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Research Report

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Flowing Toward 2050

Utah's Water Outlook




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The mission of Utah Foundation is to promote a thriving economy, a well-prepared workforce, and a high quality of life for Utahns by performing thorough, well-supported research that helps policymakers, business and community leaders, and citizens better understand complex issues and providing practical, well-reasoned recommendations for policy change.

Flowing Toward 2050

Utah's Water Outlook

Utah's population is projected to grow by 2.5 million people in the next 35 years. The implications of this projected growth are far reaching for state and local agencies and for policy makers. Previous reports in the 2014 population growth series have discussed where growth will occur, who new Utahns will be, and what they will need to continue to have the quality of life that current Utahns enjoy. This report, the third in a four-part series, focuses on the interaction between population growth and future water supply.

Two different viewpoints on Utah's water future exist – that the state currently has enough water for future demands or the state needs to develop multiple projects to ensure continued water sustainability. Increased pressure on the existing system created by projected population growth provides the groundwork for these two viewpoints. For those who believe the current, developed supply is sufficient, increased emphasis on conservation and better water management are key policy strategies. For those who think that population growth will overrun existing current supply in the next 15-20 years, emphasis is placed on development of new supply through large and small-scale projects. Financing of new development and conservation are both important topics, but this report also discusses impacts created by climate as well as conversion of agricultural land and water rights to municipal and industrial uses.

Since Utah is a desert and water is an essential element of sustaining life, discussions on water policy are not going away. This report presents six recommendations for policy strategies or further study in the fields of rate structure, local response, and planning

RECOMMENDATIONS

Rate Structure

- Re-examine the role of property tax funding for water agencies, with a goal of reducing tax support and increasing water rates.
- Create more significant price gradations in block-rate water plans.
- Install new technology to monitor water use, such as advanced metering infrastructure (AMI), which provides consumers with real-time feedback on their usage.

Local Response

- State and water conservancy districts should continue to strongly encourage municipal governments to create or update existing ordinances that support conservation.

Planning

- Analyze future needs in a range of population projections and consumption levels.
- Establish better connections between city planning departments and water conservation districts.

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INTRODUCTION

Water supply and quality have been identified as top priorities in previous Utah Foundation's Priorities Project surveys – ranking #3 in 2004 and #7 in 2008. These rankings were no doubt influenced by the five-year drought from 1999 to 2004. Although a few recent years have seen good precipitation, most of Utah are experiencing drought conditions.

In the 1979 Utah Supreme Court case, Blake v Lambert, water was called the "life-blood" of an arid state like Utah.[1] A sustainable supply of water is vital to quality of life. In recognizing future projected population growth, there is no way to remove future supply-and-demand needs for water. "Either you bring the water to L.A. or you bring L.A. to the water." This quote by John Huston from the 1974 film Chinatown is especially pertinent to continued growth in Utah. Traditionally, Utah has been a state that brings the water to residents. Although Utah's early pioneers located near water sources, by the time Utah became a state in 1896, man-made conveyance of water was employed to support growing communities. Utah's 2001 State Water Plan declared that water would not be a hindrance to growth, but there are many water issues that might require policy makers to revisit this statement.

The legacy of water in the West has been a tenuous one, with disputes not only crossing city or county boundaries, but also crossing state lines. Utah is part of the Colorado River Compact and the Bear River Compact, both of which allocate water resources to all participating states. This report focuses primarily on Utah water issues, as well as the multiple disciplines and policy areas in which water resides.

BACKGROUND

Water and Economic Development

The U.S. Geological Survey takes an inventory of water usage every five years. At publication of this report, the most current data available was from the 2005 survey. Data from the 2010 survey will be available in late-fall of this year. According to the 2005 survey, Utah had the second highest per-capita water consumption in the nation behind Nevada. Utah and Nevada are also the top two most arid states in the nation due to low average annual precipitation.

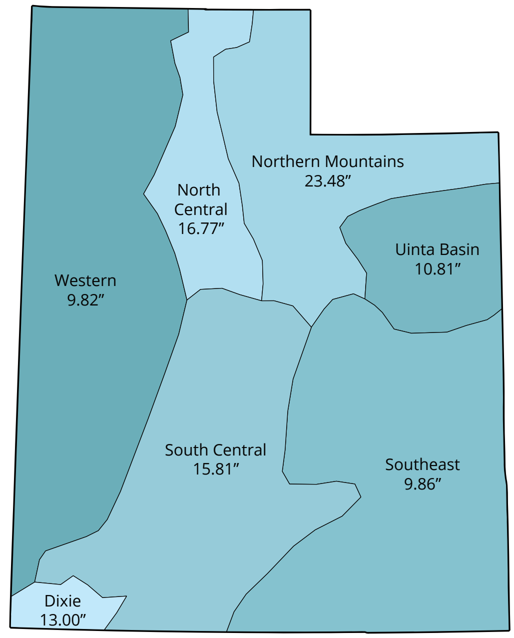
Although planning for future water supply in the state has occurred since the 1960s, it has gained more attention in the past several decades. The Utah Energy Efficiency and Conservation Plan makes mention of the relationship between energy and water, citing low costs for both water and energy as important factors in the state's economic development. This plan goes on to mention that the state's growing population is going to require continued examination of how the state and local agencies consider water and energy.[2] The Governor's Water Conservation Team and the State Water Strategy Advisory Team have been created in the past several years to provide some of this examination and to develop plans for both conserving water and planning for Utah's future.[3] These teams include various water districts, elected officials, recreational organizations, technical experts, and attorneys.

Climate Divisions

Due to Utah's varied topography, the National Climatic Data Center breaks the state into seven different climate divisions. Although the statewide average precipitation is 13.56 inches, the delivery of this precipitation varies by climate division.[4] Figure 1 shows these climate divisions with their annual average precipitation, though variations in elevation can also lead to differences in smaller areas of the climate divisions.[5] The variations in climate play a vital role in the water delivery system as well. The largest water reservoir in Utah is mountain snowpack – snow precipitation is stored until summer months when the snow melts to release billions of gallons of water. Utah Division of Water Resources (DWRe) cites this natural storage of clean water – which is then gravity fed into treatment plants – as part of the reason for the state's low costs and water rates.[6]

In addition to different climate divisions, the state is divided into 11 river basins with 38 water conservancy districts.[7] Water conservancy districts typically wholesale water-to-water systems throughout the state, which convey water to consumers. The five largest districts – Metropolitan Water District of Salt Lake and Sandy, Jordan Valley Water Conservancy District, Weber Basin Water Conservancy District, Central Utah Water Conservancy District, and the Washington County Water Conservancy District provide water for approximately 85% of Utah's population.[8] Like the DWRe, the conservancy districts are tasked with creating conservation plans, developing additional supplies, and finding ways to meet future water needs within their service areas.

Figure 1: Utah Climate Divisions and Average Annual Precipitation, 1901-2013



Source: National Climatic Data Center.

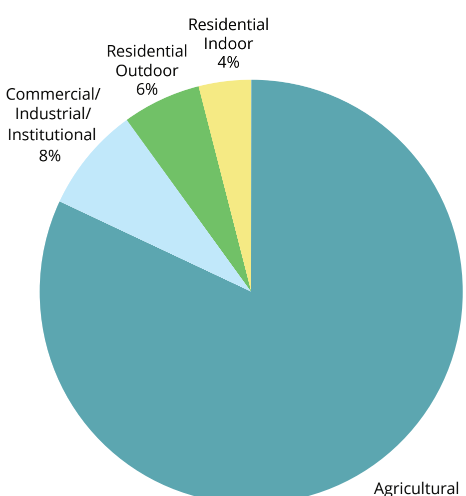
Water Usage

U.S. Geological data show an interesting comparison between western states and the rest of the nation. The lion's share of public water withdrawals in states east of the Mississippi River come from thermoelectric power. The dominant water use in almost all western states is irrigation, which includes agricultural and horticultural practices.[9] Utah follows the western pattern.

Figure 2 shows that over 80% of diverted water in Utah is used for agricultural irrigation and only 6% for residential irrigation. 90% of Utahns lived in urban areas in 2010.[10] A study by DWRe showed that in 2010, 19% of land use in Utah was considered urban and 30% was irrigated for agricultural use.[11]

Compared to agriculture, residential use is a small portion of statewide water use. One feature of residential water use is the breakdown of indoor versus outdoor usage. Statewide, approximately sixty percent of residential use goes toward outdoor uses. This dominance of outdoor use has been attributed to a combination of factors including the arid climate, a

Figure 2: Use of Diverted Water in Utah



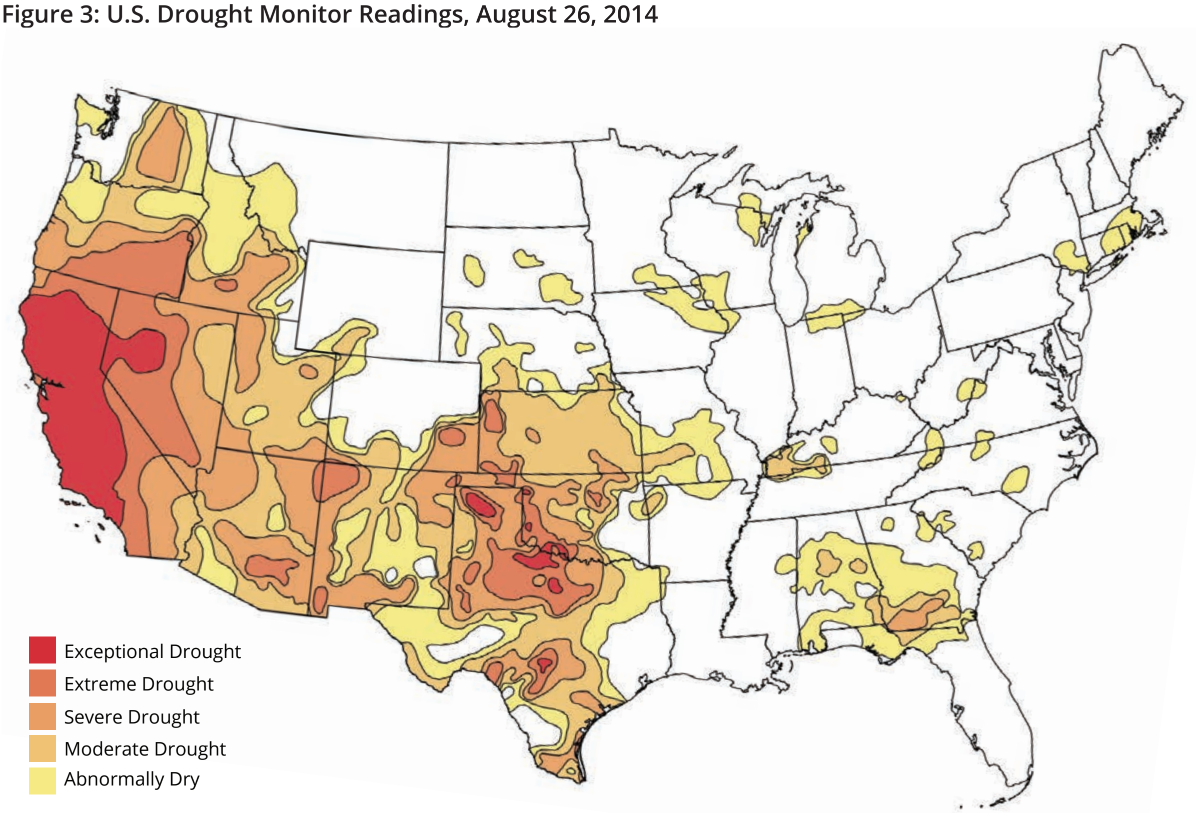
Source: Utah Office of Legislative Research and General Counsel.

desire for green lawns, and low costs for both culinary and secondary water.[12] A 2010 DWRe study estimated indoor use at 60 gallons per capita daily (gpcd) and outdoor water use at 134 gpcd.[13] In many areas of the state, secondary water systems are employed for outdoor residential water use. Secondary water systems are non-potable, generally unmetered, and are used for irrigation of lawns and gardens.[14]

Outdoor use is also seasonal. April through October sees most of the outdoor water usage, with the height of water use being in the hottest summer months – June through August. This change in demand shifts from wintertime residential deliveries of 5,000 acre-feet (an acre-foot is one acre with one foot deep water on it, approximately 325,850 gallons) per month in November to January to over 25,000 acre-feet in June through August. [15] The variation in demand generally coincides with snowmelt supply between June through September. However, during winters with lower precipitation, the impacts can be significant.

Intense droughts have repercussions on agriculture, as well as residential water use. The Palmer Drought Severity Index is used to assess drought situations on a scale of extreme drought to extremely moist.[16] In August of this year, over 70% of the state was experiencing moderate, severe, or extreme drought, shown in Figure 3.[17] Prior work by Utah Foundation discussed the drought cycle in Utah, wherein a drought seems to occur about every decade.[18] Current drought monitor readings of increasing severity seem in line with past trends.

Figure 3: U.S. Drought Monitor Readings, August 26, 2014



Source: US Drought Monitor.

Water Law

Water law in the West is complicated, with stakeholders that include individuals, businesses, local governments, state agencies, and the federal government. This section gives a basic primer to Utah water law and discusses some of the implications created by current statutes.

Utah utilizes prior appropriation doctrine to determine water rights. This doctrine determines that water should be appropriated for "beneficial use," and that the first individual to employ water to its beneficial use has the opportunity to acquire rights to water.[19] Essentially, water becomes a property right even though it is not attached to a piece of property. This water rights allocation was created from a court case in Colorado in the 1870s. The ruling gave a framework of granting water rights to those who were "first in time, first in right." These rights last in perpetuity as long as they are used for beneficial use. Further, the senior right-holder trumps the junior in times of water scarcity. The only way in which a water right may be removed is if the owner "abandons or ceases to use all or a portion of a water right for a period of seven years." The ability to lose a water right after a period of non-use has precipitated the "use it or lose it" element of water law.[20]

Colorado River Compact

The Colorado River Compact was written in 1922 and allocates water to seven states. The Compact splits the river into two regions – the Upper and Lower Colorado. Utah is part of the Upper Basin, along with Colorado, New Mexico and Wyoming. The Lower Basin includes Arizona, California and Nevada. The 1944 Water Treaty with Mexico allocated 1.5 million acre-feet to Mexico.

Arizona receives a set 50,000 acre-feet annually. Utah's allocation is based on 23% of remaining water to be split between Colorado, New Mexico, Utah, and Nevada. In 2011, Utah consumed 97.5% of its allocation.

Sources: Colorado River Compact - Colorado River Law and Policy: FAQ, Colorado River Governance Initiative and Provisional Upper Colorado River Basin Consumptive Uses and Losses Report: 2011-2015, U.S. Bureau of Reclamation.

Utah's public water systems and districts support the prior appropriation doctrine and believe it has and will continue to serve the state well.[21] Critics of prior appropriation claim that although it was a good system when the Wild West was full of agrarian settlers, it is not a system equipped to deal with urban development or emerging environmental concerns.[22] Although Utah water law has evolved over time, continued urbanization might require reexamination of best practices in the future.

How Utah Plans for Future Water Needs

In order to plan for the future, water districts and the DWRe use population projections to determine future need. The Governor's Office of Management and Budget (GOMB) projects that Utah's population will almost double by 2050. Much of this growth is projected to occur in urban areas. Further, counties neighboring the Wasatch Front (like Summit, Tooele, and Wasatch counties) are projected to see their populations more than double in the next 35 years. However, these projections are dependent on water continuing to be a readily available resource. GOMB projections are created on the assumption that water will not be an issue – reflecting views of both those who predict infrastructure improvements and those who think the existing developed supply will suffice for the next 50 years.[23]

Figure 4: Comparison of Projected Population and Annual M&I Water Demand

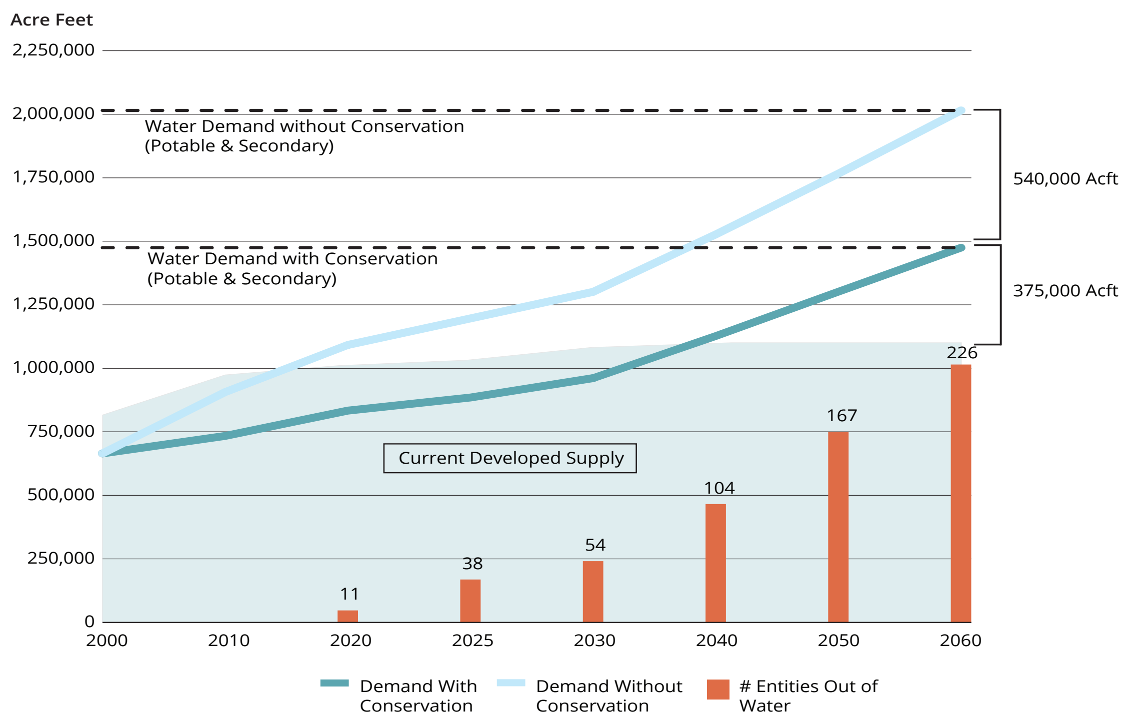
	Projected Statewide Population in 2025	Projected Water Use with 25% Conservation (acre-feet)	Change in Water Use from GOMB Based Projection (acre-feet)
GOMB	3.6 million	893,074	-
REMI	3.5 million	869,410	(23,663)
US Census	3.2 million	798,522	(94,551)

Source: Utah Foundation calculations.
Note: One acre-foot is approximately 326,000 gallons

The relationship between water and population projections is strong. Not only are population projections reliant on water availability, population projections play an essential role in determining future water needs by local and state agencies. To calculate future demand, projected per capita water use (in gallons per capita daily) can simply be multiplied by the projected population.[24] Figure 4 highlights a comparison of projected future water use from three different projections for 2025: GOMB, REMI data, and the U.S. Census Bureau. Figure 4 utilizes 295 gpcd, factoring in a 25% reduction by 2025 to determine future water needs, a methodology consistent with Division of Water Resources planning efforts. It should be noted here that 295 gpcd was the annual average of all types of municipal and industrial water use in 2001, not only residential. This baseline year of 2000 was used to create the statewide conservation goal of reducing per capita water use by at least 25% by 2050, revised in 2013 to have an end date of 2025. Although differences in population projections may seem small relative to the size of the total population, they result in multi-billion gallon water need differences.

Analysis by the DWRe using GOMB population projections shows that if 2000 consumption levels were maintained without conservation, Utah's statewide water demand will outrun currently developed supply by 2015. With the state conservation goal, this is projected to occur between 2030 and 2040.[25] Conservation efforts assumed in the model include increased efficiency, technological advances, and basic outdoor watering improvements. While individual basins may have slightly different pictures, the statewide snapshot shown in Figure 5 highlights key points compared to the existing water supply. This issue of reaching the limits of currently developed supply creates the impetus for future development of large-scale water development projects such as the Bear River Project, the Lake Powell Pipeline, and numerous smaller local projects. The problem with projections is just that – they are projections and there is potential for them to change as new trends arise.

Figure 5: DWRe Analysis of Utah's Projected M&I Potential Water Demand and Supply



Source: Division of Water Resources.
Note: One acre-foot is approximately 326,000 gallons

Many parties on different sides of the water discussion have concerns with how this general, statewide assessment is done. Questions raised regarding gpcd and connections to population projections have precipitated a legislative audit of DWRe, with results expected to be released in late 2014.[26] The findings of this audit have the potential to impact Utah water planning. Additionally, concerns of local water conservancy districts have precipitated a revisit of the past versions of the data presented in Figure 5. Considerations such as deliverability of water between and within basins, quality and usability of water supply, regulations, laws, and bond obligations which limit moving water rights would all impact future use of the currently developed supply.[27] Additionally, while there may be capacity statewide, local entities are projected to begin running out of water by 2020. The diversity of Utah's climate, water districts, and regional supplies add additional reasons for continued development of local river basin plans and communication between local water districts and the DWRe.

ISSUES

Although most Utahns may not be aware of the intricacies of western water law, water rights, and what is required to get water to their kitchen sink, the fact that Utah is a desert is common knowledge.

The 2001 State Water Plan states that water will not be a limiting factor to growth in most areas. This assumes that water could be "made available if the necessary water transfers, agreements and infrastructure were in place."[28] The balance of water needs, location of growth, and the investment needed to access water will all play large roles in future water development.

The outcomes created by potential differences in population projections, daily water consumption, and water planning all combine to create two different pictures of Utah's water future. The Governor's Office of Management and Budget releases revised population projections biennially. However, state regulations do not mandate a time frame for revising the State Water Plan. An analysis of population projection accuracy by GOMB in 2008 showed that there have been periods of both over and under-projection, with the most variance being found in boom towns and areas with smaller populations.[29] Impacts to population projections created by events like the Great Recession have only been captured in a small number of basin-level plans and project-based studies. Both running out of supply and having enough supply are dependent on population growth and management practices.

The Two Sides of Supply

In *Waters of Zion: The Politics of Water in Utah*, Dan McCool writes:

> Public officials, interest groups, and the public often make assumptions about water that, over time, solidify to become a kind of water gospel, and it is politically risky for anyone to even question their veracity.

The research for this report suggested two dominant water gospels in Utah: a) there is enough water for future generations; or b) supplies will run dry without significant investment. For those who believe there will be enough water in the state with currently developed projects, changing economics shifting agricultural water to M&I use and increased conservation efforts will be enough to remove the need for large-scale water projects in the near future. For those who believe the supply will run out without large-scale water projects, conservation is a piece of the puzzle but it will not fill the gap created between need and supply. These two differing views create different impacts in areas such as water delivery and financing, and both create different ideas of what Utah will look like in the future.

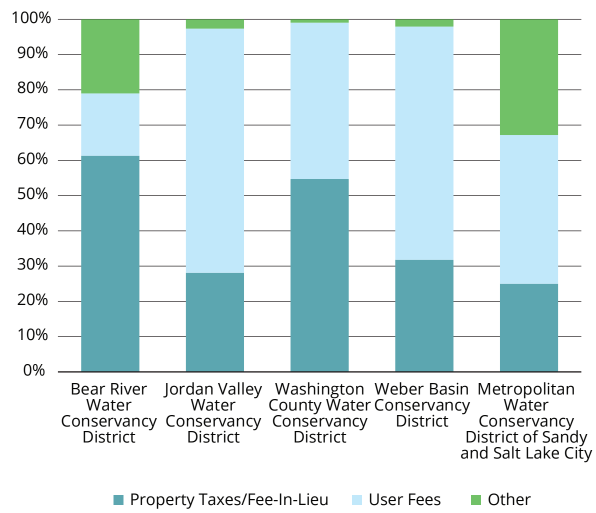
We Will Run Out

State agencies and water districts are tasked with planning for the future, preserving the quality of water, and conveying clean, affordable water to customers. In order to plan for the needs of future Utahns, available statewide resources are used to identify what we have, what we will need, and discrepancies between the two. As mentioned previously, the DWRe and water districts throughout the state use the Governor's Office of Management and Budget population projections to estimate future water use.[30] In comparing existing developed supply to future needs, the water districts and the DWRe all conclude that there will eventually be a gap without the development of new infrastructure. The largest questions for those who see significant limitations on the current developed supply are when that gap will occur, what steps can be introduced to mitigate or slow the timing of overusing supply, and how to pay for new infrastructure needs.

Figure 5 shows the state's projections for when the gap between demand and supply will occur. The decision in 2013 to accelerate the statewide conservation goal from 2050 to 2025 plays a major role in slowing the approach of the projected shortfall. From 2000 to 2010, available data show an 18% statewide reduction in water use.[31] This development moves the need to develop additional infrastructure resources from around 2015 to sometime between 2030 and 2040. As discussed previously, water districts across the state have concerns about the reality of the timing of these points. The consideration of constraints on deliverability, quality, and water right commitments, in the most recent revision of the data shows a reduction in the current developed supply of anywhere from approximately 70,000 to 200,000 acre-feet.[32]

Conservation will continue to play a role in future water development. The Division of Water Resources and water districts have projected that over 500,000 acre-feet of water will not need to be developed due to conservation efforts. However, DWRe and the districts do not think conservation alone will suffice. A large piece of the future solution includes the development of many smaller local projects and several large-scale, regional projects – the Lake Powell Pipeline, the Bear River Development, and the Central Utah Project. These three projects have been supported through legislative action in the 1990s and 2000s, in part due to their role in developing Utah's portion of interstate water rights.[33] Although the Central Utah Project has been largely completed, the other two projects are currently in various stages of environmental study. These projects are projected to cost billions of dollars, with funding currently not identified.[34]

Figure 6: Rate Structures of Selected Water Conservancy Districts



Source: State Audits.

Utah's water pricing structure provides a potential way to pay for a portion of the proposed projects. Utah water conservancy districts use a combination of property tax revenues, impact fees, and charges for services paid by water users. Figure 6 breaks down the pricing structures in several Utah water districts. In studies produced by both the Utah Rivers Council and the Jordan Valley Water Conservancy District, the practice of utilizing property tax for development, delivery, or bond issuance was seen in varying degrees in water districts across the West. Some argue that the use of property taxes helps create an inter-generational approach by requiring property owners of undeveloped land to pay for improvements which will eventually benefit any future development.[35]

The fact that overall cost of large projects can rise over time also provides an incentive for early action, rather than waiting until the need is more pressing. Any project that could cause significant environmental effects, either through federal government action or on federal land, has to go through the National Environmental Policy Act

(NEPA) process prior to final design and construction.[36] The NEPA process can take years. For example, the Lake Powell Pipeline began NEPA work in 2008, with a final record of decision expected in 2017.[37] The cost estimate for the project in 2006 was $500 million and by 2008 was over $1 billion – the longer it takes before construction starts, the more likely it is that costs will increase.[38]

Planned Future State Water Projects

Lake Powell Pipeline

The Lake Powell Pipeline Development Act, passed by the Utah State Legislature in 2006, authorized a 139 mile, buried, 69-inch pipe to convey water from Lake Powell in southeastern Utah to Sand Hollow Reservoir near St. George. Additional facilities include pumping facilities and hydroelectric generation facilities. The project is anticipated to deliver up to 26.7 billion gallons annually to Washington County Water Conservancy District and 1.3 billion gallons to Kane County Water Conservancy District. The project will pull on Utah's Upper Colorado River Compact allocation.

Bear River Development

The Bear River Development Act passed by the Utah State Legislature in 1991, directs DWRe to develop 220,000 acre-feet of Bear River water and allocates the developed water to three different conservancy districts and Cache County. The infrastructure necessary to accommodate this project would be a pipeline or canal from the Bear River to Willard Bay, conveyance and treatment facilities, and a dam in the Bear River Basin. Utah is part of the Bear River Compact, an agreement and allocation of water between Utah, Wyoming, and Idaho. The Bear River is commonly referred to as Utah's last untapped river, since projects have been studied but never built.

Sources: Planned Future State Water Projects - DWRe Website, Lake Powell Pipeline; Upper Colorado River Basin Compact, University of Arizona Law School; Bear River Basin, Planning for the future, DWRe; Journal of Land, Resources, & Environmental Law Vol 28 No 1, Fornataro, E.

We Have Enough

For those who believe that the existing developed supply will be sufficient to support future Utahns, current water management practices and the impacts these practices could potentially create play a major role in the ability to postpone development of large-scale projects. This line of thought suggests that the Division of Water Resources' assessment that Utah will reach the limits of the current developed water supply somewhere between 2030 and 2040 is misguided; instead, there is potential for future Utahns to continue to have water at least into the 50-year planning horizon without the implementation of large-scale water projects. The logic behind this argument calls on several changes of the current water practice: a stronger focus on conservation, a change in water pricing structure, and a recognition of the available potential in shifting agricultural water rights to M&I uses.

Figure 7: Public Community System Water Use, Potable and Non-Potable, 2005

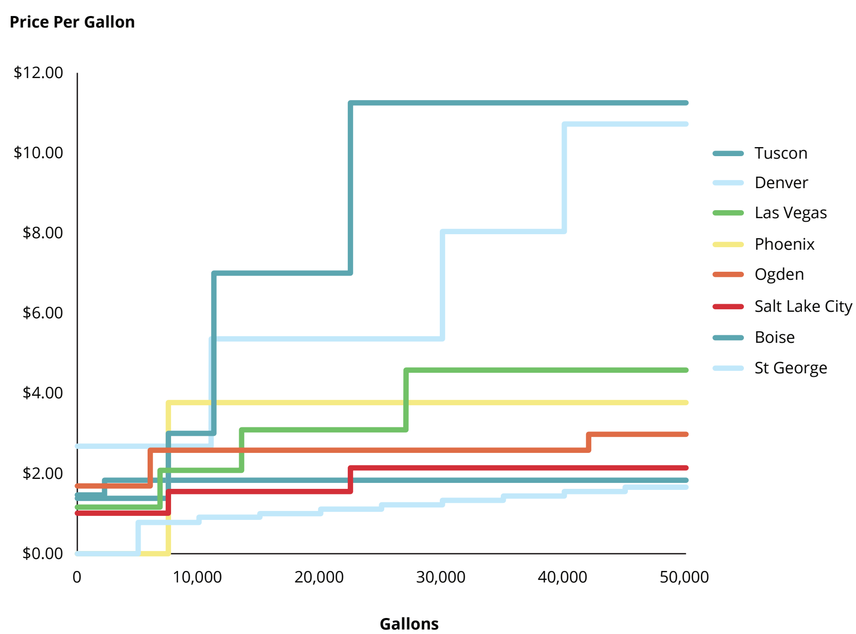
Category	Per Capita Use (gpcd)	Total Use (acre-foot/year)
Residential	182	509,000
Commercial	37	97,000
Institutional	30	85,000
Industrial	11	26,000
Total	260	717,000

Source: Municipal and Industrial Water Use in Utah, Division of Water Resources.

The state has a goal of reducing per capita water consumption by 25% by 2025.[39] This means reducing the previously mentioned 295 gpcd to around 221 gpcd, an average of all types of uses in M&I water use including commercial, industrial, and institutional. Figure 7 shows the breakdown of public community system water use in 2005. In a study produced by the Alliance for Water Efficiency and the Environmental Law Institute regarding water efficiency and conservation, Utah received a C+ grade, which was better than most of the Midwest but worse than most of western states.[40] The study utilized a 20-question survey that asked states about various agencies, permitting processes, regulations for appliances, conservation plans, funding, and other topics. In the study, Utah was highlighted for requiring water conservation plans from water providers. However, for those in the camp who say we have enough, the statewide conservation goal is too modest. Comparing both starting points and end goals shows that in states with conservation plans, Utah's baseline and target appear high. California's 20x2020 Water Conservation Plan, published in 2010, had a starting point at 192 gpcd with a goal to reduce to 154 gpcd by 2020.[41] Colorado's water planning document from 2005 uses a starting point of 172 gpcd for statewide analysis, 60% of Utah's starting point.[42]

One low-hanging fruit in this view is management of secondary water systems. Secondary water users generally pay a flat fee for an allocation of untreated irrigation water based on parcel size. Currently, most areas utilizing secondary water have no metering in place. Without metering there is no way for users or providers to know if they are within their allotted amount of water.[43] Research on secondary water shows that although secondary use reduces treated, potable water use, total water consumption actually increases.[44] Additionally, the introduction of metering and increased pricing structures have been shown to reduce secondary water use.[45] The Utah Water Research Laboratory is currently undertaking a study to look at commercially available flow metering systems for the state in an effort to increase accountability of secondary water users.[46] The Weber Basin Water Conservancy District started a pilot program in 2006 to introduce meters on secondary water systems for the same reason.[47] Initial results of the preliminary data show an increased awareness from users and shock at the amount of water they were consuming, which was much higher than they anticipated.[48] If metering is introduced in additional areas around the state, it is a near certainty that future use of secondary water would be reduced.

Figure 8: Water Rates of Selected Western Cities, 2014 Summer-Rate Schedules



Source: City Water Departments, Summer Residential Rates for Single-Family Homes.

Note: These rates are in addition to any base rate charged by the water district. Several water districts, such as St. George and Phoenix, include an allocation with their base fee – with changes noted at the first rate tier.

The impacts of metering and price changes on secondary water use can also be seen in residential water use. The current water pricing structure is seen by some to contribute to overuse of water. Utah traditionally has had low water prices and some suggest that these low prices encourage users to consume more than they need. A study produced by the Organization for Economic Co-operation and Development examining cities in the US and Europe showed that increasing water rates reduced water consumption in many different settings.[49] Although these rate increases did not typically affect indoor water use, impacts to outdoor watering were significant. The idea of an increasing block rate pricing system, where users who consume more pay a higher rate per gallon, is becoming a common practice across the Western US. Figure 8 compares the increasing block rates of several western cities, including cities in Utah that have implemented the systems. Clear differences between Utah and other states are seen in both the amount of water available at each price point, as well as the price point itself. A study by the Equinox Center for the City of San Diego showed that when water is priced using appropriately delineated usage and price points, water use is reduced by 16-37% over time.[50]

One last major existing resource discussed by those who argue that we have enough water are agricultural water rights, especially in urbanized areas. The Jordan River Basin estimated water budget in 2010 showed 32,000 acre-feet (10.4 billion gallons) of water considered for agricultural depletions.[51] Due to the urbanized nature of Salt Lake County, the amount of this put toward agriculture in the near future will be minimal. The State Water Plan (2001) projected a significant decrease in farmland within the Jordan River, Utah Lake, and Weber River basins. Although there will continue to be large areas in the state where economies continue to be heavily influenced by agriculture, growth into areas that were formerly agricultural will change the needs of the population.

These changing priorities and needs are already occurring and undergoing formal environmental processes. The Central Utah Water Conservancy District produced an environmental impact statement in 2011 regarding the conversion of agricultural water to M&I use in the Heber Valley area to prepare for future projected growth.[52] The analysis received a "Finding of No Significant Impact," allowing conversion of 12,100 acre-feet of formerly agricultural water to be open to conversion to M&I to accommodate needs of future urban development.[53]

Climate Issues

One element that Utah water planners have no influence over is potential changes to Utah's climate. The National Climate Assessment projects a reduction in both snowpack and streamflow for Utah and the rest of the Southwestern U.S. Research shows that during the last half century, snowpack in the Wasatch Range has decreased.[54] This change has been seen in both a decrease in snowfall and a "significant increase in rainfall."[55] Although summer rainstorms provide a break from the heat, they do not store water like snowpack does. Since snowpack is Utah's largest reservoir, changes in type of precipitation could create a need for additional infrastructure investment.

Currently about 30 million people are reliant on water from the Colorado River.

Climate is not restricted to one geographic area, and the connections of the Utah water system to other western states may become more of a concern in the future. This summer has seen some extreme water circumstances throughout the West. California is in a state of extreme drought, which has led to the implementation of large fines for water misuse.[56] Lake Mead is at its lowest point since being constructed in the 1930s. The drop in water level has created issues for cities throughout the Colorado River Basin and has precipitated intervention by the federal government and water agencies to incentivize reduced use.[57] Recently-released research shows that over 75% of the water loss in the Colorado River Basin since the early 2000s has come from underground resources.[58] This consumption of groundwater to compensate for gaps in supply and demand could create an unsustainable pattern of water use in the future. Currently, approximately 30 million people are reliant on water from the Colorado River, with projections showing an increase to 50 million by 2035.[59] This growth, combined with reduced future streamflows, creates the potential for future problems.[60] Continued cooperation across the Colorado River Basin States and Mexico will be required in the future as different entities seek to develop and use their allocations.

Financing

Historically, large-scale water projects in Utah were federally financed, with repayment by water users over time. Although federal funding is available for maintaining and upgrading drinking water systems through the Water Infrastructure and Innovation Act of 2013, the prospect of federal money coming to Utah for large-scale projects is very low.[61] In order for water districts to cope with continued maintenance of their systems and potentially adding large-scale investments, funding is a critical item in future water planning. Currently, costs for water supply and infrastructure costs are projected to be over $32 billion between now and 2060.[62] As mentioned previously, Utah has traditionally enjoyed low water and energy rates, although the ability for this to continue into the future is questionable if we need to develop of large-scale projects. Water users will potentially bear the cost burden, which would certainly impact water rates. The make-up of water rate structures, including property taxes and federal subsidies, may need to be reexamined in the future to help create a system that provides enough revenue for water districts to have continued funding.

Water districts are proponents of maintaining the existing combination of funding – user fees, property taxes, and impact fees. The use of property tax revenues creates a consistent revenue stream to finance projects that take years or even decades to develop, build, and fully utilize.[63] Additionally, general obligation bonds backed by property taxes have more stability and the potential for lower rates. Environmental groups, economists, academics, and the Utah Taxpayers Association propose changing the system.[64] While it may be unusual for these groups to support the same strategy, they all see the use of property tax allocations as a method of subsidized water rates and thus a disincentive for conservation. One theory supporting increasing water fees suggests that if water demand falls due to price increases, the impact will be the most effective and permanent due to the reduction being spurred by the consumer's best interest.[65]

Utah Rivers Council and the Jordan Valley Water Conservancy District performed research which shows that water districts across the West employ the use of property tax allocations, although how they are used varies by water district. In a survey of a sample of water districts in Utah and seven Western states commissioned by the Jordan Valley Water Conservancy District, six states (including Utah) utilized dedicated revenue from taxes in some form to support development and delivery of municipal and industrial (M&I) water.[66] Methods of employing property tax allocations included securing bonds, payment of bonds, and covering operation and maintenance costs. A similar analysis by the Utah Rivers Council surveyed over 50 water districts in 11 western states and found that 22% of water suppliers collected property taxes.[67] Water districts in Utah suggest that property tax allocations provide them with year-to-year budget stability that would not be present if revenue was based solely on user fees. The use of property taxes reduces costs paid by consumers, whether by paying for operations and maintenance or by granting access to reduced borrowing costs. If property tax revenues were reduced, water rates for consumers would inevitably increase. However, this rate increase provides an incentive for consumers to reduce consumption, which would help existing developed resources reach a larger population. Maintaining this tax-allocation based structure provides a reason to revisit the rate structure if Utah doubles its population.

Although outdoor water use varies, indoor water use is consistent across income levels.

An argument used in defense of the property tax allocations in urban area water rates is that it will disproportionately impact low-income residents. Although this is a compelling reason to avoid changing water structures, research shows that low-income residents consume less than other residents. Within the 2009 Residential Water Use survey by the DWRe, results showed that those in larger homes (3,000 or more square feet) used 13.6 gpcd more than homes less than 1000 square feet. In addition, the study found that indoor water use is not significantly impacted by income.[68]

On a local scale, recent analysis of Salt Lake City land cover, land use, water rates, and data from the tax assessors database showed a significant difference in water use between larger, more expensive, more suburban parcels compared to smaller, more urban, city-center parcels.[69] The difference between outdoor gpcd for the eastern benches of Salt Lake compared to the city center was about 80 gpcd in this analysis. Due to the variation in outdoor water use and stability of indoor water use, potential rate structures could be established to allow suitable amounts of water to accommodate necessary indoor use, with increasing blocks for heavy outdoor use. The research suggested that those users who used the most water would potentially not notice rate changes due to cost being less of an issue, but suggested that well-designed mechanisms that considered landscape or lot size would be useful tools to create a rate structure to compensate for potential lost revenue due to increased conservation. Analysis of different Utah water providers by the Western Resource Advocates suggests a block rate structure as a way to mitigate disproportionate impacts to water users.[70]

Agriculture

Agriculture is the most dominant water user in Utah. Between 2007 and 2012, Utah saw an increase of over 1,300 farms, although average size and total acreage in farms decreased.[71] Between 1982 and 2007, over 300,000 acres were converted from agricultural to urban development.[72] Despite conversion of agricultural lands to urban development, about 20% of Utah land was in farms in 2012.[73] Projected population growth in areas near the Wasatch Front in the future will contribute to continued reduction of Utah farmland.

Nationally, the agricultural employment percentage has been decreasing since the 1970s (at about 1.5% in 2010).[74] Utah's Department of Workforce Services projects that jobs for farmers, ranchers, and other agricultural managers will further decline in the next ten years, and most openings will be created by the need for replacements rather than expansion of operations.[75] Although small in number, Utah has seen an increase in principal farm operators under 34 since 2007.[76] This potential changing of the guard to a younger generation could help maintain Utah's agricultural heritage in areas where pressures of urbanization do not overwhelm agricultural interests.

Although interest in local food has increased in the past decade, the state does not currently have a measure for quantifying the amount of in-state agricultural production that is consumed in the state. In looking at a breakdown of crops grown on irrigated farmland, it appears that the bulk of Utah's agriculture is dedicated to alfalfa and pasture land. In 2010, over 50% of irrigated cropland was used for alfalfa and grass hay, with about 30% being pasture land. Of the remaining irrigated cropland, about 15% was used for grain (8.4%) and corn (5.3%).[77]

Agricultural watering, changes in farming technology, and crop genetics have increased efficiency and reduced the amount of water necessary for staple crops. Despite these advances in many aspects of farming, the "use it or lose it" portion of the law creates perverse incentives toward conservation within agriculture.[78] Currently, "beneficial use" includes uses such as domestic drinking water, agricultural use, aquatic life, and recreation – conservation is not considered a beneficial use.[79] In California, policy changes were introduced to reduce the perverse incentive. Farmers who had unused allocations were given the ability to sell, lease, or transfer conserved water.[80] This approach provides both incentives for farmers to conserve, as well as providing access for others to unused water.

Conversion of agricultural water to M&I has accommodated most water demands across the U.S. in recent decades.[81] By 2050, ten percent of farmland within the state is projected to be urbanized.[82] In the top three counties with the most acreage of farms – San Juan, Box Elder, and Duchesne – growth is projected to be relatively low between 2010 and 2050. Figure 9 compares these high farm acreage counties with counties with over 100% projected percent change in population between 2010 and 2050. In counties such as Morgan, Iron, Utah, and Cache, the likelihood of agricultural land being consumed by population growth is high. The connection between where agricultural water supplies are available and where growth is projected to occur raises the issue brought up by water districts in the DWRe state planning process. Although water is potentially available, how will it be conveyed, treated to adequate quality, and what will the cost implications be? These questions will need to be addressed in the future as urban development continues to grow into former agricultural areas.

Figure 9: Agricultural Land Use and Population Projections for Selected Utah Counties

	2012 Land in Farms (acres)	Percent Irrigated and Sub-Irrigated	Percent of County in Farms	Number of Farms	2010 Population	2050 Population, GOMB Projection	Projected Percent Change 2010-2050
Counties with Most Farmland Acreage, 2012							
San Juan	1,608,901	3.00%	32%	746	14,476	15,640	6%
Box Elder	1,170,736	27.10%	32%	1,235	49,975	70,501	41%
Duchesne	1,088,559	65.50%	52%	1,058	18,607	27,123	46%
Millard	577,405	32.90%	14%	728	12,503	14,422	15%
Iron	532,464	42.60%	25%	509	46,163	105,797	129%
Counties with over 100% Projected Population Change							
Washington	147,991	13.60%	10%	579	138,115	472,567	242%
Utah	343,077	23.10%	27%	2,462	516,564	1,216,695	136%
Cache	268,511	46.60%	36%	1,217	112,656	232,468	106%
Wasatch	149,224	27.20%	20%	450	23,530	76,389	225%
Tooele	347,024	11.80%	8%	729	58,218	157,821	171%
Summit	270,061	35.70%	23%	618	36,324	88,334	143%
Juab	242,909	20.90%	11%	353	10,246	23,382	128%
Morgan	228,678	39.60%	59%	301	9,469	20,654	118%
Kane	125,441	7.10%	5%	183	7,125	15,314	115%

Sources: US Census of Agriculture 2012, GOMB, Utah AGRC.

Note: Iron County is projected to see over 100% population change and also is a high farmland acreage county.

Conservation

Utah's Governor, DWRe, and water districts all recognize the important role of water conservation. Recent analysis shows that Salt Lake City and Washington County had already surpassed the state's published conservation goals by 2010, West Jordan has reduced water consumption 20% since 2000, and conservation progress can be seen around the rest of the state.[83] Continued improvements to technologies and increased awareness will be important steps in conservation. However, you don't have to look far (drought in California and low levels of Lake Mead) to see the need for policy makers and water leaders to take more assertive steps toward implementing conservation plans.

Public education and awareness is a crucial element to increase conservation. In the Weber Basin Water Conservancy District pilot project for secondary water metering, the majority of system users involved were surprised to learn how much water they were using once metering began.[84] The "Slow the Flow" public education program started encouraging Utahns to conserve water the 1990s. Both a public outreach and education program, Slow the Flow has used utilized traditional media outreach as well as a website with features such as water tips, a weekly lawn watering guide, how to find water-wise landscapers, and more.[85] Figure 10 highlights the data included in the Jordan Valley Conservation Garden guide for best watering practices in Central and Northern Utah. Similar to the raised awareness created by the Weber Conservation district's secondary metering, education projects like these can help inform residents on practices they would not know of otherwise.

Figure 10: Suggested Watering for Central and Northern Utah

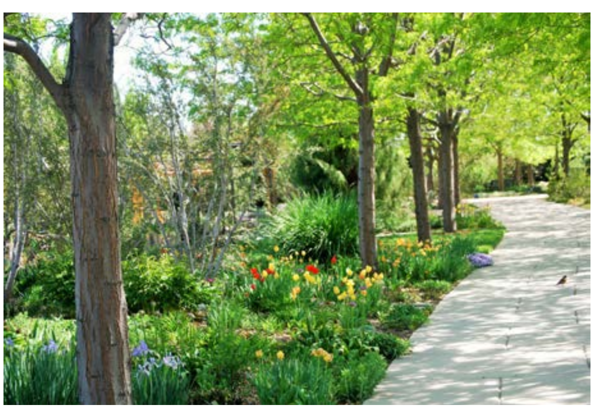
			Duration	
	Frequency	**Time of Day**	**Fixed sprinkler system**	**Rotating sprinkler system**
Mother's Day *Mid-May*	Once every 5 days	Before 8 am or after 8 pm	25 min.	45 min.
Father's Day *Late June*	Once every 3 days	Before 8 am or after 8 pm	25 min.	45 min.
Labor Day *End of September*	Once every 5 days	Before 8 am or after 8 pm	25 min.	45 min.
Columbus Day *Mid-October*		Winterize – Stop Watering		

Source: Conservation Garden Park.

Many Utahns might know of Slow the Flow. However, they may not be aware of the resources available to them through their local water conservancy district. Conservation learning gardens can be found throughout the state and are created with the express purpose of educating Utahns about best practices, climate suitable plants, and ways to maintain the aesthetics of a garden without continuing to contribute to outdoor water waste.[86] Figure 11 provides examples of water-wise gardens. As stated earlier in this report, while statewide the ratio of outdoor versus indoor use is 60/40, there is great potential to reduce outdoor use with minimal effort. Overwatering is almost standard practice for Utahns, and this is due mostly to lack of understanding. DWRe suggests that by simply changing lawn watering to best practices, the state could immediately reduce water consumption by 20%.[87] Both the state and local water districts have created examples of ordinances and conservation plans for cities to institutionalize the practices of conservation.[88]

One argument often levied against conservation is that it is expensive. While installing a new sprinkler system or changing all the plumbing fixtures in a home could be costly, the cost for conservancy districts to run programs to encourage and support conservation may not be. The Jordan Valley Water Conservancy District shows their annual cost of conservation is about $60 per acre-foot, including educational outreach programs, staff, and the Conservation Garden Park. Costs for development, operation, and maintenance of existing water projects in the same district costs hundreds of dollars annually. [89] Additionally, heightened conservation could open up water supply for more Utahns to tap into. When conservation goals are reached and combined with water-wise lot sizes and landscaping, there is potential for great savings. A local example of potential reduction in water use can be found in recent modeling analysis of Salt Lake City. The model included impacts of land use, lot sizes, landscaping, and conservation efforts on water use, which resulted in savings of anywhere from 50,000 to 209,000 acre-feet annually.[90]

Figure 11: Examples of Low-water Utah Yards



Photos Courtesy of Conservation Garden Park.

RECOMMENDATIONS

From the research involved in this paper, Utah Foundation recommends the following policies or research areas for further consideration:

Rate Structure:

- Re-examine the role of property tax funding for water agencies, with a goal of reducing tax support and increasing water rates. Although water districts support continued use of the existing system, the effects on consumption could be an easy step to increased conservation.
- Create more significant price gradations in block-rate water plans – although several water agencies feature these plans, the steps are too large or the differences in pricing are too minimal to influence water usage.
- Install new technology to monitor water use, such as advanced metering infrastructure (AMI), which provides consumers with real-time feedback on their usage. As seen with metering on secondary water, consumption patterns change when consumers are made more aware of their usage.

Local Response:

- State and water conservancy districts should continue to strongly encourage municipal governments to create or update existing ordinances that support conservation. Although education programs are important, they aren't enough.

Planning:

- Analyze future needs in a range of population projections and consumption levels. Although the connection between population projections and future water use are inextricably linked, projections are not perfect. A range of possibilities for investment, conservation, or resource development should be available to water officials and agencies in the future. Using this range of projections could help avoid committing to very expensive infrastructure projects when the need for new capacity is uncertain.
- Establish better connections between city planning departments and water conservation districts. Development of communities and a continued supply of water are too closely linked to be planned without one another.

CONCLUSION

Water in the West is complicated, and Utah does not prove the exception. Utah's water system will need to undergo changes in order to accommodate 2.5 million more Utahns in 35 years, but which approach is chosen should be selected only after careful consideration. The work of the Governor's Water Conservation Team and the State Water Strategy Advisory Team will provide important insight into future needs and the best ways to accomplish them. Continued interactions across disciplines of demography, urban planning, and water planning will help to create a holistic approach to maintain Utah's high quality of life.

Questions surrounding cost, infrastructure investment, water law, and best management practices will continue to be asked into the future, and the decisions made will impact future Utahns. Continued collaboration across agencies, districts, cities, and citizens will be necessary to create solutions that are both realistic and sustainable.

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A prior version of this report misattributed the support of the Salt Lake Chamber on specific water pricing and funding strategies. For more information about the Salt Lake Chamber's water policy positions please visit www.slchamber.com

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