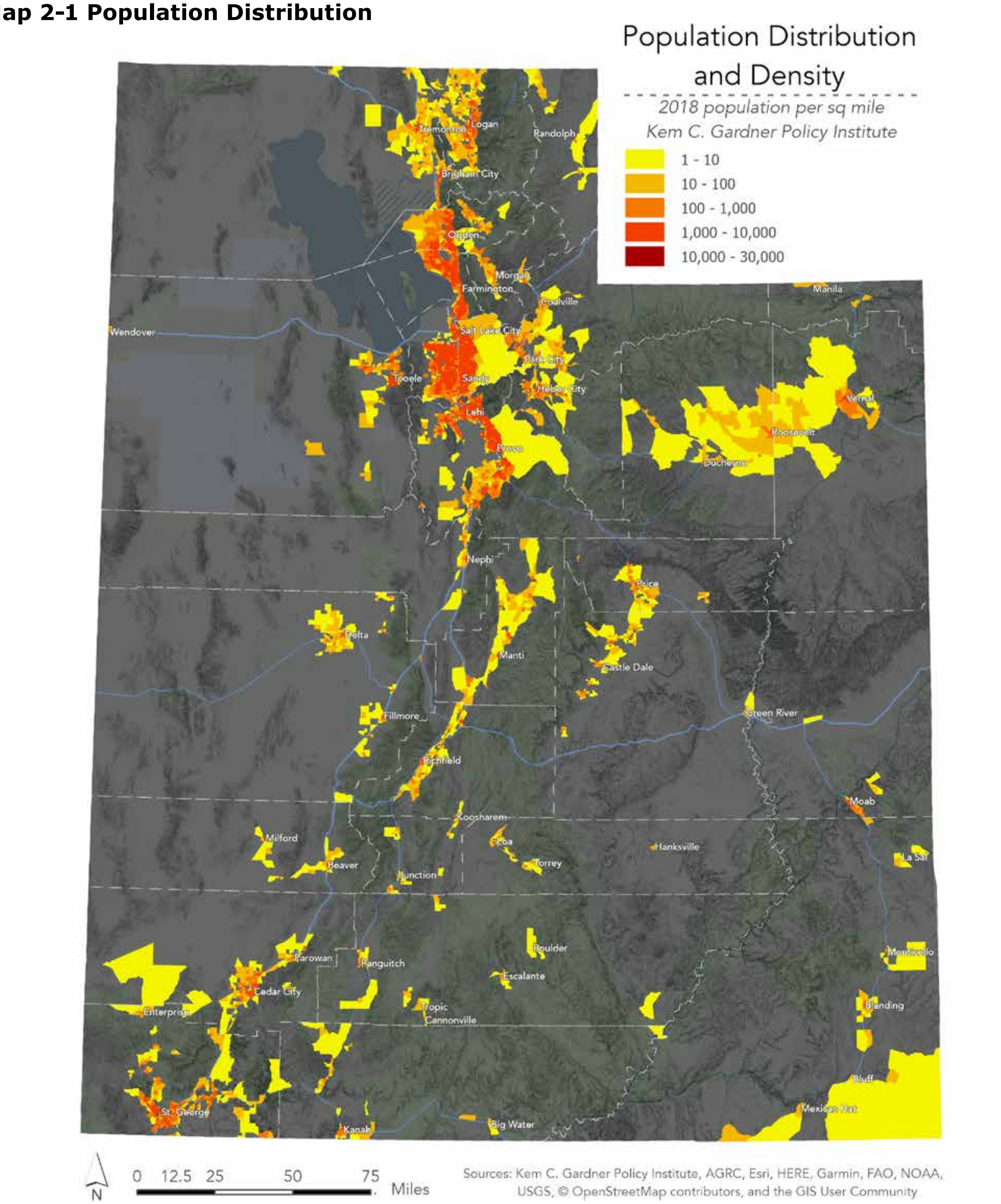
Source: Figures 2-1 and 2-2 courtesy of the Kem C. Gardner Policy Institute. Trends indicate Utah's popluation is on target to reach over 5.8 million people by 2065.

Figure 2-3 Historic & Projected Population



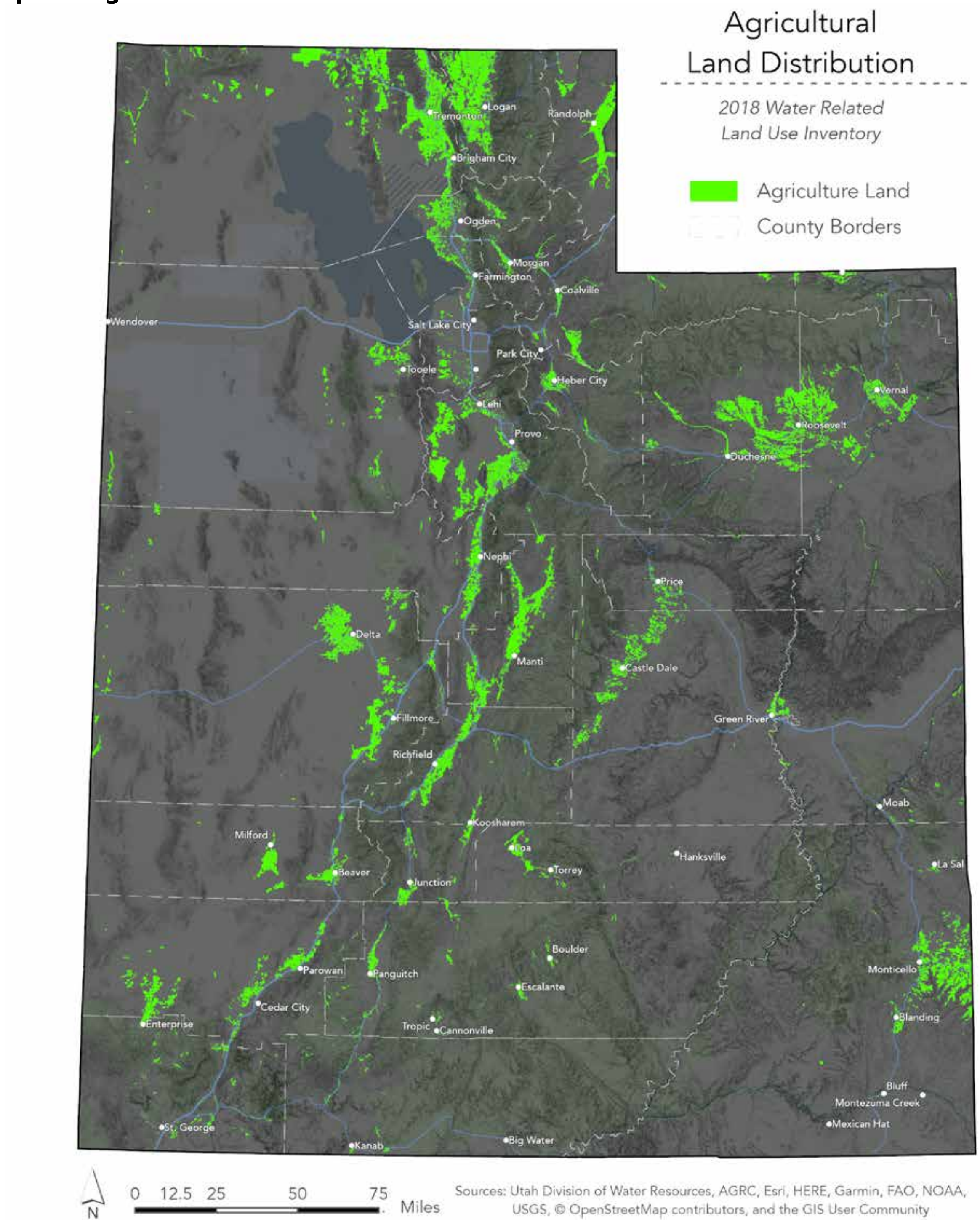
Source: Courtesy of Community Development Office, Department of Workforce Services.

Map 2-1 Population Distribution



Map 2-1 shows Utah's population distribution and density. The dark orange and red identify the most densely populated areas of the state with more than 1,000 people per square mile. Every county and basin have high-density areas, signifying an urban setting. Within these areas, the water-related issues are primarily about finding and delivering adequate, high-quality drinking water for residential, commercial, industrial, and institutional uses. The yellow and orange colors identify Utah's rural areas of 1-1,000 people per square mile.

Map 2-2 Agriculture Land



Map 2-2 illustrates how Utah's agricultural land aligns closely with the rural communities and areas of low population identified in Map 2-1. Rural communities are typically very concerned with maintaining an adequate supply of irrigation water for agriculture in addition to delivering adequate potable water supplies. Water-related issues may differ somewhat between urban and rural Utah, but both of these settings exist throughout the state.

How Utah Reports Water Use

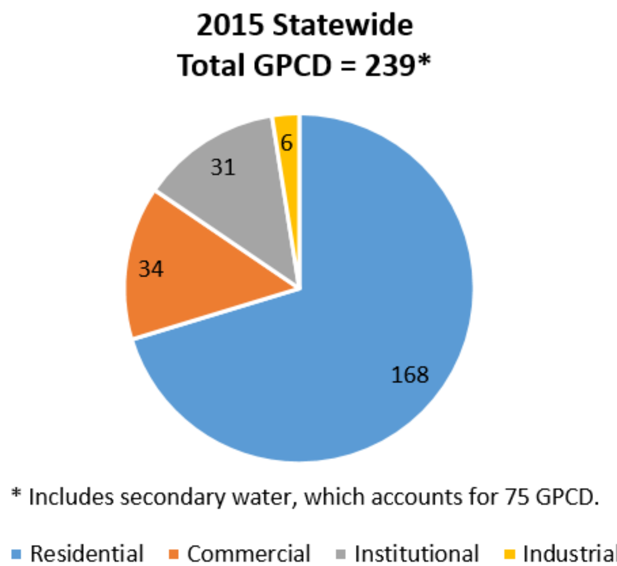
In 2017, as required by the legislature, an independent third-party evaluated the methodology the Division of Water Resources used to report the state's 2015 water use. The third-party review concluded that the potable data was accurate and had only a 0.03% margin of error. However, it also found the Division was underestimating secondary use by nearly 30% and that its methodology should be updated.

Now, the Division uses spatial data to determine lot size, infrared technology to determine green space, and gridded ET (evapotranspiration) to estimate water demand. The Division also reduced irrigation efficiency from 50% to 40% to evaluate water needs. These changes have improved secondary water use estimates.

The 2015 M&I data is the baseline for comparison and planning. Figure 2-4 summarizes the 2015 M&I water use by public systems in gallons per capita per day (GPCD). Since 2015, the Division has reported public system M&I data every year instead of every five years. This information is available on the Division's [Open Water Data] website.

The Division, the Division of Water Rights (Water Rights), and the Division of Drinking Water have worked together to improve the water use data collection and reporting process. Water Rights meets with each water system to train them on how to report system data on the updated water use data form. After the water systems submit their data to Water Rights, the Division looks over the data and flags anything that appears questionable. Water Rights contacts the water system and corrects any mistakes. This process keeps the data in one dataset. Graphic 2-1 shows the process for collecting and validating M&I water use data.

Figure 2-4 2015 Statewide Total M&I Water Use in Public Systems (GPCD)



Source: DWRe 2015 M&I Water Use Report

Tracking water use is an essential part of the state's water planning. These numbers are used to set goals and demonstrate accountability. The Division often reports water use in GPCD, which is calculated by dividing water use by the permanent resident population and dividing by 365 (the number of days in a year).

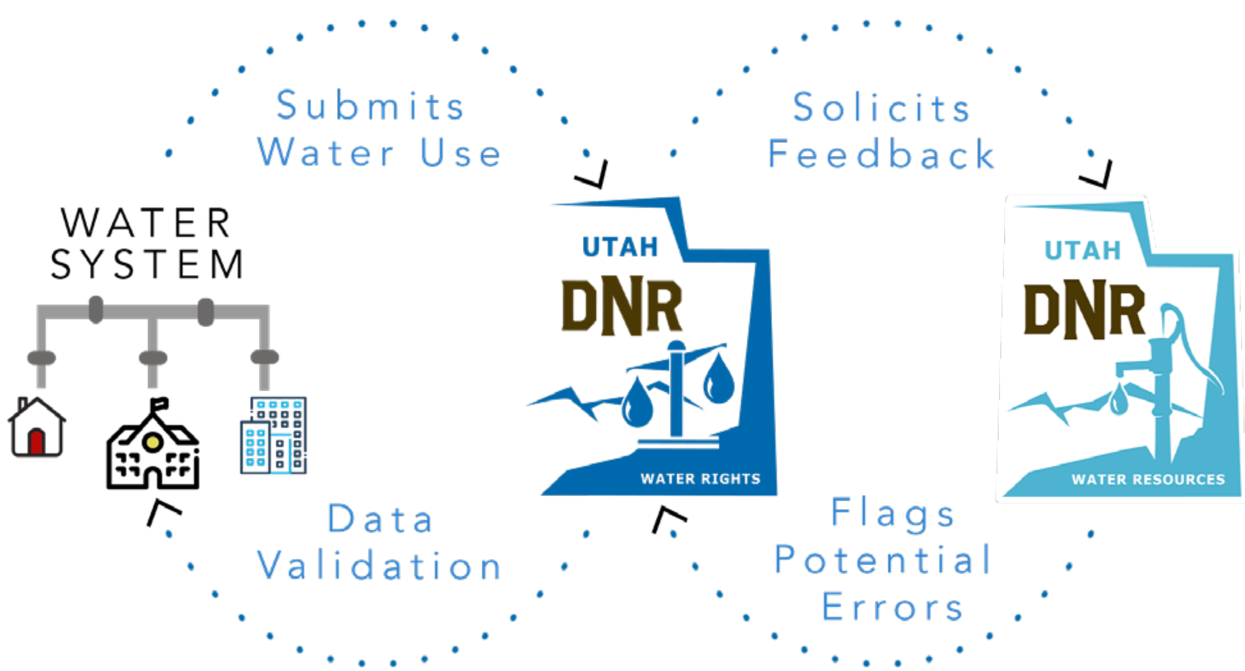
There isn't a national standard for calculating water use. Some cities and states only report certain types of water use and/or may apply a credit for water that is returned to the system. Or, some cities and states may only report single-family residential potable water use and exclude multi-family residential use, commercial, institutional, industrial, secondary and/or recycled water.

Utah accounts for **all** water use types (potable, secondary, and recycled water) by **all** industries (residential, commercial, institutional, and industrial) and doesn't apply credits for flows returned to the system. This comprehensive process may give the false impression that Utahns use more water than people in other states.

Utah's water use is often compared to that of other western cities and states that don't use the same calculation method or even collect the same data. The result can be an "apples-to-oranges" comparison. For example, the city of St. George compared to the entire state of Nevada or New Mexico. Or the State of Utah compared to cities such as Tucson, Las Vegas, and Albuquerque. It's more relevant to compare current numbers against past performance and ensure the state sees improved conservation and efficiency.

Since GPCD is impacted by population, how a city or state calculates population also affects water reporting. Some calculate population by applying the average person per household to all residential units rather than using the U.S. Census Bureau (Census Bureau) population estimates. Utah uses the Census Bureau's estimated permanent resident population, adjusted to water provider service area boundaries. Many of Utah's counties, including Washington, Rich, Grand, Kane, and Summit, have a high number of second homes and are popular tourist destinations. However, seasonal residents and visitors are not included in the Census Bureau population, so this water use is added to the permanent population's use, showing a higher GPCD than for those states and cities that use the average person per

Graphic 2-1 M&I Data Collection and Validation Process



household calculation method. The different methods aren't good or bad – just different. That's why it's important to understand how water use, water use accounting, and population impact results. Table 2-1 shows total water use in Utah's public water systems in both acre-feet and GPCD.

The majority of secondary water use is estimated by the Division. Water Rights collects metered secondary water data where available. The Division updated its secondary water use assumptions, but the combination of more systems reporting and a large number of unmetered systems results in data fluctuations. This is likely not the result of more use but rather evolving data sources and estimation methods.

Universal secondary metering would greatly enhance the reliability and credibility of secondary water use numbers. Where secondary meters have been installed, not only are water use numbers more reliable but overall water use is reduced. Implementing universal secondary metering may be cost-prohibitive for some water providers and systems that need to be retrofitted. However, Utah Code 73-10-34 (SB52) which passed during the 2019 Utah Legislative session, requires a meter on all new connections in Utah's urban counties (class I and II – populations above 125,000). Additional legislation will likely be needed to achieve universal secondary water metering across the state.

Major self-supplied industrial water users report their water use to Water Rights. Water that is self-supplied is diverted by the owner of a water right for their own purpose. The amount of water used by self-supplied industries can be substantial. Table 2-2 shows the total reported self-supplied industry water use.

Table 2-1 Total Public System Water Use* and GPCD

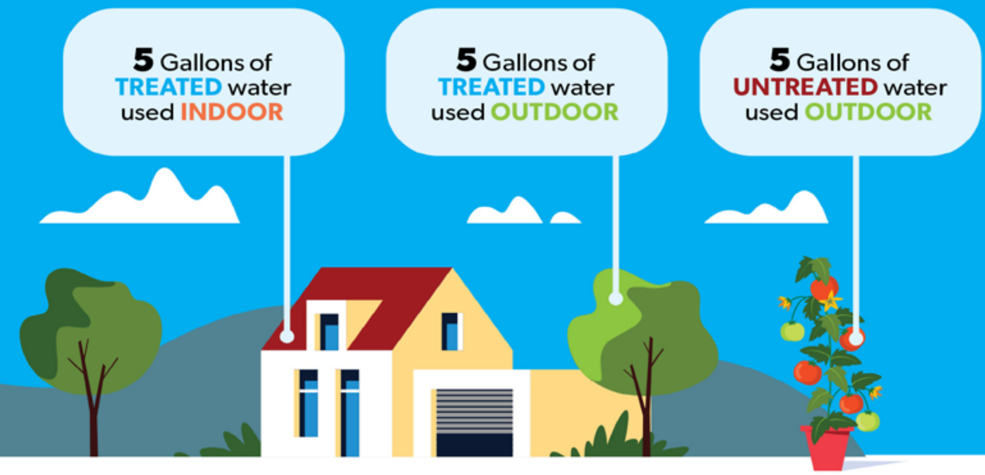
Year	Population	Total Public System Use (ac-ft)	Total Public System (GPCD)
2015	2,948,080	790,122	239
2016	3,131,205	858,593	245
2017	3,184,064	870,158	244
2018	3,231,494	871,084	241
2019	3,281,630	811,838	221

*Total public system water use is water delivered to residential, municipal, industrial, and institutional user connections by a public water provider.

Table 2-2 Self-Supplied Industry Water Use (ac-ft)

Year	ac-ft
2015	579,591
2016	513,685
2017	566,493
2018	598,223

CALCULATING WATER USE
THE NUMBERS GAME



HOW MUCH WATER DOES THIS PERSON USE?

- **A.** 3.3 gallons
- **B.** 5 gallons
- **C.** 10 gallons
- **D.** 15 gallons
- **E.** All of the above

Cities and states have different ways of calculating water use – there isn't a national standard. These varied calculation methods drastically alter the numbers, which is why water providers throughout the nation discourage using gallons per capita per day (**GPCD**) to determine a community's water use efficiency.

$$\text{GPCD} = \frac{(\text{water use} \,/\, \text{permanent population})}{365}$$

(number of days in a year)

HERE'S HOW THE NUMBERS ARE CALCULATED:

10 gallons / **3** people = **3.3** gallons

Treated water use divided by the U.S. Census persons per household. Even though only 1 person lives in the home, the census average is 3 and therefore the use is reported as 3.3 gallons.

This method dramatically inflates population and decreases water use; however, in areas with large second home populations such as Washington County, this method would provide a more accurate estimate of per person residential use.

10 gallons – **5** gallons = **5** gallons

Depleted treated water use for 1 person. Even though the person used 10 gallons of treated water, 5 of it was used indoors and was returned to the system (via the sewer). If you use 10 but return 5, you report 5.

5 gallons + **5** gallons = **10** gallons

Treated water use for 1 person

10 gallons + **5** gallons = **15** gallons

Treated and untreated water use for 1 person

All calculations are based on actual practices in other cities and/or states.

TO ANSWER THE QUESTION:

How much water does this person use? The answer is E. All the above. The amount calculated depends on where you live and how that water provider calculates water. In this scenario, Utah would report 15 gallons of use.

Utah has one of the most comprehensive water reporting practices in the nation, reporting all treated and untreated water use. While this practice is important for planning purposes, it often gives the false impression that Utah uses more water than other states.

So, the next time you hear that Utah uses more water than other cities or states—**check the math.**

Washington County Water Conservancy District

wcwcd.org

The Importance of Water Planning

Water planning is a cornerstone to successful water management. Data is used to drive informed decisions and set the state and water systems up for success. The Division utilizes data to evaluate water conservation progress, track population projections, compare water supply and demand projections, and help identify what actions, if taken now, will benefit current and future generations. The Division focuses heavily on water planning because, without it, families and communities wouldn't be able to grow and prosper. The Division's water planning efforts help Utah communities to thrive.

Chapter 2 Links

Open Water Data Website - dwre-utahdnr.opendata.arcgis.com

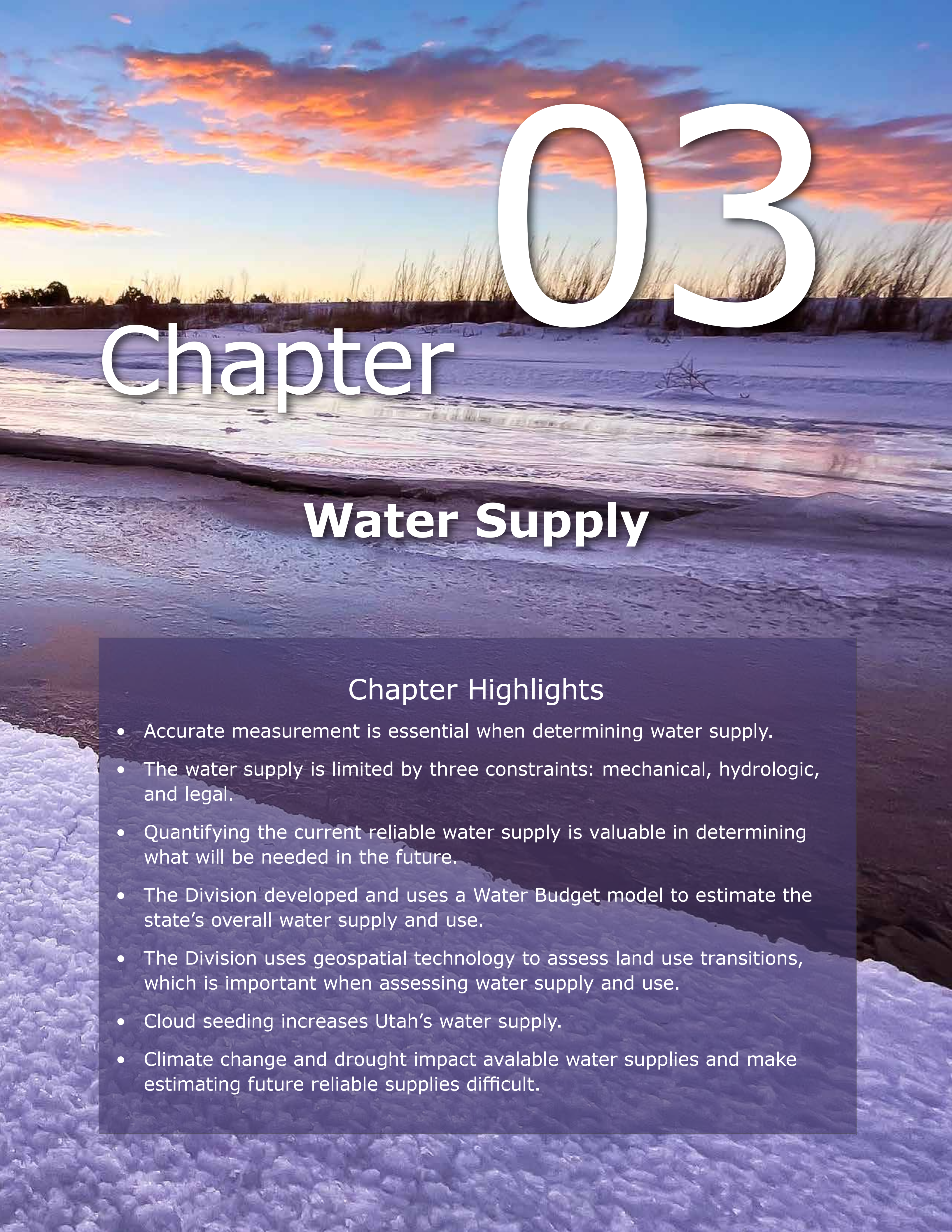
Kem C. Gardner Policy Institute Population Estimates - https://gardner.utah.edu/demographics/population-projections/

2015 Legislative Audit: A Performance Audit of Projections of Utah's Water Needs - https://le.utah.gov/audit/15_01rpt.pdf

Third-party Review - https://water.utah.gov/wp-content/uploads/2019/12/WaterUseDataCollectionReport2018.pdf


Sunset over Jordanelle Reservoir
PC: Utah Division of State Parks

Near the Ashley Valley Water Treatment Plant, Vernal
PC: Rob Hall



Chapter 03

Water Supply

Chapter Highlights

- Accurate measurement is essential when determining water supply.
- The water supply is limited by three constraints: mechanical, hydrologic, and legal.
- Quantifying the current reliable water supply is valuable in determining what will be needed in the future.
- The Division developed and uses a Water Budget model to estimate the state’s overall water supply and use.
- The Division uses geospatial technology to assess land use transitions, which is important when assessing water supply and use.
- Cloud seeding increases Utah’s water supply.
- Climate change and drought impact avalable water supplies and make estimating future reliable supplies difficult.

Water Supply

Introduction

Meeting Utah's future water supply needs depends on reliable data, modeling, collaborative planning, and data-driven actions. To plan for more people, it's vital to understand the importance of water use efficiency, location of remaining available water resources, and where additional supply is needed. The highest quality and most readily available water sources for the municipal and industrial (M&I) and agricultural sectors have already been developed. As a result, water conservation is essential as Utah continues to grow. New projects to divert, store, or augment the water supply are becoming increasingly complex and expensive, but are necessary to meet future water needs (see Chapter 6).

Measuring the Water Supply

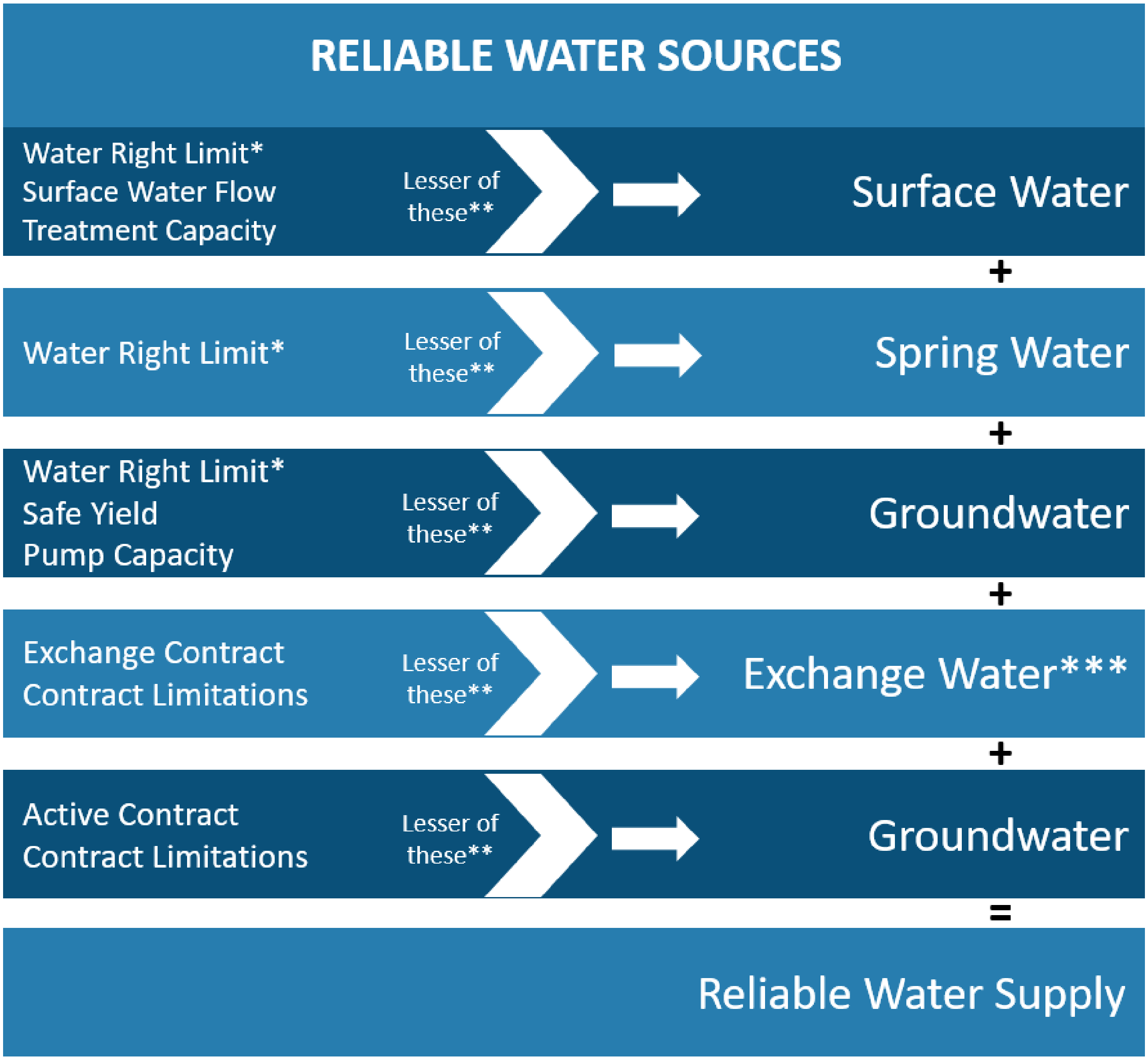
Accurate measurement is essential when determining water supply. Measuring supply includes collecting streamflow data, diversions, withdrawals from wells and springs, and inflow and outflow from reservoirs. Understanding how water data is obtained and its limitations are critical to using and interpreting it correctly. Measurements continue to improve as technologies evolve – which leads to more reliable data.

A water supplier's maximum developed water supply is limited by three constraints:

- Mechanical constraints (such as pump capacity)
- Hydrologic constraint (such as reliable streamflow or safe groundwater yield)
- Legal constraint (such as water right or legal contract)

Tibble Fork Reservoir, American Fork Canyon
PC: Shelby Ericksen

Graphic 3-1 Water Supply Constraints



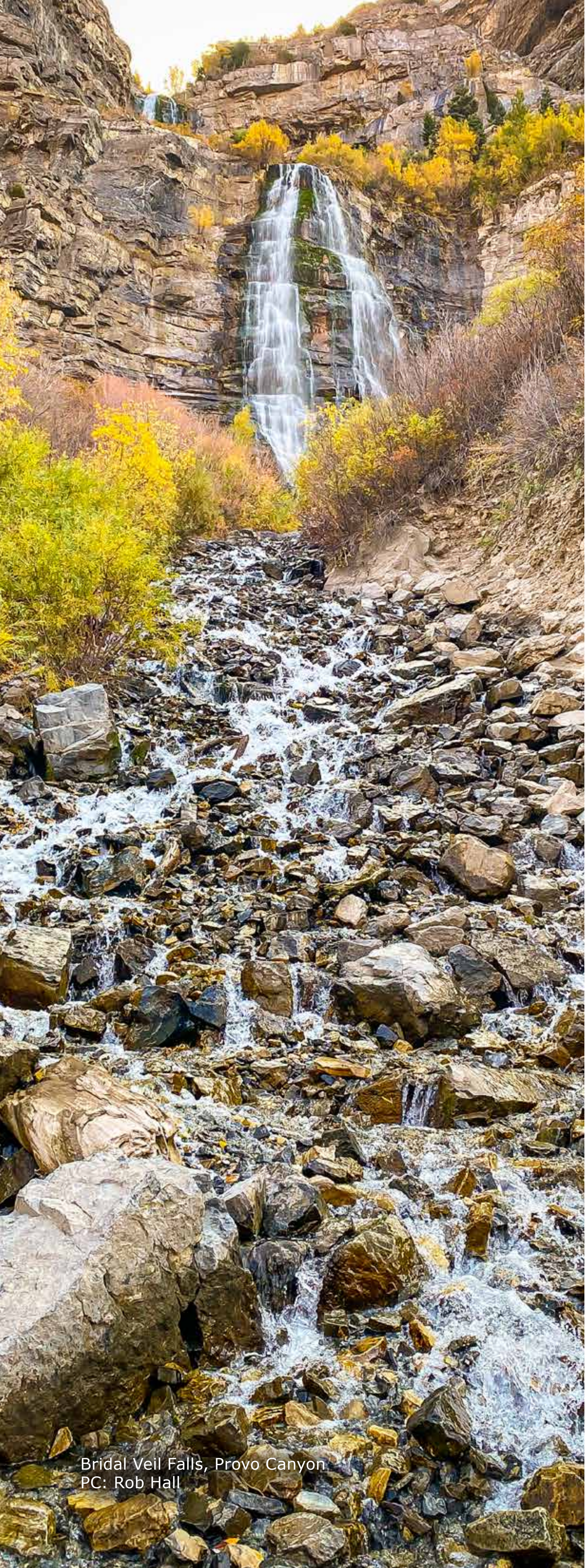
* The water right limit is roughly estimated by the Division and may not always reflect the actual limit that is determined through a more detailed evaluation.

** Each of the elements listed is compared to the other elements and only the lesser value is used to determine the total reliable supply for the system.

*** Water from a seasonal source traded or exchanged for water from a reliable source. Trade is formalized by contractual agreement.

Due to fluctuating water sources, not all the maximum developed water supply is available for use to meet water needs. Annual reliable potable supplies are determined using various sources of average annual water supply. The Utah Division of Water Resources (Division) analyzes reliable supply for public water systems to determine how much water is, and will be, available via sources like wells, springs, and reservoirs.

Graphic 3-1 shows how the reliable water supply is estimated for public water suppliers who have not conducted their own analysis.


Bridal Veil Falls, Provo Canyon
PC: Rob Hall

Existing Reliable Supply

Supply source and water use records obtained from the Utah Division of Water Rights (Water Rights) provide the basis for the Division estimates of reliable M&I supplies. Interviews with water system operators are conducted to gain more information. Reliable supply values provided by the water supplier are preferred when possible. Every five years, the Division uses Water Right's data, estimates secondary uses, and reports M&I water suppliers' reliable supply. The reliable supply data in this report is for 2015. The process of collecting, reviewing, validating, and analyzing data takes about two years from the time data is submitted to Water Rights until it is publicly available. The 2020 data is expected in late summer 2021 and will be published in an M&I water use report in 2022.

Water suppliers evaluate their current supply capacity to understand when more water will be needed. An audit report recommended, and the Division agrees, that water suppliers need to determine the reliable supply for their water system (OLAG 2015). When a reliable supply is not provided by a water supplier, the Division estimates a reliable supply by examining the limiting factors that include a combination of water rights, surface supplies, water system treatment capacity, groundwater supplies, and supplier delivery capacity. The limiting factors among these areas help define a supplier's reliable supply. For example, system treatment capacity, rather than the physical availability of water, could be the factor limiting reliable supply. Water data can be found on the Division's [Open Water Data]() website.

When secondary water is used within water suppliers' boundaries, the estimated use is accepted as part of the reliable supply. Historically, secondary water use has been unmetered by water suppliers and underestimated by the Division. In recent years, many systems have started metering pressurized secondary water use, which has improved water use data and water efficiency. The Division combines readings from metered secondary water with improved estimates of unmetered use to quantify secondary water used within M&I system boundaries. It is assumed that the secondary supply is at least equal to the secondary use. This assumed secondary water supply and the potable reliable supply are added together and represent the total reliable supply (secondary water supply estimate + reliable potable water supply = total reliable supply).

Table 3-1 shows total reliable supplies by basin for the year 2015. Additional details are contained in Appendix G. For a general discussion of how these reliable supplies are used to help identify when and where additional water supplies may be needed, see Chapter 6.

Horse Tail Falls, Alpine
PC: Rob Hall

Table 3-1 Total Reliable Supply by Basin (2015)

Basin	Potable Supply (ac-ft)				Secondary Use (ac-ft)	Total Reliable Supply (ac-ft)
	Wells	Springs	Surface	Total		
Bear River	59,200	46,800	34,000	140,000	14,800	154,800
Cedar/Beaver	21,100	3,600	-	24,700	4,500	29,200
Jordan River	99,000	6,500	179,400	284,900	30,700	315,600
Kanab Creek/Virgin River	30,200	8,500	27,400	66,100	13,000	79,100
Sevier River	21,100	22,400	-	43,500	11,900	55,400
Southeast Colorado River	5,900	2,900	4,100	12,900	1,500	14,400
Uintah	4,900	9,700	37,500	52,100	4,600	56,700
Utah Lake	152,900	57,800	49,000	259,700	60,500	320,200
Weber River	99,100	9,200	87,500	195,800	92,500	288,300
West Colorado River	1,700	9,100	15,600	26,400	8,400	34,800
West Desert	22,700	5,000	-	27,700	4,000	31,700
State Total	**517,800**	**181,300**	**434,500**	**1,133,600**	**246,500**	**1,380,100**

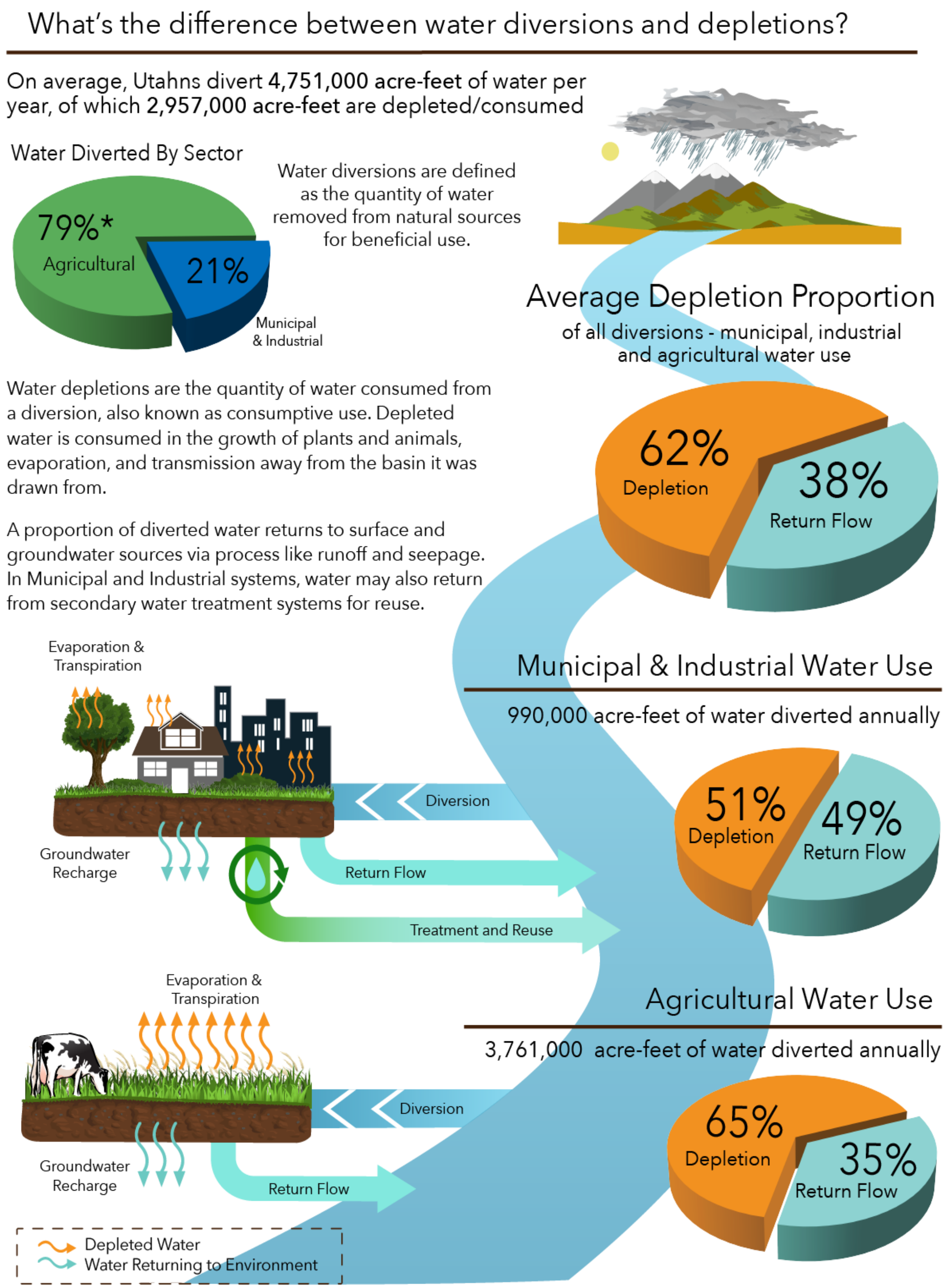
Data source: 2015 Municipal and Industrial Water Use Data Report version3. 2020. Table A-3, A-4 Reliable Potable Supply by Basin.

Diversion vs. Depletion

The amount of water diverted (moved from its original location to another location) for a particular use does not always match the amount of water depleted or taken out of the watershed. When discussing water use, it is necessary to differentiate between diverted water and depleted water. For example, as water is used for agricultural purposes, some water returns to streams or recharges the groundwater in the watershed. The diverted water that returns to the watershed is not depleted (removed/exhausted from the system). Depletion typically is caused by evaporation and transpiration through crops and land cover.

Diverted water used for M&I irrigation (lawn and garden) also partially returns to the system. Most of the M&I water diverted for indoor use (e.g. washing and food preparation) is not depleted. It returns to the watershed after being treated at a wastewater treatment plant. Water that reenters the watershed can then be diverted downstream for another use. Graphic 3-2 describes the difference between diversions and depletions.

Graphic 3-2 Diversion vs. Depletion



Source: Utah Division of Water Resources; Water Budget State Averages (1989-2018)

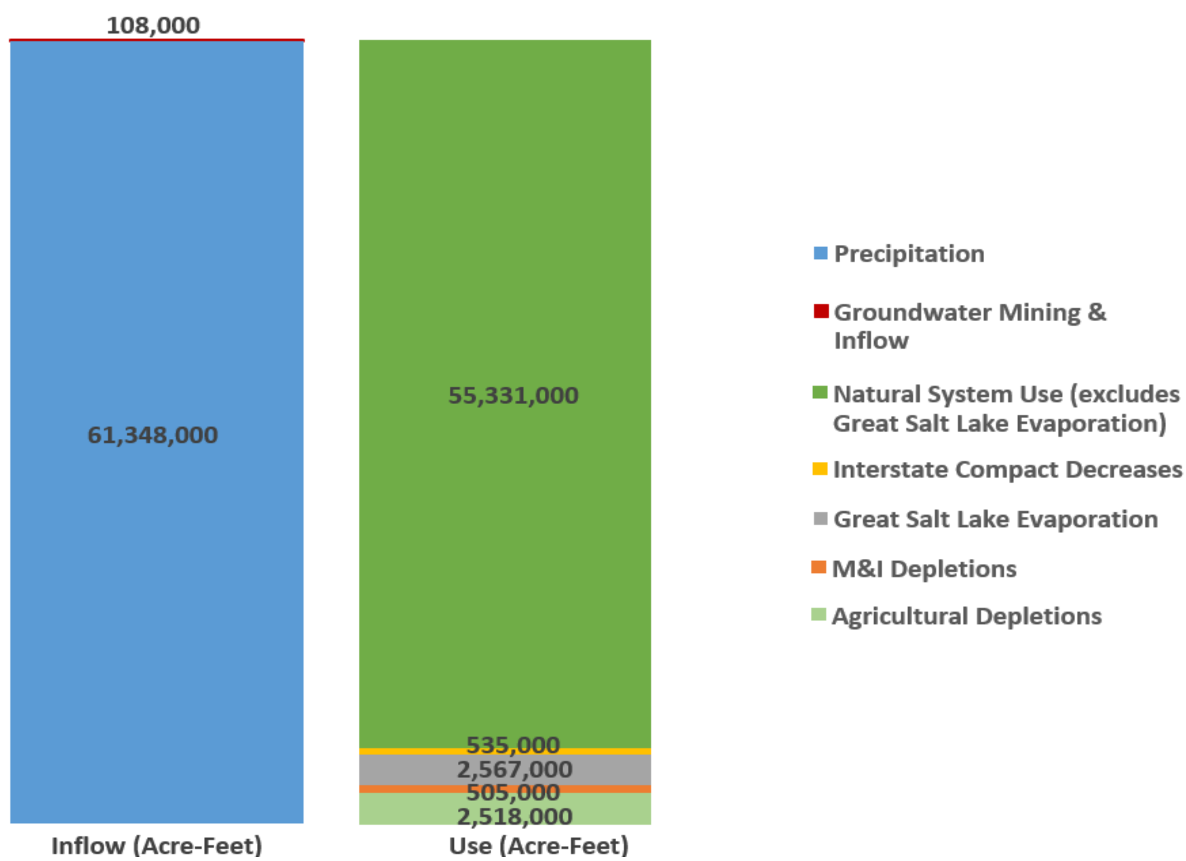
*data from the last five years (2013-2018) indicates about 75% of diversions are from agriculture

Water Budget

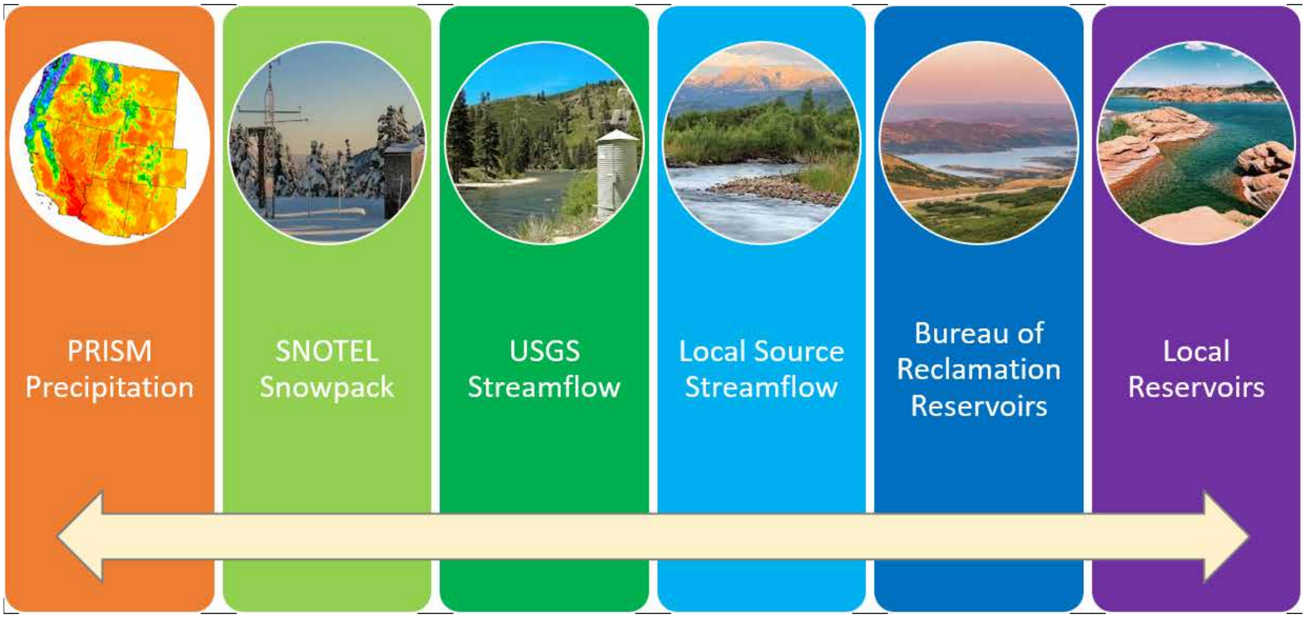
The Division has spent many years developing and refining a Water Budget model to estimate total water use in the state. Output from this model is available on the Division's Open Water Data website. The Water Budget is primarily focused on agriculture, but incorporates all uses. Graphic 3-3 shows the state's estimate of the overall water supply and use. The Water Budget takes into account the available water supply, including precipitation, groundwater, and reservoir storage (Graphic 3-4). It also estimates water diverted and depleted, including riparian, evaporation, agricultural (crop types), and M&I uses. The model provides a general summary due to the broad scope and geographic area. It's useful for understanding the big picture for statewide water planning and illustrates the continuity from one hydrologic basin to another. However, not all of this water can be captured and put to use.

Precipitation data for the state is estimated by the PRISM Climate Group at Oregon State University. PRISM data shows Utah as one of the driest states in the nation. Utah's average annual precipitation is about 13 inches and ranks Utah among the top five driest states, depending on the water year. The average annual precipitation estimates across the state vary dramatically, with the highest over 60 inches occurring near Willard Peak and the lowest below 5 inches falling near Wendover, Utah. Predictably, the highest precipitation areas are the mountain ranges, where much of the precipitation falls as snow.

Graphic 3-3 Estimated Statewide Water Supply and Use



Graphic 3-4 Water Supply Data Sources

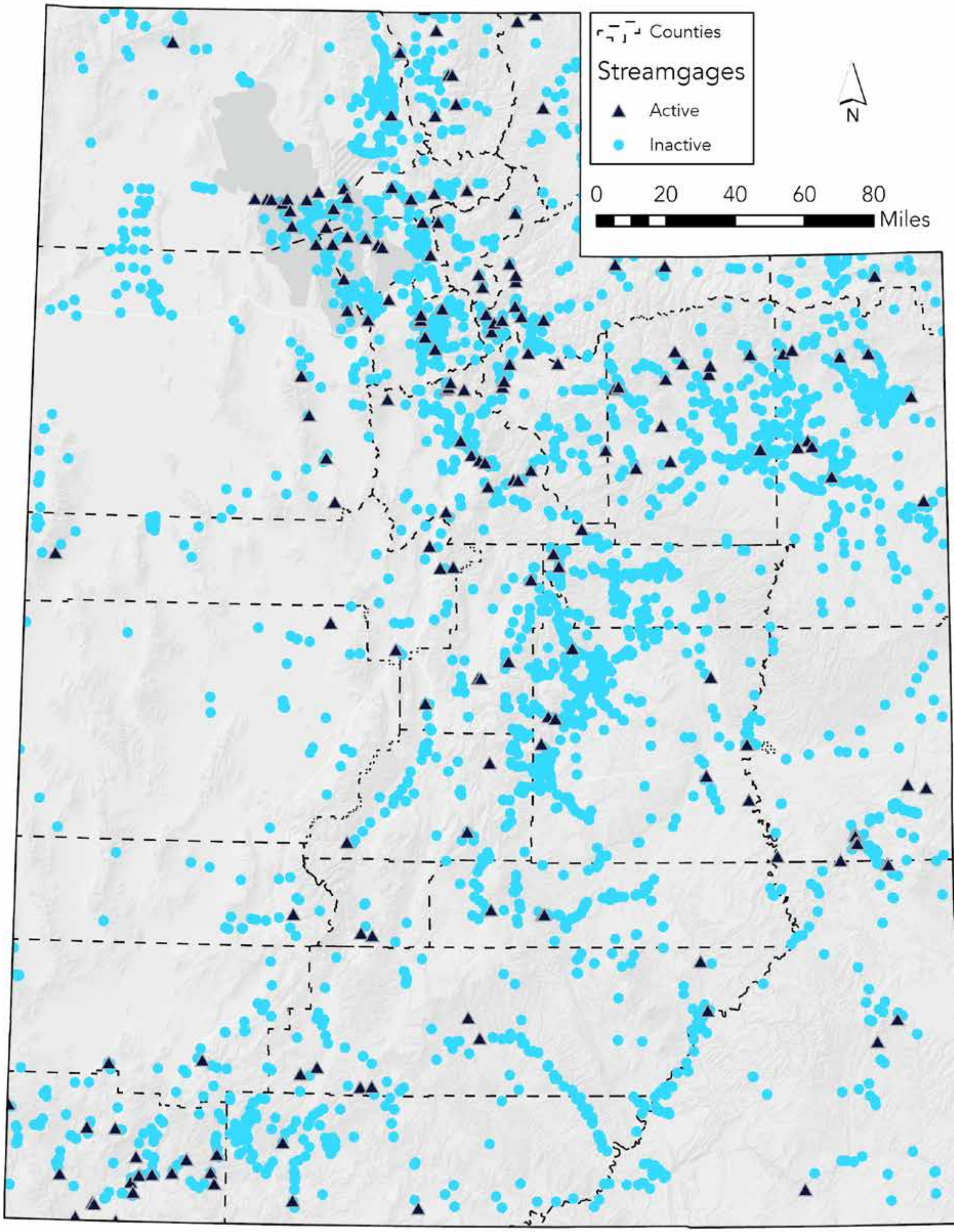


Although snowfall is included in PRISM's total precipitation data, snowfall data is sometimes separated from rainfall for modeling and water supply projections. The Natural Resources Conservation Service (NRCS) operates a data collection network called SNOTEL (short for Snow Telemetry). SNOTEL stations, located in high-mountain watersheds, collect snowpack and related climate data. This data is used to forecast yearly water supplies, predict floods, and conduct general climate research.

The U.S. Geological Survey (USGS) is the primary source for streamflow data. If a USGS streamgages is no longer active, its historical flow is correlated with flows of nearby active streamgages to estimate flows. Data from streamgages maintained by irrigation companies, water systems, and other local sources is also used where available.

Spanish Fork River
PC: Rob Hall

Map 3-1 USGS Streamgage Locations



Data Sources: Streamgages - USGS. Base Layer - Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

The Division plans to analyze existing streamgage networks and identify where additional monitoring is needed.

Water Budget Changes

Over the last 30 years, the Water Budget model has changed and improved with new data, models, and technology. Land use data (houses, golf courses, crops, or pastures) comes from the Division's Water-Related Land Use Survey. Originally, land use across the state was identified and categorized visually by Division staff over a six-year cycle. In 2017, the model started using aerial imagery to identify fields and the U.S. Department of Agriculture Cropland Data Layer to produce an annual land use dataset (Graphic 3-5). Details of the Water-Related Land Use program are available on the Division's [Open Water Data]website.

Water Budget Results

Utah receives an average of 61.3 million acre-feet of water from precipitation each year. Approximately 8.7 million acre-feet per year of water flows into the state through interstate streams. Much of the interstate stream water in the Colorado River Basin cannot be used within Utah because it's required to be delivered to the Lower Colorado River Basin states. Utah's use of Colorado River water is managed and protected by compacts, which allocate all system users a legal appropriation. (See Chapter 8).

Natural systems consume the vast majority of precipitation that Utah receives. Natural systems include forests, rangelands, riparian habitat, wetlands, lakes, and other water bodies, as well as groundwater aquifers. The remainder of the water is used for agriculture or municipal and industrial

Graphic 3-5 Water-Related Land Use Data Collection Evolution

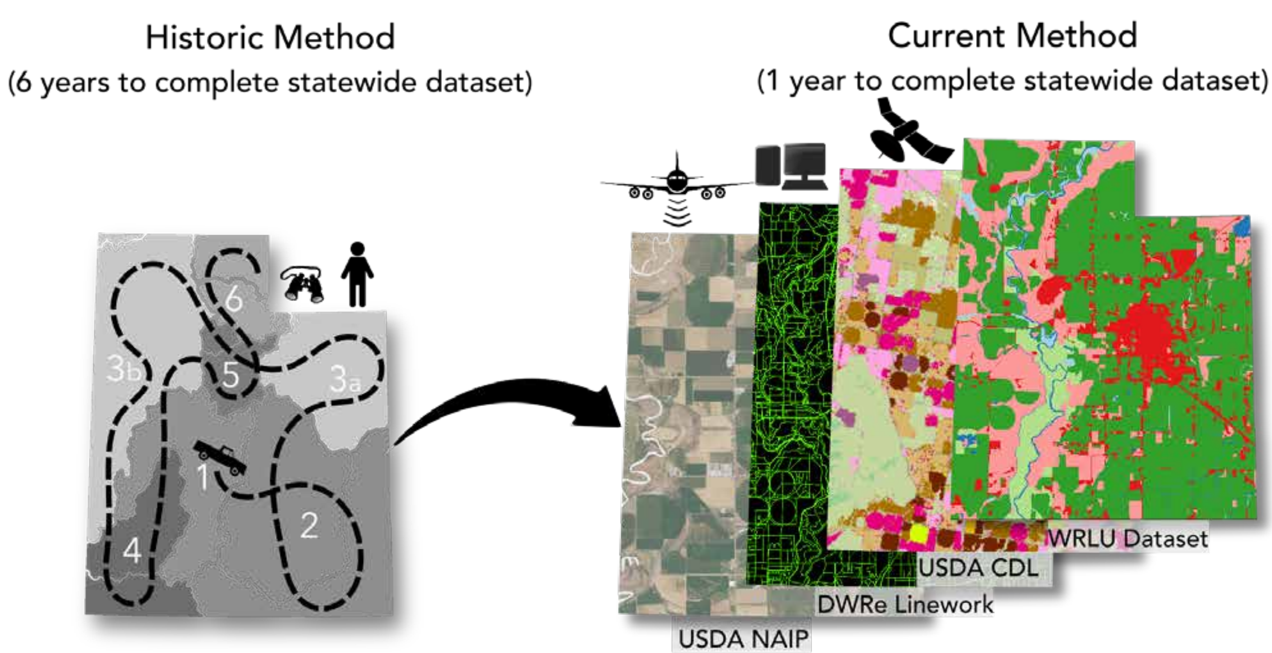


Figure 3-1 Water Diversions in Utah River Basins

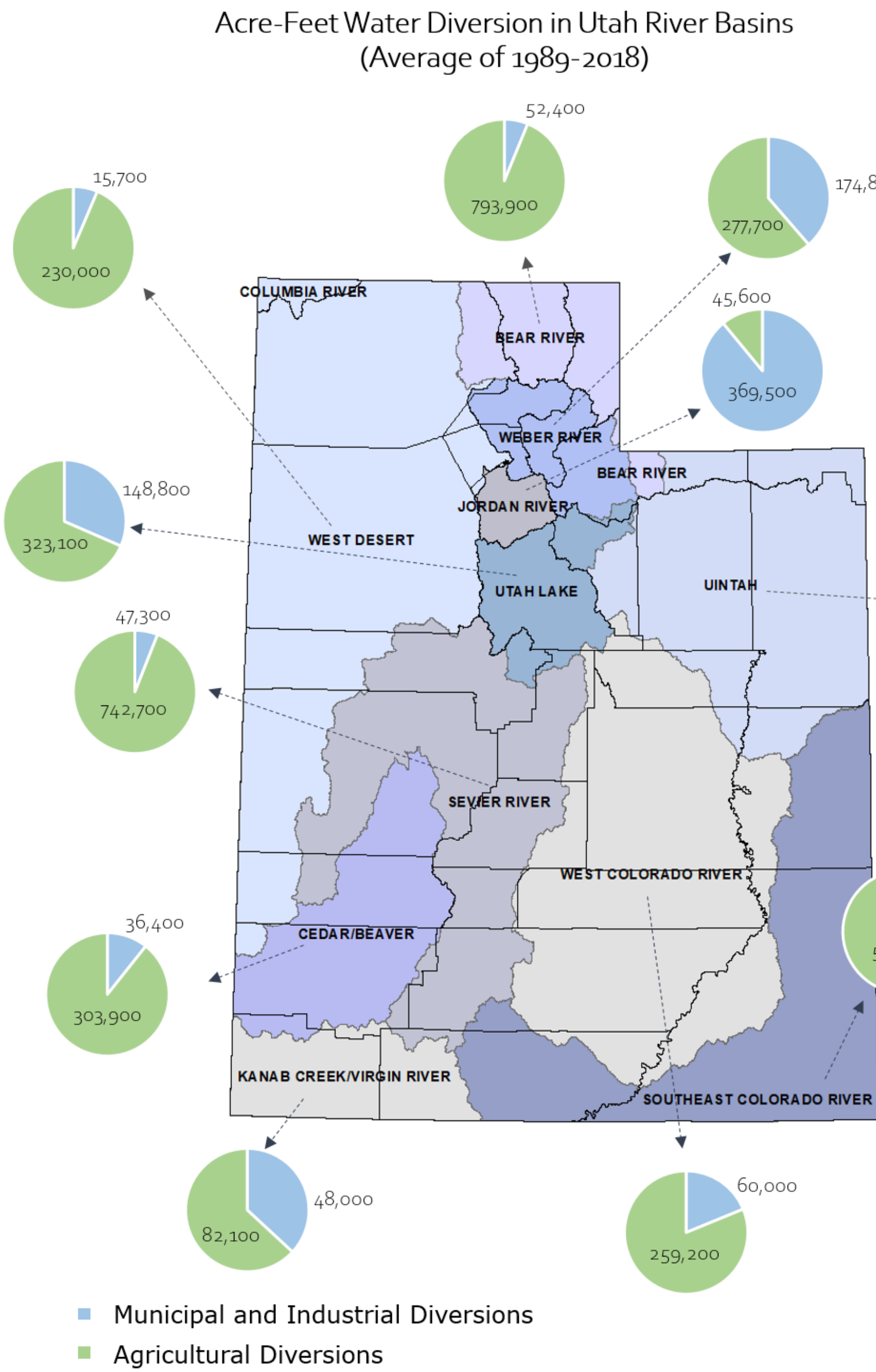
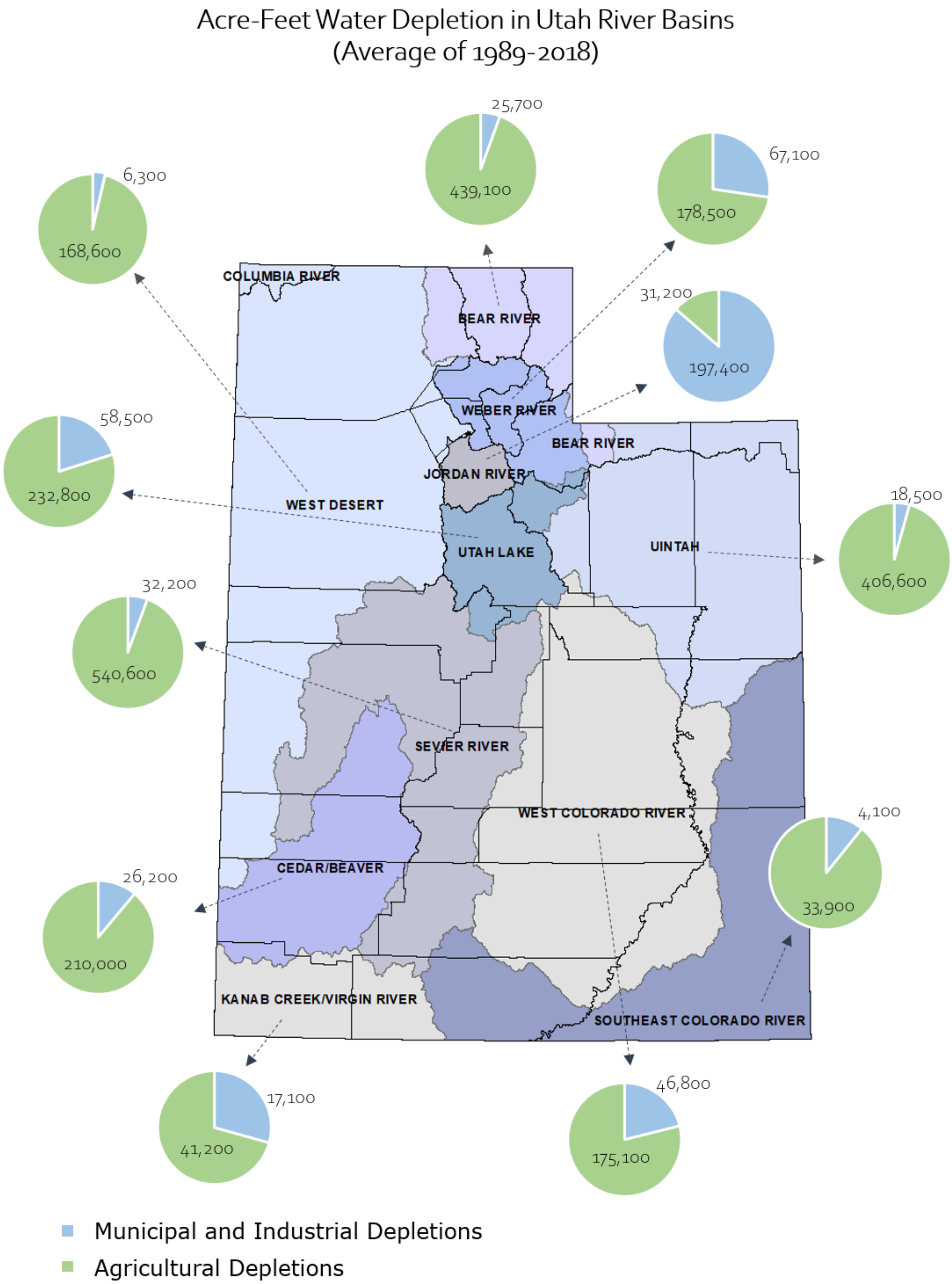


Figure 3-2 Water Depletions in Utah River Basins



Lower Kanarra Creek Falls
PC: Todd Stonely

uses as shown in figures 3-1 and 3-2. The figures show 10 of the 11 basins divert water mostly for agricultural use rather than M&I use. As discussed previously, more water is diverted than depleted. Water Budget data is presented in tabular form in Appendix D.

Evaporation & Evapotranspiration

Evaporation takes a significant amount of Utah's water and is included in the Water Budget model. This is especially significant in a semi-arid state like Utah. The model estimates that evaporation on Great Salt Lake is about 2.6 million acre-feet per year. The model also estimates that evaporation from all storage reservoirs in the state is approximately 1.0 million acre-feet per year. Additional evaporation occurs on lakes, natural and constructed wetlands, and other open bodies of water located throughout the state.

Evapotranspiration (ET), the amount of water used by plants and the water that evaporates from the soil, is an important factor in how much water is depleted. To estimate evapotranspiration, the Water Budget model uses Penman's method, which is endorsed by the American Society of Civil Engineers. This method allows for more crop types to be used, and results for each crop are recorded monthly rather than yearly.

Cloud Seeding – Increasing Water Supply

Weather modification, or cloud seeding, is a process that augments existing water supplies. Wintertime cloud seeding helps produce precipitation at targeted times and places. Utah's first cloud seeding project began in 1951. In 1973, the Utah Legislature passed the Modification of Weather Act (Utah Code 73-15), authorizing the Division to manage the program. The Utah Board of Water Resources shares the cost of cloud seeding projects with local sponsors and other interested parties. Currently, the cost-share amount is up to 50% until the annual budget is met. Utah will continue to expand its cloud seeding program and adopt new technologies as budgets allow.

Cloud seeding generator | PC North American Weather Modification Council

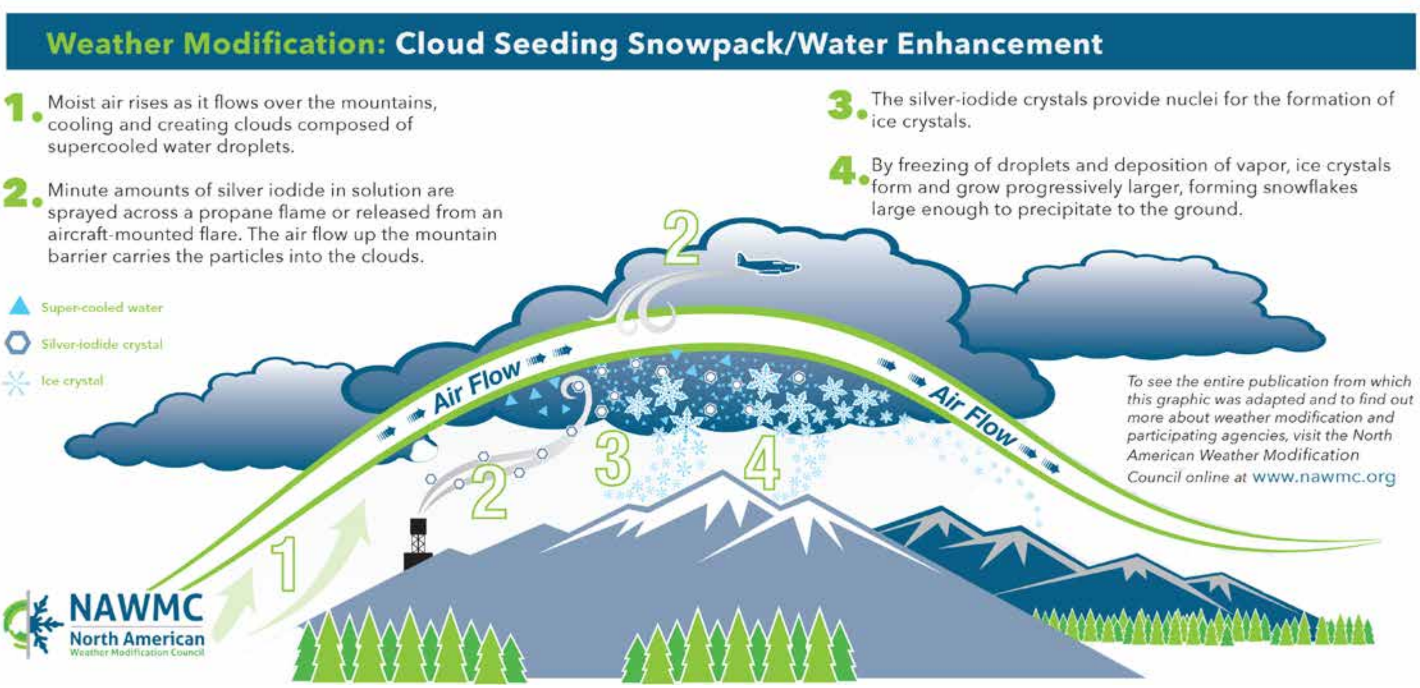
Early snowfall near Alta
PC: Marcie McCartney

Ski day
PC: Candice Hasenyager

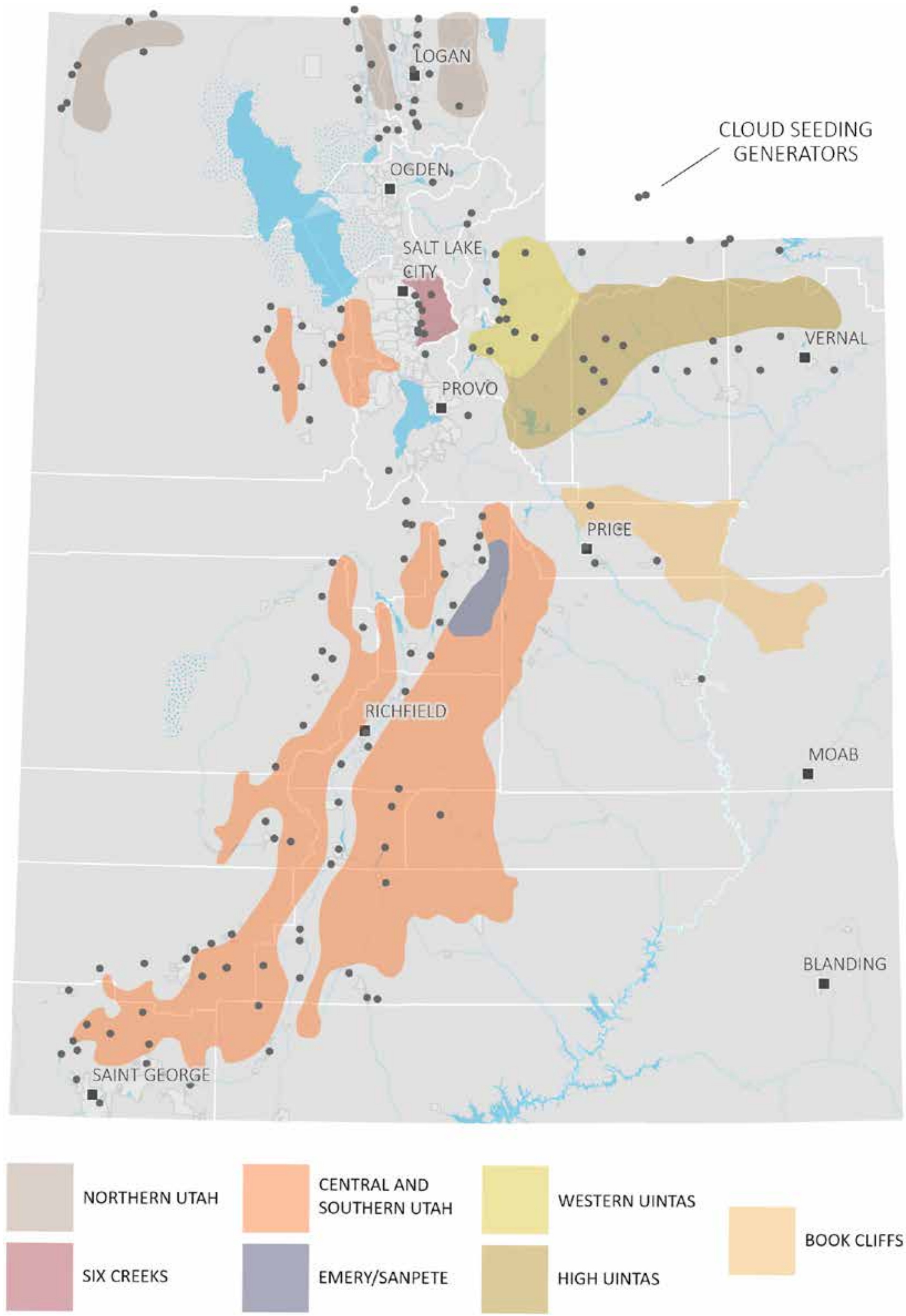
How Cloud Seeding Works

In mountainous regions like Utah, clouds form as moist air rises and cools during its passage up and over mountain ranges. Many of these clouds retain more than 90% of their moisture. Typically, silver iodide is released into the air from ground generators to produce artificial nuclei. The nuclei help ice crystals to form from the moisture in the surrounding air, forming particles large enough to fall to the ground as snow. Graphic 3-6 shows the cloud seeding process. Cloud seeding only takes place in the winter when the optimum conditions exist, primarily super-cooled moisture and prevailing winds. There are currently seven active cloud seeding projects in the state and more than 170 generators, as shown in Map 3-2.

Graphic 3-6 Cloud Seeding Process



Map 3-2 Cloud Seeding Project Areas



Cloud Seeding Cost

In 2015, the Division completed a study that indicated an increase of 3-17% Snow Water Equivalent (SWE) in cloud seeding areas. This resulted in an average annual increase in runoff of nearly 186,700 acre-feet at a cost of about $2.20 per acre-foot. Cloud seeding is a valuable program that augments the water supply at low-cost per acre-foot.

Table 3-2 lists the estimated 2015 increase in runoff, the cost of operation, and the resulting cost per acre-foot.

Table 3-2 Estimated Increased Runoff and Costs of Cloud Seeding Projects (2015)

Project	Estimated Increased Runoff (ac-ft)	Project Cost	Unit Cost ($/ac-ft)
Northern Utah	50,698	$81,929	$1.62
Central & So Ut	83,654	$169,359	$2.02
Western Uintas	22,364	$69,753	$3.12
High Uinta	29,947	$86,758	$2.90
Total	186,663	$407,798	$2.18*

*Indicates average unit cost rather than total.


New snowfall, Brighton Resort, 2019
PC: Dallin McCartney

Water Storage

Groundwater and reservoirs provide valuable storage for the water supply. Both groundwater and reservoir levels are influenced by precipitation, streamflow, and snowpack. Within the Water Budget model, groundwater withdrawals are estimated based on M&I use, agricultural and riparian demand, and [USGS Groundwater Reports](). Reservoir data is obtained from the [U.S. Bureau of Reclamation]() and other local reservoir operators. Current reservoir conditions are available on the [Bureau of Reclamation's]() website.

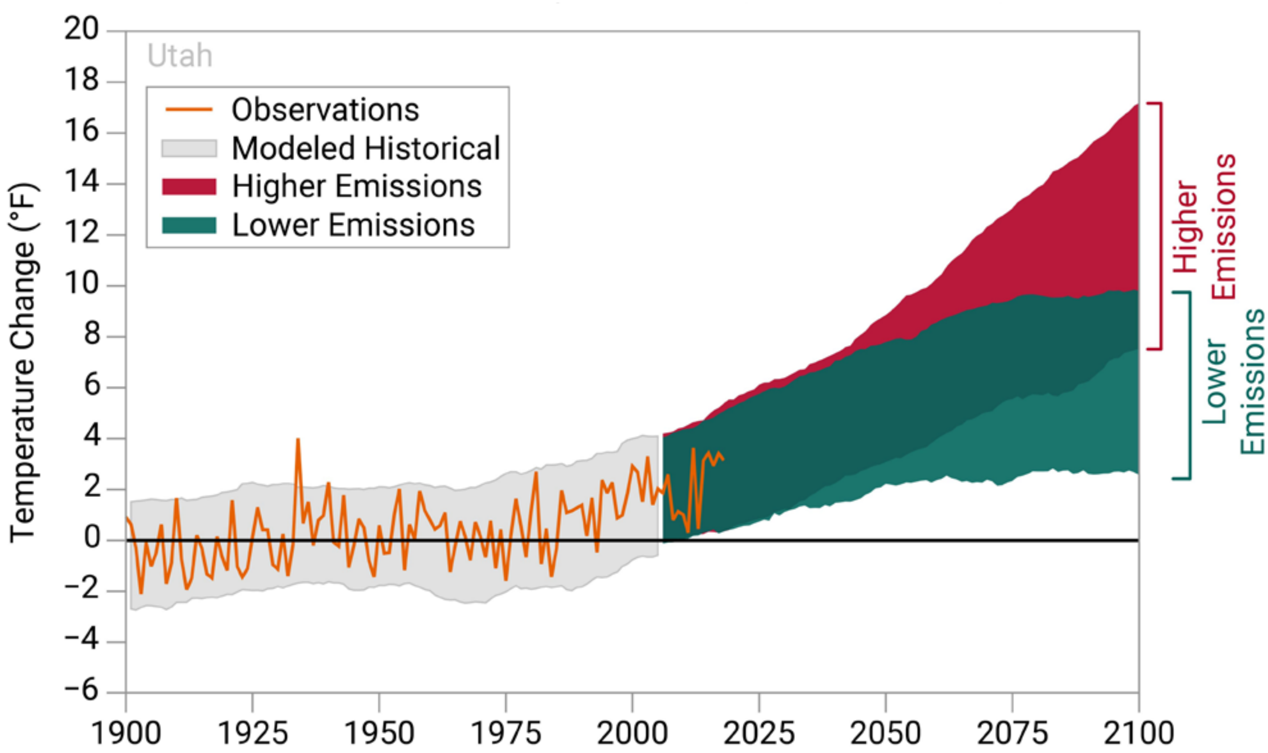
Water Supply Challenges

Climate Change

Utah's climate is highly variable and strongly influenced by topographic and land-surface contrasts, prevailing weather patterns, and proximity to the Pacific Ocean, Gulf of California, and Gulf of Mexico. Utah's historical temperature records from 1950 to 2017 show average temperatures in the state warmed by about 2°F. This rate of change is similar to the average warming of the western United States but higher than the national values of 1.3-1.9°F. The climate-warming rate in Utah in recent decades (2000 to 2017) is higher compared to records from 1950 to 2000. Figure 3-3 illustrates the change in warming rates. Most of the global and regional climate model projections indicate that annual average temperatures across Utah are likely to increase from 5°F to 7°F by the end of the 21st century (Khatri, K 2020).

The same kind of changes are not evident in historically observed precipitation records as they are for temperature. Precipitation

Figure 3-3 Temperature Change Projections



Source: Khatri, K 2020.

varies substantially across Utah depending on exposure to the typical seasonal weather patterns and elevation. Utah's precipitation increases in the winter and decreases in the summer. The majority of the regional future climate studies indicate decreases in snow accumulation and earlier snowmelt in the future. It is also predicted that changes in the frequency, duration, and magnitude of extreme weather events will be some of the consequences of a changing climate.

Changes in climatic variables, including temperature and precipitation, will affect snow hydrology, surface water, reservoir storage, and groundwater in multiple ways. Among the most significant of these anticipated effects are changes in snowpack accumulation and snowmelt, changes in runoff timing and quantity, and additional risks associated with extreme drought and runoff events. Changing climate will alter the hydrologic cycle, simultaneously affecting both water demand and water supply.

Planning for adaptation and mitigation measures to manage and respond to climate change is widely accepted in water planning circles today. Climate change estimates are used to review the suitability of current and planned water resources practices, policies, and infrastructure. The Division is working to evaluate and analyze how, where, and when climate risks will impact Utah's water resources. To plan for adaptation and mitigate the potential changes, climate change is accounted for in water models. The Division is currently using a 10% net increase in evapotranspiration by 2065 in the water demand model (see Chapter 4) and a possible reduction of 10% in future reliable supplies (see Chapter 6).

Drought

Water cannot be counted on to fall where, when, or in the amount we expect. Intense and prolonged drought have prompted research and action to help mitigate impacts. Tree ring studies show that prolonged periods of drought have occurred historically and are expected to occur in the future. Drought can affect many aspects of life in Utah, including agriculture, recreation, environment, tourism, the economy, and even residential landscaping resulting from water restrictions.

The 2018 water year (October 1, 2017, through September 30, 2018) consisted of record-low snowpack and an associated record-low spring runoff. This, combined with one of the warmest summers ever recorded, resulted in the governor declaring a statewide drought emergency. The effects of the drought were offset by high water levels in many reservoirs from a wet 2017 water year. Water reserves are critical to help areas cope with dry years. While most areas can manage one severely dry year, providing an adequate water supply over several years of drought is more challenging. The 2019 water year saw both extremes with high winter precipitation and an extremely dry summer in some areas. St. George set a new record with 155 days in a row with no measurable precipitation.

The 2020 water year had record dry weather and was the eighth-warmest calendar year on record. Soil moisture was also the driest since monitoring began in 2006, which reduces the effect of snowmelt as it's absorbed by dry soils rather than filling streams, rivers, and reservoirs.

The 2021 water year did not provide much relief. The intensity of the drought was extreme or exceptional (the worst two ratings) for most of Utah throughout the year. On March 17, 2021, Gov. Cox declared a state of emergency due to drought, and the state took unprecidented actions to help reduce water use and mitigate impacts of ongoing drought.

Utah Drought Planning

Utah has a State Drought Response Plan. The purpose of the this plan is to provide an effective and systematic way for the state to respond to emergency drought circumstances. As there is no universally accepted definition of drought, the Surface Water Supply Index (SWSI) is currently used to objectively quantify a drought that triggers specific state actions. The plan outlines itemized drought response actions and identifies which SWSI values will initiate the described actions.

Within each of the actions, tasks are assigned to different task forces. The task forces gather water availability and drought impact information and provide this information to state government leadership and response agencies. The 2013 State Drought Response Plan can be found on the Division's website. The Division is working with the Division of Emergency Management to update the plan to include lessons learned from the recent drought as well as new drought measurement methods.

The Evaporative Demand Drought Index estimates the changing evaporative demand and is a new method for measuring drought. The National Oceanic and Atmospheric Administration (NOAA) defines evaporative demand as the "thirst of the atmosphere for any water – on the surface of lakes, rivers, in soils, or in plants." The index accurately signaled the onset of a 2015 drought in Wyoming as well as a 2017 drought in South Dakota's Black Hills and the southeastern

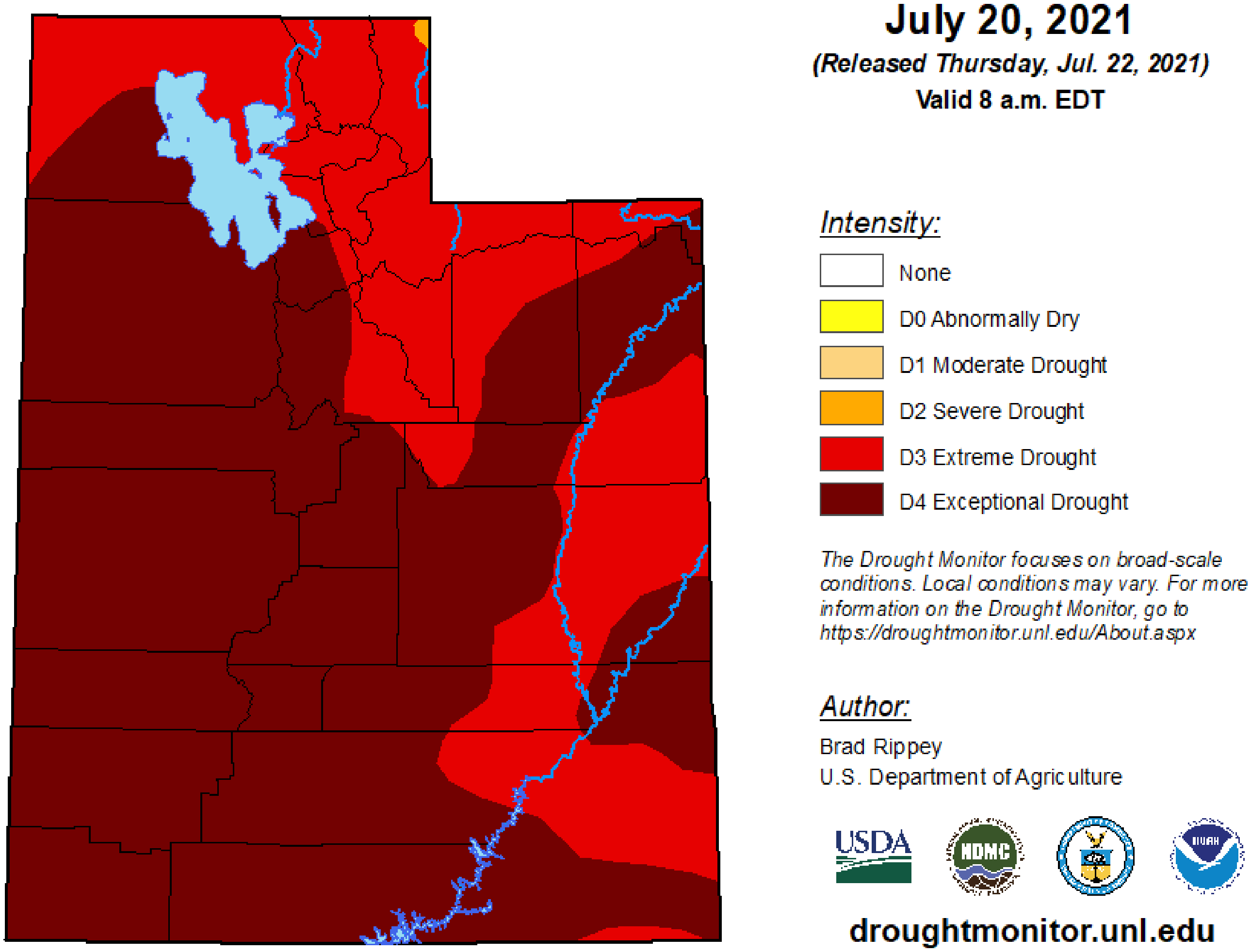
United States (NOAA 2017). Currently, the widely accepted U.S. Drought Monitor is the tool of choice, although the Evaporative Demand Drought Index is gaining support.

The U.S. Drought Monitor Map is updated weekly by the National Drought Mitigation Center. The U.S. Drought Monitor website houses current and historical maps. To populate the map, the Drought Monitor authors use multiple weather indicators as well as information from the state on its current water situation. Since rainfall and weather data are more sparse in many rural areas, the Division, the Utah Department of Agriculture and Food, and the Utah Climate Center host monthly webinars with state and federal partners to provide feedback to the Drought Monitor authors. The goal of these webinars is to gather and share information, which helps create maps that more accurately represent the statewide drought situation.

Drought Mitigation

While Utah has a Drought Response Plan, drought mitigation plans are best prepared on a local level. A mitigation plan includes advance preparation for potential drought conditions, rather than a response once a drought hits. Mitigation plans prepare for droughts locally, creating capital

Graphic 3-7 U.S. Drought Monitor Map for Utah



improvement plans, water use reductions, and vulnerability assessments for water systems.

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Evaluate and advance a standard methodology used to determine depletion.
- Analyze existing streamgage and weather station networks within the state and identify where additional resources are needed.
- Investigate ways to improve the Water Budget and supply measurements.
- Identify new cloud seeding areas, implement new technology as it's available, and continue to fund cloud seeding projects to augment Utah's water supply.
- Continue to incorporate climate change in planning models.
- Update and revise the Drought Response Plan.

Chapter 3 Links

Open Water Data Website - dwre-utahdnr.opendata.arcgis.com

PRISM - http://prism.oregonstate.edu/

SNOTEL - https://www.wcc.nrcs.usda.gov/snow/about.html

Streamgages - https://waterdata.usgs.gov/nwis/rt

USGS Groundwater Reports - https://ut.water.usgs.gov/publications/pubsgw.html

U.S. Bureau of Reclamation - https://www.usbr.gov/uc/water/index.html

Tea-cup Diagrams of Current Reservoir Conditions - https://www.usbr.gov/uc/water/basin/index.html

Cloud Seeding to Increase Precipitation Act (Utah Code 73-15) - https://le.utah.gov/xcode/Title73/Chapter15/73-15.html

Cloud Seeding Study - https://water.utah.gov/wp-content/uploads/2019/CloudSeeding/Cloudseeding2015Final.pdf

2013 State Drought Response Plan - https://water.utah.gov/water-data/drought/

Division Website - https://water.utah.gov/

U.S. Drought Monitor - https://droughtmonitor.unl.edu/

Drought Mitigation Plans - https://drought.unl.edu/droughtplanning/InfobyState.aspx

Statewide Water Infrastructure Plan - http://prepare60.com/Content/SWIP.pdf

Prepare 60 Website - http://prepare60.com

Division of Drinking Water System Sizing and Capacity Evaluation - https://deq.utah.gov/drinking-water/system-sizing-and-capacity-evaluation

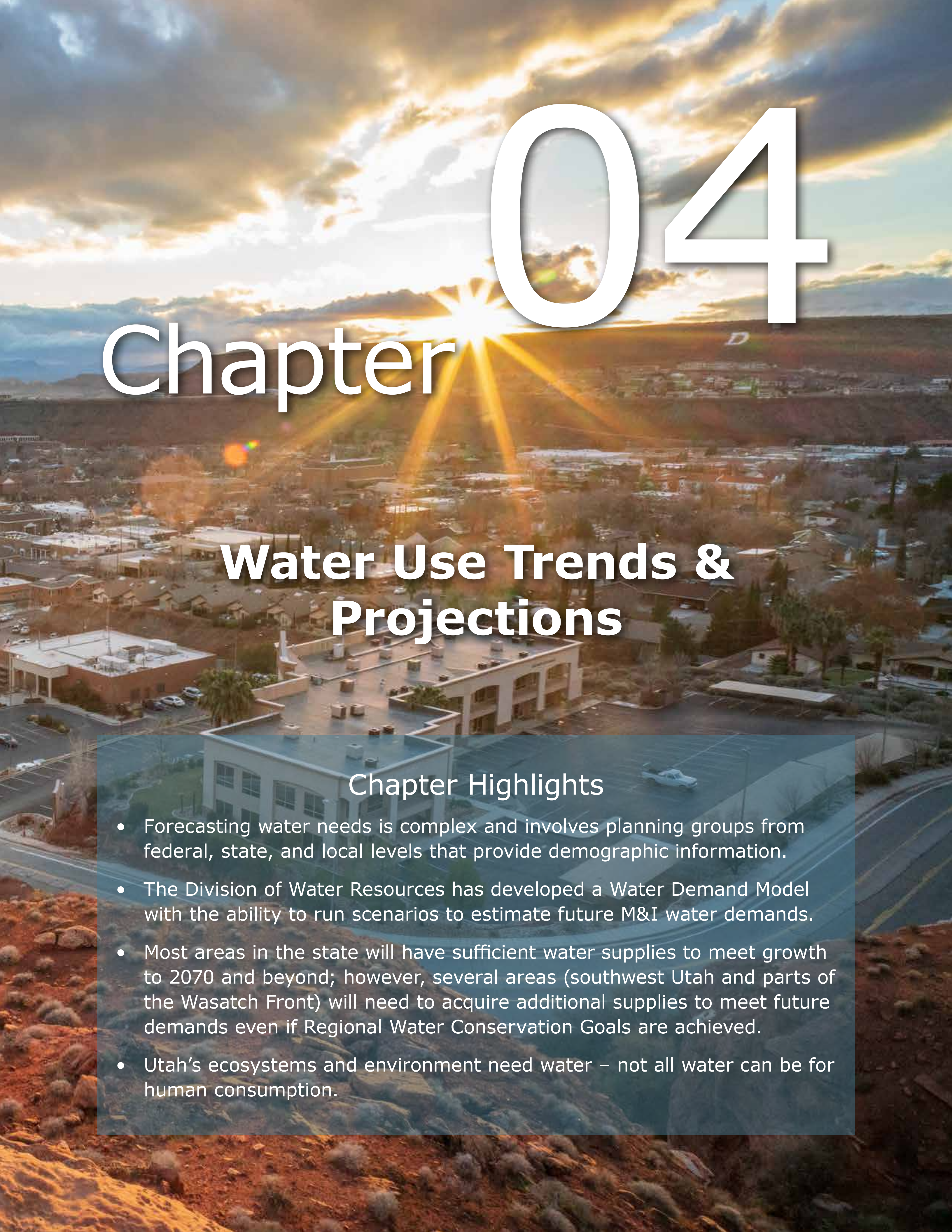
Citations

Khatri, K. and Courtney Strong, 2020. *Climate Change, Water Resources, and Potential Adaptation Strategies in Utah.* Salt Lake City, Utah. (https://water.utah.gov/wp-content/uploads/2020/11/Finaldraft_ClimateChangeUtah__March2020.pdf)

OLAG 2015. Office of the Legislative Auditor General, *A Performance Audit of Projections of Utah's Water Needs,* 2015.

NOAA 2017. National Oceanic and Atmoshperic Administration, "New NOAA tool is helping to predict U.S. droughts, global famine," November 30, 2017. (https://research.noaa.gov/article/ArtMID/587/ArticleID/12/A-new-NOAA-tool-is-helping-to-predict-US-droughts-global-famine)

Sun setting over St. George



Chapter 04

Water Use Trends & Projections

Chapter Highlights

- Forecasting water needs is complex and involves planning groups from federal, state, and local levels that provide demographic information.
- The Division of Water Resources has developed a Water Demand Model with the ability to run scenarios to estimate future M&I water demands.
- Most areas in the state will have sufficient water supplies to meet growth to 2070 and beyond; however, several areas (southwest Utah and parts of the Wasatch Front) will need to acquire additional supplies to meet future demands even if Regional Water Conservation Goals are achieved.
- Utah’s ecosystems and environment need water – not all water can be for human consumption.

Estimating Future Population

One of the primary steps in forecasting water needs is estimating future population. As mentioned in Chapter 2, the Kem C. Gardner Policy Institute (Gardner Policy Institute) at the University of Utah calculates, projects, and publishes population estimates for the State of Utah at the county level. After these county estimates are published, a group consisting of Utah's metropolitan planning organizations and a consultant working for the Utah Department of Transportation, divide these estimates into smaller units called traffic analysis zones (TAZs). These zones are used as inputs to the Division's Population Distribution Model. The purpose of this model is to distribute county populations into individual water system boundaries by using TAZs and census blocks. Once this is completed, the Division uses this data to estimate future water demands using a scenario-based water demand model.

Water Demand Model

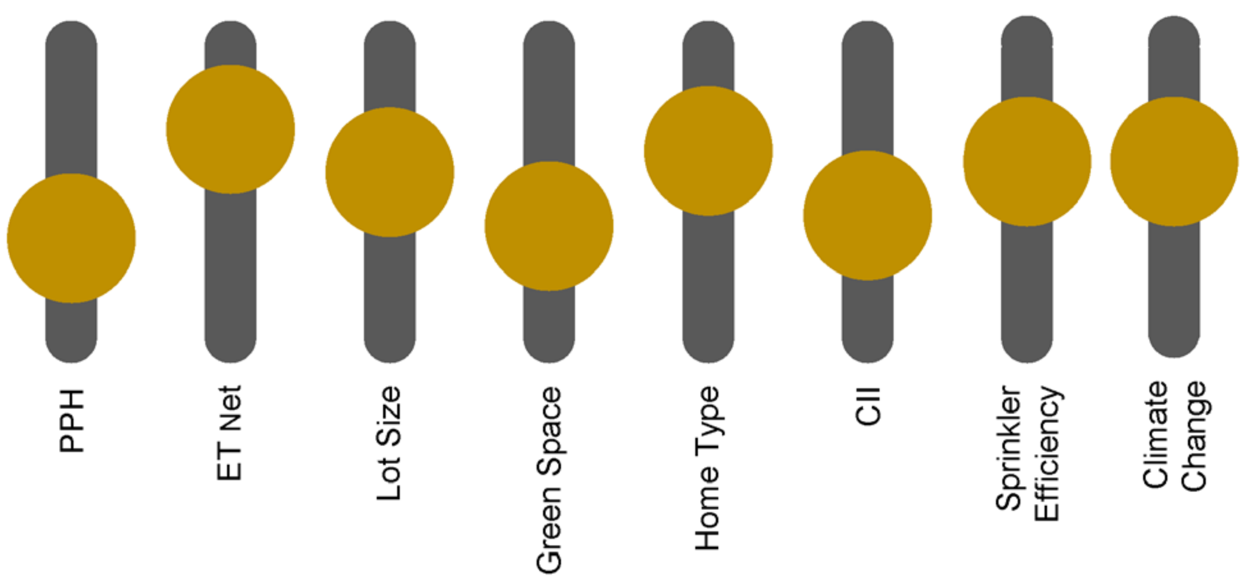
The Division has developed a statewide Water Demand Model (Demand Model) that makes it possible to investigate various scenarios and project municipal and industrial water demand based on alternative growth, development, and conservation choices – the model doesn't account for agriculture water use. The Demand Model uses factors that directly affect water consumption and have a known or well-estimated rate of change that can be validated. Inputs to the Demand Model are shown in Graphic 4-1.

Water Demand Model Inputs

A description of each of the inputs and some influences follows:

- **Persons per household (PPH)**: Changes in PPH are captured by the Gardner Policy Institute county scale population projections. Water supplier's

Graphic 4-1 Demand Model Inputs



PPH changes reflect these countywide projections. PPH is declining throughout the state.

- **Net evapotranspiration (ETNet)**: Net evapotranspiration for turfgrass is calculated from gridded-ET, which uses North American Land Data Assimilation System data. The gridded-ET data set incorporates data collected from 1979 through the present day. Raw data values are corrected for elevation, mountainous terrain, time of day shadowing, and wind. The resulting values from these data sets are called ETNet or NetET.
- **Lot size**: The size of residential parcels is measured in acres. This value can vary from supplier to supplier. The general trend is for lot size to decrease with changing social interests and with rising land prices. In general, rural areas show slower decreases in lot size than urban areas.
- **Green space**: Trends for urban residences are for reduced green space on the same size lot. Single- and multi-family homes differ in percentage of green space. If more waterwise landscape practices are adopted, this factor could drop water use significantly.
- **Home type**: Single-family, multi-family, townhomes, and apartments generally have significant differences in PPH, lot size, and green space. With rising land costs, multi-family, townhome, and apartment building permits have increased in proportion compared to single-family building permits in recent years.


Localscape in Cottonwood Heights
PC: Jordan Valley Water Conservancy District

- **Commercial, Industrial, and Institutional (CII)**: This is the number of connections and the water use of each of these user types within each water supplier's area.
- **Population**: This is the full-time, permanent residential population. Some seasonal adjustments are made where transient residential populations are significant.
- **Sprinkler Efficiency**: This is the sprinkler application efficiency, which is generally 60%. The efficiency, as used in the model, encompasses behavior of the system operator (e.g. if the homeowner turns off their system after a storm) and any other losses beyond the connection (e.g. leaks in a homeowner's system). As landscaping practices change, this factor may improve through the increasing use of drip irrigation systems and other practices.
- **Climate change**: This is incorporated in the Demand Model by adjusting ETNet values over time to reflect the predictive results of climate models. In the Baseline and Regional Conservation Goal (RCG) scenarios, ETNet is progressively increased to 11% at 2070.

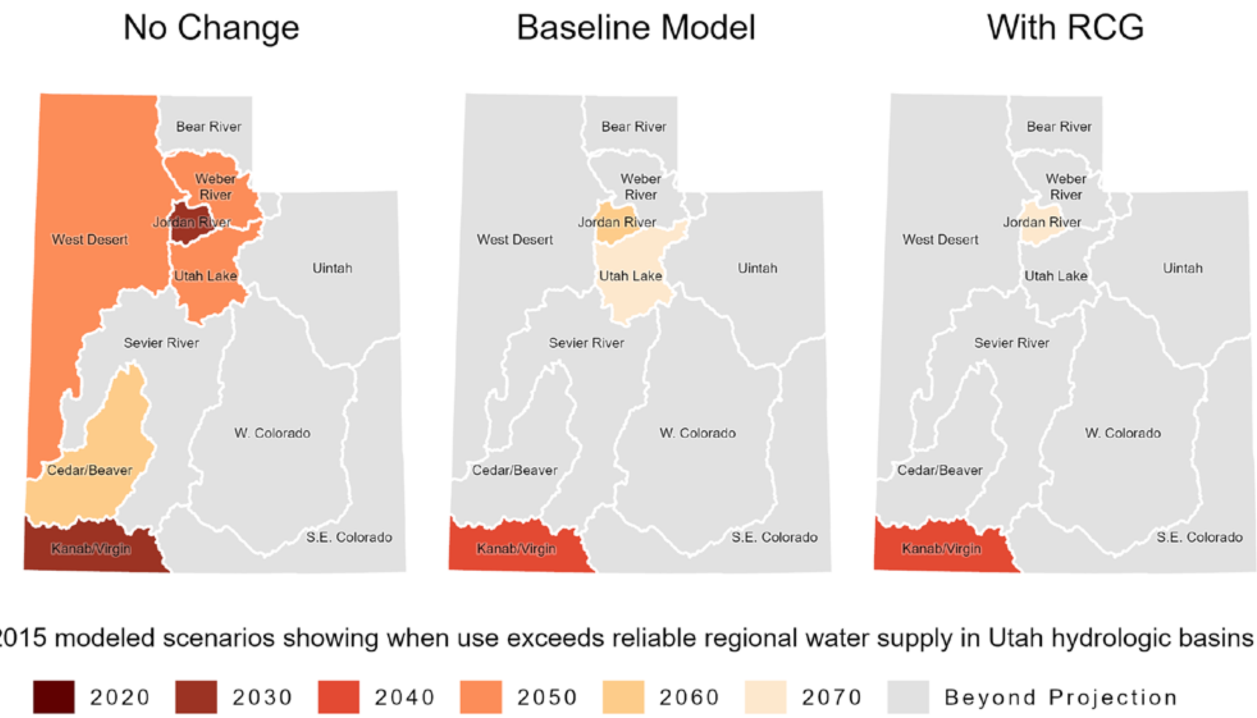

Deer Creek Reservoir
PC: Utah Division of State Parks

The Demand Model allows factors to be adjusted that reflect trends within water supplier boundaries for regional or local conditions and demographics. Input data are acquired from local and state data sets. The resulting Demand Model projections represent the customer demand and don't include system water losses or additional water that is required to maintain and operate the system. Water losses include distribution system leaks, overflow from storage reservoirs, unauthorized use, metering errors, and systemic data handling errors. An independent review of the 2015 M&I water use numbers (BCA & HAL 2018) recommended the system demand be estimated at 15% greater than the customer demand to meet all system needs. System demand represents the total amount of water necessary to operate the system without shortages and is discussed in Chapter 6.

Graphic 4-2 depicts when river basins will run short of M&I water supply based on customer demands under the three different scenarios modeled, which are shown later in Table 4-1. Individual basin demands, enumerated in these tables, are similarly presented in Appendix E, Demand Model Results by Basin.

The Demand Model predicts water needs over the next 45 years using the Gardner Policy Institute population projections out to 2065. The model then uses extrapolated population growth ranges to extend demand predictions an additional five years through 2070. Predicted M&I customer demands are summed by river basin in Table 4-1.

Graphic 4-2 Demand Model Scenario Results



Demand Model Descriptions

No Change:

- Expected Growth Rates
- Baseline (2015) rates of use
- No climate change considered

Baseline Model:

- Expected growth rates
- Current (2019) conservation practices and trends in place
- Partial conversion to higher efficiency household appliances and landscapes
- Climate change of 11 percent ETNet by 2070

With Regional Conservation Goals (RCG):

- Expected growth rates
- Meeting regional conservation goals through additional conservation practices
- Climate change of 11 percent ETNet by 2070

Table 4-1 Projected Municipal and Industrial Water Demands

Basin Name * 2015 use (Acre-Feet) RS 2015 reliable supply	Model	2020	2030	2040	2050	2060	2070
Bear River * * * 56,300 Ac-Ft RS 154,800 Ac-Ft	No Change	65,100	79,100	93,300	105,100	118,000	130,600
	Baseline	61,400	66,600	73,500	80,500	87,900	95,300
	RCG	57,400	59,100	63,500	68,400	73,300	78,500
Cedar/Beaver * 15,900 Ac-Ft RS 29,200 Ac-Ft	No Change	17,700	21,100	24,200	26,900	30000	33,500
	Baseline	16,900	18,500	20,200	22,000	24,100	26,600
	RCG	16,600	17,300	18,300	19,800	21,400	23,300
Jordan River * 257,300 Ac-Ft RS 315,500 Ac-Ft	No Change	284,400	324,600	361,600	396,100	429,900	459,600
	Baseline	274,100	285,200	297,900	314,000	329,400	340,700
	RCG	267,300	272,400	282,500	298,300	315,000	324,900
Kanab/Virgin * * * 53,800 Ac-Ft RS 79,100 Ac-Ft	No Change	71,900	98,100	125,600	154,200	187,200	219,800
	Baseline	64,100	78,500	94,500	113,000	133,500	153,500
	RCG	61,900	75,100	89,900	107,700	127,100	146,000
S.E. Colorado * 5,570 Ac-Ft RS 14,300 Ac-Ft	No Change	6,300	7,500	8,500	9,500	10,400	11,400
	Baseline	5,900	6,400	6,900	7,500	8,100	8,700
	RCG	5,700	6,100	6,600	7,200	7,800	8,500
Sevier River * 26,800 Ac-Ft RS 55,500 Ac-Ft	No Change	27,600	32,500	36,500	39,700	43,700	48,200
	Baseline	27,000	29,200	31,200	33,300	36,100	39,100
	RCG	27,300	27,100	28,400	30,500	33,500	36,800
Uintah * 16,900 Ac-Ft RS 56,700 Ac-Ft	No Change	17,700	20,800	23,600	26,200	28,400	30,500
	Baseline	17,600	19,100	20,600	22,400	24,100	25,500
	RCG	17,100	16,800	17,900	19,600	21,100	22,500
Utah Lake * 152,700 Ac-Ft RS 320,200 Ac-Ft	No Change	178,500	232,800	296,100	362,500	428,400	500,000
	Baseline	165,800	192,600	226,200	264,800	302,200	341,900
	RCG	165,100	181,800	206,400	241,500	273,800	308,000
W. Colorado * 15,100 Ac-Ft RS 34,800 Ac-Ft	No Change	16,500	18,900	20,800	22,500	24,300	26,400
	Baseline	16,200	17,300	18,200	19,300	20,500	21,700
	RCG	14,900	14,400	14,900	15,900	17,100	18,200
Weber River * 174,500 Ac-Ft RS 288,300 Ac-Ft	No Change	200,800	238,400	273,200	301,700	326,200	351,100
	Baseline	187,700	197,800	211,100	226,300	238,700	251,100
	RCG	177,700	172,400	174,200	186,300	194,500	203,100
West Desert * 15,400 Ac-Ft RS 31,700 Ac-Ft	No Change	18,300	24,100	29,400	33400	36,800	39,700
	Baseline	17,000	20,200	23,300	25,900	28,200	30,200
	RCG	16,900	19,600	21,900	23,800	25,300	26,600

State Totals * 790,100 Ac-Ft RS 1,380,000 Ac-Ft	No Change	904,800	1,097,800	1,292,900	1,477,600	1,663,400	1,850,700
	Baseline	853,800	931,200	1,023,700	1,129,100	1,232,900	1,334,300
	RCG	827,900	862,200	924,600	1,019,200	1,109,800	1,196,300

* Data sourced from Utah Division of Water Resources 2015 Municipal and Industrial Water Use Report. All data rounded to the nearest 100th acre-foot (ac-ft).
* * High seasonal changes in population that include second homes and other transient visitation are accounted for in the Bear River Basin and Kanab/Virgin River Basin populations.

Color indicates that use estimate approaches or exceeds reliable regional supply

less ... more

View of Wasatch Mountains from Daybreak, South Jordan
PC: Cindy Costa

Localscapes Design
PC: Jordan Valley Water Conservancy District

Localscapes Design
PC: Jordan Valley Water Conservancy District

Figure 4-1 Projected Customer Demand for the State of Utah

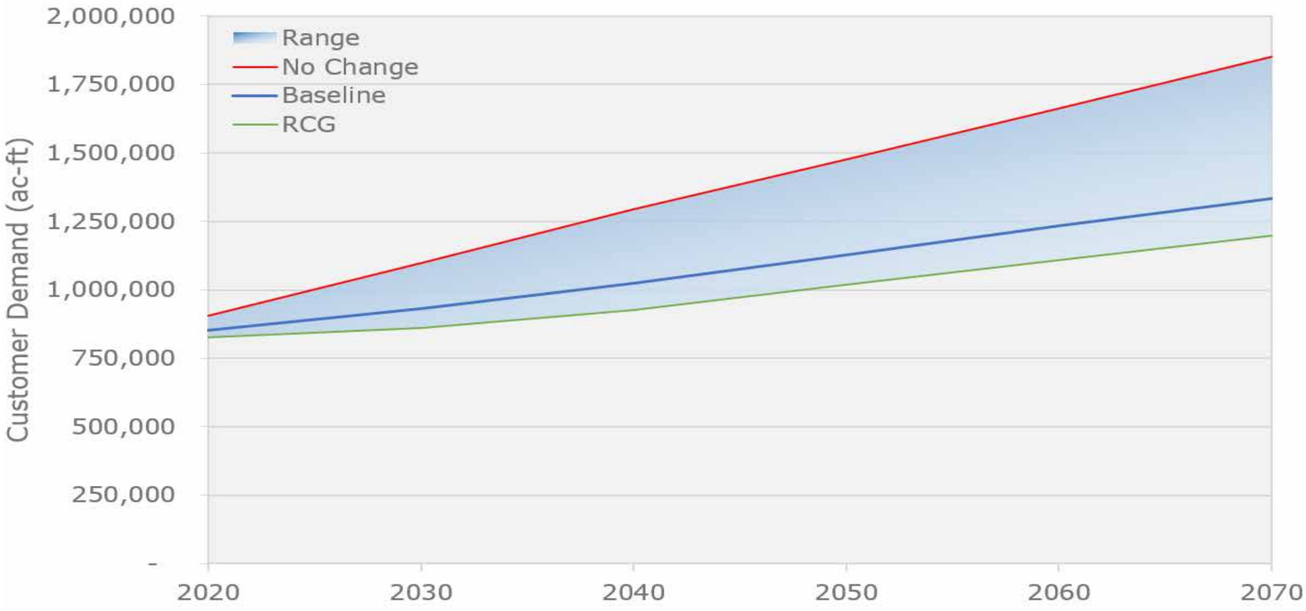


Figure 4-1 shows projected demands for the state based on the three modeled scenarios: No Change, Regional Conservation Goals (RCG), and Baseline.

Of particular note is the approximate 500,000 acre-feet difference between the No Change and the Baseline scenarios, which is nearly double the capacity of Jordanelle Reservoir.

Table 4-2 and Figure 4-2 show the combined results of the Wasatch Metro area (Jordan River, Utah Lake, and Weber River basins).

Table 4-2 Projected Municipal & Industrial Customer Demands for Wasatch Metro

Basin Name * 2015 use (Acre-Feet) RS 2015 reliable supply	Model	2020	2030	2040	2050	2060	2070
Jordan River * 257,300 Ac-Ft RS 315,500 Ac-Ft	No Change	284,400	324,600	361,600	396,100	429,900	459,600
	Baseline	274,100	285,200	297,900	314,000	329,400	340,700
	RCG	267,300	272,400	282,500	298,300	315000	324,900
Utah Lake * 152,700 Ac-Ft RS 320,200 Ac-Ft	No Change	178,500	232,800	296,100	362,500	428,400	500,000
	Baseline	165,800	192,600	226,200	264,800	302,200	341,900
	RCG	165,100	181,800	206,400	241,500	273,800	308,000
Weber River * 174,500 Ac-Ft RS 288,300 Ac-Ft	No Change	200,800	238,400	273,200	301,700	326,200	351,100
	Baseline	187,700	197,800	211,100	226,300	238,700	251,100
	RCG	177,700	172,400	174,200	186,300	194,500	203,100
Wasatch Metro * 584,400 Ac-Ft RS 923,800 Ac-Ft	No Change	663,700	795,700	930,900	1,060,300	1,184,500	1,310,700
	Baseline	627,600	675,600	735,200	805,100	870,400	933,700
	RCG	610,100	626,600	663,100	726,100	783,300	836,100

* Data sourced from Utah Division of Water Resources 2015 Municipal and Industrial Water Use Report.
All data rounded to the nearest 100th acre-foot (ac-ft).

Color indicates that use estimate approaches or exceeds reliable regional supply

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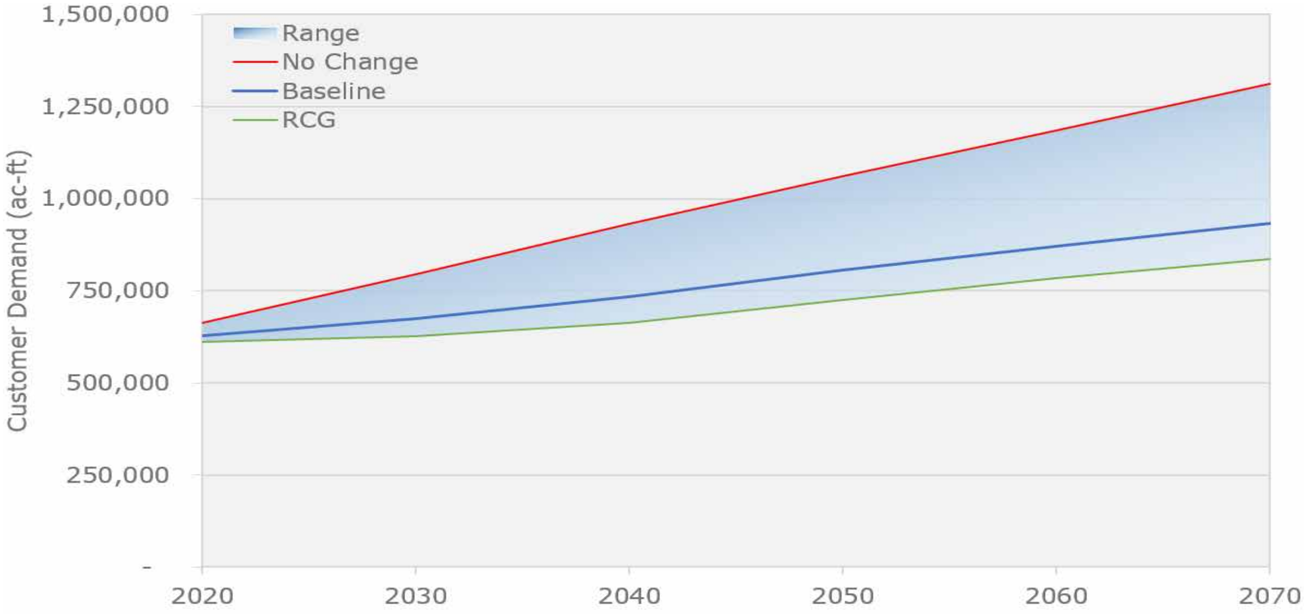
Figure 4-2 Projected Customer Demand for Wasatch Metropolitan Area



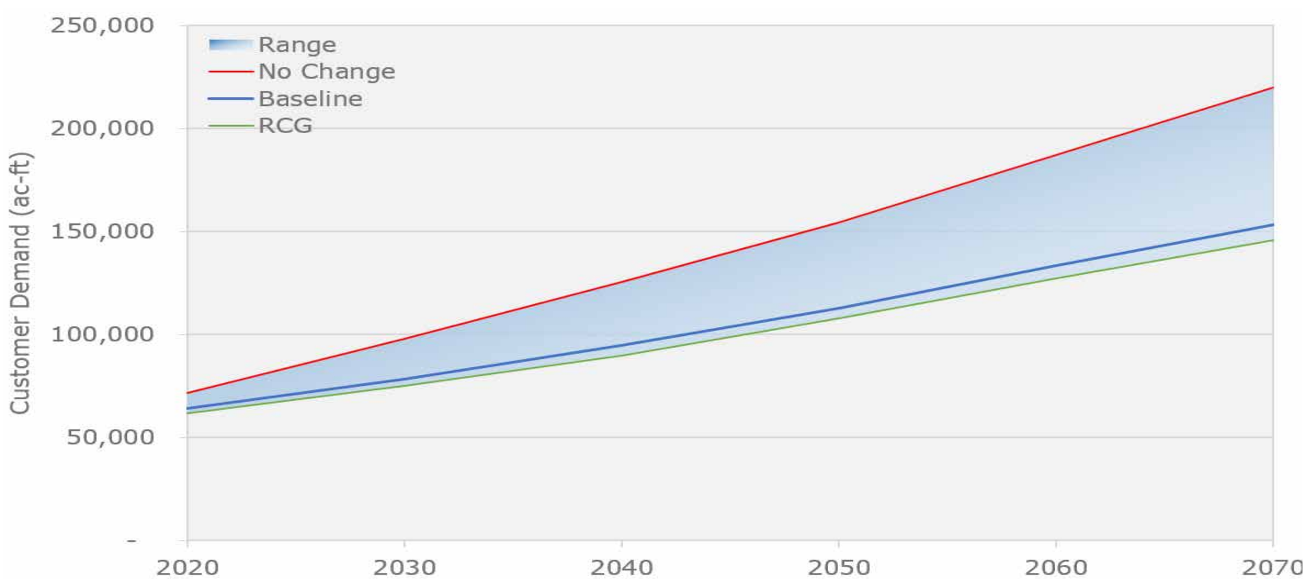
These are the river basins where the bulk of the state's population resides and where the most M&I water is used.

Figure 4-3 shows the resulting projected M&I customer demands for the fast-growing Kanab/Virgin River Basin. Notice how close together the lines are for RCG and Baseline track on this graph.

This trend indicates the recommended water conservation measures are already being used in the Kanab/Virgin River Basin. In this area, continued progress will require additional effort and innovation.

Demand model tables and graphs for all basins are provided in Appendix E.

Figure 4-3 Projected Customer Demand for Kanab/Virgin River Basin



Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Continue to work with other state agencies and water suppliers to obtain accurate water use records and measurements.
- Improve the Water Demand Model as new data, plans, and information become available.
- Encourage the use of the Water Demand Model by water suppliers for running various scenarios to help with planning efforts.

Chapter 4 Links

Regional Conservation Goals - https://conservewater.utah.gov/regional-water-conservation-goals/

Recommended State Water Strategy - https://envisionutah.org/utah-water-strategy-project

Kem C. Gardner Policy Institute Population Estimates - https://gardner.utah.edu/demographics/population-projections/

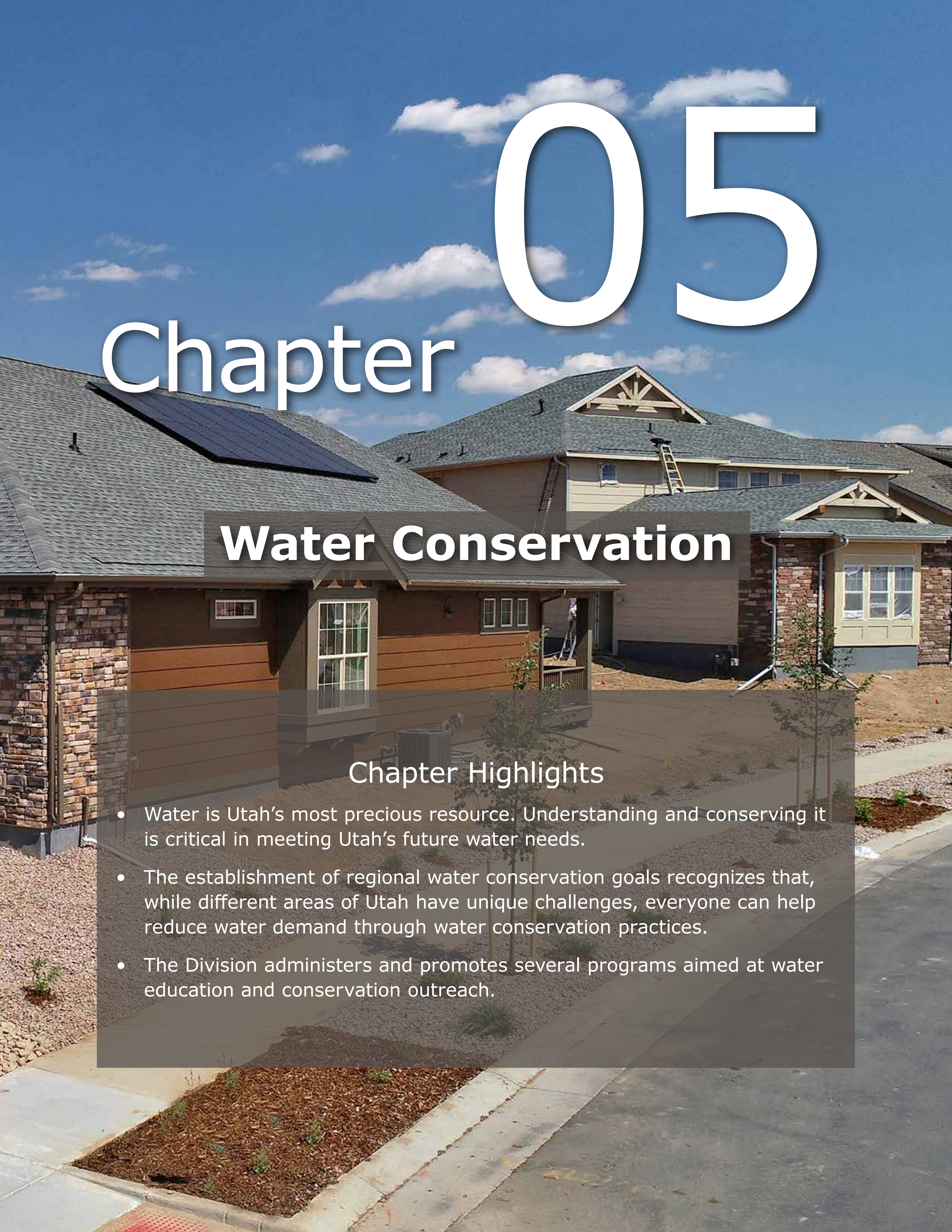
Open Water Data Website - dwre-utahdnr.opendata.arcgis.com

Citations

BCA & HAL 2018. Bowen Collins & Associates and Hansen Allen & Luce, Inc. State of Utah Water Use Data Collection Program Report,Salt Lake City, Utah, January 2018. (https://water.utah.gov/wp-content/uploads/2019/12/WaterUseDataCollectionReport2018.pdf)

Jordanelle State Park
PC: Utah Division of State Parks

Waterwise landscapes can greatly reduce the water demand associated with new development



Chapter 05

Water Conservation

Chapter Highlights

- Water is Utah's most precious resource. Understanding and conserving it is critical in meeting Utah's future water needs.
- The establishment of regional water conservation goals recognizes that, while different areas of Utah have unique challenges, everyone can help reduce water demand through water conservation practices.
- The Division administers and promotes several programs aimed at water education and conservation outreach.

Water is Utah's Most Precious Resource

Water is necessary for life. Everything from our lifestyles to our gardens to the network servers that allow us to browse social media depends on it. Utah has a semi-arid climate and is one of the driest states in the nation. Utahns must work together to appreciate and conserve water.

The Utah Division of Water Resources (Division) administers water conservation and education outreach to inform, promote, and strengthen Utah's waterwise ethic, which leads to more efficient use of this precious resource.

The Division has been promoting water conservation practices for over 30 years, including:

- Emphasizing water conservation in state and river basin water plans.
- Implementing state water funding boards' water conservation policies.
- Administering the Water Conservation Plan Act.
- Supporting and leading the media campaign of the Governor's Water Conservation Team.
- Researching new water conservation technologies and practices.
- Promoting water reuse.
- Recommending Best Management Practices for Utah's water providers.
- Setting the example of efficient water use at state facilities.
- Implementing Regional Water Conservation Goals.

The State of Utah continues to make significant progress in water conservation. According to the 2015 Municipal and Industrial Water Use Report, statewide water use decreased by about 18% from 2000 to 2015. New regional water conservation goals were developed to enhance water conservation efforts around the state. Regional goals are specified in the document titled Utah's Regional M&I Water Conservation Goals and are shown in Graphic 5-2.

Region-specific goals for Utah make sense, given Utah's diverse geography. Utah is the first state to establish conservation goals on a regional level. The regions (see Graphic 5-2) were created based on the Board of Water Resource's river districts, except the Lower Colorado River North and Lower Colorado River South regions.

The regional goals build on the previous statewide goal of reducing per-capita use by 25% by 2025. Reaching these regional goals will require actions including policy and ordinance changes on the state, county, and municipal levels.

As part of the Division's effort to develop regional water conservation goals, over 1,650 people participated in a water conservation survey. The Division also held open houses in eight different locations across the state in the fall of 2018 to solicit input and answer questions. This robust public process resulted in 330 public comments. After public input was compiled, a team consisting of water providers, members from the Governor's office, and Division staff

Graphic 5-2 What Is the Regional Water Conservation Goal Where You Live?

worked with a third-party consultant to provide input on region-specific M&I water conservation goals. These regional goals will help guide the state's water industry in planning future infrastructure, policies, and programs consistent with Utah's semi-arid climate and growing demand for water. The Division appreciates all who participated in developing these goals.

Fast-Tracking Water Conservation

On July 29, 2021, Governor Cox held a press conference to show his administration's commitment to advancing more aggressive water conservation measures in Utah. This included four focus areas to fast-track water conservation and water planning (see Graphic 5-3).

Expanding Turf Buyback

Turf buyback programs like "Flip Your Strip'' offered by local water conservancy districts along the Wasatch Front provide a valuable incentive for people to replace thirsty grass with waterwise options. These programs are typically only offered by local water agencies. Utah wants to be the first state to expand the turf buyback program statewide. The goal is to plant grass in areas where it's actively used rather than using it as the default groundcover. Implementing a statewide rebate program will show Utah is serious about conservation and leading the way.

Integrating Land Use & Water Planning

As one of the fastest-growing states in the nation, how we grow and develop today will set our water use for decades to come. Land use planning is often undertaken independently of water planning efforts, even though the two can and should inform one another. Integrating these and requiring water-efficient landscape ordinances from the beginning of a development proposal is more cost-effective than retrofitting existing landscapes. The state is enlisting the help of local officials to adopt water efficiency standards for new development.

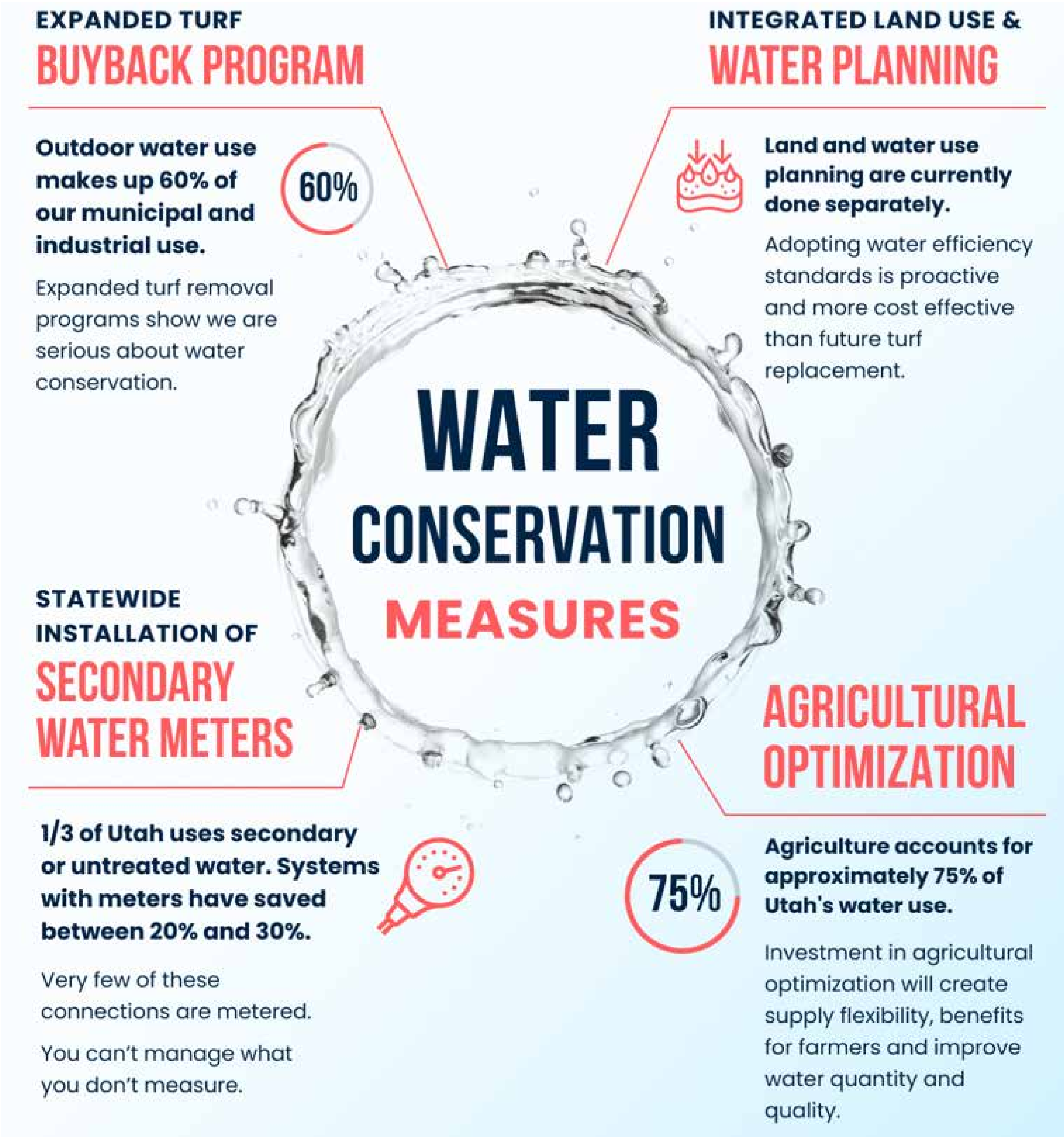
Secondary Water Meters

Installing secondary meters saves water. Data shows significant savings of 20-30%. Over the last few years, legislation has been passed to require meters on new secondary connections, and $2 million annually has been appropriated in matching grant funds to offset the cost of installation in first- and second-class counties. This effort must be accelerated statewide.

Agricultural Optimization

The state is facing critical long-term reliable water supply issues. The agricultural sector accounts for about 75% of the state's total water use. (It ranges from 6% in Salt Lake County, to 58% in Utah and Juab counties, and 95% in rural areas like Millard, Cache and Uintah counties.) Agriculture and agricultural water use need to be part of any water planning discussion. Over the last few years, the state has invested approximately $7.3 million in agricultural optimization research and projects. Continued investment will help the state evaluate ways to improve agricultural water use practices, create benefits for farmers, optimize water use, and protect water quantity and quality for all uses in the system.

Graphic 5-3 Four Focus Areas to Fast-Track Water Conservation and Planning



Water Conservation Plans

Water Conservation Plans help water providers and suppliers prepare for their future water needs by creating goals and implementing water efficiency and conservation management strategies. The Water Conservation Plan Act (Act) (Utah Code 73-10-32) was enacted in 1998. The Act requires culinary water providers with 500+ connections and smaller systems that seek funding from the state to prepare a water conservation plan and submit it to the Division every five years. By statute, the plan "shall contain a clearly stated overall water use reduction goal and an implementation plan for each of the water conservation measures it chooses to use, including a timeline for action and an evaluation process to measure progress." The Division also requests each water system to describe its pricing structure, reliable water supply, and future demand in its water conservation plan. The Act applies to approximately 175 water systems throughout the state.

A water conservation plan provides an opportunity for water systems to define their water conservation programs and celebrate their accomplishments. Water conservation coordinators are key to successful water conservation programs on a state, county, and municipal level. Coordinators assist planners as they develop water conservation plans to ensure water resources are considered when planning for development, encourage the public to implement wise water-saving tactics, and offer educational resources to water users.

The Division provides planning resources to water systems through its Water Conservation website. The website lists water systems that have water conservation plans due and lists systems that are compliant/noncompliant with the Act. It also serves as an educational resource for the public to learn about water conservation, the value of water, and how to use water efficiently.

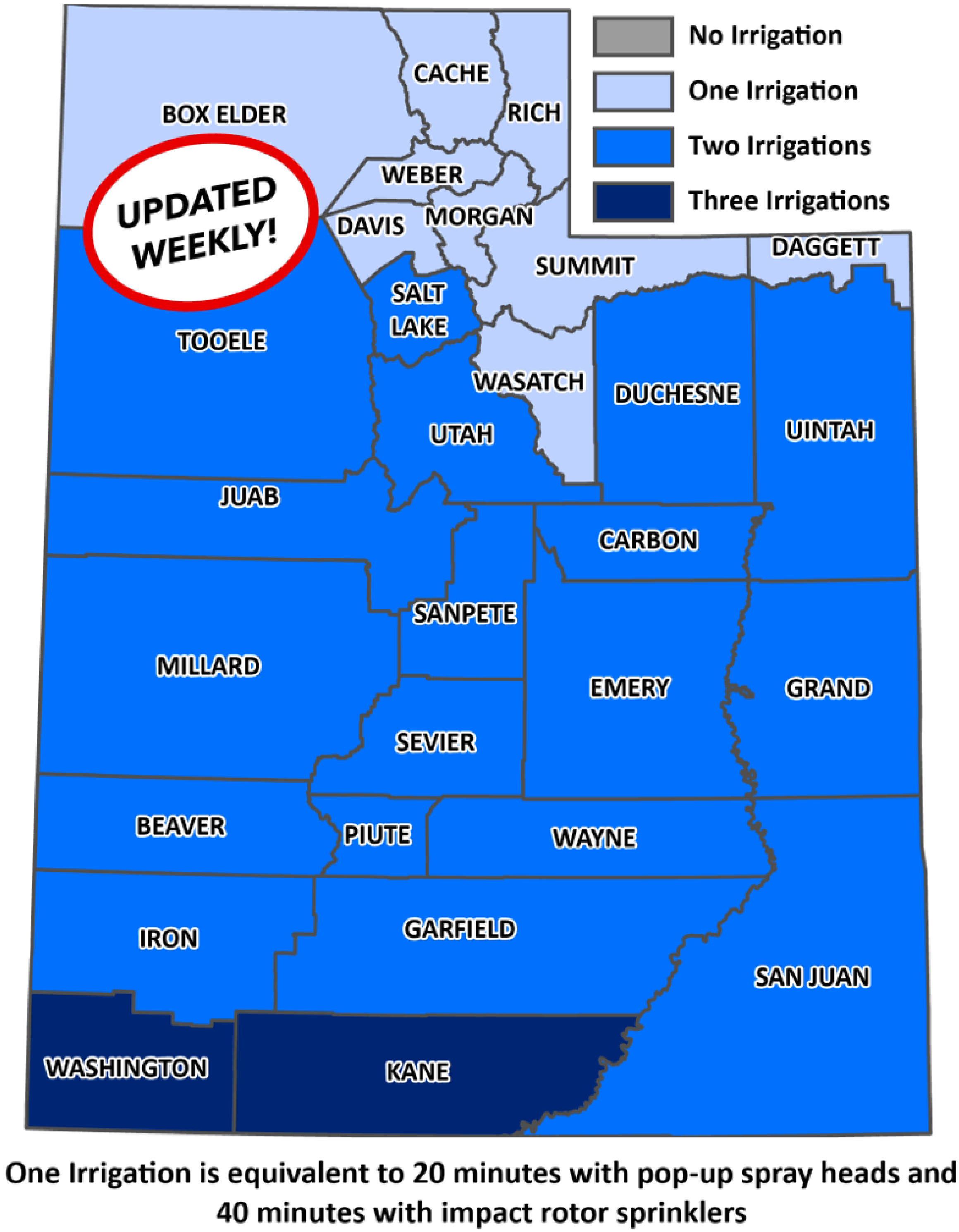
Utah's Weekly Lawn Watering Guide

The Division posts a Weekly Lawn Watering Guide online during the irrigation season (see Graphic 5-4). This guide provides watering recommendations based on current weather patterns and evapotranspiration rates in each county. The Division uses social media to publicize the recommendations and has built a large following on Facebook due in part to the popularity of the guide. These are general county recommendations. Additional area-specific information may be available from local water providers.

Water Loss Accounting

The Division has partnered with several water conservancy districts, Rural Water Users Association, and the Intermountain Section of the American Water Works Association to provide training for water providers to implement water loss auditing in their systems. A system audit involves measuring or estimating all of the water passing through the system. After water uses are measured or estimated, a system water balance is created. The audit produces valuable information that can lead to more efficient water use, more accurate accounting, recovery of lost revenue, and

Graphic 5-4 Division Lawn Watering Guide



leak detection and reduction. Audit results help managers and engineers make informed decisions regarding necessary system rehabilitation and meter replacement and management. The state continues to work with stakeholders and promotes training programs and education through standardized training on water audits.

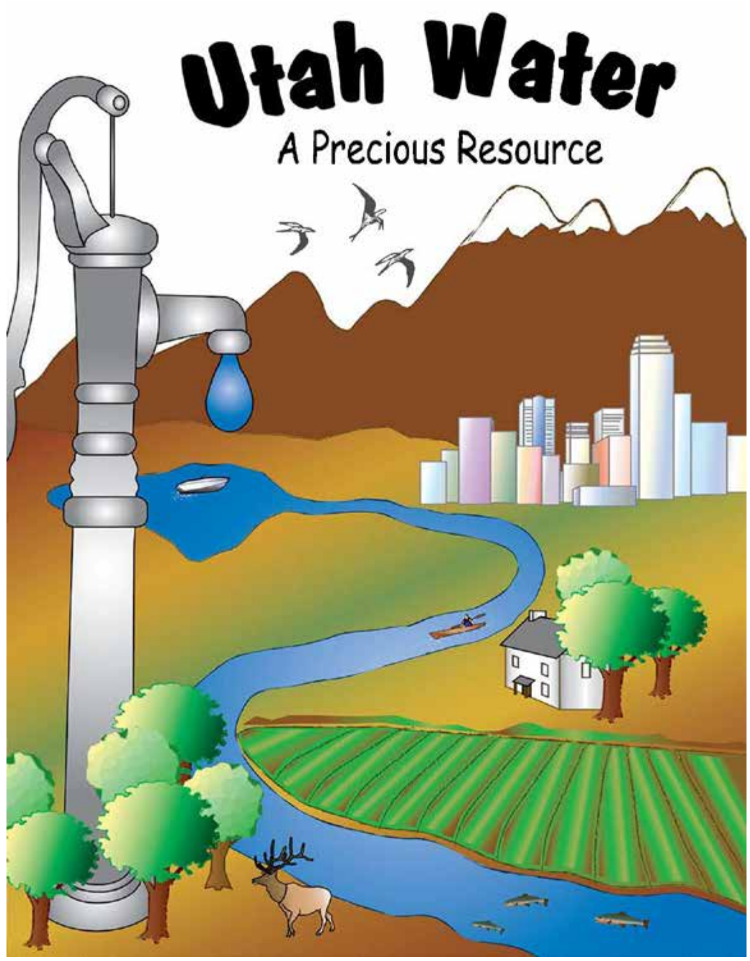
Water Education

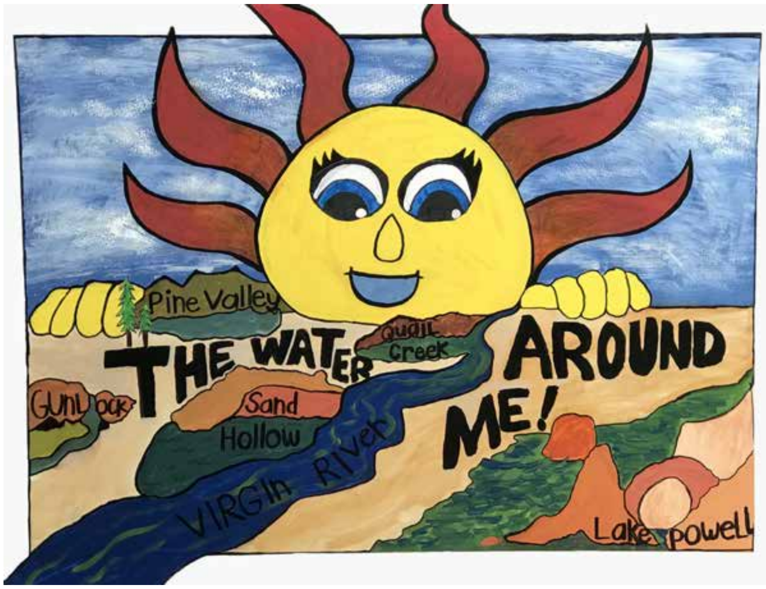
A foundational understanding of water leads to responsible water use, which is why the Division has supported water education efforts. However, in the summer of 2020, due to budget cuts triggered by the COVID-19 pandemic, the Division's education program was cut, eliminating resources previously provided to schools and teachers.

Water education in elementary school helps to prepare children to become responsible water users as adults. Early education instills a sense of ownership, builds values, and strengthens the lifelong waterwise ethic Utah has cultivated over the years. Elementary students are introduced to the concept of water as a finite resource and understand that they must use it wisely. Children proudly share what they learn with those around them and often become champions for waterwise choices.

Before the budget cuts, the Division collaborated with the Utah State Board of Education, the Loveland Living Planet Aquarium, municipal agencies, water providers, and other organizations to support water education. The Division's annual poster contest allowed students to express their ideas about water-related themes through art. This creative expression allows for a deeper understanding and appreciation of a resource we don't think about all the time, but use every day, water. The Division encourages schools to prioritize water education and develop a meaningful water education curriculum so the next generation understands how we use water, why we need it, and how we can be better stewards of Utah's most precious resource.

The Division will continue to provide educational materials and lesson plans with its remaining budget. Resources are available on the water conservation website.





Artist: P. Haymore, 2020 Grand Prize Winning Poster

Utah Water – A Precious Resource is a free activity book for elementary school-age children. Using fun facts, colorful graphics, puzzles, and water experiments, the activity book teaches about water in Utah. The book contains valuable information about Utah water and focuses on how to use water responsibly. Copies of the book can be ordered from the [water conservation website].

The Division also seeks to educate all Utahns about their responsibility to be wise water stewards. Among other things, the Division's water conservation website contains valuable information on free landscape watering checks, water-wise landscaping or Localscapes, and water-saving rebates. The Division is working with communities and billing software companies to also provide more useful water use information on customer water bills. In addition to state programs, many water conservancy districts and public water providers landscape their property with waterwise landscaping examples and provide educational materials. Some systems offer a self-guided tour through a demonstration garden to inform visitors which plants to use and group together. They also teach waterwise landscaping classes. Utah State University and various community education programs also have classes and information on landscaping and waterwise practices.

Learning Leads to Taking Action

Water education and conservation aren't two separate efforts. Education leads to making better decisions and taking action. Statewide education and conservation programs are critical as Utah meets the needs of its growing population. The Division will strive to reestablish its education program. Not educating Utah's future generations about the water cycle, water conservation, and the critical role water plays in all aspects of life will impair Utah's long-term waterwise ethic. In the meantime, the Division will seek opportunities for partnerships to provide water education.

There's Work to Do

From individuals to industry, there are still many things to do to improve and advance water conservation in Utah. The following pages offer examples.

INDIVIDUALS

- Understand water bill and use
- Transition to waterwise landscapes
- Convert to more efficient irrigation, including drip irrigation
- Avoid watering during the hottest times of day
- Find and repair leaks
- Install smart irrigation controllers
- Replace aging fixtures and appliances

STATE GOVERNMENT

- Utilize state water experts to inform legislative policies
- Enact laws requiring waterwise practices at state-owned facilities
- Prioritize water conservation funding
- Continue to fund statewide rebates
- Implement building and landscape water-efficiency audits at state buildings

DIVISION OF WATER RESOURCES

- Advise state leaders on water policies
- Continue to encourage effective water efficiency practices
- Collect and analyze data to support water conservation
- Assist regions to measure water conservation goal progress
- Promote water loss accounting audits
- Provide funding for secondary water metering


On a walk with a dear friend through a water-wise landscape
PC: Kelly Koji

Division employee, Boyd Phillips, celebrating his 90th birthday
PC: Joel Williams

Utah Division of Water Resources Staff (2019)


Lehi City neighborhood
PC: Rob Hall


Division staff tour of Weber Basin Water Conservancy District


Causey Reservoir near Huntsville
PC: Marcie McCartney

MUNICIPALITIES

- Remove laws, ordinances, and HOA bylaws that conflict with water conservation
- Create ordinances that encourage water conservation
- Incorporate waterwise landscaping and other conservation strategies in future planning
- Implement water conservation practices at government facilities
- Integrate land use and water planning

WATER SYSTEMS

- Quantify reliable water supply
- Develop quality water conservation plans
- Provide accurate water use data to the Division of Water Rights
- Hire a water conservation specialist
- Install meters on all new secondary water connections (Class I and II counties)
- Adopt educational water billing practices and tiered rate structures that reflect the true cost of water

WATER ASSOCIATIONS and ORGANIZATIONS

- Promote water conservation efforts throughout the state
- Promote presentations that focus on water conservation at conferences and symposiums
- Educate members on current water issues and upcoming policies

Water Partnerships

The Division partners with water districts to promote responsible water use. Through the Utah Water Savers program, statewide rebates for the purchase and installation of low-flow toilets and smart controllers for irrigation systems are available. Regional water providers may offer additional rebates.

Slow The Flow is aimed at changing water use behaviors and teaching skills necessary to conserve water in Utah. The statewide campaign often creates commercials and public service announcements. In addition, partnerships have been created with local businesses to encourage water conservation, including: Snowbird, Home Depot, Sprinkler Supply Company, and Garbett Homes.

The Division is a founding partner of Localscapes. Waterwise landscaping has been recommended since it was introduced in the 1990 State Water Plan. Localscapes, developed by Jordan Valley Water Conservancy District, is a waterwise landscape approach. It is a series of landscaping patterns and practices that take into account Utah's unique climate.

The Division promotes the Utah State University Extension Water Check program. This program evaluates automated sprinkler system efficiency and provides customized irrigation schedules.

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Explore ways to help counties and water systems meet their regional water conservation goals.
- Continue to provide technical assistance for water conservation plans submitted to the Division.
- Provide recommendations and additional resources to systems with water conservation plans due.
- Find ways to enhance water conservation education within existing resources and pursue re-establishing a water education program.
- Collaborate with stakeholders to increase water audits throughout the state.
- Expand secondary metering program statewide.
- Expand “Flip your Strip” program statewide.
- Study and develop tools on integrating water and land use planning to share with municipalities and counties.

Chapter 5 Links

Regional Water Conservation Goals - https://conservewater.utah.gov/regional-water-conservation-goals/

2015 Municipal and Industrial Water Use Report - https://water.utah.gov/wp-content/uploads/2019/08/2015-MI-Data-2019-v2.pdf

Utah’s Regional M&I Water Conservation Goals - https://water.utah.gov/wp-content/uploads/2019/12/Regional-Water-Conservation-Goals-Report-Final.pdf

Water Conservation Plan Act Utah Code 73-10-32 - https://le.utah.gov/xcode/Title73/Chapter10/73-10-S32.html

Water Conservation Website - https://conservewater.utah.gov/

Weekly Lawn Watering Guide - https://conservewater.utah.gov/guide.html

Utah Water Savers - https://utahwatersavers.com/

Slow The Flow - https://slowtheflow.org/about-us/

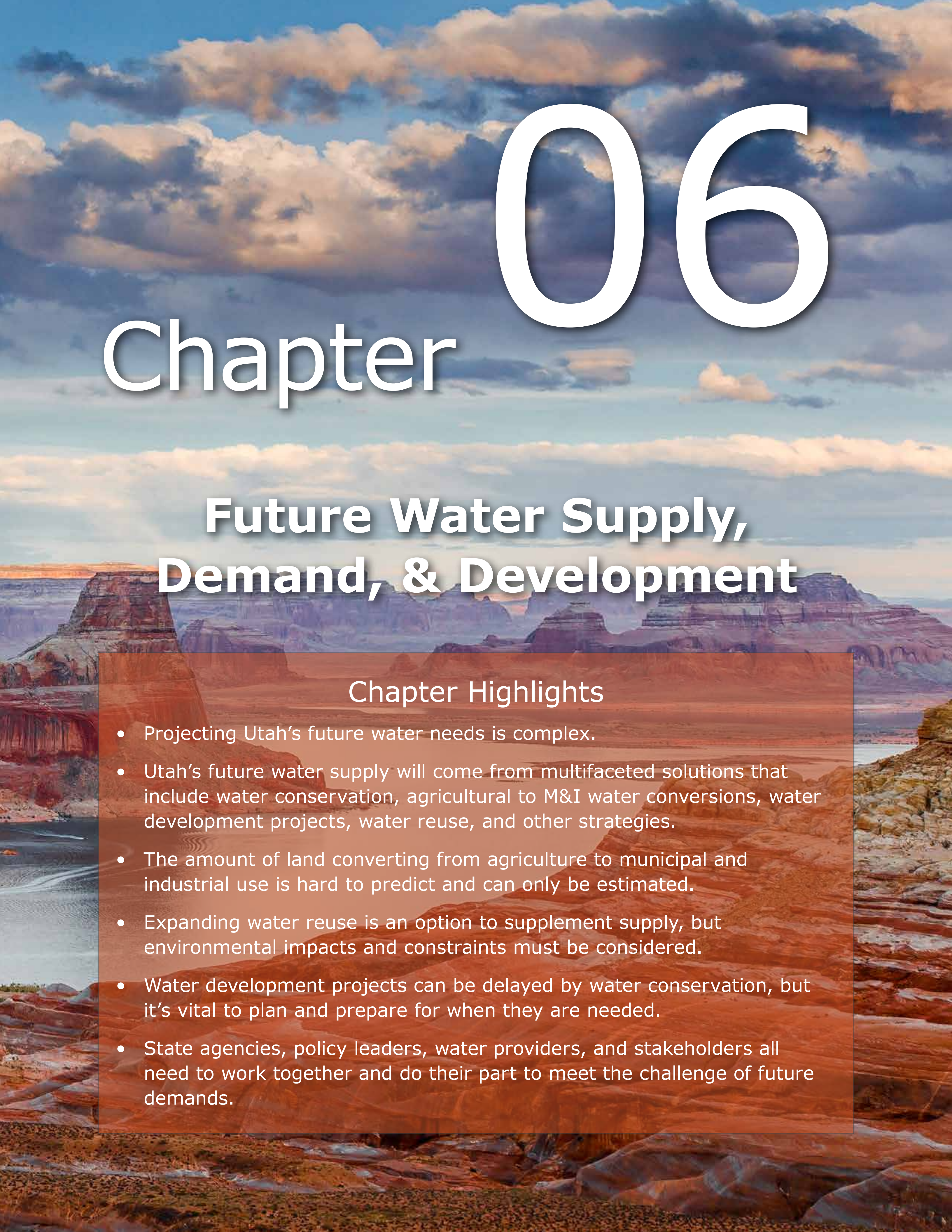
Localscapes - https://localscapes.com/

USU Extension Water Check Program - https://extension.usu.edu/news_sections/agriculture_and_natural_resources/water-check-program-2016

Water Loss Accounting HB40 - https://le.utah.gov/~2020/bills/static/HB0040.html

Utah Water – A Precious Resource - https://watered.utah.gov/wp-content/uploads/2019/02/UWAPR_10-17-16-small.pdf

Lake Powell from Alstrom Point



Chapter 06

Future Water Supply, Demand, & Development

Chapter Highlights

- Projecting Utah's future water needs is complex.
- Utah's future water supply will come from multifaceted solutions that include water conservation, agricultural to M&I water conversions, water development projects, water reuse, and other strategies.
- The amount of land converting from agriculture to municipal and industrial use is hard to predict and can only be estimated.
- Expanding water reuse is an option to supplement supply, but environmental impacts and constraints must be considered.
- Water development projects can be delayed by water conservation, but it's vital to plan and prepare for when they are needed.
- State agencies, policy leaders, water providers, and stakeholders all need to work together and do their part to meet the challenge of future demands.


Pelicans on Great Salt Lake


As new families move to Utah, water demands will increase
PC: Nate Bonney


Sunset over St. George

Water is complicated, and understanding when additional water will be needed requires a detailed accounting of current water and reasonable predictions of future water demands. Utah's future water supply will come from a combination of water conservation, agricultural to M&I water conversions, water development projects, water reuse, optimization, and other management strategies. Water conservation may delay the need for new development projects, but it's critical to continue to plan and prepare for when projects are needed.

When planning for water needs, environmental impacts and constraints must be considered. Solutions require collaboration among state agencies, policy leaders, water providers, and various stakeholders to meet the challenge of future demands. This chapter focuses on when and where future water supplies will be needed and identifies several projects and strategies that will help satisfy these needs.

Using Supply and System Demand Estimates to Predict Future Needs

Future water supply and demand uncertainties make predicting future needs challenging. However, when you put the Division's best estimates of 2015 reliable supplies (from Chapter 3) and the demand projections (from Chapter 4) together, a picture of possible future water needs begins to take shape.

Figure 6-1 depicts the reliable supply and system demand projections for the state. The chart's system demand projections are made up of the customer demand projection scenarios (from Chapter 4) with the addition of approximately 15% to account for water loss in water distribution systems (BCA & HAL 2018). The dark blue shaded area in Figure 6-1 shows the 2015 reliable supply for Utah – for simplicity, it is assumed to remain constant through 2070. This area does not include any new supplies added since 2015 or into the future. This simplified figure demonstrates both the utility and limitations of the data collected.

A typical supply and demand curve illustrates a general timeline of when existing reliable supplies will be exceeded for an area. However, the figure can be misleading, which is the case with Figure 6-1. If all of the reliable supply in the state is and will be available to all M&I water users, the figure is a good illustration. Since communities and water supplies are widely dispersed and impossible to interconnect statewide, some regions and individual water systems throughout the state will run short of water sooner than Figure 6-1 indicates, and others will have an adequate supply for many more decades.

Demand Model Scenarios

No Change

- Expected growth rates
- Baseline (2015) rates of use
- No climate change considered

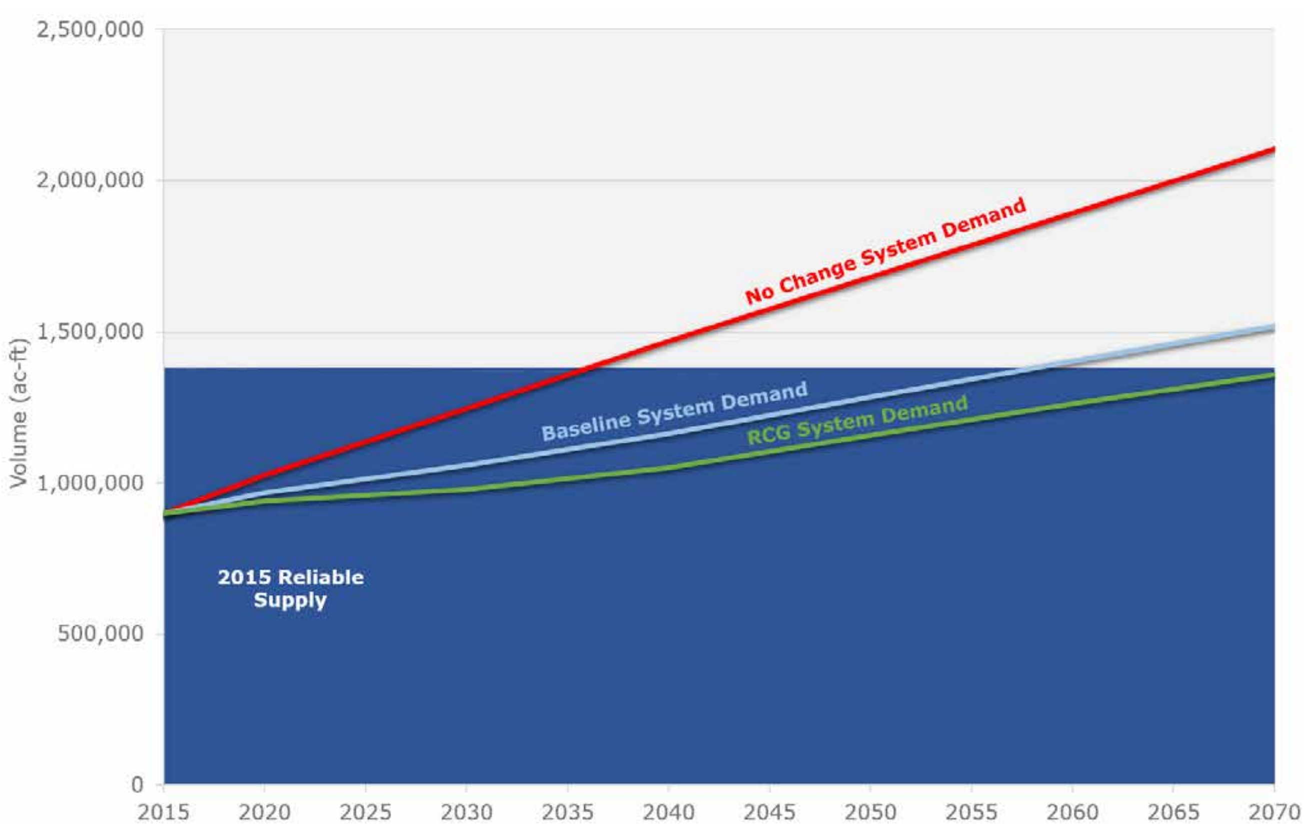
Baseline

- Expected growth rates
- Current (2019) conservation practices and trends in place
- Climate change increase of 11% ETNet by 2070

Regional Conservation Goals

- Expected growth rates
- Meeting regional conservation goals through additional conservation practices
- Climate change increase of 11% ETNet by 2070

Figure 6-1 Water Supply vs. System Demand for the State of Utah



Paddleboarding
PC: Candice Hasenyager

In a relatively small geographic area where the population is concentrated and water systems can share water supplies, the supply and demand curve can provide a good timeline of regional need. The St. George area is a good example of this (see Figure 6-4 presented later in this chapter). The Washington County Water Conservancy District connects many of the nearby cities through its regional supply pipeline network, allowing most of the population to be supplied through interconnected water distribution.

Water Conservation, Agricultural to M&I Conversions, and Development Work Together

Planning now for future water supplies is necessary. While water conservation is important (see Chapter 5), water conservation alone will not be sufficient to meet all future needs. Agricultural to M&I conversions and further water development will also be necessary.

Utahns have communicated they value maintaining a vibrant agricultural sector. As communities grow, water that is currently tied to agricultural land and that can be converted to urban use as the land is developed will account for some of the needed supply – so there will likely be a decrease in agriculture land in urban areas. Historically, as Utah's population increased, the easily accessible water was developed. Most water development options that remain are larger, more costly projects. Water development decisions should be made using the best science, engineering, data, system management, and accounting practices. Meeting future water needs will require the creative use of a variety of solutions.

Estimating Agricultural to M&I Conversions

As the state population grows, urban areas will grow and develop nearby agricultural lands. Where agricultural lands are developed, water associated with those lands will typically be transferred for municipal and industrial use. The Division developed a model to estimate the amount of water that could be added to M&I supplies through the transfer process. Statewide, the amount of water that may become available as a result of agricultural land conversion to M&I use from 2020 through 2070 is estimated between 147,000 acre-feet and 245,000 acre-feet. Table 6-1 shows potential water transfers over the review period by basin. The Wasatch Metro area is the sum of Jordan River, Utah Lake, and Weber basins.

These results are a general range of possible additional water supply. The Division does not predict when or which agricultural lands will be developed. This happens on a willing buyer, willing seller basis. These limitations make projecting future additional supply at a specific place and time impossible. The general projections inform planners of possible water resources and a general amount. More detailed research must be conducted at the local level to better understand actual transfers.

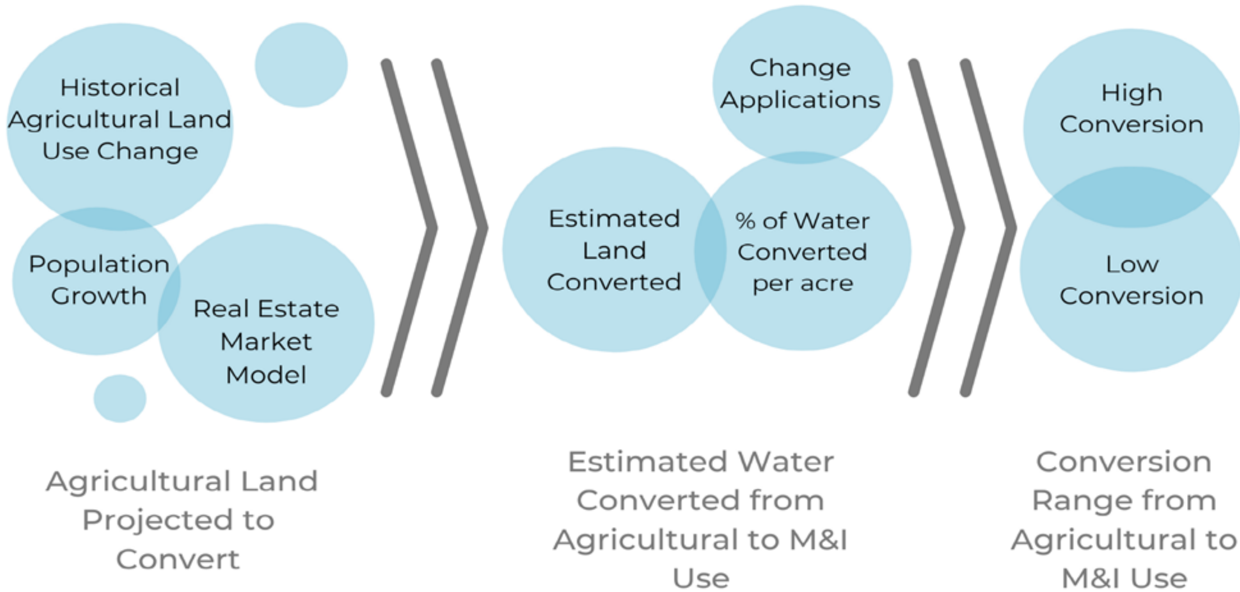
The Division's process for estimating future agricultural land and water transfers, shown

Table 6-1 Estimated Agricultural to Municipal and Industrial Conversion by Basin in acre-feet

	2020-2030		2030-2040		2040-2050		2050-2060		2060-2070	
Basin	Low	High	Low	High	Low	High	Low	High	Low	High
Bear	2,600	4,300	3,600	6,000	8,100	13,600	8,000	13,400	8,000	13,400
Cedar/Beaver	300	400	400	700	600	1,100	600	1,000	600	1,000
Kanab/Virgin	300	500	600	1,100	1,100	1,900	900	1,700	900	1,700
Jordan River	2,400	3,900	1,700	2,800	1,200	1,900	1,000	1,700	1,000	1,700
Utah Lake	8,200	13,700	8,100	13,400	10,500	17,600	8,700	14,500	8,700	14,500
Uinta	100	200	100	100	100	200	100	100	100	100
Sevier	1,000	1,600	1,400	2,300	1,900	3,100	1,700	2,900	1,700	2,900
West Desert	2,600	4,300	2,900	4,800	3,500	5,900	3,000	5,000	3000	5,000
Weber	9,500	15,800	7,400	12,300	7,300	12,200	5,900	9,800	5,900	9,800
*Wasatch Metro	20,100	33,400	17,200	28,500	19,000	31,700	15,600	26,000	15,600	26,000
State Total	**27,000**	**44,700**	**26,200**	**43,500**	**34,300**	**57,500**	**29,900**	**50,100**	**29,900**	**50,100**

*Wasatch Metro is the combined total of Jordan River, Utah Lake, and Weber basins.

Graphic 6-1 Agricultural to M&I Conversion Estimation Process



in simplified terms in Graphic 6-1, relies upon existing models and information from the following sources:

- Utah Division of Water Resources
- Utah Division of Water Rights
- Kem C. Gardner Policy Institute
- Wasatch Front Regional Council

The Division's Water-related Land Use Program survey results were used to determine how much land in each county changed from agricultural to urban use in the past. Water-related land use surveys published in 2000, 2010, and 2017 established a historic basis for Utah's projections. The Division found that 19 counties are trending toward decreasing agricultural land. The 19 counties are Beaver, Box Elder, Cache, Carbon, Daggett, Davis, Iron, Kane, Millard, Piute, Salt Lake, Sanpete, Sevier, Summit, Tooele, Uintah, Utah, Washington, and Weber.

The Division obtained water right change application data from the Division of Water Rights to determine how much water was transferred from agricultural to municipal use over that same period of record (2000 through 2017). The amount of water that is depleted by an irrigation water right varies geographically. The Division used an approximate statewide average value to estimate the amount of water allowed to be depleted under all approved change applications transferring agricultural water rights to new municipal uses.

Kem C. Gardner Policy Institute's county population projections (Gardner Policy Institute 2019) were used to calculate the growth rate and identify fast-growing counties. Of the 29 counties in Utah, 15 counties were eliminated from further review because the projected growth can likely be supported without significant agricultural land and water transfers. The remaining 14 counties are Box Elder, Cache, Davis, Iron, Juab, Morgan, Salt Lake, Sanpete, Summit, Tooele, Utah, Wasatch, Washington, and Weber. A table of counties ranked by population growth rate is found in Appendix F. Juab County is particularly interesting because its population is growing rapidly, but its agricultural land area is also increasing. This indicates agricultural water transfers are likely not being used to provide water for the growing population. Therefore, Juab County was removed from further analysis. The Division created projections for the remaining 13 counties.

Land parcel development results came from the Wasatch Front Regional Council Real Estate Market Model (Real Estate Model). Although this model is specific to urban counties (i.e., Weber, Davis, Salt Lake, and Utah), the Division also used it to inform estimates of land transfers near urban areas in other counties. The Division assumed land transfers near fast-growing urban areas will occur in the same manner as the Real Estate Model projects.

After the historic land use data was analyzed and graphed (Appendix F), the Division correlated the findings with recent (2017 and 2018) data for population and water-related land use to generate a trendline. The trendline was extended to project out to 2065. A ratio of county agricultural area to the Wasatch Front Regional Council area was used to scale projected land transfers in each of the 13 counties that were analyzed.

The Utah Division of Water Rights' Utah Water Duty map (Appendix F) was used to estimate the amount of water associated with land transfers. The Division calculated an average water duty for each county (Appendix F) weighted by the irrigated area in each water duty zone. Agricultural land transferred to municipal use was multiplied by the average county water duty to estimate the amount of water which may become available for development.

Table 6-2 shows the results of this process. The "Low Range" value is 25% less than the calculated value, and the "High Range" value is 25% more than the calculated value. The wide range for the estimates reflect uncertainty in base assumptions.

Fruita Historical District, Capital Reef National Park

Kanarra Creek Upper Falls
PC: Todd Stonely

Table 6-2 Potential Conversion from Agricultural to Municipal and Industrial (M&I) Use

County	Low Range (ac-ft)	Calculated Value (ac-ft)	High Range (ac-ft)
Box Elder	5,900	7,800	9,800
Cache	22,600	30,100	37,600
Davis	9,300	12,400	15,500
Iron	1,400	1,800	2,300
Morgan	1,100	1,400	1,800
Salt Lake	6,800	9,000	11,300
Sanpete	7,100	9,400	11,800
Summit	8,100	10,800	13,500
Tooele	11,700	15,600	19,500
Utah	38,500	51,300	64,100
Wasatch	600	800	1,000
Washington	4,100	5,500	6,900
Weber	15,700	20,900	26,100
Total	**132,900**	**176,800**	**221,200**

Estimated conversion for years 2020 though 2065. (Note: The Division of Water Resources' results have not been independently validated.)

How Much Is Enough?

Knowing the reliable supply and agricultural conversion estimates helps water providers determine when additional water supply or infrastructure may be needed. Comparing the reliable supply of an individual system with its projected system water demands indicates approximately when the reliable supply will be exceeded. At a statewide level, the projections are more general and cannot be used to make specific conclusions about when and where additional water supplies will be needed.

As mentioned before, communities and water supplies are widely dispersed and impossible to interconnect statewide. So water supply from northern Utah is not available to meet water demands in southern Utah. Local analysis results in more accurate projections. Nevertheless, statewide projections are useful to provide general observations. Figure 6-2 shows the supply and system demand for the State of Utah.

Individual reliable supply estimates for 2015 have been summed statewide and are shown in dark blue. The white-dashed line that curves down toward the right side of the figure represents the potentially diminished reliable supply due to the effects of climate change. Predicting the impacts of climate change on future water supplies is difficult, and the Division is preparing models to help refine these estimates in the future. Regional water providers have already seen the impacts of climate change on their supplies, and these observed trends are generally consistent with the projected 10% potential decrease by 2070 depicted. The lighter blue areas show the estimated quantities of additional M&I water coming from agricultural conversions over the next 50 years.

The solid lines show the system demand projections under various demand model scenarios. The solid red line depicts the 2015 M&I use rates applied to population growth without additional conservation or consideration of climate change. The solid, light-blue line depicts current conservation practices and trends plus increases in net ET (evapotranspiration) due to climate change. The solid green line depicts the same increases in net ET plus reaching Regional Conservation Goals (RCG).

When demands exceed the 2015 reliable supply depends upon population growth,

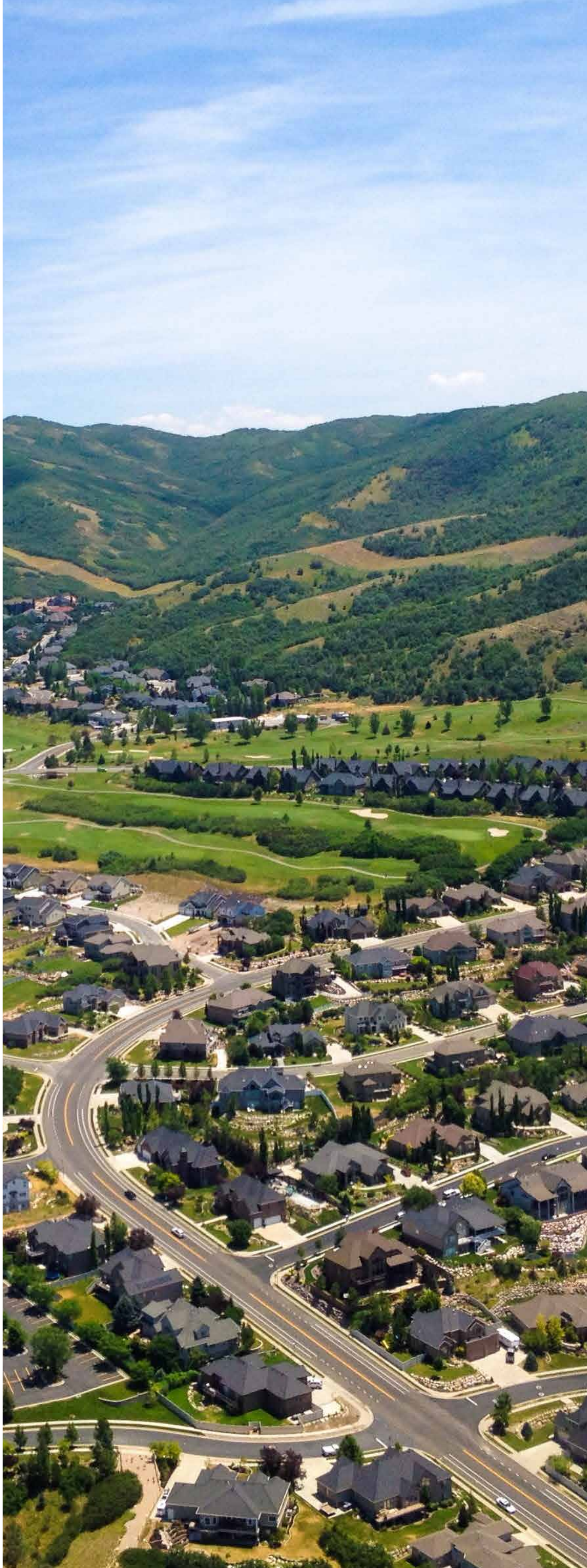
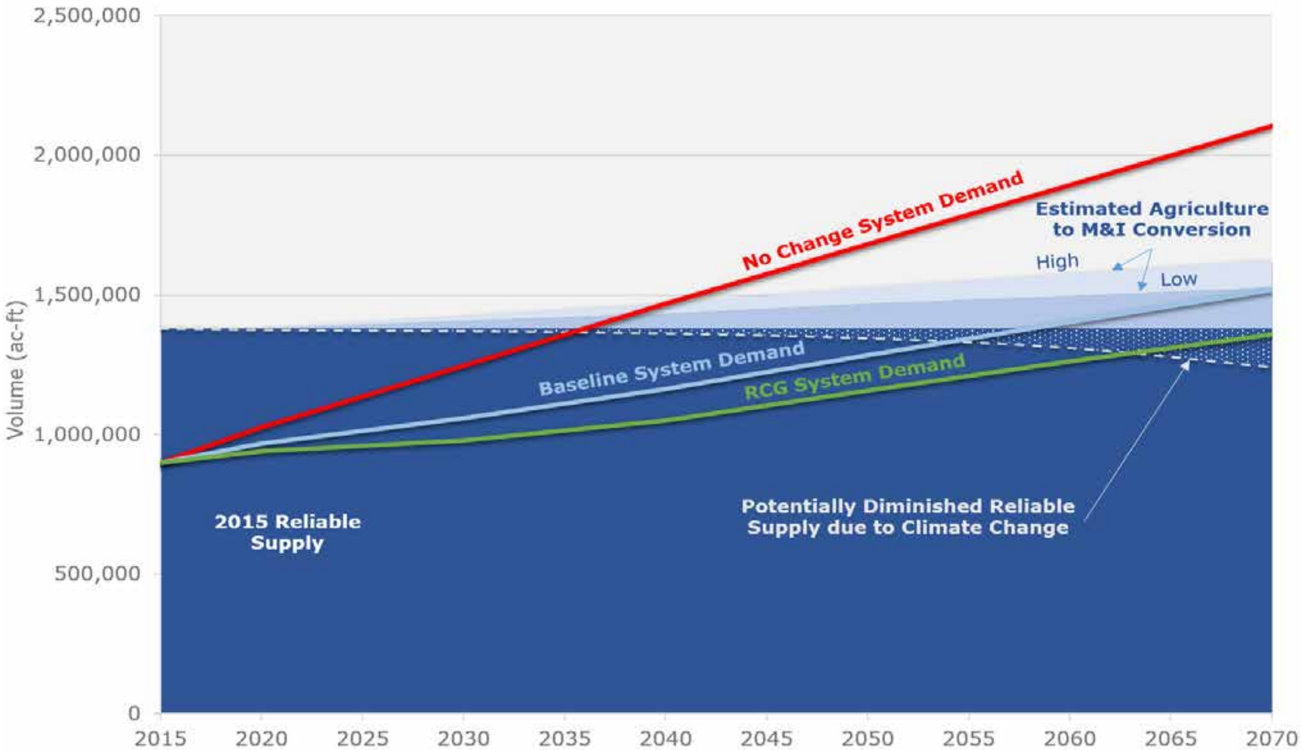


Figure 6-2 Water Supply and System Demand for the State of Utah

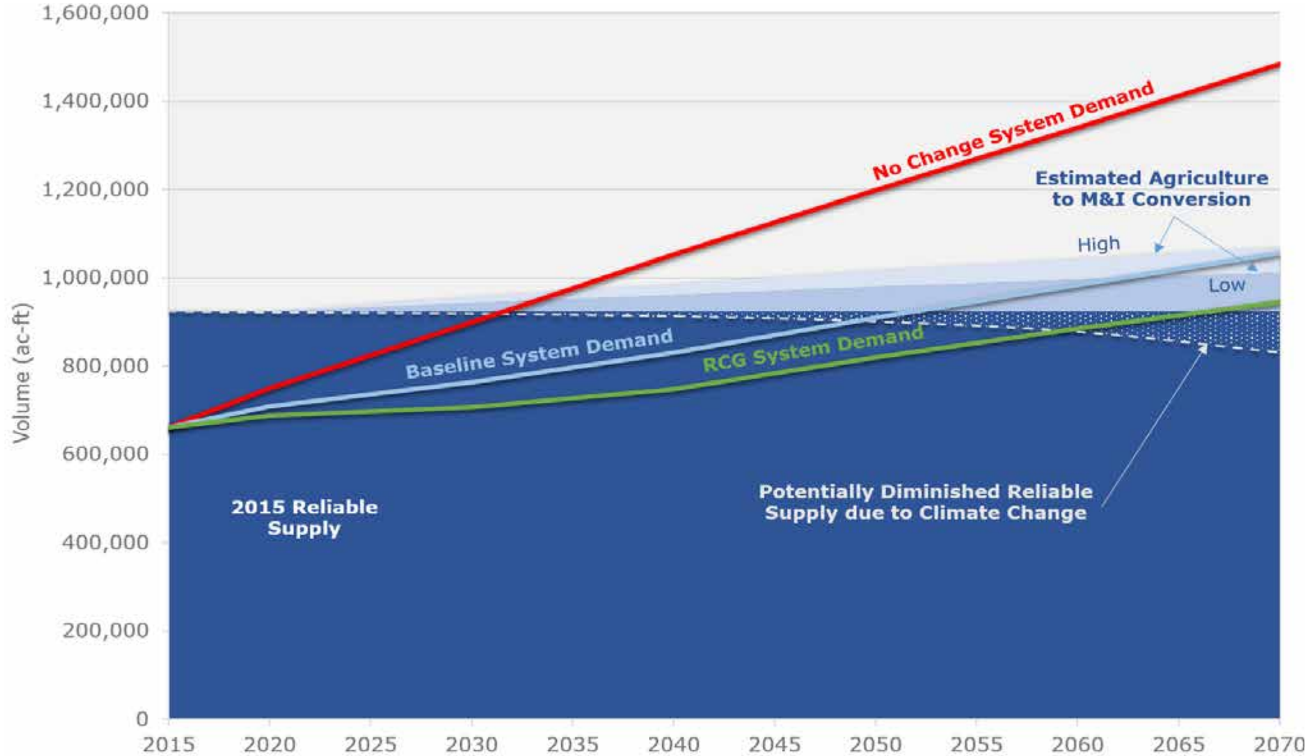


the level of conservation or water use reduction that is achieved, and the amount of water converted from irrigated agriculture. Projecting 2015 use forward with future population projections (red line) shows the 2015 reliable supply will be exceeded sometime between 2030 and 2040. If 2015 programs and efforts to promote water conservation are continued, that date may be pushed out nearly to 2055 (light blue line) even when considering estimated reductions in supply due to climate change. Add in agricultural conversions, and the state appears to have sufficient water through 2070. If the state meets the regional goals and the projected milestones, 2015 reliable supplies would be sufficient without agricultural conversions beyond 2060.

The reliable supply of a region, such as a river basin or several basins, can also be represented by summing the supply of individual systems as shown in Figure 6-3, for the Wasatch Metropolitan (Metro) Area. In this area, a lot of irrigated land has been converted and is being used by cities and water conservancy districts. The estimated amount of future agricultural water conversions will not satisfy the needs of the growing population of the Wasatch Metro Area beyond 2070 without more conservation.

Although the Wasatch Metro Area has some interconnectivity between supplies and systems, local shortages will occur sooner than Figure 6-3 indicates. Additional demand could be met through agricultural conversions alone through 2050 if the Regional Conservation Goals are met. Much of the remaining irrigation water comes from Utah Lake because it’s unsuitable for M&I use without extensive filtration.

Figure 6-3 Water Supply and Demand for Wasatch Metro Area



Also, a portion of the current, reliable supply is secondary water. Supplementing potable water with secondary water will require additional treatment capacity to convert secondary water to culinary use when it's needed. Converting existing communities to a dual water system using poorer quality secondary water will also require new infrastructure. The complexities of water supply for local demands are not easily illustrated in these figures.

Figure 6-4 illustrates the need for water in southwest Utah. Even with water conservation and agricultural to M&I conversions, additional water will be needed in the Kanab Creek/Virgin River basin in the next 10 to 15 years to accommodate projected population growth. Agricultural conversions will only contribute a small amount to the reliable water supply due to limited irrigated agriculture remaining.

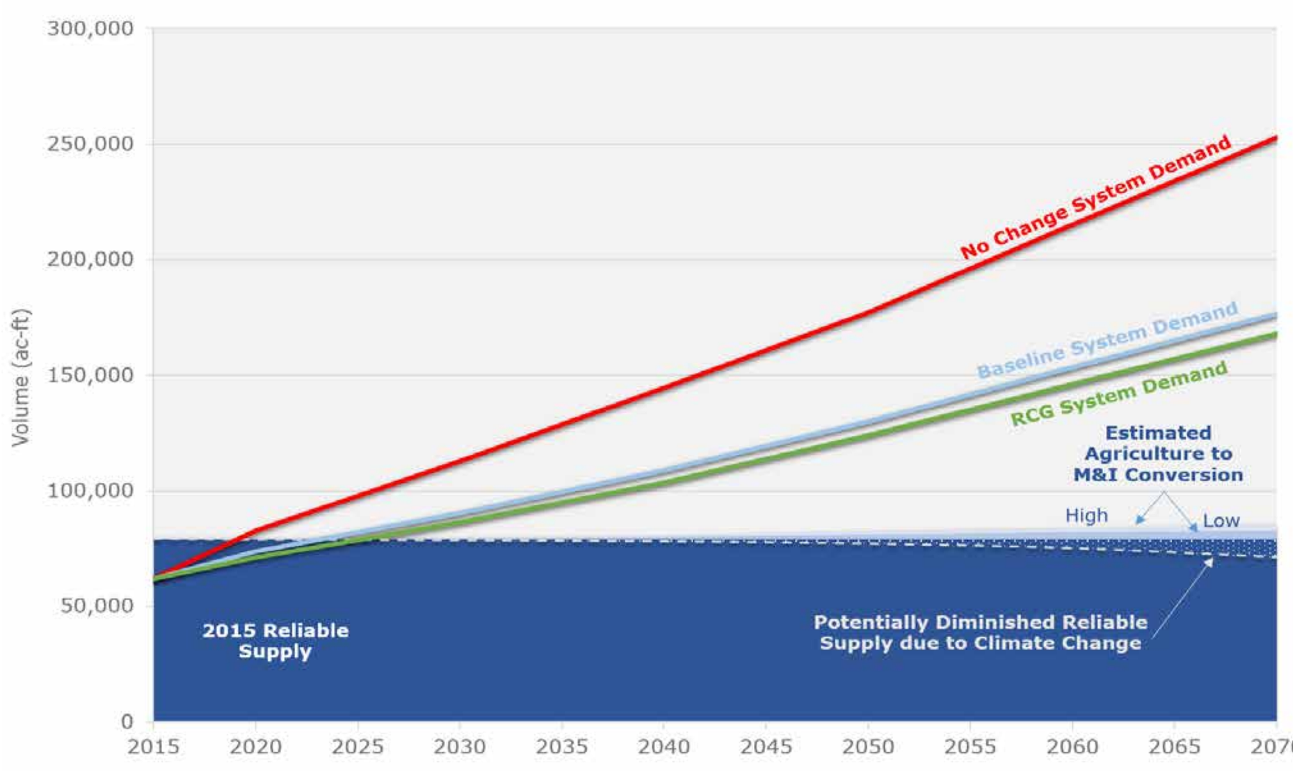
Figure 6-4 represents 2015 reliable water supplies for the region. The population is served by an interconnected water supply system with limited water supply options.

The Santa Clara River and Virgin River flows are fully developed. Washington County residents achieved a 25% water-use reduction by 2015 and have continued to make progress. Reaching the target regional conservation goal will only extend water supplies by two or three years. The addition of approximately 84,000 acre-feet of water from the proposed Lake Powell Pipeline project will delay water shortages.

Water Supply Infrastructure Needs

Water infrastructure refers to all of the components of water systems (dams, pipelines, water treatment plants, pumping

Figure 6-4 Water Supply and Demand – Kanab/Virgin River Basin



Note: Similar figures for each basin with a brief description of conditions are located in Appendix G.

plants, wells, etc.) that move and treat water. Once installed, system components gradually degrade or become inadequate. Corrosion and wear weaken metals and concrete, and soil pressures stress pipes. Pipelines, originally installed with capacities anticipating future needs, may soon be inadequate due to accelerated development, growing populations, and changing standards. Keeping up with system maintenance and growth requirements is expensive, so many water systems address issues as they occur. With the projected population growth anticipated over the next 50 years, the existing infrastructure will need to be replaced and upgraded in most areas.

In 2020, the major water conservancy districts in the state (also known as Prepare60) and Division of Water Resources updated the Statewide Water Infrastructure Plan (SWIP). The SWIP is a roadmap to plan for Utah's long-term future water needs. The plan focuses on conservation, infrastructure repair and replacement, regional and federal projects, and state projects. It evaluates water supply needs, conservation efforts, and infrastructure investments necessary to serve Utah's rapidly growing population. The plan only considers municipal and industrial water and excludes stormwater, wastewater, and agricultural needs.

*The following two pages were provided by Prepare60 and summarize the 2020 SWIP.

STATEWIDE WATER INFRASTRUCTURE PLAN

To prepare for substantial population and economic growth, Utah and its municipal water providers will need to spend an estimated $38 billion on repair & replacement, conservation, and new supply projects.

ACTIONS NEEDED

Looking to the future requires more than just projections. Each river basin in Utah will need to take action in the following areas:

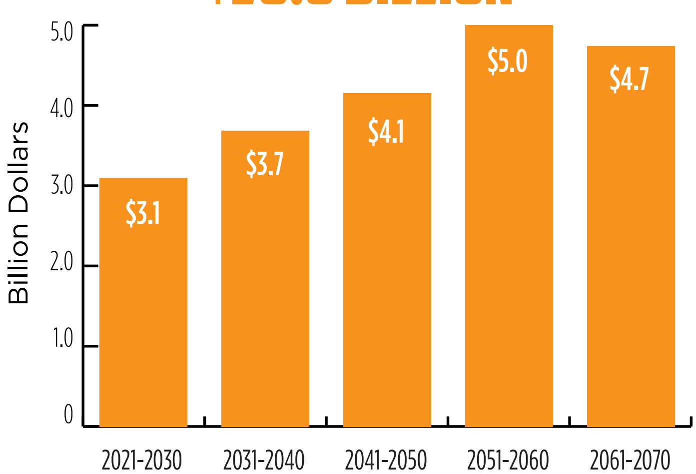
- Water conservation
- Repair and replacement of aging infrastructure
- Watershed protection
- Conversion of agricultural water as land is developed
- Water reuse projects
- Development of new infrastructure and water supplies, both local and regional

ESTIMATED STATEWIDE INFRASTRUCTURE COSTS

Below is a summary of anticipated costs. Detailed cost breakdowns for each basin are available on pages 6-16 of this report.

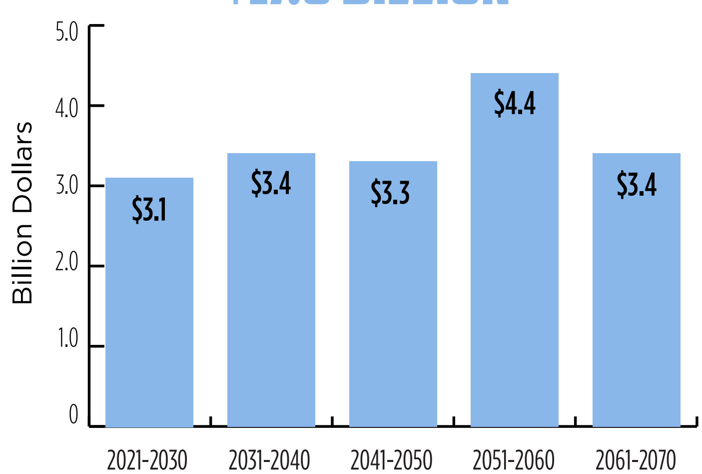
REPAIR & REPLACEMENT OF AGING INFRASTRUCTURE

$20.6 BILLION



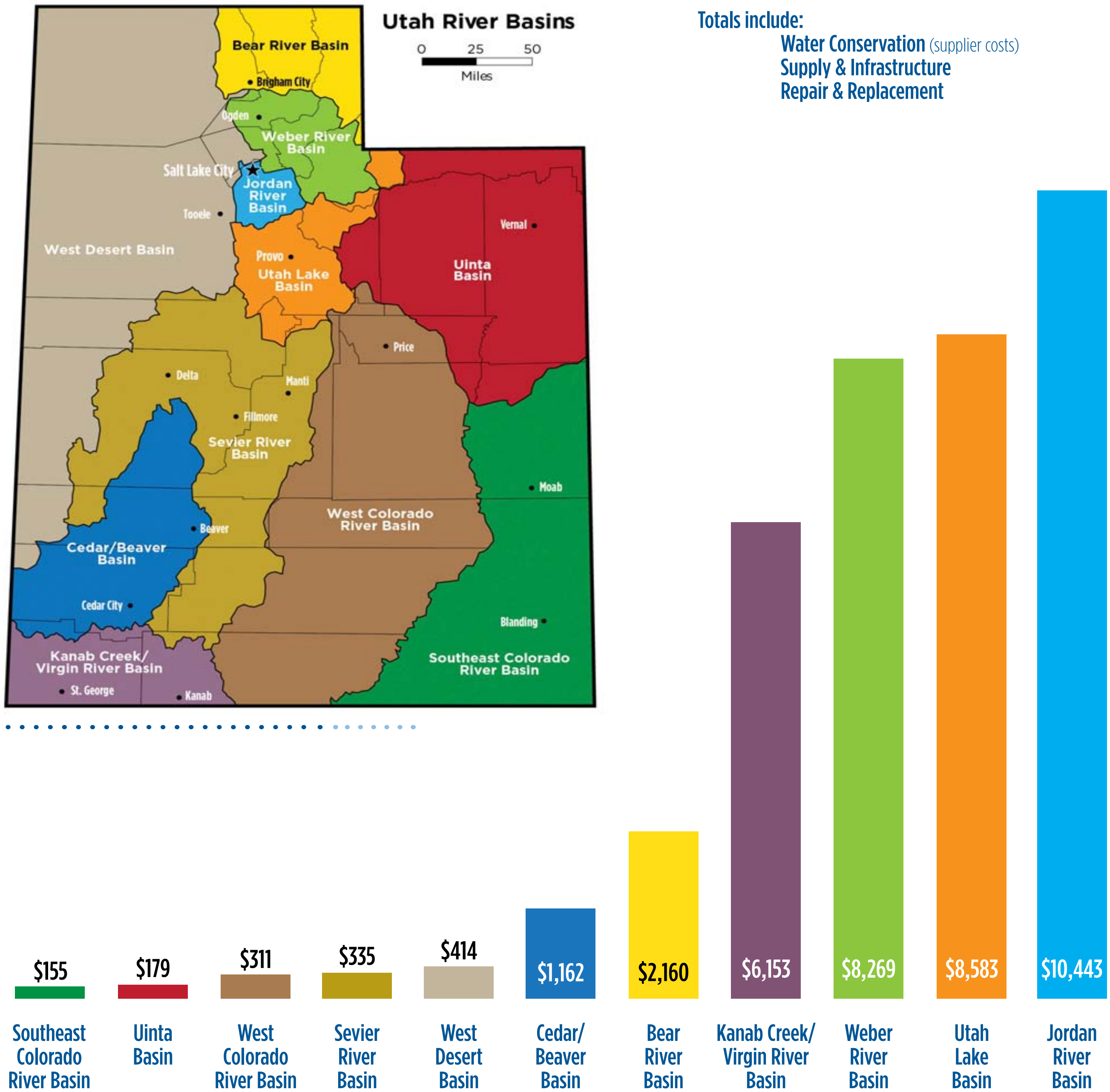
NEW INFRASTRUCTURE, WATER SUPPLIES, and WATER SUPPLIER CONSERVATION COSTS

$17.6 BILLION



Statewide cost projections by decade in billions of dollars, not including $9.5 billion in conservation costs paid by businesses and homeowners.

TOTAL INVESTMENT NEEDED in Millions of Dollars



Securing current and future generations' water supply =

$38 BILLION

(not including an additional $9.5B in community conservation costs)

Development Projects

If you turn on the tap and water comes out, you've benefited from a water development project. Past water planners and managers recognized the need to develop supplies for future generations, and Utahns have water as a result. Today's water planners and managers are committed to ensuring future generations have a clean, safe, and accessible water supply via various solutions, including water development projects. The dialogue below describes some major water developments already in place or currently being planned, including several mandated by legislation. Notwithstanding these directives, not everyone agrees with the need for, or the specifics of, the proposed projects. Each project will go through a National Environmental Policy Act process, which allows for public comment and input before the best course of action is determined.

Central Utah Project

The Central Utah Project (CUP) began in the 1950s under the direction of the U.S. Bureau of Reclamation. The purpose of the project was to provide water from the Green River to the Great Basin (Wasatch Front), using some of Utah's Colorado River allocation. Initially, the project consisted of six units: Bonneville, Jensen, Vernal, Uintah, Upalco, and Ute Indian. The largest and most complex of these is the Bonneville unit, which diverts water from the Uintah Basin to the densely populated Wasatch Front. The Central Utah Water Conservancy District (CUWCD) operates the Bonneville Unit. The other units were designed to provide for the development of local water supplies within the Uintah Basin. The CUP develops water for irrigation, municipal and industrial use, and power generation. The project is also managed to provide flood control, recreation, environmental, and water quality benefits.

Central Water Project

CUWCD has taken on another unique project, the Central Water Project. This project will provide approximately 53,300 acre-feet of culinary water to customers in northern Utah County and southern Salt Lake County. The district purchased the water rights for this project from the former Geneva Steel owner, U.S. Steel Company. The project is estimated to be fully developed over 25 years.

Lake Powell Pipeline Project

In 2006, the Utah Legislature passed the Lake Powell Pipeline Development Act (Utah Code 73-28), directing the Board of Water Resources (Board) to construct the Lake Powell Pipeline (LPP). At full capacity, this water delivery project will deliver up to approximately 84,000 acre-feet of water to diversify and augment the water resources needed to serve the expanding economy and growing population in southwest Utah. Population growth projections in Washington County show that water demand will exceed local supplies, resulting in shortages if additional water sources aren't developed in the next decade despite increased conservation achievements.

According to the Kem C. Gardner Policy Institute, Washington County is projected to experience the most rapid growth rate (229%) in the state. As of 2020, the county is home to almost 200,000 residents and is projected to exceed 500,000 by 2065. The county also has many seasonal residents and more than 6 million annual visitors.

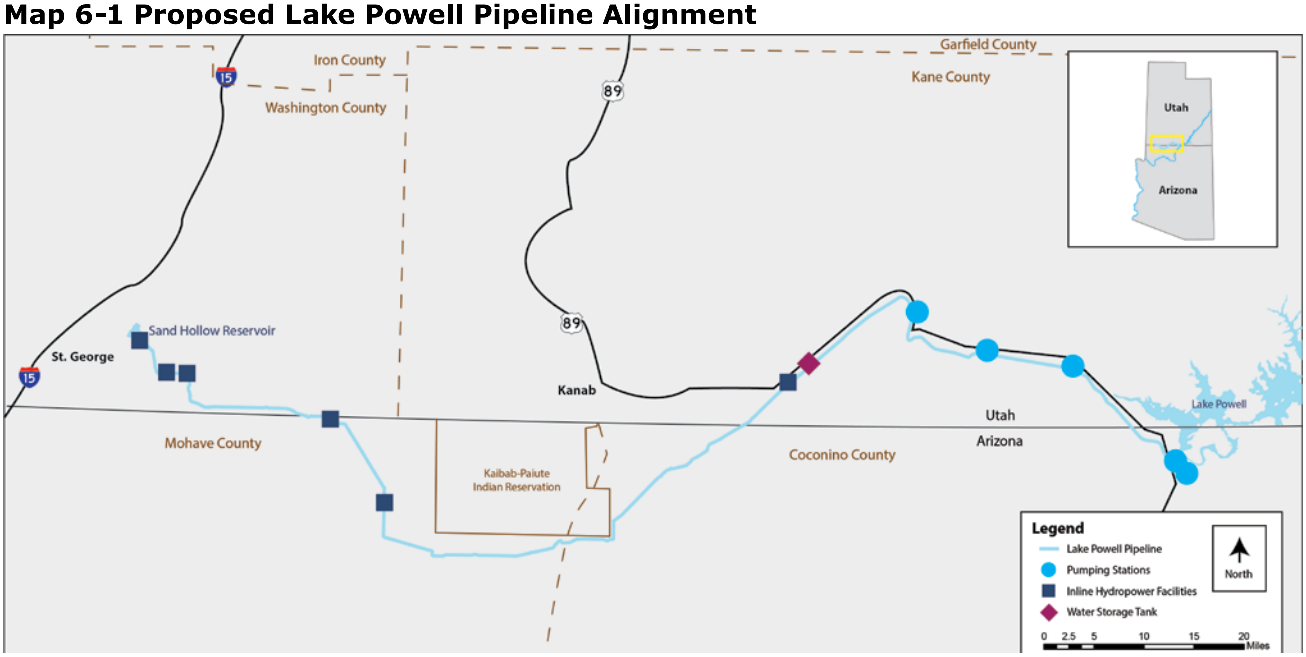
Unlike the residents of the Wasatch Front who receive water from local and imported sources (such as the Colorado River), most residents in Washington County are primarily dependent upon a single water source – the Virgin River basin. This river basin has variable water quality and quantity. The LPP will diversify the region's water sources and build more resiliency and reliability for current and future residents. The LPP will consist of approximately 140 miles of underground pipeline, five pump stations, and six hydroelectric generation facilities (see Map 6-1).

The LPP is part of a comprehensive, long-term water supply plan that includes new resource development and increased water conservation. The Bureau of Reclamation is leading the project through the National Environmental Policy Act (NEPA) review. The draft Environmental Impact Statement (EIS) was released on June 9, 2020. A supplemental draft EIS is currently underway to address comments received during the public comment period. Visit LPPUtah.org for more information and project updates.

Central Iron County Water Supply Projects

Cedar Valley, in Iron County, is a terminal basin with little surface water (supplied primarily from Coal Creek) and declining groundwater. The aquifer that supplies water to the residents and businesses within the valley is being overdrawn by about 7,000 acre-feet annually (DWRi 2012). Groundwater is "mined" when it's pumped from an aquifer faster than it can be refilled. A consequence of extensive groundwater

Map 6-1 Proposed Lake Powell Pipeline Alignment



Source: Washington County Water Conservancy District.

Man & dog kayaking on Lake Powell
PC:Marcie McCartney

mining in the Cedar Valley resulted in consolidation (subsidence) of soils, reduced aquifer capacity, and surface fissures. In layman terms, over time the aquifer materials compact. In response, the Central Iron County Water Conservancy District (Central Iron County) and many relying on the aquifer, have started groundwater recharge using excess flows and unused winter flow from Coal Creek.

Airport Recharge Project

In the first winter of operation, the Airport Recharge Project replaced about 2,000 acre-feet of water into the aquifer. Although this is a great step forward, the State Engineer is responsible for developing a groundwater management plan for the aquifer that will balance recharge and withdrawl. Even with a balancing plan, the needs of a growing population will have to be met by other means in the near future. Conservation and recharge alone won't meet the increasing needs in the valley, and water will need to be imported from other areas.

Pine Valley Water Supply and Conservation Project

In 2006, Central Iron County filed an application with the State Engineer for groundwater in the Hamlin (10,000 acre-feet), Pine (15,000 acre-feet), and Wah Wah (12,000 acre-feet) valleys, located to the northwest of Cedar Valley. The first phase of the West Desert Pumping Project is the Pine Valley Water Supply and Conservation Project (Pine Valley Project). It proposes pumping available groundwater from Pine Valley and delivering it to Cedar Valley.

Central Iron County began working on the permitting process for the project in 2013 by drilling test wells, conducting studies, and beginning the NEPA process. As part of the process, Central Iron County began working with Water Rights to create a groundwater management plan. This plan will outline the process to restore the Cedar Valley aquifer. In 2018, Central Iron County submitted an application for an EIS with the BLM. A Record of Decision for the EIS is expected in 2022. The timeline is illustrated in Graphic 6-2.

If the project is approved, the pipeline will utilize new and existing rights-of-way to deliver the water. The preliminary cost estimate for the Pine Valley Project is about $254 million. The components of the two main lines will include approximately 66 miles of underground pipe, 13-16 wells, 5-8 pump stations, and a solar power generation plant. The Pine Valley Project will help bring balance to the Cedar Valley aquifer and provide for growth in the valley.

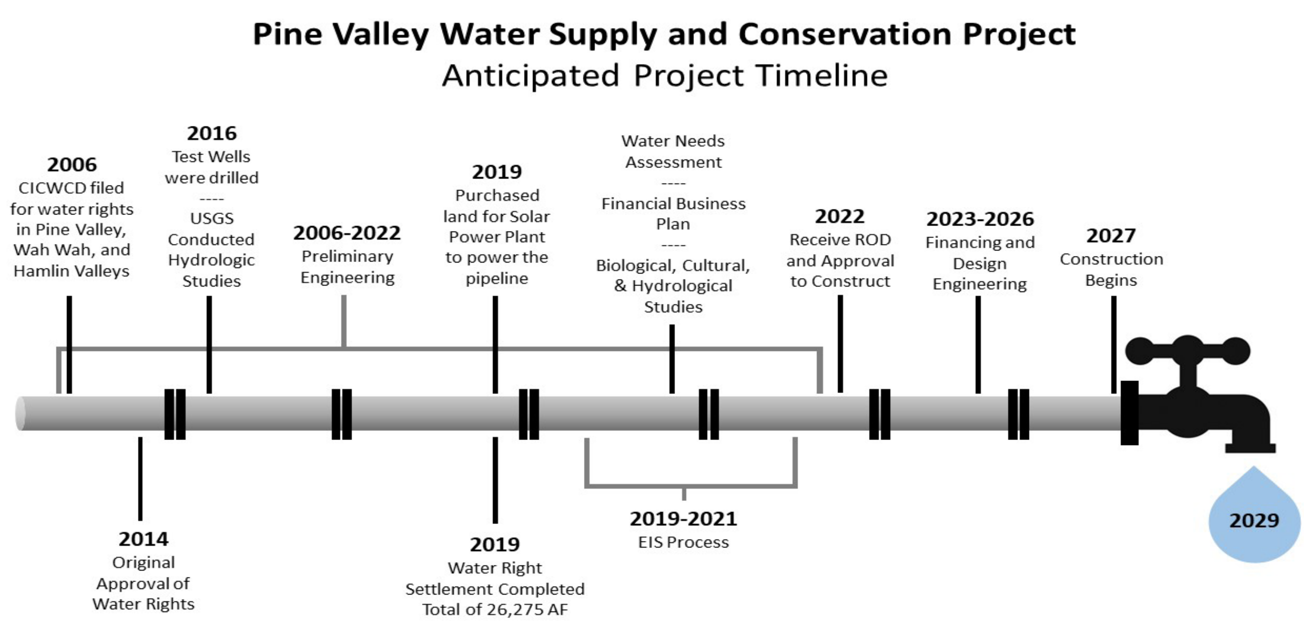
Bear River Development

In 1991, the Utah Legislature passed the Bear River Development Act (Act) (Utah Code 73-26). The Act directs the Division to "develop the surface waters of the Bear River and its tributaries through the planning and construction of reservoirs and associated facilities as authorized and funded by the Legislature." The "associated facilities" include pipelines, pump stations, and reservoirs.

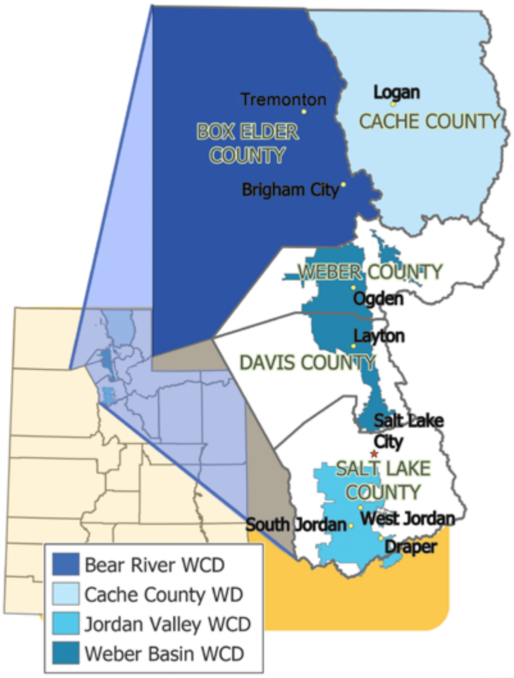
A large-diameter pipeline will be needed to convey water through Box Elder County to the West Haven Treatment Plant that will be built jointly by Weber Basin Water Conservancy District and Jordan Valley Water Conservancy District. Another pipeline may be needed to convey water to Cache County from a reservoir in Box Elder County. Reservoirs will be needed to store water after it is diverted.

When the legislation passed in 1991, the need for water from the Bear River Development (BRD) was expected in 2015. Conservation efforts, technology improvements (e.g. secondary meters), and smaller water projects have delayed the need. It's currently anticipated that BRD water will not be needed until after 2045-2050 or later. Graphic 6-3, details how much water will be used by each benefiting water district of the project.

Graphic 6-2 Timeline of Pine Valley NEPA Process & Development



Graphic 6-3 Bear River Development Allocation



Allocation

The Bear River Development will provide 220,000 ac-ft of water at full development to be distributed by the following water districts:

- Bear River WCD 60,000 ac-ft
- Cache WD 60,000 ac-ft
- Jordan Valley WCD 50,000 ac-ft
- Weber Basin WCD 50,000 ac-ft

Although the need for BRD water is projected to be three decades away, it's vital to continue the planning process by preserving rights-of-way for a large-diameter pipeline through Box Elder, Davis, and Weber counties. Due to the potential size of this pipeline, 8 to 10 feet in diameter, as much as 100 feet in width of right-of-way is needed for future construction, placement, and maintenance purposes. The increasing development occurring along Interstate 15 through Box Elder, Davis, and Weber counties has heightened the need to begin the early acquisition of right-of-way. This will reduce future impacts to the surrounding communities.

In 2019, the Division completed a Bear River Development Feasibility Study to identify potential reservoir sites and pipeline corridors that could work together as one system. The study is a conceptual engineering overview of how the associated facilities and reservoirs would work together. It also provides a plan to phase construction so water is provided incrementally as needed.

Cost estimates were produced for 13 scenarios of reservoir combinations. These estimates range between $1.5 and $2.8 billion. An updated cost estimate will be prepared when the environmental studies are complete and alignment and design are determined. As stated in the Act, the cost of construction and environmental mitigation will be repaid to the state by the participating water districts. These districts will also pay for the operation, maintenance, and repair of the system, as well as any costs for water treatment.

An environmental review process, in accordance with the NEPA, will need to be completed prior to any construction.

Board of Water Resources Funding

The Board of Water Resources (Board) is the policymaking body of the Division. The Board was established to provide funding for water infrastructure projects (Utah Code 73-10). The financing comes from revolving funds established by the Utah Legislature. As projects are repaid, the funds are utilized again to assist in financing additional projects. Since the Board was established in 1947, it has provided over $850 million in funding for over 1,600 projects totaling approximately $2.3 billion.

The four accounts managed by the Board and specific funding programs within the funds are shown in Graphic 6-4.

Further information about the Board's funding programs is available on the Board Funding webpage.

Other Water Project Funding

Other state and federal agencies, boards, and commissions provide funding for water projects through grants and loans. The following is a list of some of the more common funding sources:

State

- Utah Community Impact Board
- Utah Community Development Block Grant Program
- Utah Division of Drinking Water
- State Revolving Fund
- Utah Wastewater Loan Funds (Utah Water Quality Board)
- Utah Department of Agriculture and Food
- Agricultural Resource Development Loans
- Agriculture Water Optimization Funding

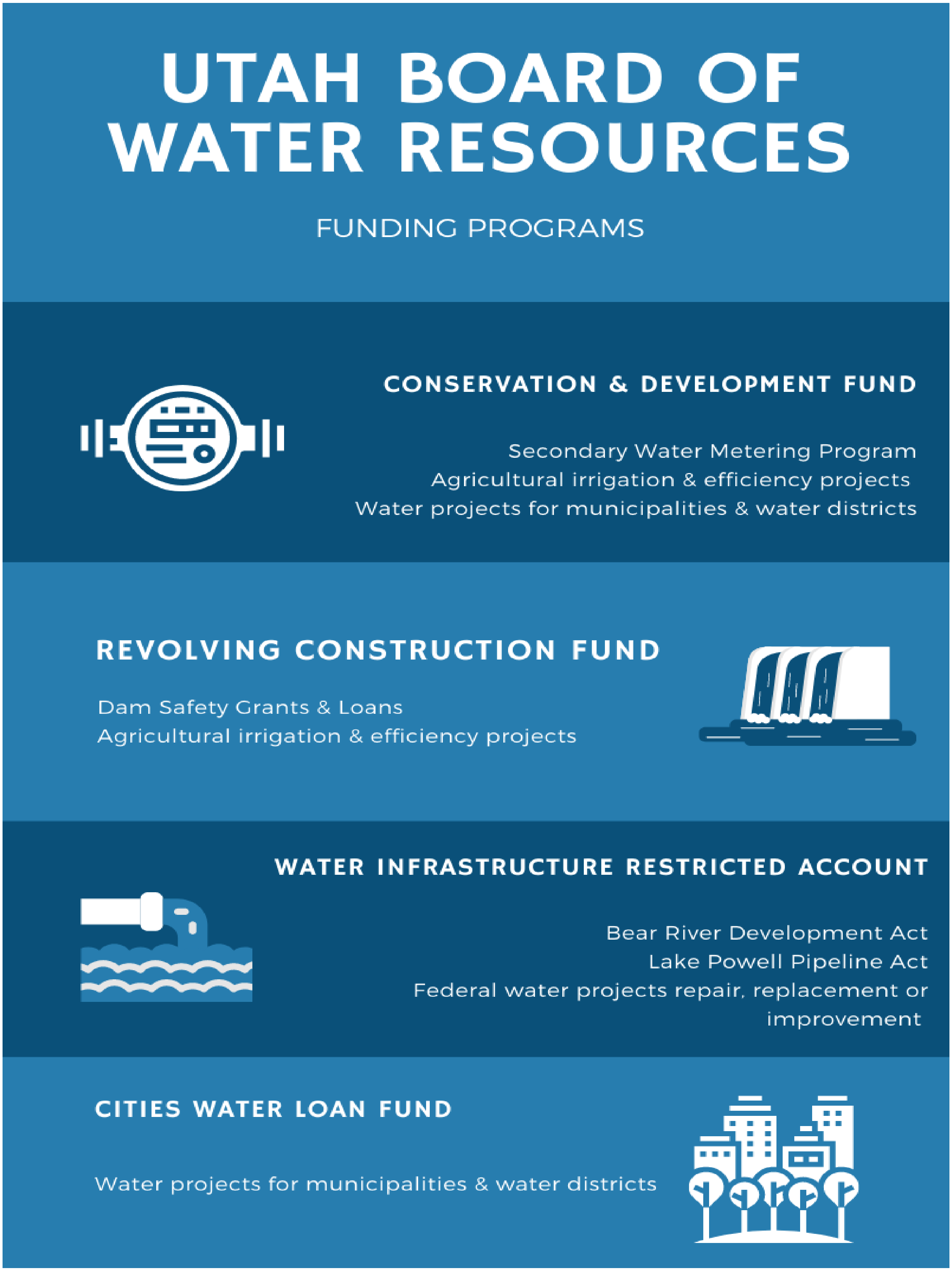
Federal

- Federal Safe Drinking Water Act, Administered by the Utah Division of Drinking Water
- Safe Drinking Water Revolving Fund
- United States Department of Agriculture (USDA)
- Clean Water Act (Adminstered by Utah Division of Drinking Water)
- Clean Water State Revolving Fund (Administered by Utah Division of Water Quality)
- Rural Development Grants and Loans
- Natural Resources Conservation Services (NRCS) Financial Assistance
- Environmental Protection Agency (EPA)
- Water Infrastructure Finance and Innovative Act (WIFIA)
- Farm Service Agency
- Farm Loan Programs

Bureau of Reclamation

- WaterSMART Grant Program
- Colorado River Basin Salinity Control Program

Graphic 6-4 Board of Water Resources' Funding Programs



Water Reuse

Wastewater effluent (treated wastewater) from sewage treatment plants is typically discharged into streams. That water is diverted, treated, and indirectly reused by other users downstream of these discharges. This can occur many times as effluent is returned to the river. The phrase “we all live downstream” is literally true. In the context of this report, “water reuse” refers to the direct reuse of wastewater, which involves treatment and disinfection, and the planned use of the resulting effluent for a beneficial purpose. A water right is necessary in order to reuse water. Water reuse is an important option to supplement future water supplies.

Potential Water Reuse Benefits and Applications

The 2021 National Water Reuse Action Plan (WRAP) was developed in collaboration with partners across the water sector. Actions in the plan are intended to drive progress on reuse and address local and national barriers across a range of topics including technical, institutional, and financial. According to the U.S. Environmental Protection Agency (EPA), reuse water may be used for:

- Agriculture, landscape, public park, and golf course irrigation
- Cooling water for power plants and oil refineries
- Processing water for mills and plants
- Toilet flushing
- Direct potable use
- Indirect potable use
- Dust control, concrete mixing, and other construction activities
- Artificial water-bodies – such as ornamental ponds and golf course water features

Water Reuse in Utah

In 1995, the Utah Legislature enacted the Water Reuse Act (Utah Code 73-3c-302) to govern the reuse of treated wastewater. The current administrative rule requires submitting a project plan to Water Rights that, among other things, includes:

- A description of the underlying water right.
- A description of the quantity, quality, and use of the treated wastewater to be delivered, and the location of the site.
- A description of public notification.
- Requirements for any necessary groundwater discharge permits, underground injection control permits, etc.
- A detailed operation and management plan that includes: a copy of the contract with the user, a plan for the prevention of cross-connections between the treated effluent distribution lines and potable water lines, schedules for routine maintenance, and a contingency plan for system failure or upsets.

Before wastewater can be reused, it is required to undergo treatment to protect public health and the environment. There are two levels of treatment required, depending upon the intended use:

- Type II is acceptable mainly for agriculture irrigation purposes where it is not likely to come in direct contact with the edible parts of crops or humans.

- Type I is required for municipal irrigation purposes and other uses where human contact is likely. It requires Type II treatment plus additional filtration and disinfection.

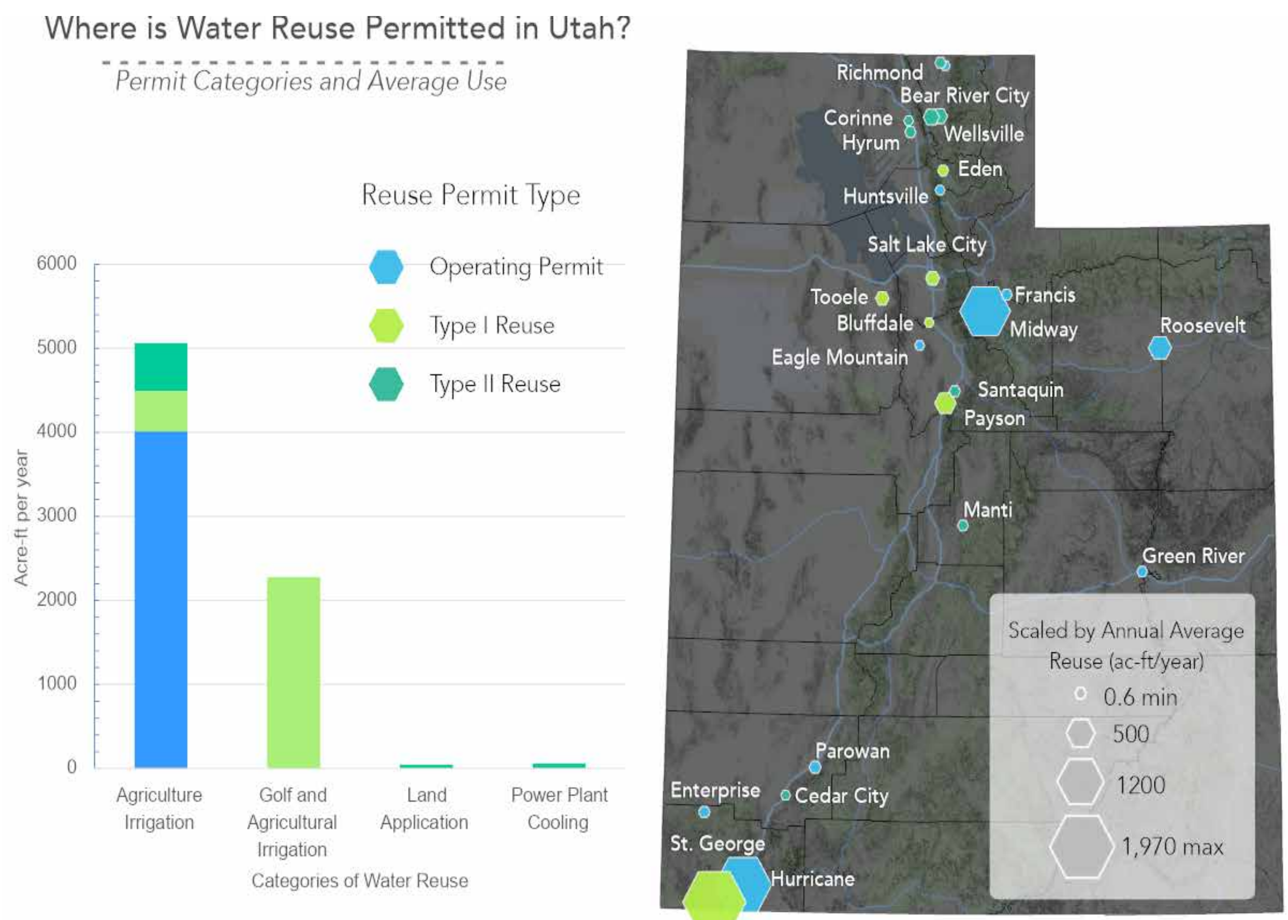
Graphic 6-5 shows the existing water reuse projects that have been permitted in Utah.

A few wastewater treatment plants have current operating permits that allow the disposal of their wastewater through land-application. These land-application waste streams can be applied to crops, but sometimes are simply spread on the ground to evaporate. Lists of existing Type I and Type II water reuse projects and operating permits are included in Appendix H. The Division of Water Quality (Water Quality) regulates water reuse, while Water Rights evaluates compliance with the associated water rights. Water Quality is currently developing a clearer distinction between a reuse permit and a land-application permit.

The Future of Water Reuse

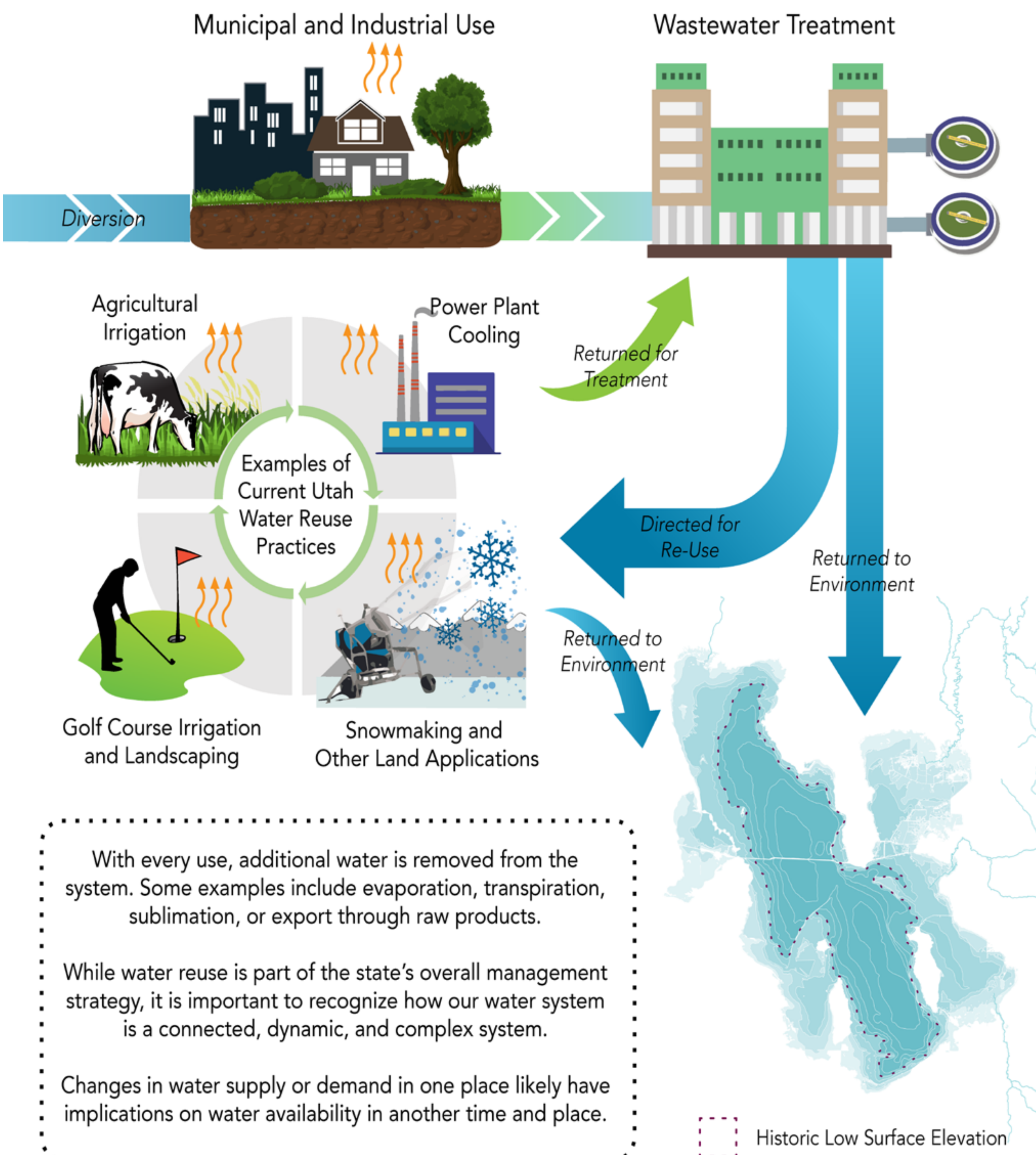
As the state's population continues to grow, so does the demand for water and the need for water reuse. In the 2005 report [Water Reuse in Utah](), the Division estimated that there could be about 490,000 acre-feet of wastewater per year produced statewide by 2030. Current wastewater volumes support this estimate.

Graphic 6-5 Reuse Projects in Utah



Graphic 6-6 How Does Water Reuse Impact Great Salt Lake?

Water reuse includes intentionally capturing wastewater and treating it so it can be reused for another beneficial purpose. However, these practices will reduce the volume of water which would have otherwise been discharged and returned to natural systems like Great Salt Lake.



This potential water source could relieve the load on potable water treatment plants by using reuse water for non-potable demands, like irrigation. In order to be feasible, the cost of reuse water must be less than the cost of other potential water sources. It should be noted that water reused, rather than returned to the natural system, increases depletions (Chapter 3), and may have a negative impact on the environment.

For example, effluent flows within the Great Salt Lake Basin may be needed to help sustain lake levels, and if that water is reused it would likely adversely impact lake levels (see Graphic 6-6).

Utah's water needs will not be met by development alone. They will not be met by conservation alone. While agricultural land and water continue to transition to urban uses in many regions, the burden of providing water for a growing population can't only fall on the backs of farmers. Environmental impacts must also be considered. The water supply challenges Utah faces are complex and the solutions will need to be balanced. The Division is confident that Utah is up to the challenge.

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Refine the Division's Agricultural to M&I water conversion estimates.
- Complete the National Environmental Policy Act process for the Lake Powell Pipeline.
- Acquire right-of-way property for the proposed Bear River Development project.
- Continue planning for and studying options for Bear River Development.
- Prepare and plan for water development projects to ensure water supplies are available when needed.
- Recommend water reuse projects for suitable areas.
- Partner with secondary water providers to utilize available secondary metering funding.

Chapter 6 Links

Open Water Data Website - dwre-utahdnr.opendata.arcgis.com

Vibrant Agricultural Sector (Your Utah Your Future) - https://yourutahyourfuture.org/topics/water

Utah Division of Water Resources Water Related Land Use Data - https://dwre-utahdnr.opendata.arcgis.com/pages/wrlu-data

Kem C. Gardner Policy Institute 2015 - 2015 State and County Projections - https://gardner.utah.edu/wp-content/uploads/Projections-Brief-Final-Updated-Feb2019.pdf

Wasatch Front Regional Council Real Estate Market Model - https://wfrc.org/programs/models-forecasting/

Utah Division of Water Rights Utah Water Duty Map - https://www.waterrights.utah.gov/gisinfo/maps/aduty.pdf

2015 Legislative Audit: A Performance Audit of Projections of Utah's Water Needs - https://le.utah.gov/audit/15_01rpt.pdf

Central Utah Water Conservancy District Website - http://www.cuwcd.com/index.htm

Lake Powell Pipeline Development Act (Utah Code 73-28) - https://le.utah.gov/xcode/Title73/Chapter28/73-28.html

LPPUtah Website - https://lpputah.org/

Groundwater Management Plan for Cedar Valley - https://www.waterrights.utah.gov/groundwater/ManagementReports/CedarValley/CedarValley.asp

Pine Valley Water Supply and Conservation Project - https://cicwcd.org/west-desert-water-development-project/

Bear River Development Act (Utah Code 73-26) - https://le.utah.gov/xcode/Title73/Chapter26/73-26-S103.html

Bear River Development Feasibility Study - https://water.utah.gov/bear-river/

Reuse Water - https://www.epa.gov/waterreuse

Water Reuse Act (Utah Code 73-3c-302) - https://le.utah.gov/xcode/Title73/Chapter3C/73-3c-S302.html

Water Reuse in Utah - https://water.utah.gov/wp-content/uploads/2019/12/Water-Reuse-in-Utah-Water-Resources-2005.pdf

WaterSMART Grant Program - https://www.usbr.gov/watersmart/weeg/

Colorado River Basin Salinity Control Program - https://www.usbr.gov/uc/progact/salinity/

Farm Service Agency Farm Loan Programs - https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/index

Water Infrastructure Finance and Innovation Act - https://www.epa.gov/wifia

Board of Water Resources (Utah Code 73-10) - https://le.utah.gov/xcode/Title73/Chapter10/73-10-S1.html

Secondary Water Metering Program - https://water.utah.gov/wp-content/uploads/2019/Funding/PDF/Secondary-Water-Meter-Funding-Guidelines.pdf

Board Funding website - https://water.utah.gov/development-branch/funding/

Utah Community Development Block Grant Program - https://jobs.utah.gov/housing/community/cdbg/index.htmll

State Revolving Fund - https://deq.utah.gov/drinking-water/drinking-water-boards-srf-program-funding-opportunities

Agricultural Resource Development Loans - https://ag.utah.gov/farmers/conservation-division/what-is-the-ardl-program/

Federal Safe Drinking Water, Revolving Fund - https://deq.utah.gov/drinking-water/federal-state-revolving-fund-srf-program-drinking-water

U.S. Department of Agriculture Rural Development - https://www.usda.gov/topics/farming/grants-and-loans

Natural Resources Conservation Services - https://www.nrcs.usda.gov/wps/portal/

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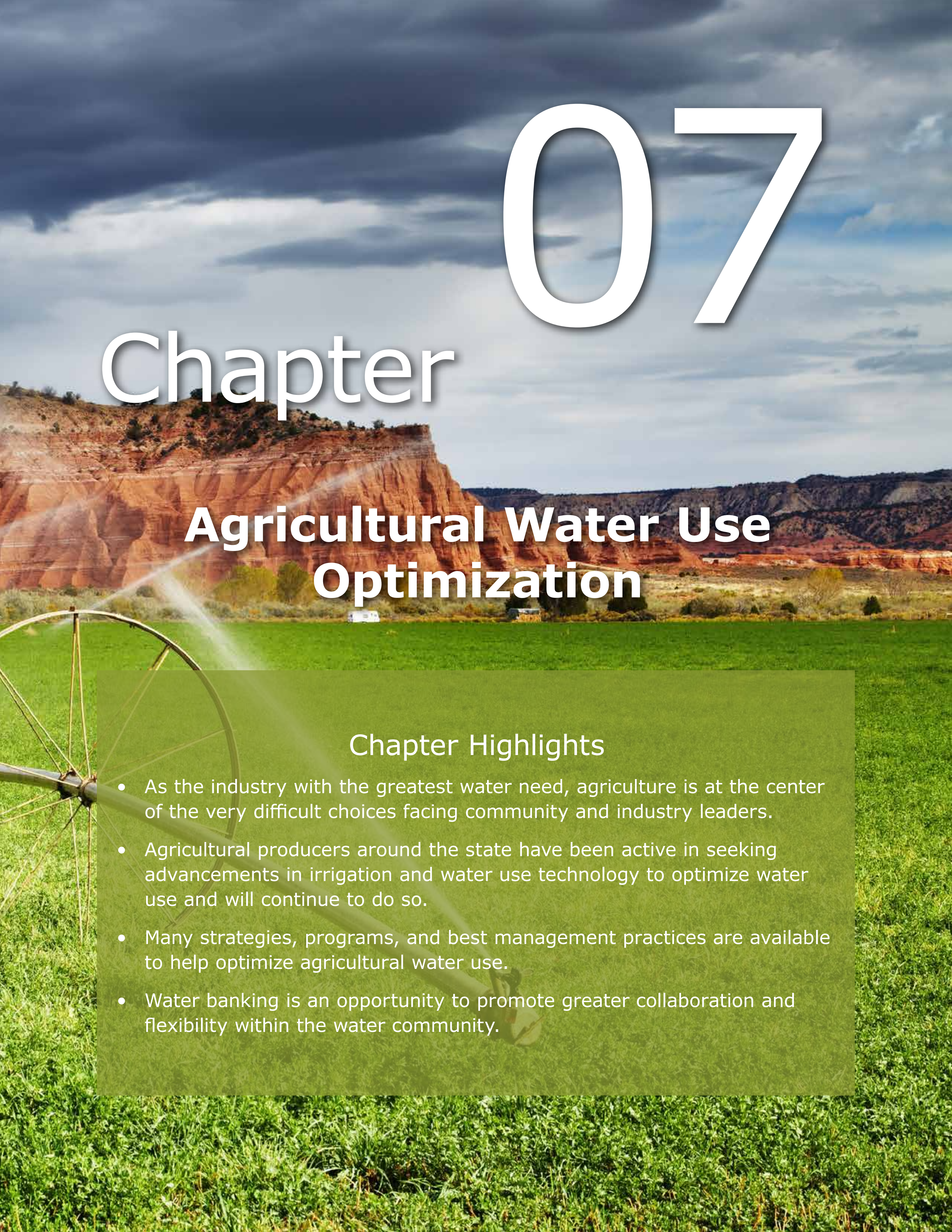
DWRi 2012. Utah Division of Water Rights, Beryl Enterprise Ground Water Management Plan, December 21, 2012. (https://www.waterrights.utah.gov/groundwater/ManagementReports/BerylEnt/BerylEnterprise_Management_Plan.pdf)

Gardner Policy Institute 2019. Kem C. Gardner Policy Institute, Utah's Long-Term Demographic and Economic Projections Summary, Research Brief, [July 2017] February 2019; (https://gardner.utah.edu/wp-content/uploads/Projections-Brief-Final-Updated-Feb2019.pdf).

Construction crew working on the stability berm at Millsite Dam near Ferron, Utah.
PC: Tom Cox

Old wheel-line sprinkler near Cannonville



Chapter 07

Agricultural Water Use Optimization

Chapter Highlights

- As the industry with the greatest water need, agriculture is at the center of the very difficult choices facing community and industry leaders.
- Agricultural producers around the state have been active in seeking advancements in irrigation and water use technology to optimize water use and will continue to do so.
- Many strategies, programs, and best management practices are available to help optimize agricultural water use.
- Water banking is an opportunity to promote greater collaboration and flexibility within the water community.

Agriculture is the industry that uses land, water, and other resources to grow food, fiber, and fuel. Because of Utah's semi-arid climate, agriculture requires significant volumes of water to be productive. The demand for water by agriculture is reflected in the Division of Water Resources' (Division) Water Budget Model, which estimates approximately 75% of the state's water diversions are for agriculture. Clearly, any discussion of water in Utah would be incomplete without addressing agriculture.

Agriculture is an essential industry. Everything that grows on the farm and ends on our tables requires water. Fortunately, agricultural producers around the state are actively seeking advancements in irrigation and water management technology to optimize water use. In this context, optimize means to make the best or most effective use of the water that is available and in some cases even reducing consumptive use. Optimizing agricultural water use will not only help ensure agricultural productivity, but will improve overall water management within a watershed and basin.

Picking Utah strawberries

Utah is at a crossroads in water need as population growth, drought and climate variation, and the need to maintain viable natural systems all converge. Add to this the very high public and social interest in maintaining food production and other valuable services provided by agriculture and you have a recipe for potential conflict. As the industry with the greatest water need, agriculture is at the center of the very difficult choices facing community and industry leaders. While there is little debate about the need for agricultural water to be transferred to meet growing M&I demands as farm lands are developed to accommodate growth, there are still many questions about who should bear the costs and who should receive the benefits of agricultural water use optimization.

While this plan is not able to resolve all these issues, it is hoped that it can help lay a foundation for future processes and discussions that are necessary to ensure future water security. As such, this chapter summarizes some broad strategies, programs, and best management practices that are available to help optimize water use in agriculture.

Recommended State Water Strategy

In 2017, the Governor's State Water Advisory Team issued the Recommended State Water

Strategy. One of the key policy questions addressed in this document was “How does Utah provide water for agricultural lands and food production in the face of competing water demands?” The document made several recommendations in response to this question, including the following:

- Support agriculture’s infrastructure, water use measurement, data, and reporting needs.
- Establish basin-level councils to create benefits for farmers who help optimize regional water supplies, conserve in-stream flows, or enhance water quality.
- Create mechanisms that help agricultural water users contribute to improving water quantity and quality management.

Since then, the State Legislature has taken several actions on these recommendations that help establish a foundation for agricultural water management and optimization efforts. The following four sections provide a brief description of these actions.

Agricultural Water Optimization Task Force

In 2018, the State Legislature created the Agricultural Water Optimization Task Force (Utah Code 73-10g-Part 2) and appropriated $1.2 million to help address some of the recommendations of the strategy document related to agriculture. The task force was directed to: (1) identify critical issues facing the State’s long-term water supply, particularly how to optimize agricultural water supply and use in light of future needs; (2) identify obstacles and constraints on the quantification of agricultural water use and recommend ways to improve the quantification on a basin level; and (3) identify ways to maintain or increase agricultural production while reducing the agriculture industry’s water diversion and consumption.

So far, the task force has funded a few demonstration projects and produced several reports investigating various issues and sharing the results of specific

Low head center-pivot irrigation system in Utah Valley agricultural water optimization projects. For more information on the Task Force's work, see the Division's Agricultural Water Optimization webpage.

Utah Department of Agriculture and Food Water Optimization Program

In 2019, the State Legislature also began providing funding for the implementation of agricultural water optimization projects directly with agricultural producers. In 2019, 2020, and 2021, the legislature allocated $3 million. This funding is administered by the Utah Department of Agriculture and Food (UDAF) and is provided as a matching grant to eligible applicants. The purpose of the grants is to reduce consumptive water use, provide increased operational flexibility for agricultural water users, and show accurate, real-time measurement of diverted water to demonstrate water savings.

Grant recipients are required to report data to the state for three years following implementation of their project. For further details, see UDAF's Water Optimization Program webpage.

Utah Watershed Councils Act

In 2020, the Utah Legislature passed the Watershed Councils Act (Utah Code 73-10g-Part 3), which directs the Division of Water Resources to create the Utah Watersheds Council (a state council) and 12 local watershed councils. The intent of the Act is to "develop diverse and balanced stakeholder forums for discussion of water policy and resource issues at watershed and state levels."

Flood irrigation of corn near Herriman
PC: Ron Ollis

Providing opportunities for the agricultural community to have a seat at the table is a clear priority of the act. The Utah Watersheds Council will include the Commissioner of the Department of Agriculture and Food, the Utah State University Extension Vice President, as well as a representative of agricultural interests selected by the governor from persons nominated jointly by the Commissioner of the Department of Agriculture and Food, the President of the Utah Farm Bureau, and the Utah State University Extension Vice President. The act also encourages each local watershed council to include representatives from agriculture, mutual irrigation companies, and local sponsors of reclamation projects.

Although these councils are not vested with regulatory, infrastructure financing, or enforcement powers or responsibilities, they provide the opportunity for all council members to have a voice in water-related discussions.

For more information about watershed councils, see the [Division's Watershed Councils webpage].

Water Banking Act

In 2020, the Water Banking Act became law ([Utah Code 73-31]). This act authorizes the Board of Water Resources (Board) to approve the creation of formal water banks. A water bank is an institutional mechanism that facilitates the temporary transfer of water and can help agricultural water users contribute to improving water management in a watershed where there are many competing needs.

Water banks facilitate the voluntary, temporary transfer of a water right from one user to another through low-cost transactions. Water banking isn't new, but the concept hasn't been formally used in Utah. Water banking is a market tool that may provide both income to water right owners and greater access to water. Water banking is an alternative to "buy and dry" practices and is an opportunity to promote greater collaboration and flexibility within the water community. Water banks could also allow water users to invest in water saving technologies that reduce consumption through the potential lease or sale of water.

In 2019, the Division received a $400,000 WaterSMART Water Marketing Strategy grant from the Bureau of Reclamation to develop a statewide strategy – how water banks could be set up and operate. Information gathered from three pilot water banks will be used to develop the strategy. The legislature appropriated an additional $400,000 for the study.

Best Management Practices

There are numerous ways to improve the management of agricultural water. These are typically divided into two categories: off-farm or conveyance system improvements and on-farm improvements. The following sections discuss some best management practices for each and also provides relevant data demonstrating the effectiveness of certain practices or the progress that has already been made.

Conveyance System Improvements

The effectiveness of conveyance systems to deliver water to farms varies depending on the conveyance type, soil, slope, length of the canal or ditch, and condition of the infrastructure. In unlined, earthen canals, conveyance water loss can be as high as 50%. Concrete or polymer-lined canals experience much lower losses, while properly maintained and piped irrigation water that is monitored for leaks can nearly eliminate losses.

Conveyance systems can also be greatly improved by the use of Supervisory Control and Data Acquisition (SCADA) technology. SCADA systems utilize a network of water level and flow measurement devices to automate system operations. With real-time capability to monitor and manage entire irrigation systems, SCADA technology reduces excess application, improves canal safety, and reduces system losses.

Since 2010, the Board has funded 95 projects that improve the performance of conveyance systems. These projects


Utah County farmland

primarily included piping open channels or lining canals and ditches to reduce seepage and evaporation losses. More than 350 miles of open canals were improved through these Board-funded projects, with an estimated reduction of water loss of over 119,000 acre-feet annually (DWRe 2019). The Division of Water Rights' database indicates that only about 20% of the nearly 4,600 miles of irrigation canals are piped in Utah (DWRi 2018). The remaining 3,600 miles of open canals represent a significant opportunity to improve conveyance of Utah's agricultural water.

On-farm Improvements

In addition to conveyance improvements, there are many opportunities to improve water management at individual farms. A few of these are listed below:

- Selecting a crop that has a lower water demand.
- Carefully monitoring soil temperature and moisture and adjusting irrigation schedules to only replenish the root zone as needed.
- Changing the irrigation application method to optimize water use.
- Enhancing the soils to improve water retention and crop growing conditions.

An example of how crop selection can make a big difference in water consumed is the Beryl-Enterprise area in Iron County. Irrigators there recently converted many acres of alfalfa to corn, grain, or pasture in order to reduce groundwater depletions. Subsequent data from the Utah Division of Water Rights shows that average annual groundwater depletions have declined by an average of over 6,000 acre-feet annually (DWRi 2012 & DWRi 2013–2018).

Recent land use data from the Division (2017) indicates that 77,000 agricultural acres were converted from flood to sprinkle irrigation since 2007. Additionally, more than 1,200 acres have been converted to drip irrigation (DWRe 1986-2017). Drip irrigation systems are about 85% – 90% efficient (Peters, et al 2020).

In 2018, the Utah Legislature provided $200,000 to convert pivot sprinkler systems to Low Elevation Spray Application and Mobile Drip Irrigation systems in Cedar Valley, Iron County. With this funding, the Central Iron County Water Conservancy District helped retrofit more than 20 irrigation systems. These systems are now being studied to determine their potential to help reduce the average 7,000 acre-foot per year overdraft of the Cedar Valley aquifer.

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Encourage agricultural water users to actively participate in local watershed councils.
- Continue to fund water conveyance improvement projects through the Board of Water Resources.
- Continue to fund on-farm water optimization projects through the Utah Department of Agriculture and Food.
- Prepare and publish a Statewide Water Marketing Strategy that includes water banking lessons learned from pilot projects around the state.

Chapter 7 Links

Recommended State Water Strategy - https://envisionutah.org/utah-water-strategy-project

Agricultural Water Optimization Task Force Statute - https://le.utah.gov/xcode/Title73/Chapter10G/73-10g-P2.html

Division Agricultural Water Optimization Task Force Webpage - https://water.utah.gov/agwateroptimization/

UDAF's Water Optimization Program - https://ag.utah.gov/farmers/conservation-division/water-optimization-program/

Utah Watershed Councils Act - https://le.utah.gov/xcode/Title73/Chapter10G/73-10g-P3.html

Division's Watershed Councils Webpage - https://water.utah.gov/watershed-councils/

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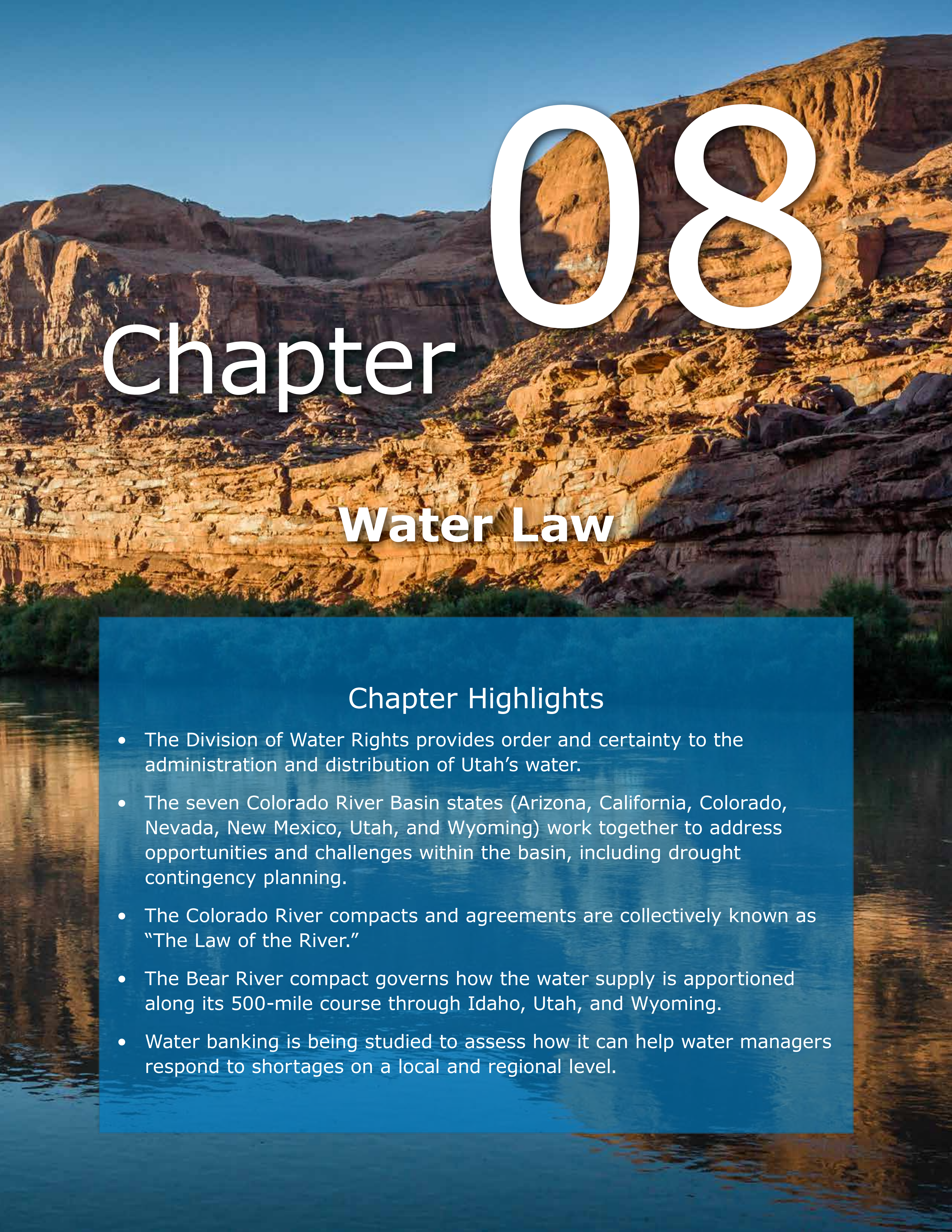
DWRi 2013-2018. Utah Division of Water Rights, *Beryl Enterprise Groundwater System Annual River Commissioner Report,* 2013 to 2018.

DWRe 1986-2017. Division of Water Resources, Utah Water Related Land Use (1986-2017).

Peters, et al 2020. *Literature Review of Current & Upcoming Irrigation Technologies and Practices Applicable to Utah,* University of Utah, November 25, 2020.

Colorado River near Moab, Utah



Chapter 08

Water Law

Chapter Highlights

- The Division of Water Rights provides order and certainty to the administration and distribution of Utah's water.
- The seven Colorado River Basin states (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) work together to address opportunities and challenges within the basin, including drought contingency planning.
- The Colorado River compacts and agreements are collectively known as "The Law of the River."
- The Bear River compact governs how the water supply is apportioned along its 500-mile course through Idaho, Utah, and Wyoming.
- Water banking is being studied to assess how it can help water managers respond to shortages on a local and regional level.

Introduction to Utah Water Rights Law

By: Utah Division of Water Rights

The Office of the State Engineer was created in 1897. In 1967, the name of the Office of the State Engineer was changed to the Division of Water Rights with the State Engineer designated as the Director. The State Engineer, as Director of the Division of Water Rights, is responsible for the general administrative supervision of the waters of the state and the measurement, appropriation, apportionment, and distribution of those waters. The State Engineer apportions and distributes the water according to the respective rights of appropriators. (Utah Code 73-2-1)

All water use within the State of Utah is governed by Utah Code, Title 73. Water law in Utah is based on the principles of public ownership of water, the doctrines of prior appropriation and beneficial use. Tens of thousands of water rights exist in Utah based on these principles. It is the role of the State Engineer to create and maintain a public record of all water rights within the state to provide order and certainty in the appropriation and distribution of the public's water.

Water Rights

Under Utah law, water rights can be acquired in only three ways: (1) by application to the State Engineer's Office; (2) by diligent use prior to the enactment of the statutes establishing the application process as the sole method of appropriation ("diligence rights"); and (3) by adverse use or adverse possession.

Currently, the only way to initiate a new water right is by application to the State Engineer's Office. If the State Engineer approves an application, the applicant may proceed, within a set time, to divert the water and put it to beneficial use. After putting the water to use in accordance with the application, the applicant files proof of beneficial use and, if the State Engineer determines that the water is put to use as contemplated by the application approval, the State Engineer issues a certificate of appropriation perfecting the right.

Diligence claims are based on the continuous beneficial use of water dating back to before March 12, 1903, for surface water, or March 22, 1935, for underground water. Prior to these dates, a water user could acquire a water right by diverting and using the water for a beneficial use. After those dates, new water rights could be acquired only by application to the State Engineer's Office.

Prior to 1939, water rights could also be acquired by the adverse use of a valid right. In 1939, the Utah Legislature amended the statutes to prohibit acquisition of a water right by adverse use or adverse possession.

The State Engineer processes thousands of applications annually. Many areas of the state are administratively "closed" to new appropriations of water. In those areas, new diversions and uses of water are established by the modification of existing water rights. Such modifications are accomplished by the filing of change applications. The State Engineer is continually working to bring transparency and efficiency to these records and application processes.

Water Right Adjudication

The Division of Water Rights' Adjudication Program brings order and certainty to the water rights record by defining existing rights, quantifying unknown rights, removing forfeited rights from the record, and submitting appealed actions to a district court to be confirmed by judicial decree.

The State Engineer is directed in statute (Utah Code 73-4) to conduct surveys of water diversions and uses, provide notice to all potential water right claimants to submit claims, evaluate those claims, and prepare a proposed determination of water rights. A proposed determination is the recommendation of the State Engineer to the court with respect to water rights within an area. Statutorily, the court defers to the State Engineer's determination, unless the determination is contested. After any objections to a proposed determination are resolved by the court, a final decree is entered for all rights to the use of water which removes ambiguity about unrecorded claims.

Although water right adjudications have been ongoing throughout the state for more than a century, recent efforts and increased funding have focused on efforts in the Utah Lake, Jordan River, Spanish Valley (i.e., Moab), and Virgin River drainages. Within the next five years, it is anticipated that the State Engineer will have finalized recommendations within those adjudication areas and will proceed with obtaining interlocutory (provisional decree) and final decrees from the respective courts.

Water Distribution According to Existing Water Rights

The State Engineer is responsible for apportioning and distributing water according to existing water rights. When it is deemed necessary to ensure accurate distribution, the State Engineer can establish distribution systems and appoint river commissioners (Utah Code 73-5) to oversee the diversion of water. Within a distribution system, a river commissioner regulates and controls the diversion of water according to established water rights.

Large amounts of data are collected on every system and distribution accounting models are created to accurately determine the amount of available water to each user under the respective water rights. The river commissioners, under the direction of the State Engineer, are responsible to adjust diversions as water supply fluctuates throughout the year. These water deliveries are based on the priority of a water right and available water supply. The developed accounting models and records are publicly available on the Division of Water Rights' website.

Federally Reserved Water Rights

When the federal government reserves public lands for Native American reservations, military reservations, national parks, national forests, or monuments, water is implicitly reserved to satisfy the purposes for which the reservation was created. These federal reserved water rights can create conflict with already established state-based water rights and uses.

To mitigate the impact from federal reserved water rights, the State of Utah has successfully negotiated settlements of federally reserved water right claims for both Native American trust lands and other existing federal reservations.

As of 2021, Utah has negotiated reserved rights settlements for:

- Uintah Ouray Indian Reservation, Shivwits Band Reservation, and Navajo Nation
- Cedar Breaks, Hovenweep, Promontory Point, Rainbow Bridge, Timpanogos Cave, and Natural Bridges National Monuments
- Arches, Bryce Canyon, and Zion National Parks, and Golden Spike Historical Park.

Utah is negotiating settlements for:

- Ute Tribe
- Goshutes Tribe
- Dinosaur National Monument
- Capitol Reef and Canyonlands National Parks
- Certain U.S. Forest Service areas

Conclusion

Water law in Utah is a long established legal framework providing for the effective management of the state's water supply. Modifications to water law and policy have been made over the years to ensure continued order and certainty in the use of water. Additional resiliency and adaptability are key for stable communities and the expected economic growth. Building transparency and clarity into the water rights system will provide security for existing rights and allow for economic development and stability in the future.

Interstate Streams

Utah shares the waters of the Colorado River and the Bear River with other western states. The Colorado River is also shared with Mexico. Both rivers are significant sources of water for Utah and its citizens, and the allocation of water among the various parties is dictated by compact and subsequent agreements.

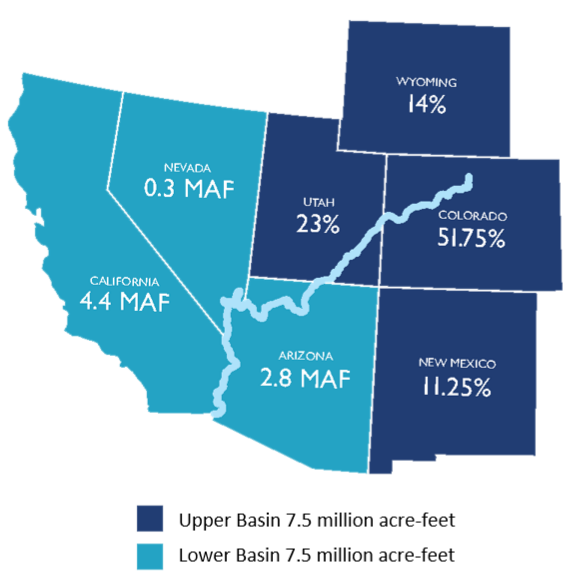
Colorado River Compact

The Colorado River Compact is an agreement among the seven western states in the Colorado River Basin. The compact, signed in 1922 by all of the basin states except Arizona, divided the river's waters between the Upper and Lower Basin states. Subsequent agreements and decrees added Arizona and divided each basin's allotment between member states, and have adapted the regulation and use of the river as needed. Utah, Colorado, Wyoming, and New Mexico comprise the Upper Basin, and California, Arizona, and Nevada comprise the Lower Basin. Mexico signed a treaty with the U.S. in 1944 regarding Colorado River allocations. These compacts and agreements along with other decisions are collectively known as "The Law of the River." The Law of the River is dynamic and is adapted to changing conditions.

The compact allocates an annual 7.5 million acre-feet (maf) to both the upper and lower basins and was based on the 1905 to 1922 average annual flow of 16.4 maf at Lee Ferry (the measuring point, as designated by the 1922 Compact for meeting the Lower Basin's allocation). Mexico receives 1.5 maf out of the total flow. Recent estimates indicate the river's current flows are approximately 14.6 maf, according to the 2019 Upper Colorado River Commission's 71st Annual Report, indicating that the 16.4 maf per year used for compact negotiations may have been from a relatively wet period. Consequently, the 2007 Upper Basin's Hydrologic Determination is closer to 6.0 maf inclusive of Colorado River Storage Project evaporations.

In 2007, the Lower Basin states agreed to share shortages in the Colorado River. Under this agreement, releases from Lake Powell are made in accordance with the Law of the River, but they are also adjusted based on the expected elevations of Lake Mead and Lake Powell. The Upper Basin may not deplete more than would allow the 75 maf over a 10-year period to be released to the lower basin plus half of the Mexican deficiency (750,000 acre-feet). In a typical year, the Upper Basin depletion would be 8.23 maf, calculated as 7.5 maf to the lower basin, 0.75 maf to Mexico less .02 maf from the Paria below Glen Canyon Dam. Shortages in the Upper Basin would be the result of not being able to meet the compact's requirement to the Lower Basin and Mexico over the 10-year rolling average described previously.

Graphic 8-1 Colorado River Allocations



In addition to reductions for the basin states during shortages as outlined in the 2007 Interim Guidelines, Mexico has agreed to reductions in its 1.5 maf annual treaty allotment in exchange for water storage in the U.S. through a 2012 ammendment to the 1944 treaty, titled "Minute 319." This minute, along with "Minute 323" signed in 2017, specifies how surplus water will be shared with Mexico and provides for repairs and improvements to Mexico's canal system, which delivers water from the Colorado River to Tijuana and other parts of Mexico. These have been financed by entities in the U.S. in exchange for the water conserved by the improvements.

Drought Contingency Planning

Due to persistent drought, Colorado River inflows have been below normal for most years since 2000. Only five years have been above normal during that period. Because of this, the seven Colorado River Compact states have been working out agreements that will help preserve storage in Lake Powell and Lake Mead, and protect river operations. The Upper and Lower Colorado River Basin states have developed contingency plans both independently and collaboratively. The product of these discussions is five agreements that comprise the Drought Contingency Plan (DCP) for the Colorado River.

They are:

- Companion Agreement

- Upper Basin Drought Response Operations Agreement
- Upper Basin Demand Management Storage Agreement
- Lower Basin Drought Contingency Plan Agreement
- Lower Basin Drought Contingency Operations

These documents were all signed into law in the spring of 2019. While the greater details of the documents have been agreed upon, finer details regarding the Upper Basin's Drought Response Operations Agreement (DROA) and a potential Demand Management Program are still ongoing.

The primary focus of these agreements and programs is to ensure compact compliance. Another related focus is to protect power generation of Lake Powell at Glen Canyon Dam. Power revenues are critical to supporting irrigation projects, salinity control projects, several important environmental programs (such as the San Juan and Upper Colorado River Endangered Fish Recovery Programs), and other important costs.

Recovery of endangered fish species is vital to preserving the Upper Basin's ability to use and develop its remaining shares of the Colorado River. Keeping Lake Powell's water-elevation at 3,525 feet above sea level accomplishes both protecting the power generation pool and meeting the Upper Basin's release obligations to the Lower Basin. As water levels decline toward this elevation, drought-storage releases from Colorado River Storage Project reservoirs augment river flows. Drought response operations for these reservoirs are still being developed. Under the DROA, projections from the Bureau of Reclamation are used to determine whether drought response operations are triggered. These operations were triggered for the

Ceremonial signing of Drought Contingency Plans at Hoover Dam, May 2019. Representing the State of Utah, former Utah Division of Water Resources Director, Eric Millis, pictured third from left.
PC: Bureau of Reclamaation

first time in 2021, requiring 183,000 acre-feet of water to be released from upstream reservoirs to Lake Powell.

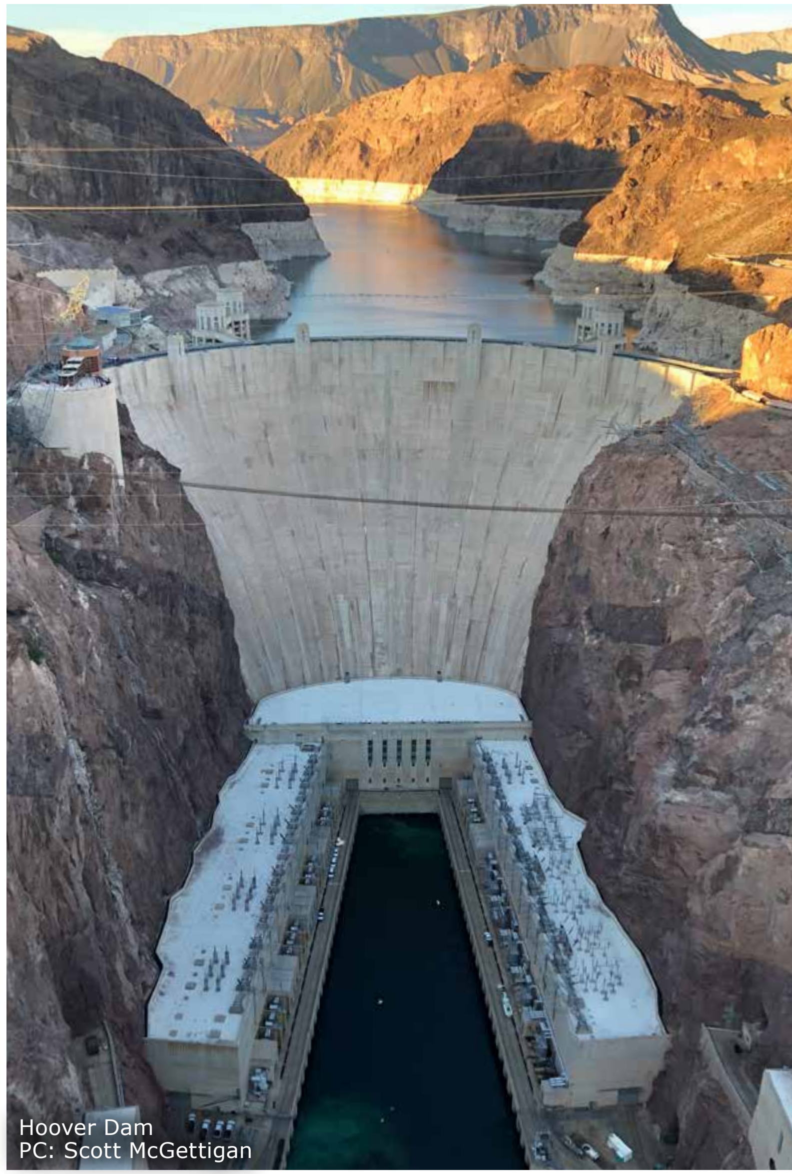
Utah's Colorado River Use

Utah's allocation of the Colorado River is 23% of the Upper Basin's total, currently estimated to be 1.369 million acre-feet. Of this, Utah is currently using about 1 million acre-feet. The remaining 369,000 acre-feet is expected to be fully used in the future. Reserved water right settlements for the Ute Tribe and the Utah portion of Navajo Nation must be satisfied with this remaining water. The proposed Lake Powell Pipeline will deliver almost a quarter of the remaining allocation to southwest Utah. Other agricultural, municipal, and industrial needs are expected to use the remaining water.

In 2007, the seven Colorado River Basin states negotiated shortage sharing guidelines that expire in 2026. The states have begun the process of renegotiating these guidelines. Climatic conditions may impact the amount of water available for use by the Colorado River Basin states. Taking this into consideration, along with the water reserved for the Ute Indian Tribe and Navajo Nation based on negotiated settlements and the need for water for the Lake Powell Pipeline, energy development, agriculture, and municipalities in Utah, most, if not all, of Utah's Colorado River apportionment is committed.

Colorado River Authority

During the 2021 legislative session, the Utah State Legislature created a new



Hoover Dam
PC: Scott McGettigan

entity dealing with the Colorado River. The Colorado River Authority of Utah is a state agency under the Governor's Office whose mission is to protect, preserve, conserve, and develop Utah's Colorado River system interests. The Division will work closely with the Authority and its River Commissioner to strengthen its relationships with the six other Colorado River Basin states and will work to develop collaborative and science-based solutions to the many challenges facing the river.


Horse grazing near Bear Lake

Salinity Control Agreements

The Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) authorized salinity control projects in the U.S. in an effort to meet water quality obligations made by agreement with Mexico. Minute 242 (1973) sets the criteria for the water quality standard that gets delivered to Mexico. Under provisions of the Minute, water delivered to Mexico cannot exceed a flow-weighted average total dissolved solids of 115 parts per million (ppm), plus or minus 30 ppm above the salinity of water reaching Imperial Dam in the U.S. As part of the Act, salinity control projects in the Colorado River Basin have been implemented along with the construction of a desalinization plant near Yuma, Arizona. On-farm efforts that reduce salinity through improved irrigation efficiency, thereby reducing deep percolation and runoff, have been applied to lands in Utah with good results. Efforts basin-wide have decreased salinity in the river to provide significantly improved water quality for Mexico and the Lower Basin states.

Bear River Compact

The Bear River is the largest river in North America that ends at an inland sea. It runs through northern Utah, southwestern Wyoming, and southeastern Idaho. Originating in Utah's Uinta Mountains, the river crosses state borders five times before terminating in the Great Salt Lake, approximately 90 miles from where it began.

The average annual supply of the Bear River that reaches Great Salt Lake has historically been 1.2 million acre-feet (1941-1990). Due to the effects of drought in subsequent years, that amount has been reduced to about 850,000 acre-feet annually.

Formed in 1959, the Bear River Commission (Commission) is responsible for dividing and managing the waters of the Bear River. The Commission is made up of three representatives from each of the states. In addition to the nine state commissioners, the U.S. President appoints a non-voting Federal Government Commissioner who acts as chair of the Commission.

The Bear River Compact (Compact), like the Colorado River Compact, governs how the water supply is apportioned along its course. The Compact is the guiding document for river operations. Every 20 years, the Commission reviews the Compact and river operations, allowing public and stakeholder discussion, and incorporates necessary changes. The most recent review was in 2017 and was formally adopted in April 2020.

The Compact is a document, voluntarily negotiated and adopted by the states, which establishes the rights and obligations of Idaho, Utah, and Wyoming with respect to the waters of the Bear River. The Compact refers to provisions established in the original (1958) and amended (1980) Bear River Compact.

The Compact:

- Divides the Bear River into three main divisions: the Upper Division, the Central Division, and the Lower Division.
- Specifically identifies which river flows and canal diversions are to be assigned to each of the divisions
- Apportions direct flows of the Bear River and its tributaries between Utah and Wyoming in the Upper Division
- Apportions direct flows of the Bear River and its tributaries between Idaho and Wyoming in the Central Division
- Grants Idaho the first right to develop and deplete 125,000 acre-feet in the Lower Division
- Grants Utah the second right to develop and deplete 275,000 acre-feet in the Lower Division
- Divides the next 150,000 acre-feet of water depletion equally between Utah and Idaho in the Lower Division
- Divides water in excess of the above allocations between Utah and Idaho, with Idaho receiving 30% and Utah 70% in the Lower Division
- Defines 36,500 acre-feet of "Original Compact Storage" above Bear Lake and allocates storage to each of the states as follows:

Utah	17,750 acre-feet
Wyoming	17,750 acre-feet
Idaho	1,000 acre-feet

- Grants additional storage above Bear Lake for 74,500 acre-feet, of which 4,500 acre-feet is granted to Idaho and 35,000 acre-feet is granted both to Utah and Wyoming

These and other Compact provisions are carried out by the Commission. Apportionments of Bear River flows are made by the Commission's Engineer-Manager to each state. Every two years, the Commission publishes a report of its activities and operations under the Compact. The Twentieth Biennial Report, covering the 2017 – 2018 water years, along with all prior reports, can be found on the Bear River Commission website.

Water Banking in Utah

Temporary water shortages may occur as the result of drought conditions. Developing a cooperative plan for water resource and system management at the local and regional level can help water managers cope with shortages if they occur. This is often accomplished without committing large sums of money for capital expenditures for new supplies that would otherwise be required. Water banking, as described in Chapter 7, is one method that can help managers cope with shortages.

The 2017 Recommended State Water Strategy (Strategy) recognized that "Utah faces a daunting challenge. We have the distinction of being both one of the driest states in the nation and one of the fastest-growing." The Strategy proposed developing a water banking program in Utah. Water banking as described in Utah 2020 legislative documents, "... facilitates the voluntary temporary transfer of the use of water rights from one user to another" (SB26). Water banking was included in the Strategy to facilitate:

- Protection or enhancement of instream flows for the natural system, wildlife and recreation uses
- Balancing the competing uses of Utah's water supply
- Flexibility to Utah water law
- Protection of agricultural uses

Such transfers would need to be expedited through the Division of Water Rights with minimal administrative processes and low transaction costs.

In 2017, the "Public Water Supplier Amendments" (SB214) would have expanded the current instream flow provisions to allow municipal suppliers to hold water rights for instream flow purposes. While this bill did not pass, it stirred active debate about the role of instream flows in Utah. A work group was convened to discuss Utah's instream flow processes with stakeholders.

After extensive research, the work group identified water banking as a mechanism to increase instream flows and to carry out many other recommendations from the Strategy, such as:

- Facilitating non-permanent transfers of water through leases, contracts, or other voluntary arrangements to support competing water uses, including increasing municipal demands
- Creating an alternative to permanent "buy and dry" water transfers in which agricultural water rights are acquired for municipal and industrial use and the related farmland is permanently retired
- Developing water markets to incentivize wise use and efficient allocation of scarce water resources

The focus of the work group transitioned to water banking in order to determine how water marketing organizations could be created and operated in Utah. Specifically, the committee examined how water marketing can be implemented within the limitations of Utah water law, which laws needed to be expanded to support water banking, and also created a pilot project group intended to test administrative and systematic concepts.

In 2018 and 2019, the water banking work group developed a model in which local water users would create and manage water banks in a given region, with each organization tailoring the program to the needs of its specific area or watershed. The water banking work group explored the legal and logistical barriers to water markets in Utah.

In 2020, "Water Banking Amendments" (SB26) was passed to run a 10-year pilot project to allow for the creation of state recognized water banks. The objectives of SB26 are to:

Promote

- Transparency and access to water markets
- Temporary, flexible, and low-cost water transactions between water users
- Optimal use of the public's water
- Utah's agricultural economy by providing access to water resource and income

Facilitate

- Robust and sustainable agricultural production while meeting municipal and industrial demand
- Water quality improvement
- Water rights administration and distribution
- A healthy and resilient natural environment

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Develop a policy to establish a process for consultation with federally recognized Indian Tribes to comply with Executive Order 2014/005.
- Research and engage stakeholders in the development of a Demand Management program for water users that rely on the Colorado River.
- Continue to work closely with other interstate compact states to adapt to changing conditions, find collaborative solutions to difficult challenges, and preserve each state's rights to their respective compact allocations.

Chapter 8 Links

State Engineer (Utah Code 73-2) - https://le.utah.gov/xcode/Title73/Chapter2/73-2.html

Navajo Utah Water Rights Settlement Act (HR644) - https://www.congress.gov/bill/116th-congress/house-bill/644

Division of Water Rights, Compacts and Agreements - https://www.waterrights.utah.gov/wrinfo/policy/compacts.asp

U.S. Indian Water Rights Settlements - https://fas.org/sgp/crs/misc/R44148.pdf

Congressional Research Service - https://crsreports.congress.gov/

Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) - https://www.congress.gov/bill/93rd-congress/house-bill/12165

Bear River Compact - https://www.congress.gov/bill/96th-congress/house-bill/4320

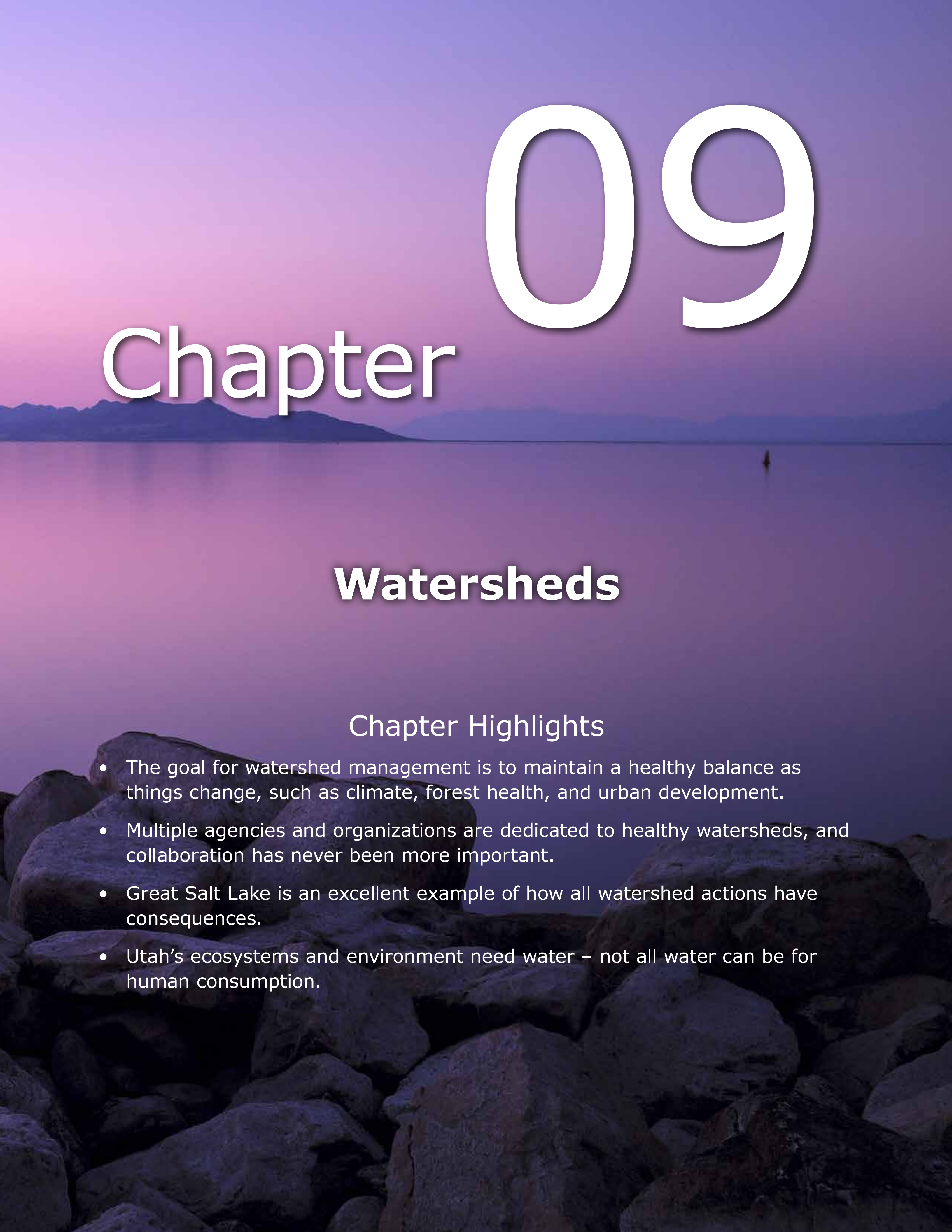
Nineteenth Biennial Report – Bear River Commission - http://bearrivercommission.org/docs/19th%20%20BIENNIAL%20REPORT%20-%20FINAL.pdf

Bear River Commission Website - http://bearrivercommission.org/

Recommended State Water Strategy - https://envisionutah.org/utah-water-strategy-project

Water Banking Amendments (SB26) - https://le.utah.gov/~2020/bills/static/SB0026.html

Colorado River Authority of Utah - https://cra-utah.org/



Chapter 09

Watersheds

Chapter Highlights

- The goal for watershed management is to maintain a healthy balance as things change, such as climate, forest health, and urban development.
- Multiple agencies and organizations are dedicated to healthy watersheds, and collaboration has never been more important.
- Great Salt Lake is an excellent example of how all watershed actions have consequences.
- Utah’s ecosystems and environment need water – not all water can be for human consumption.

Utah is known for its recreation, beautiful landscapes, mountains, and the greatest snow on earth. Relatively healthy watersheds support this quality of life with high-quality, clean, reliable, and inexpensive water because spring runoff, streams, and gravity do the hard work for us (the existing water supply doesn't need to be pumped hundreds of miles to our taps).

Watershed management aims to maintain a healthy balance as things change, such as climate, forest health, and urban developments. There are several agencies and organizations that are dedicated to healthy watersheds, and collaboration has never been more important.

Watersheds and the ecosystems within are fragile and need water. Human uses, although essential, need to be carefully managed to avoid irreparable harm to natural systems. Great Salt Lake is an excellent example of how upstream actions can impact the entire watershed downstream.

Watersheds are the source of a region's water and life. Utah is fortunate to have relatively healthy watersheds. There is no other feature that defines an area more.

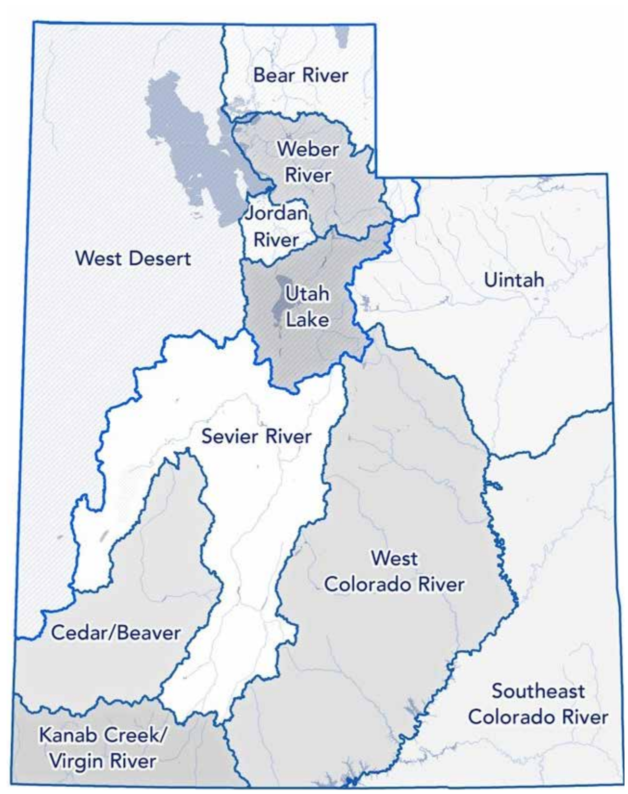
Map 9-1 depicts the state's river basin planning areas and Regional Watershed Councils. The Division of Water Resources (Division) defines watersheds by the basin planning area.

A healthy watershed is essential to support various interests including quality of life, natural and man-made environments, economic viability, water quality, and outdoor recreation. This chapter gives a general watershed overview. More detailed watershed information is provided within the Division's river basin plans, Division of Water Quality, and other state and federal agencies.

What is a Watershed?

A watershed is an area that collects snow and rain. Watershed boundaries are created by natural geographic features that determine where water will collect and run off. All precipitation will be funneled from the highest point to the lowest point. Some of the water is used to rejuvenate soils, some fills streams and reservoirs to provide a sustainable supply of water, and some supports important ecosystems.

Map 9-1 Utah River Basin Planning Areas



River Basin Plans

To facilitate water planning, the Division divided the state into 11 smaller watersheds or river basin planning areas (see Map 9-1). River basin plans provide useful water supply and watershed information to help the state, regional, and local water districts, counties, and cities make informed water-related decisions. These plans also identify issues that are unique to each area and provide a valuable platform for stakeholders to help formulate solutions that are best suited for local conditions. The Division publishes river basin plans for each area as needed. These are available on the Division's website.

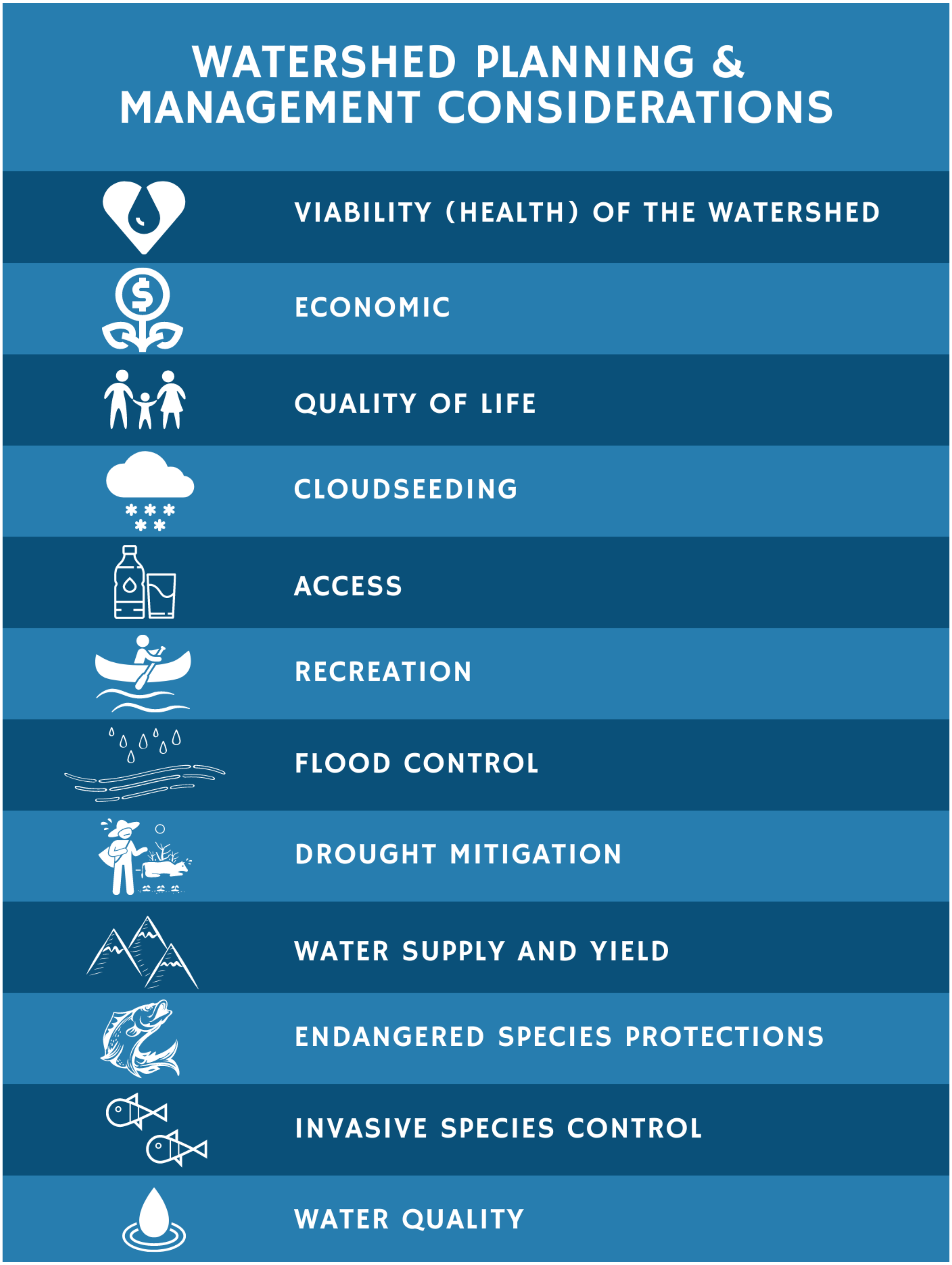
Big Picture Watershed Challenges

Watersheds throughout the world are experiencing challenges, and Utah's are no different. There are multiple considerations, risks, and opportunities within watershed health (see Graphic 9-1).

Water resources are essential for ecosystems, wildlife, water quality, humans, and economies to thrive. Environmental flows will be critical in some areas to maintain healthy watersheds and to keep species from needing protection under the Endangered Species Act. Providing sufficient water for these needs will also keep species management under state authority and help Utah continue economic growth and

Bald eagles fishing at Farmington Bay
PC: Cindy Costa

Graphic 9-1 Watershed Planning and Management Considerations



development without regulatory uncertainty. Healthy watersheds and evironmental flows also enhance outdoor recreational activities, such as boating and angling.

Water planners and managers are tasked with trying to find the right balance among them. Not every decision leads to a healthy watershed. It's important to recognize that collaboration needs to happen with federal, state, local, non-governmental organizations, and the public to address issues and find solutions that will continue to support Utah's watersheds.

Impaired Waters

The Utah Department of Environmental Quality's Division of Water Quality (Water Quality) protects, maintains, and improves the water quality of Utah's surface and groundwater through its regulatory, non-regulatory, and grants and loans programs. Water Quality ensures the state's waters meet the requirements of the Clean Water Act and Utah Water Quality Act through:

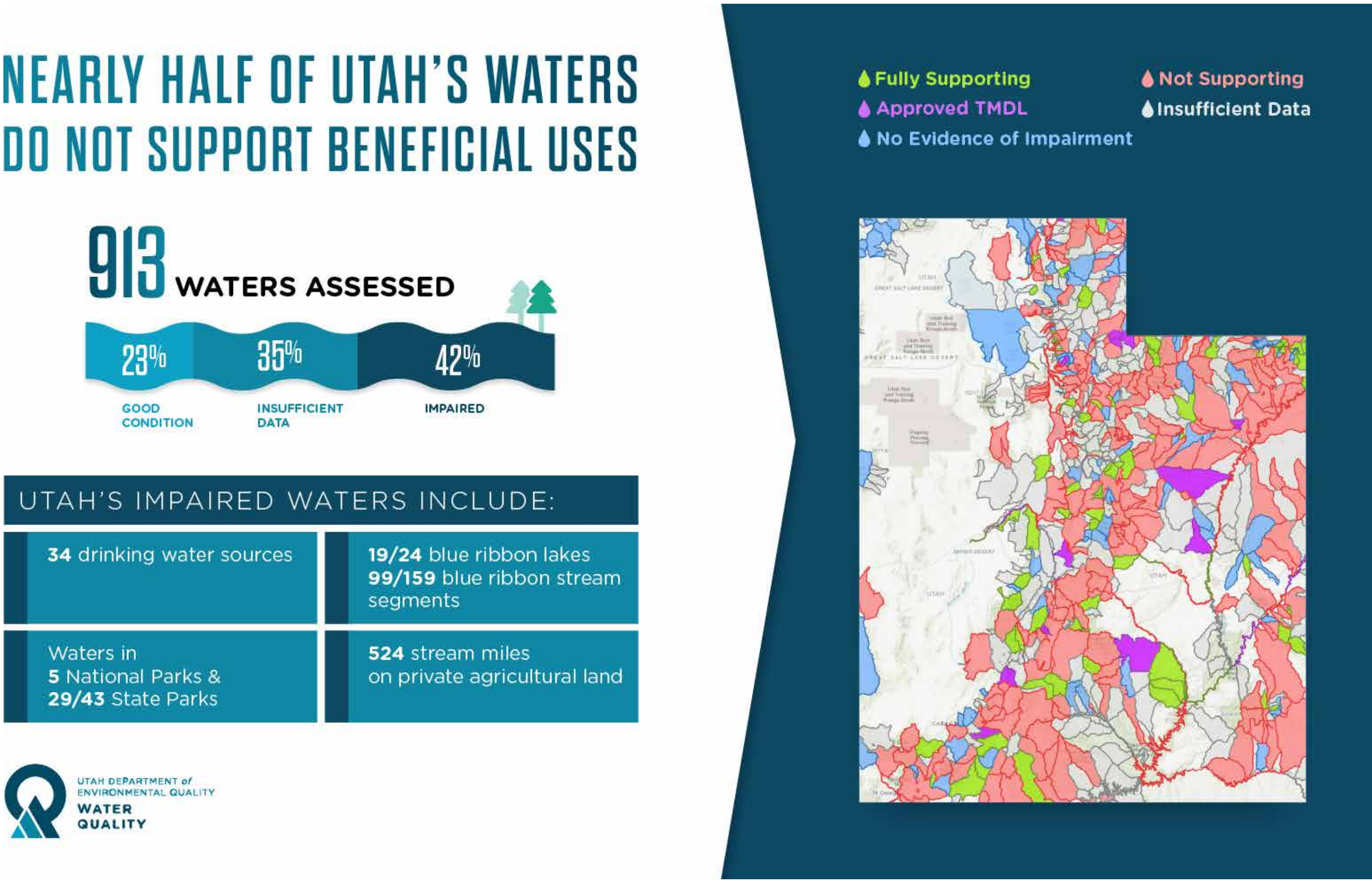
- Water quality standards
- Permits, inspections, and compliance/ enforcement for pollutants discharged to surface and groundwater
- Water quality monitoring and assessment
- Watershed protection plans that bring impaired waters into compliance with water quality standards
- Grants and loans for the construction of wastewater/stormwater infrastructure
- Funding to address nonpoint source pollution
- Spill response

Water Quality prepares a biennial Integrated Report (biennial report) on the state's water quality to fulfill requirements under the Clean Water Act. The biennial report includes a list that describes the general water quality of Utah's assessable waters and another list of waterbodies that are impaired (not meeting water quality standards) for one or more pollutants.

Water quality assessments for the biennial report are based on data collected throughout the state for assessment units. Assessment units are geographic areas that loosely follow hydrologic unit boundaries and typically include rivers, streams, lakes, ponds, and reservoirs. Each assessment unit has unique beneficial uses specified in state water quality standards (R317-2). Beneficial uses include sources of domestic water, recreation, aquatic life, agriculture, and uses specific to the Great Salt Lake. Water quality standards use numeric criteria for toxic pollutants (e.g. metals, organics) and conventional pollutants (e.g. pH, dissolved oxygen, temperature, total dissolved solids) as well as narrative criteria. Water Quality develops, maintains, and updates the 303(d) assessment methods it uses to evaluate the water quality in these assessment units against water quality standards.

Water Quality assessed the water quality in 913 assessment units for the 2018/2020 biennial report over the period of record of October 1, 2010 to September 30, 2018. Of the assessment units, 23% were fully supporting their beneficial uses, 35% had insufficient data to assess, and the remaining 42% were listed as impaired (not supporting one or more beneficial uses). These results are shown in Graphic 9-2.

Graphic 9-2 Overview of Utah's Supporting and Impaired Waterbodies



Water Quality uses the biennial report to identify water quality issues, and the total maximum daily load (TMDL) process to bring impaired waterbodies back into compliance with state standards. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still maintain its beneficial uses. Pollution sources may be point (e.g., wastewater treatment plants and municipal stormwater) and/or nonpoint sources (e.g., stormwater and agricultural runoff). Point source reductions are generally addressed through permits, while nonpoint source reductions are addressed through voluntary, incentive-based programs.

Each TMDL characterizes the sources contributing to the impairment for a particular waterbody and identifies the pollutant reductions required from these sources. Impaired waterbodies are listed for the specific water quality parameter that fails to meet state standards. These parameters can include metals, salts (total dissolved solids), dissolved oxygen, E. coli (an indicator of fecal contamination), temperature, or macroinvertebrates. Each watershed has different sources or issues to address. Table 9-1 summarizes the water quality impairments in Utah waterbodies by basin.

Table 9-1 Summary of Impairments by Basin

Basin Name	Impaired Parameter	# of Impairments
West Desert	pH	3
	Boron	1
	E. coli	1
Bear River	Max. Temperature	14
	E. coli	13
	Macroinvertebrates	8
Weber River	E. coli	13
	Copper	11
	Max. Temperature	9
Jordan River	E. coli	15
	Macroinvertebrates	15
	Total Dissolved Solids	14
Utah Lake (Upper Provo River)	E. coli	6
	Aluminum	4
	Macroinvertebrates	3
Uintah Basin	Aluminum	16
	Min. Dissolved Oxygen	16
	Max. Temperature	14
Utah Lake (Lower Provo River)	pH	9
	E. coli	3
	Macroinvertebrates	3
Lower Sevier River	Max. Temperature	6
	Total Dissolved Solids	5
	Copper	4
W Colorado River	Max. Temperature	21
	Macroinvertebrates	14
	Min. Dissolved Oxygen	12
Cedar-Beaver	Max. Temperature	5
	E. coli	3
	Aluminum	2
Upper Sevier River	Max. Temperature	8
	E. coli	3
	Macroinvertebrates	3
SE Colorado River	Total Dissolved Solids	9
	Macroinvertebrates	8
	Max. Temperature	8
Lower Colorado River	Max. Temperature	9
	Total Dissolved Solids	7
	Boron	5


Sailing on Great Salt Lake
PC: Utah Division of State Parks

Water Quality is currently implementing 65 TMDLs in partnership with local, state, and federal agencies, local conservation districts, and watershed groups. Water Quality prioritizes its list of impaired waters slated for restoration under a TMDL based on the risk to human health from the impairment, public input, and activities associated with beneficial uses (i.e., blue-ribbon fisheries, proximity to drinking water sources, high recreational use in state and national parks). Unfortunately, Water Quality is unable to conduct a TMDL on every impaired waterbody given existing resources. It does, however, provide grants for watershed plans and is exploring other tools (e.g., market-based approaches) to address impairments. Water Quality also administers up to $2 million annually in state and federal grants to address nonpoint source pollution.

Growth poses a significant challenge to Utah's water quality. Increased demand for water coupled with increased point and nonpoint discharges inevitably lead to impacts that harm water quality. Aging infrastructure, limited resources, and continuing deterioration of water quality without commensurate means to protect and maintain it will perpetuate this decline. Any development of water resources should consider the infrastructure needs to treat the water to meet the water quality requirements of the intended use.

Wildfires also impact watershed health, ranging from immediate effects during a fire to long-term watershed changes. According to the USGS, runoff from burned areas contains ash, which can change the chemistry of lakes, wetlands, reservoirs, rivers, and streams. This runoff can also include other contaminants and impact erosion.

Watershed Councils

Recognizing the many unique and complex issues that face Utah watersheds and the need for better collaboration, the state is working toward establishing a statewide watershed council, as well as local watershed councils. These councils will provide a forum for state and local agencies, industry, conservation groups, recreation interests, tribal interests, water quality experts, and other interested stakeholders to come together to discuss important issues and work together to devise sustainable solutions. In accordance with the Watershed Council Act (State Code 73-10g-Part 3), passed during the 2020 Legislative session, the Division is organizing the Utah Watersheds Council, a statewide council and 11 local watershed councils in each of the Division's river basin planning areas (see Map 9-1), with an additional local watershed council for the Great Salt Lake watershed.

Addressing only one or two challenges in a watershed can be harmful due to the interconnected nature. Invasive species impact recreation. Viability and water quality impact endangered species. Water supply impacts economics, as does the expense of mitigation efforts. All this underscores that ignoring one need can have a domino effect. Promoting integrated water resources management that balances impacts and benefits should be the collective goal. There is perhaps no greater example of the need for collaborative solutions in Utah than the challenges and opportunities tied to Great Salt Lake.

Keeping the "Great" in Great Salt Lake

Great Salt Lake water levels have been declining for many years. In 2021, due in part to extreme drought, Great Salt Lake reached all-time low levels since lake level monitoring began in 1847. These developments have highlighted the concerns surrounding the long-term health and viability of the Great Salt Lake.

Great Salt Lake and its associated wetlands are critical ecosystems for migratory birds and a variety of other wildlife species. Five out of the 11 watersheds in Utah flow into Great Salt Lake. If less water flows to Great Salt Lake, there could be serious impacts to the natural system, wildlife, and human health. Utah faces the challenge of balancing the water needs for a growing Wasatch Front population with maintaining a healthy Great Salt Lake.

In 2016, the Division partnered with state agencies and institutions to produce the Great Salt Lake White Paper (USU 2016). The paper outlines the impact humans have had on Great Salt Lake since settlers entered the valley, and how future development could impact the terminal lake.

Water development is projected to be needed on the Bear River. Diverting and depleting water from any of the five watersheds that would have flowed into Great Salt Lake lowers its water level. The proposed Bear

River Development project, for example, is estimated to impact lake elevation by an average of 8.5 inches. A drop in elevation (caused by humans or a changing climate) decreases the surface area of Great Salt Lake, which can result in exposed lake bed, increased dust, impacts to ecosystems and wildlife, and reduced air quality. In order to balance future demands within this valuable and unique watershed, people, and organizations with varying priorities and interests will need to collaborate. Keeping the "Great" in Great Salt Lake depends on it.

In the 2019 General Legislative Session, HCR10 was passed that recognizes the importance of flows to Great Salt Lake, its wetlands, and the need to address declining water levels. HCR10 has created a collaborative process where various stakeholders and interest groups encourage participation to strengthen Great Salt Lake and improve lake levels. The Division will continue to provide modeling support as part of this collaborative process, including refined estimates of the impacts of proposed water developments and climate change on water levels in the lake.

The Future of Utah's Watersheds

Water policy is set at federal, state, and local levels. However, individual actions impact watershed health, and participating in these discussions is something all Utahns can do. Whether learning about watershed restoration projects, forest and wildlife management practices, becoming involved in water quality discussions, or asking how current and future water supply plans impact a watershed, each person's feedback, involvement, and ideas are important.

Recommendations

The Division will work with cooperating partners to implement the following recommendations:

- Research and identify ways to get more water to Great Salt Lake.
- Continue to collaborate in efforts to achieve HCR10 goals, which brings stakeholders together to protect and preserve Great Salt Lake.
- Establish the Utah Watersheds Council and local watershed councils.
- Continue working with the Aquatic Invasive Species Task Force to prevent the spread and establishment of aquatic invasive species in Utah's watersheds.
- Work with stakeholders to identify and secure critical environmental water needs.
- Consider infrastructure needs to treat water to meet the water quality needs of the intended use.

Chapter 9 Links

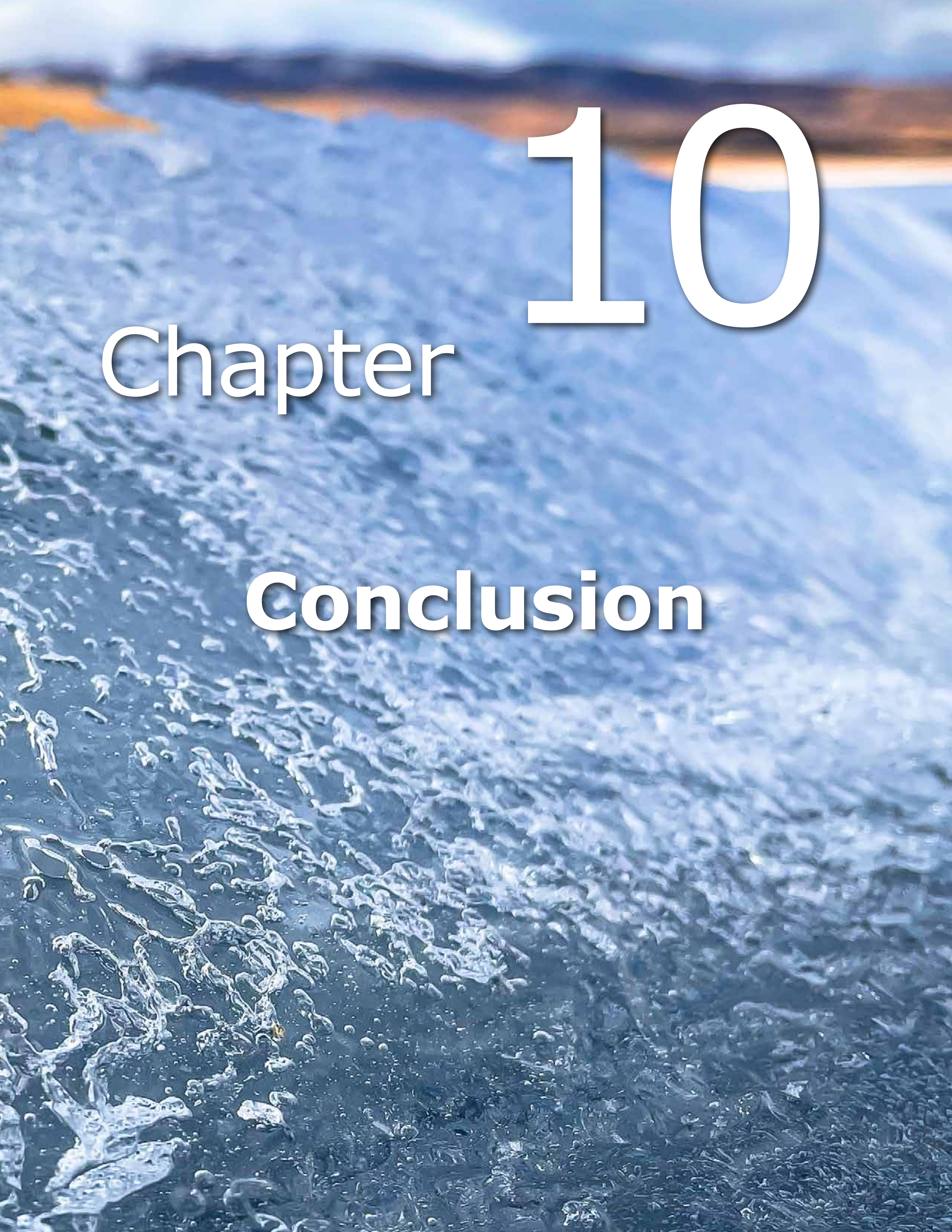
HB166 Watershed Council Act - https://le.utah.gov/~2020/bills/static/HB0166.html

Great Salt Lake White Paper - https://qcnr.usu.edu/pdfs/publications/Great%20Salt%20Lake%20Water%20Level_Feb%2024%202016.pdf

Bear River Development Feasibility Study - https://water.utah.gov/bear-river/

Sunset at Great Salt Lake

Ice wave at Rockport Reservoir
PC: Rob Hall



Chapter 10

Conclusion

The Division is pursuing a balanced approach to meeting future water needs. Policymakers, regional water providers, organizations, municipalities, and individuals are encouraged to use this plan as a guide to implement policies and practices within their circle of influence to build a resilient and sustainable water future. The Division encourages adoption of technological and water management advances to become more efficient and improve data quality and reliability.

We are committed to coordinating with federal, state, and local stakeholders to improve the data collection network. The Division posts water data on its [Open Water Data website] to provide transparent access to data used for planning and other purposes. The Division is automating and documenting its methodologies to improve transparency of the calculations and reduce the variability of the results.

With this plan, the Division set out to create an actionable document that would guide and direct water management efforts within the state over the next several years. The plan lays out goals in Chapter 1 and a series of recommendations in subsequent chapters.

Like the goals, these recommendations fall under one of the three principles of water management: reliable data, supply security, and healthy environment. The recommendations made in this report are summarized in subsequent paragraphs. Like the goals, the Division will work with cooperating partners to implement the recommendations by 2026.

Summary of Recommendations

Reliable Data

Reliable data is needed to make informed water management decisions. As our confidence in existing data increases, so will our confidence in future supply and demand projections. The Division is committed to improving data quality and pursuing needed

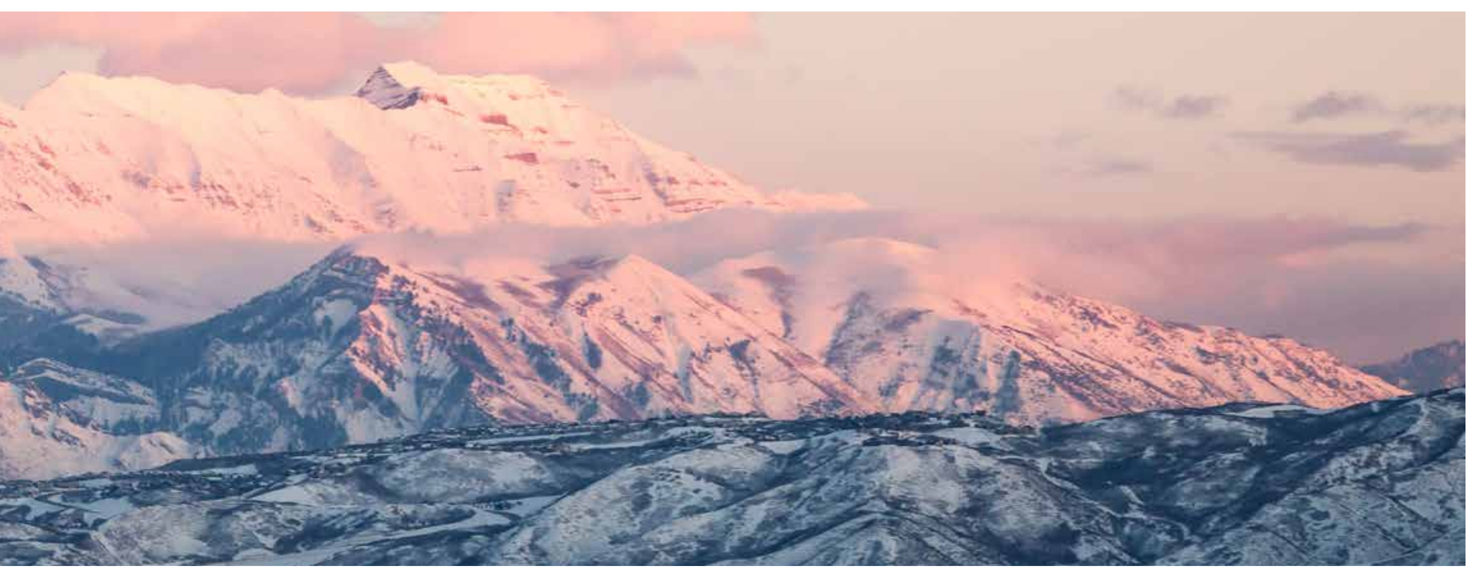
studies that will enlighten future decision-making. The following recommendations reflect this commitment:

- Evaluate and advance a standard methodology used to determine depletion.
- Analyze existing streamgage and weather station networks and identify where additional resources are needed.
- Investigate ways to improve the Water Budget and supply measurements.
- Identify new cloud seeding areas, implement new technology as it's available, and continue to fund cloud seeding projects to augment Utah's water supply.
- Continue to incorporate climate change in planning models.
- Continue to work with other state agencies and water suppliers to obtain accurate water use records and measurements.
- Improve the Water Demand Model as new data, plans, and information become available.
- Encourage the use of the Water Demand Model by water suppliers for running various scenarios to help with planning efforts.

Supply Security

Securing a reliable water supply requires a comprehensive approach. Utah's water needs won't be met by development alone, and they won't be met by conservation alone. Converting agricultural water supplies as farmland is developed will help meet needs in high-growth areas, but it too will not be sufficient to meet growing M&I needs. The following recommendations reflect the importance of employing diverse means and methods:

- Explore ways to assist counties and water systems in meeting their regional water conservation goals.
- Continue to provide technical assistance for water conservation plan submittal.
- Provide recommendations and additional resources to systems with water conservation plans due.



- Research and implement a pilot Demand Management program for water users that rely on the Colorado River.
- Find ways to enhance water conservation education within existing resources and pursue re-establishing the water education program.
- Collaborate with stakeholders to increase water audits throughout the state.
- Provide funding to expand secondary metering program statewide.
- Expand “Flip your Strip” program statewide.
- Study and develop tools on integrating water and land use planning to share with municipalities and counties.
- Prepare and plan for water development projects to ensure water supplies are available when needed.
- Complete the National Environmental Policy Act process for the Lake Powell Pipeline.
- Refine the Division’s agricultural to M&I water conversion estimates.
- Continue planning for and studying options for Bear River Development.
- Acquire right-of-way property for the proposed Bear River Development project.
- Update the 2005 Water Reuse in Utah report.
- Continue to fund water conveyance improvement projects through the Board of Water Resources.
- Continue to fund on-farm water optimization projects through the Utah Department of Agriculture and Food.
- Update and revise the Drought Response Plan.
- Prepare and publish a Statewide Water Marketing Strategy that includes water banking lessons learned from pilot projects around the state.
- Develop a policy to establish a process for consultation with federally recognized Native American Tribes to comply with Executive Order 2014/005.

Healthy Environment

Preserving the health of watersheds and the environment is essential to wise water management. Much work is needed to address impaired waters and preserve beneficial uses. The following recommendations, while just a beginning, will help sustain healthy watersheds throughout the state:

- Work with Great Salt Lake Advisory Council to research and identify ways to get more water to Great Salt Lake.
- Continue to collaborate in efforts to achieve HCR10 goals, which brings stakeholders together to protect and preserve Great Salt Lake.
- Establish the Utah Watersheds Council and local watershed councils.
- Continue working with the Aquatic Invasive Species Task Force to prevent the spread and establishment of aquatic invasive species in Utah’s watersheds.
- Work with stakeholders to identify and secure critical environmental water needs.
- Consider infrastructure needs to treat water to meet the water quality needs of the intended use.
- Continue to collaborate in efforts to achieve HCR10 goals.

Water flowing over the spillway at Gunlock Reservoir
PC: Washington County Water Conservancy District

Mission:
Plan, conserve, develop and protect Utah’s water resources.

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