Water Conservation Plan



Updated December 2015

WASHINGTON COUNTY
WATER CONSERVANCY DISTRICT

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CHAPTER 1

INTRODUCTION

Washington County Area

Utah is the second-driest state in the nation with 13 inches of precipitation per year. Washington County is located in the southwest corner of Utah adjacent to both Nevada and Arizona. In Washington County the annual precipitation rate of 12 inches is considerably less than the rest of the state. The City of St. George is even lower at 8 inches per year. With approximately 300 sunny days each year, our warm climate, state and national parks, and numerous tourist activities increasingly draw visitors and winter "snowbird" residents to the area. This expanding influx of people, our desert climate plus periods of drought renders the water supply limited and unpredictable.

Washington County is the fifth-largest county in Utah and for the past 50 years has consistently been one of the fastest-growing areas in the state. The county currently reports the third-fastest growth rate in Utah. *(U.S. Department of Commerce, Census Bureau 2013)*

In the mid-20th Century, agriculture, an important part of our community since the pioneer days, found residential growth stressing our scarce water supplies. Community, state, and federal leaders, cognizant of this reality, began early to develop a water management plan for this area that encompassed water use with a heavy emphasis on conservation. In the 1960s, the U.S. Bureau of Reclamation proposed The Dixie Project to capture water from the Virgin River and create a reservoir with the capacity to hold 250,000 acre-feet ("AF") of water. Due to the estimated cost of $60 million, plus geological and environmental concerns, the project was abandoned by the federal agency. Although this project was abandoned, with the creation of the Washington County Water Conservancy District (WCWCD), many other water projects (detailed in Chapter 2) have been built to provide Washington County with a reliable water supply.

2015 Conservation Plan Update

In August of 1993, facing rapid population growth and a limited water supply, the district approved a Long Term Framework for a Water Resource Management, Development and

Protection Plan, which states, "*The District shall develop a water conservation plan which promotes public education and information dissemination concerning water conservation; and promotes the adoption of technologies, practices, and devices which will yield improvements in the efficiency and management of water use."* That same month the WCWCD board called on community citizens and formed a Water Conservation and Drought Management Committee. The evolution of the resulting conservation plan is the product of their efforts to set the foundation for future community conservation and wise water use.

State Legislature

Understanding of our water-related issues was demonstrated by the Utah Legislature with the Water Conservation Plan Act (Section 73-10-32 Utah Code Annotated). This Water Conservation Plan ("WCP") addresses the key role that water conservation programs and practices will play in meeting future water needs while considering the diversity, reliability, and conservation concerns of leaders and citizens of both Washington County and the state.

In 1998 the Utah State Legislature passed the "Water Conservation Plan Act", House Bill 418. This law required culinary water providers and conservancy districts to prepare a water conservation plan and submit it to the Utah Division of Water Resources ("DWRe") by April 1, 1999. The act was amended in 2004 (House Bill 71) and is codified as Section 73-10-32 of the Utah State Code. The law states:

(2) (a) Each water conservation plan shall contain:

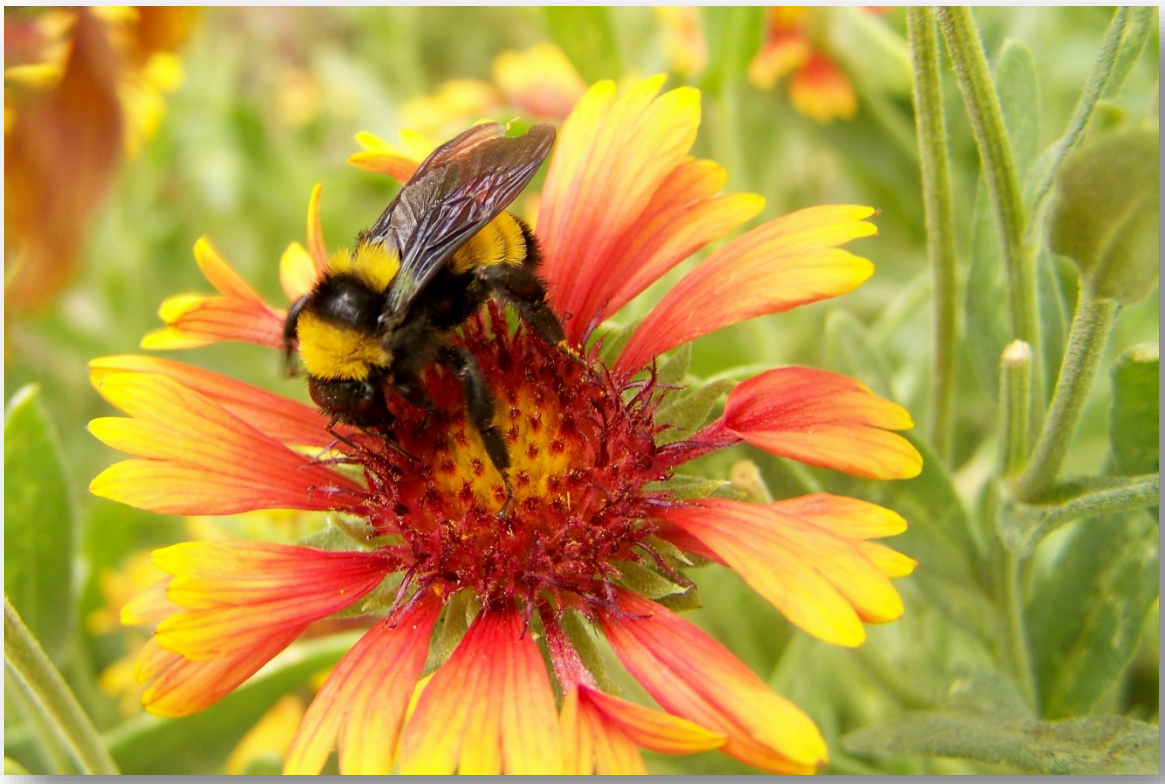
(i) a clearly stated overall water use reduction goal and an implementation plan for each of the water conservation measures it chooses to use, including a timeline for action and an evaluation process to measure progress.

(ii) a requirement that each water conservancy district and retail water provider devote part of at least one regular meeting every five years of its governing body to a discussion and formal adoption of the water conservation plan, and allow public comment on it.

(iii) a requirement that a notification procedure be implemented that includes the delivery of the water conservation plan to the media and to the governing body of each municipality and county served by the water conservancy district or retail water provider; and

(iv) a copy of the minutes of the meeting and the notification procedure required in Subsections (2) (a) (ii) and (iii) which shall be added as an appendix to the plan.

As required by the state legislature, WCWCD has previously complied with the law (1996, 2005 and 2010), and this 2015 Water Conservation Plan Update further satisfies the five-year update requirement of the Water Conservation Plan Act. The Appendix of this Plan Update contains a copy of the advertisement posting the date and time for the public hearing, minutes of the public hearing where public comment was received, posting of WCWCD Board meeting for adoption of the 2015 Conservation Plan, minutes of said meeting, and a copy of all written comments, both mailed and e-mailed by the comment deadline.



CHAPTER 2
WATER RESOURCES: CURRENT WATER SUPPLY

About WCWCD

The creation of Washington County Water Conservancy District (WCWCD) came from an overwhelming majority vote of property owners in Washington County. On November 28, 1962, WCWCD was organized and approved; initially to sponsor the Dixie Project or a similar water storage project. Water rights were transferred from the State Water Board ("Board") to the District in 1973. This enabled the successful construction of what is now known as the Quail Creek Reservoir. The project cost was $23.5 million with a storage capacity of 40,000 acre-feet. The water from this reservoir is treated in the Quail Creek Regional Water Treatment Plant. To meet demands of the burgeoning population and vibrant recreational activity, the water treatment plant increased its original processing capacity from 20 million gallons daily to 60 million gallons daily.



Quail Creek Reservoir

Authorization of Operating Agency

WCWCD was created through petitions signed by a majority of property owners to authorize taxation of real property for the development, sharing, and management of water supplies. It is a not-for-profit public agency and a political subdivision of the State of Utah. Its

seven-member board of trustees, appointed by the Washington County Commission, is primarily responsible for permanent long-term water resource planning, development, management, control, delivery, use, and wholesale water distribution to cities and improvement districts within the Washington County area. WCWCD serves over 85 percent of the county's population, 5.6 million tourists annually, 8,570 Dixie State College students and a 245-bed hospital complex.

District Responsibilities

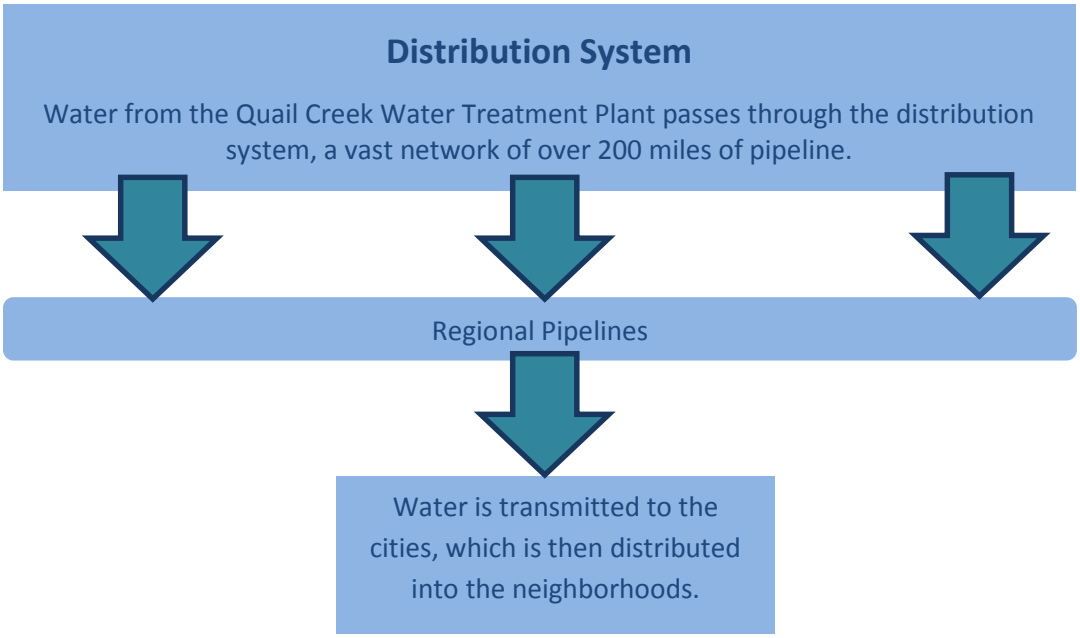
As the wholesale water provider to southern Utah's largest municipal water agencies, WCWCD is responsible for planning, development, acquisition, construction, operation, and overall management of the region's current and future water resources. This responsibility includes:

- managing all presently available water supplies
- managing regional resources
- managing conservation programs
- ensuring that regional water quality meets or exceeds state and federal standards
- allocating and distributing regional water resources
- uniting with the office of Governor Gary R. Herbert, and following his directive to reduce daily per capita water use 25 percent by 2025.

These coordinated efforts will augment operational capacity and flexibility to promote the general welfare of Washington County residents while solidifying a cohesive position on water issues facing southern Utah as well as the entire state. This program includes the building and operating of regional facilities to provide a reliable drinking water supply and delivery system for residents today and into the future.

While WCWCD performs a critical role in managing water, it does not have the authority to regulate water use by end users or to establish customer rates. Such policies, codes, and regulations are implemented through each of the municipalities. Regarding regulatory issues, WCWCD's role is to facilitate information sharing and collaboration. This role has resulted in the creation of successful community-wide water-efficiency policies, such as permanent mandatory watering restrictions and conservation-related requirements in new construction. Education, community outreach, and incentive programs are largely coordinated by the district with support and involvement from its member agencies, community stakeholders, key government agencies, and the general public.

Figure 2-1. Current Water Distribution System



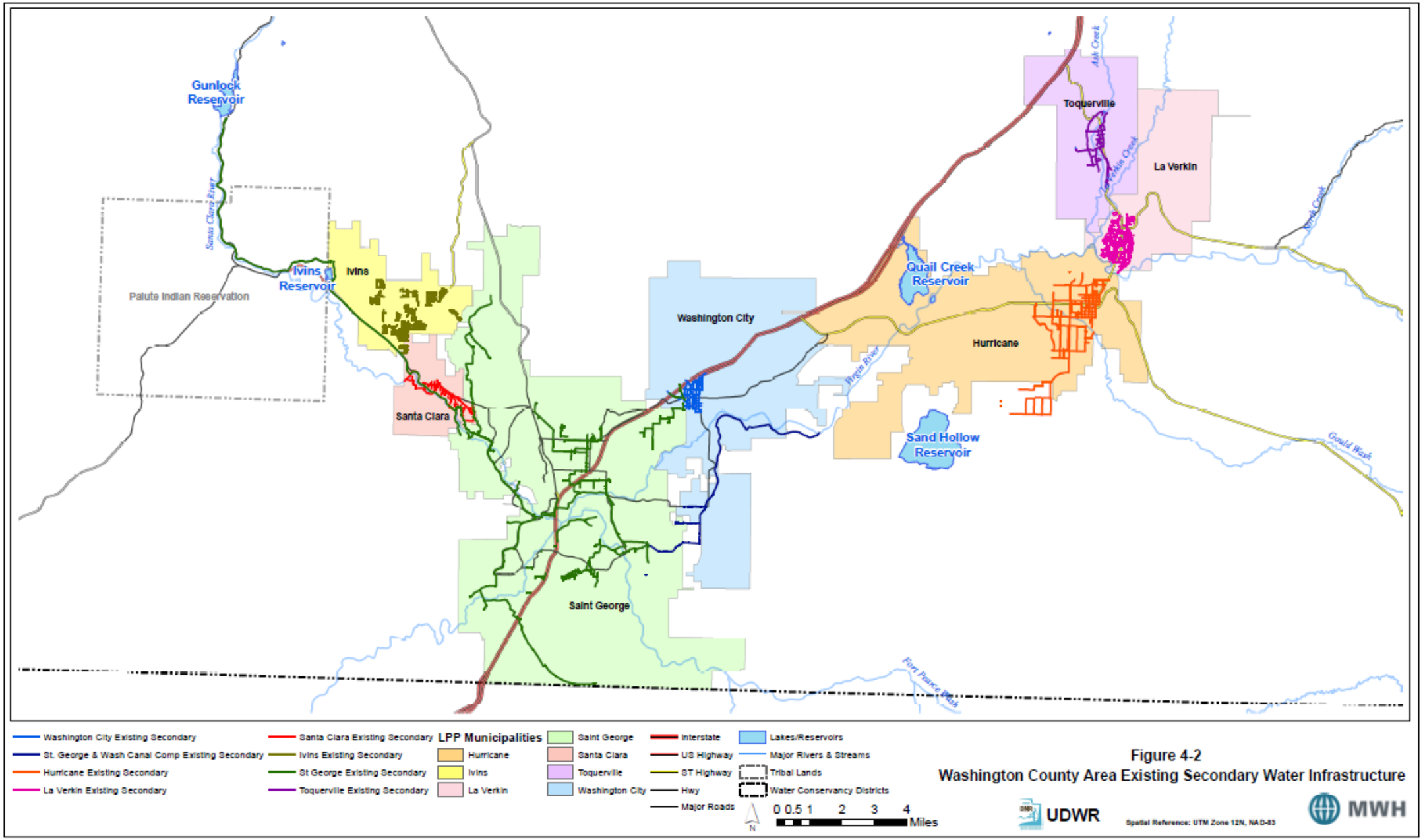
Source: WCWCD Water Line; Spring 2009.

WCWCD has worked to develop and manage a flexible portfolio of existing and future water resource options available to meet demands over time. Options include water conservation, reclaimed or reuse water, groundwater, groundwater storage, and all surface water presently available in the Virgin River basin. Planning allows us to assess our overall water supply and make appropriate decisions regarding what resources to bring on-line when necessary. The map of **Figure 2-2** shows the service area of the district.

Integrated Water Resource Planning – Citizen Involvement

Community participation has always been an important element of Washington County's water planning efforts. In August of 1993, facing rapid population growth and a limited water supply, the District approved a Long Term Framework for a Water Resource Management, Development and Protection Plan, which states, *"The District shall develop a water conservation plan which promotes public education and information dissemination concerning water conservation; and promotes the adoption of technologies, practices, and devices which will yield improvements in the efficiency and management of water use."* That same month the WCWCD board called on community citizens and formed a Water Conservation and Drought Management Committee. The evolution of the resulting conservation plan is the product of their efforts to set the foundation for future community conservation and wise water use.

Figure 2-2. Map of WCWCD Regional Service Area





Sand Hollow Reservoir

In 2012, the WCWCD appointed a stakeholder group of 28 citizens representing a broad spectrum of community interests to review, discuss, and address complex water-related issues and challenges Washington County faces today and into the future. The Citizens Integrated Resource Planning Advisory Committee ("CIRPAC") held 14 two-hour meetings between September 2012 and May 2014. Since that time, two separate subcommittees have been researching all funding-related and enhanced conservation issues. (See WCWCD Conservation Work Group Report in Appendix)

The recommendations or goals from the subcommittees will help the WCWCD Board of Trustees review and provide potential updated guidelines and programs to be implemented by staff in the coming years.

In 2015, MWH prepared a Water Needs Assessment for the Lake Powell Pipeline. The following information for this section was taken from this document and referenced as "WNA 2015".

Inventory of Present WCWCD Water Resources

WCWCD Water Supply Overview:

Washington County water supplies come from a combination of groundwater (springs and wells) and surface water (direct diversions and reservoirs). The Navajo Sandstone Aquifer and shallow alluvial aquifers provide groundwater resources. Surface water sources consist of the Virgin River and its tributaries. In 2010, approximately 20 percent of the developed potable water

supplies for public community water systems in Washington County were from groundwater sources and 80 percent were from surface water sources. Groundwater supplies developed by public drinking water systems are generally of high quality and can be used directly for potable uses after disinfection. Surface water supplies are used directly to meet secondary water demands or are treated to meet culinary demands. The cities and towns in Washington County developed independent water collection and treatment systems over the years. Since the WCWCD's first project in the mid-1980s, the major municipal water systems have become increasingly integrated.

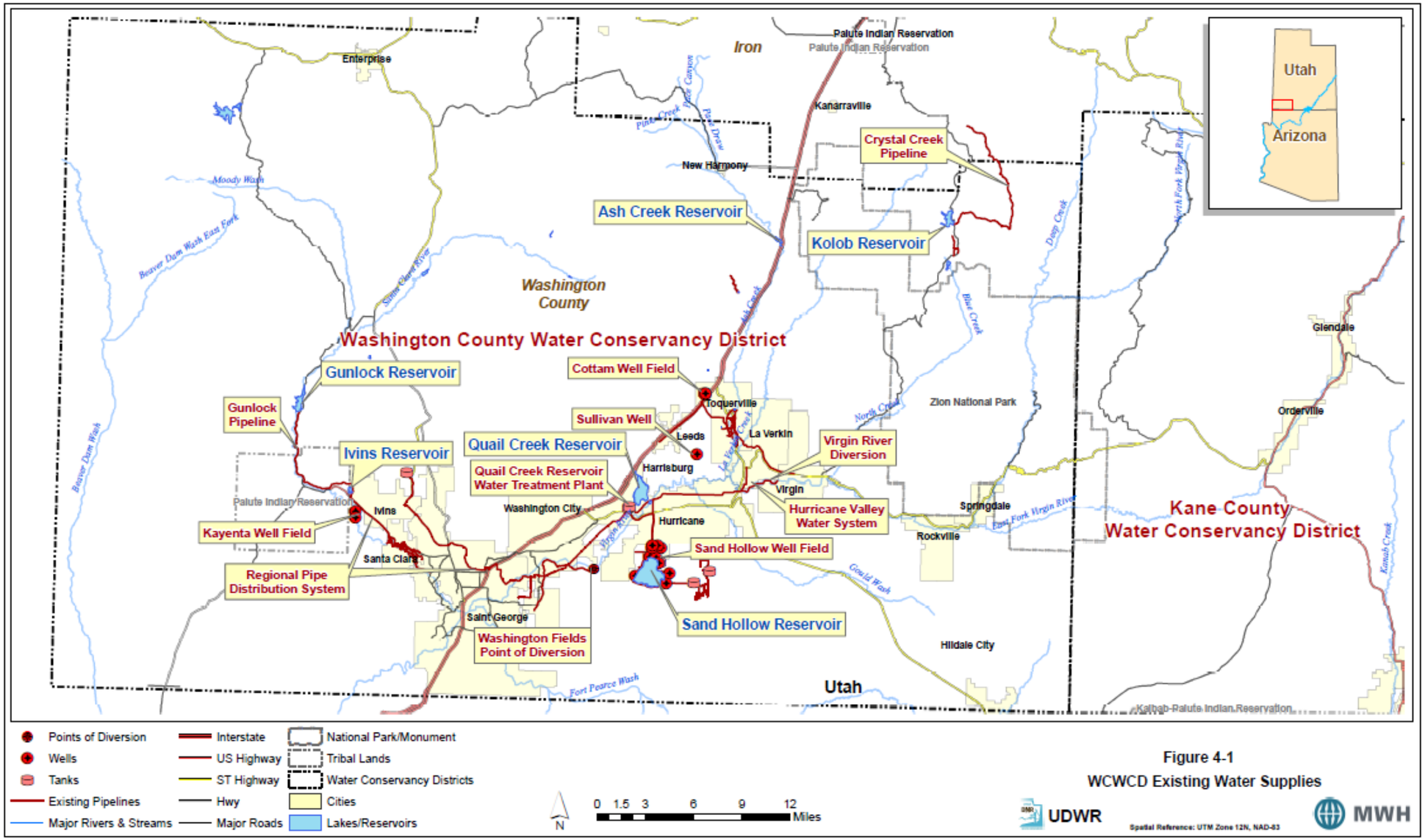
Groundwater sources within the WCWCD service area are considered to be fully appropriated and closed to further appropriations at this time, with the exception of the Canaan Gap drainage east of the Hurricane Cliffs and the Beaver Dam Wash drainage, which are open to small groundwater appropriations for domestic filings. New diversions and uses must be accomplished by change applications filed on previously approved water rights. Changes between surface and ground sources are reviewed for hydrologic connection to avoid interference with existing water rights.

WCWCD Existing Supplies

Because most of the readily available water in the county has been developed and most of the county is closed by the State Engineer to the acquisition of new water rights, the municipalities are generally relying upon the District for future water supplies, most of which will be provided through large water projects that require a regional funding base.

The following information lists WCWCD culinary water supplies. The yield estimates used for Washington County are considered reliable because groundwater supplies can be used to supplement surface water supplies to fully meet demands during extreme drought years. Additionally, operational flexibility is continually being enhanced by the District in order to avert water supply shortages. **Figure 2-3** maps the projects and water sources in Washington County.

Figure 2-3. WCWCD Water Sources.



Quail Creek and Sand Hollow System. Quail Creek and Sand Hollow reservoirs are a combined system, receiving Virgin River water from the Quail Creek Diversion structure through a pipeline network. Water delivery to these off-stream reservoirs is limited by the capacity and operational requirements of the diversion structure and pipeline system. Quail Creek Reservoir has a capacity of 40,000 ac-ft and supplies raw water to the Quail Creek Water Treatment Plant. Sand Hollow Reservoir has a 50,000 ac-ft capacity with an active pool of about 30,000 ac-ft and a drought pool of 20,000 ac-ft reserved for extreme drought. The drought pool is included in the reliable yield for Sand Hollow Reservoir. In addition, the reservoir serves as a groundwater recharge facility to the Navajo Sandstone Aquifer which currently stores about 100,000 ac-ft with an estimated future capacity of about 300,000 ac-ft. Water may be delivered from Sand Hollow to Quail Creek Reservoir or directly to the Quail Creek Water Treatment Plant.

Kolob Reservoir. Kolob Reservoir, 5,585 ac-ft, on a tributary of the Virgin River, was built in 1957 and later acquired by WCWCD. Water from the reservoir is released to the Virgin River for diversion at the Quail Creek diversion structure.

Crystal Creek Pipeline. Water is diverted from Crystal Creek and conveyed through a 12-mile pipeline to Kolob Reservoir to augment deliveries to Quail Creek and Sand Hollow reservoirs. The yield for the Crystal Creek Pipeline was assumed to be “new water” that would otherwise not be diverted from the Virgin River because it utilizes excess capacity in Kolob Reservoir.



Crystal Creek Diversion

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Gunlock Reservoir. Gunlock Reservoir, 10,884 ac-ft, was built on the Santa Clara River in 1970 for storage and delivery to irrigation companies in Gunlock, Santa Clara and Ivins. Most of the water stored in Gunlock Reservoir is diverted through the Gunlock to Santa Clara Pipeline to meet secondary water demands. The Gunlock to Santa Clara Pipeline is described on page 24.

Meadow Hollow Reservoir. Meadow Hollow Reservoir, 600 ac-ft, is located on Spring Creek and LaVerkin Creek in Iron County and was built in 1948 for irrigation purposes.

Ash Creek Reservoir. Ash Creek Reservoir receives snowmelt and peak flow runoff from the Ash Creek drainage basin. The reservoir seldom fills, does not retain water, and the storage capacity has been restricted significantly because of dam safety concerns by the Utah State Engineer. The Ash Creek Pipeline is currently being built to convey water from Ash Creek Reservoir to the proposed Toquer Reservoir near Anderson Junction.



Ash Creek Reservoir

Culinary Water Systems

Quail Creek Water Treatment Plant. The Quail Creek Water Treatment Plant is an integral component of WCWCD's water system. This 60 million gallon per day (mgd) plant can receive water from three sources: Quail Creek Reservoir, Sand Hollow Reservoir and the Virgin River and delivers culinary water to RWSA municipal customers described on page 31. Located just below Quail Creek Reservoir, this conventional filtration plant will eventually be expanded to treat 80 mgd.

Sand Hollow Wells. The Sand Hollow Well Field includes 13 wells that draw water from pre-reservoir groundwater rights and from water recharged to the Navajo Sandstone Aquifer by Sand Hollow Reservoir. Water is chlorinated and pumped to two storage tanks with a total of 3 million gallons of storage capacity prior to delivery to RWSA municipal customers and Sky Ranch and Cliff Dwellers retail customers.

An evaluation of aquifer storage and recovery at Sand Hollow is presented in the Groundwater Resources Technical Report. Currently the District estimates that there is approximately 120,000 ac-ft stored in the aquifer that could be used for this purpose. Most of the recharged water stored in the Navajo Sandstone Aquifer would be reserved for use during dry periods to compensate for any deficit between annual supply and demand.

Cottam Wells System. The Cottam Well system delivers water from two wells via pipeline to Toquerville, LaVerkin and Virgin and, if needed, to Hurricane and Leeds. This system also supplies water to about 20 customers in WCWCD's retail system, Casa de Oro, near Leeds.

Kayenta (Ence Wells) Water System. The Kayenta Wells (also known as the Ence Wells) are two wells with a total pumping capacity of 310 gallons per minute located within the incorporated boundary of Ivins. They provide water to the residential community of Kayenta.

Regional Pipeline Transmission System. The Regional Pipeline transmission system (pipeline, 500,000 gallon tank and two pump stations) conveys water from the Quail Creek Water Treatment Plant and Sand Hollow Wells to St. George, Santa Clara, Washington and Ivins.

Retail Water Systems. The WCWCD delivers retail water to the residential communities of Sky Ranch and Cliff Dwellers, south of Hurricane, the Casa de Oro subdivision near Leeds and certain areas on Kolob plateau.

Secondary Water Systems

Secondary water is non-potable water that may be used for outdoor landscape irrigation. Secondary water is a significant factor in assessing WCWCD service area supplies because of the significant amount of untreated water that cannot be economically used any other way. Water quality is compromised by the LaVerkin hot springs, as described in WNA 2015. Historically secondary water was available in certain communities based upon surface water diversions

developed by irrigation companies. Today, secondary water deliveries may be provided from these untreated water sources and from treated municipal reuse water. In all cases, infrastructure, including main delivery lines and lateral pipelines, can limit the ability to deliver secondary water to neighborhoods and communities. Meeting outdoor irrigation or industrial demands with secondary water allows higher quality potable supplies to be reserved for culinary purposes. Because of the value of secondary water in offsetting demand on culinary systems, and because of the limited infrastructure, secondary water is delivered to public parks, golf courses and other areas over the entire 24 hour period the water is available regardless of time of day water restrictions.



TSWS Upper Pond

Toquerville Secondary Water System. WCWCD, Toquerville City and the Toquerville Irrigation Company created the Toquerville Secondary Water System (TSWS) by contract in 1998, relying upon the water available from Toquerville Springs. The WCWCD purchased irrigation company water rights (except those belonging to the municipality) and converted the open ditch irrigation system to a pressurized system that distributes water to residents of the Toquerville area on a retail basis. The system includes water rights totaling 2,063 ac-ft per year. In 2014 the system served 400 connections; a maximum of 1,000 connections are possible on the system. TSWS reported a total secondary water use of 178 ac-ft per year in 2010. The 2010 secondary use was assumed to be equal to the reliable secondary supply of the system.

Gunlock to Santa Clara Pipeline. Secondary water on the Santa Clara River is stored in the Gunlock and Ivins Reservoirs and delivered through the Gunlock to Santa Clara pipeline. The Gunlock to Santa Clara Project, constructed in 2004, replaced four previous diversions and converted the old flood irrigation system to a pressurized system, with a pipeline from Gunlock Reservoir to Ivins Reservoir and beyond to deliver secondary water in Ivins and Santa Clara and to the Shivwits Band of Paiute Indians. Ivins Reservoir also stores reuse water. The pipeline

provides secondary M&I water to Green Springs Golf Course, St. George City parks, Ivins City parks, and about 100 residences. The Santa Clara secondary system is supplemented by the Sunbrook #1 and #2 wells, and the Mathis, Moores, and Frie wells. The Santa Clara River constitutes a "flashy" hydrology that is highly variable thereby making it difficult to accurately estimate reliable supply, but WCWCD estimates reliable yield of the system to be approximately 2,500 ac-ft per year of secondary water supply.

St. George Secondary Systems. St. George has a wastewater treatment plant, reuse plant, and an extensive secondary distribution system.

St. George Wastewater Treatment Plant. The St. George Wastewater Treatment Plant (WWTP) produces Type II effluent using an extended aeration treatment process that uses physical and biological processes to treat sewage. The current design capacity of the WWTP is about 17 million gallons per day (mgd). The wastewater effluent is either treated by the reuse plant or discharged to the Virgin River.

Utilizing Reuse Water. Delivering reuse water began in 2006. WWTP treats water for secondary water delivery, in conjunction with the Shivwits Band of Paiute Indians water rights settlement on Santa Clara River water, under which St. George agreed to deliver 2,000 ac-ft of reuse water annually to the Band. Utah water law specifies that original water rights owners retain ownership after the first-use water has been treated for reuse so the St. George treatment plan relies upon agreements reached with WCWCD and municipal entities to distribute the reclaimed water. The reuse plant filters and chlorinates WWTP water producing Type I effluent that can be used for secondary purposes where human exposure is likely. Current capacity of the reuse plant is 7 mgd with two filters treating 3.5 mgd each. The plant is designed to expand to 10.5 mgd capacity with the addition of a third filter. The typical effluent of the WWTP is good quality which enhances efficiency of the reuse plant. The average water quality of the reuse effluent in comparison to the Utah's water quality limits are displayed in **Table 4-2** below.

Demand for reuse water exists only during the irrigation season; as a result the reuse plant is only operated from late March to late October. There is currently no storage for reuse water. When supply exceeds secondary demand, and reuse plant is shut down, and wastewater effluent is discharged to the Virgin River. Because of this limitation, the current maximum annual yield from the reuse facility is approximately 5,800 ac-ft per year, with 3,900 ac-ft per year committed to Shivwits Band of Paiute Indian Reservation and area golf courses. In 2007, approximately 2,460 ac-ft of reuse water was treated and distributed (WNA 2015).

Currently reuse water has better water quality (approximately 1,200 ppm TDS) than the Virgin River water available for secondary use (approximately 2,500 ppm TDS) and thus would improve secondary water quality. But over time, increases in total dissolved solids and other constituents in the return flows, after repeated reuse treatment, could degrade water quality where reuse water is used or stored.

Secondary Distribution Sources. Secondary water from the St. George and Washington Canal Company system and the Gunlock to Santa Clara pipeline system is currently being used to offset demand on potable supplies in certain areas of St. George. In 2010, WCWCD worked with the Canal Company to replace 22.6 miles of the St. George and Washington Canal and its laterals, which had a long history of leakage and evaporation losses, with pipeline. The pipe can facilitate pressurization for residential sprinkler system in the Washington Fields area. Secondary water and



Gunlock to Santa Clara Pipeline for irrigation use.

reuse water are intermixed in Santa Clara secondary systems. Springs located northeast of downtown called the East/West City Springs feed a small ditch system in downtown St. George. This system primarily serves residential customers. Other secondary systems also offset culinary

demand in St. George. Springs in western Washington City supply water for a private secondary system called the Sandburg System, serving 3 schools, 2 parks, and a ball field in northeast St. George and western Washington City. Most of the secondary water delivery system is pressurized and interconnected with the exception of the small ditch system in downtown St. George and the Sandburg system mentioned above. The network of distribution lines within the system runs from Gunlock Reservoir to Washington Fields as can be seen in **Figure 2-4**.



Dawn Eide-Albrecht presents on adaptive desert plants at the annual water fair.

Figure 2-4. Washington County Secondary Sources and infrastructure.

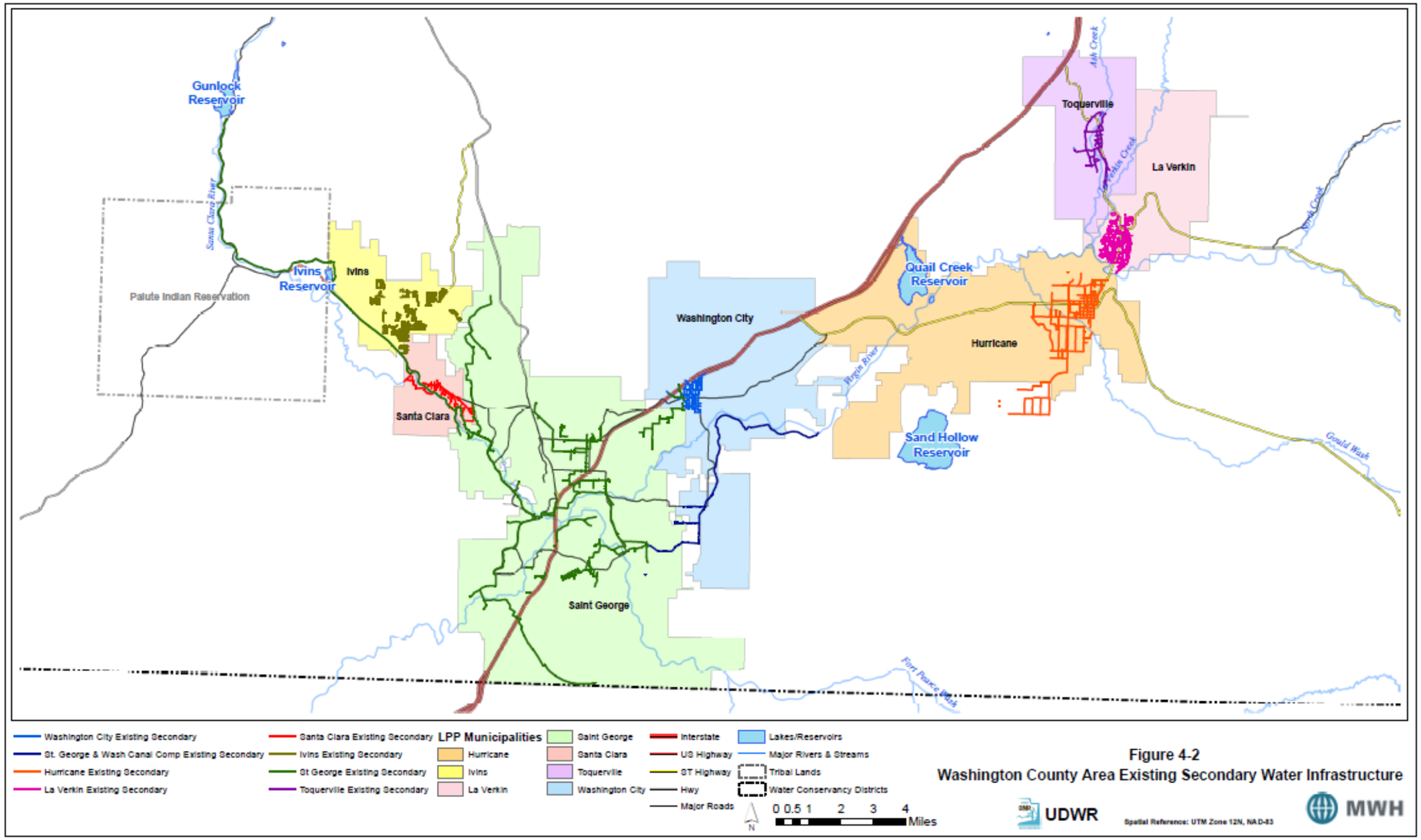


Table 2-1 summarizes the reliable yield for WCWCD projects for culinary and secondary purposes. Culinary supplies can also be used to meet secondary water demands if necessary.

Table 2-1. WCWCD Existing Projects and Water Uses

Project	Reliable Culinary Quality Water Yield (ac-ft/yr)[1]	Reliable Secondary Quality Water Yield (ac-ft/yr)[4]
Quail Creek and Sand Hollow Reservoirs[2]	24,922	0
Sand Hollow Non-Recharge Groundwater[3]	4,000	0
Cottam Well Field	875	0
Kayenta Water System (Ence Wells)	250	0
Crystal Creek Pipeline	2,000	0
Toquerville Secondary Water System	0	178
Total	32,047	178

Notes:
[1]Source of data: WNA 2015.
[2]Reliable yield for Quail and Sand Hollow Reservoirs includes yields from Kolob and Meadow Hollow Reservoirs.
[3]Supply utilizes water rights and natural basin recharge.
[4]Assumed reliable supplies are equivalent to current secondary water use.

Intersystem Agreements – Regional Water Supply Agreement

On April 23, 2006, the WCWCD entered into a cooperative Regional Water Supply Agreement ("RWSA") that currently includes eight municipal customers in Washington County. Each city is listed below with the date when they joined the intersystem.

Collectively, these cities provide water and wastewater services to nearly 150,000 southern Utah residents and close to 3 million annual visitors. The RWSA implemented a new approach to pricing water, which eliminated the need for take-or-pay contracts and created pricing mechanisms to encourage water conservation. In addition, the agreement encourages better partnerships in resource sharing. The RWSA also imposes conservation and water quality requirements on municipal water customers through uniform stipulations on water use, landscape ordinances, and water reuse. Impact fees are charged on new residential and commercial development to cover the costs of water development to meet the needs of growth. Impact fee rates, which are designed to encourage smaller lot sizes and additional water conservation, are based on three criteria: lot size, amount of irrigated landscape, and meter size.

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2009



2006



2006



2011



2007



2006



2006



2006

The coordinated efforts of the WCWCD members will augment operational capacity and flexibility necessary to promote the general welfare of the residents of Washington County and solidifies a cohesive position on water issues facing southern Utah as well as the entire state. This program includes the building and operating of regional facilities to provide a reliable drinking water supply and a delivery system for all WCWCD member agencies and their people today and well into the future. Nevertheless, with our projected growth WCWCD will still need to develop additional water supplies to meet the increased demand for drinking water. It points directly to our challenge to further diversify our options.

RWSA Key in Additional Conservation Strategies. The RWSA provides the structure by which the WCWCD will provide water throughout the county in the future. The municipal customers will retain their existing water resources, rights and facilities, except to the extent that they choose to integrate them with the District's water supplies provided through the RWSA. **Table 2-3** lists the additional water resources of these cities. The RWSA changes the approach for providing water supply, with water being sold at rates that are structured to encourage conservation (i.e., customers only pay for water they use, not for typical take-and-pay contracts).

Table 2-3. Inventory of District Member Agency Additional Resources

Water Supplier	Reliable Potable Water Supply (ac-ft/yr)[2]		
	Springs	Wells	Total[1]
Hurricane City Water System[3]	1,614	1,854	3,468
Ivins City[3]	48	177	226
LaVerkin City[3]	661	0	661
Leeds Domestic Water Users Assoc.	80	339	418
Santa Clara Municipal Water System[3, 4]	97	1,274	1,371
St. George, City of[3, 6]	1,200	11,113	12,313
Toquerville Water Dept. [3]	363	0	363
Washington Municipal Water System[3]	0	1,904	1,904
Totals	4,063	16,661	20,724

Notes:

[1]Wells are limited to 50% of their maximum capacity for reliable supply when well/pump capacity is the limiting factor. Springs and surface water supplies are equal to their respective maximum capacities.

[2]Reliable water supply is considered to be equal to calculated water use.

[3]Has contract with WCWCD for additional water supply

[4]Reliable well supply is calculated based on Santa Clara's 24.7% ownership of wells in Snow Canyon Compact yield.

[5] Reliable well supply is calculated based on St. George's 63.3% ownership of wells in Snow Canyon Compact yield. However, St. George has more well water rights available for additional supply, if needed.

[6]

Source: WNA 2015.

CHAPTER 3
CURRENT WATER DEMANDS

When planning for the future water needs of a community, water managers calculate current water demand on a per capita daily use. This measurement, known as per capita daily water use (GPCD), allows defining future water needs based on projected population for that area. For ensuring proper planning, Utah State requires utilities to use the Governor's Office Planning and Budget (GOPB) population projections. **Table 3-1** shows Washington County's population in 2010.

Table 3-1. Population Projections for Washington County's Major Cities.

City/District	Population 2010
Hurricane	13,300
Ivins	6,410
LaVerkin	4,060
Santa Clara	6,500
St. George	72,750
Washington	18,760
WCWCD	138,530

Source: WNA 2015.

Current Per Capita Water Use – Potable, Secondary

A calculation of gallons of water used per person per day (GPCD) is used to evaluate an area's water use. In Utah, this is calculated by comparing the combined uses of all water (both potable and non-potable) with the number of people living in the area. Washington County is unique in that people not counted in the census population own 25 percent of the homes. The area also supports thousands of students and visitors who are not represented in the population count.

While combining all water use to calculate GPCD allows the state to better predict future water demand, it means the daily water use numbers assigned to each resident are high since they reflect water use from all categories. Because the industry has not established a standard for

measuring GPCD, the protocol established by the state is accurate for evaluating the utility's water use reduction and planning its future water needs, but it is unreliable for comparisons against other utilities. Each utility's water system is unique, as is its own method for calculating GPCD.

Total Current Water Use – Residential, Commercial, Institutional And Industrial

GPCD is calculated to help plan for an area's future water needs. Under contract with the State of Utah, Montgomery Watson & Harza Americas, Inc. (MWH) prepared a water needs assessment to determine future water needs for Washington County. The assessment uses population projections to estimate water demand in each category of water use. The following tables and charts incorporate the findings of this report and further clarify the water use in each group.

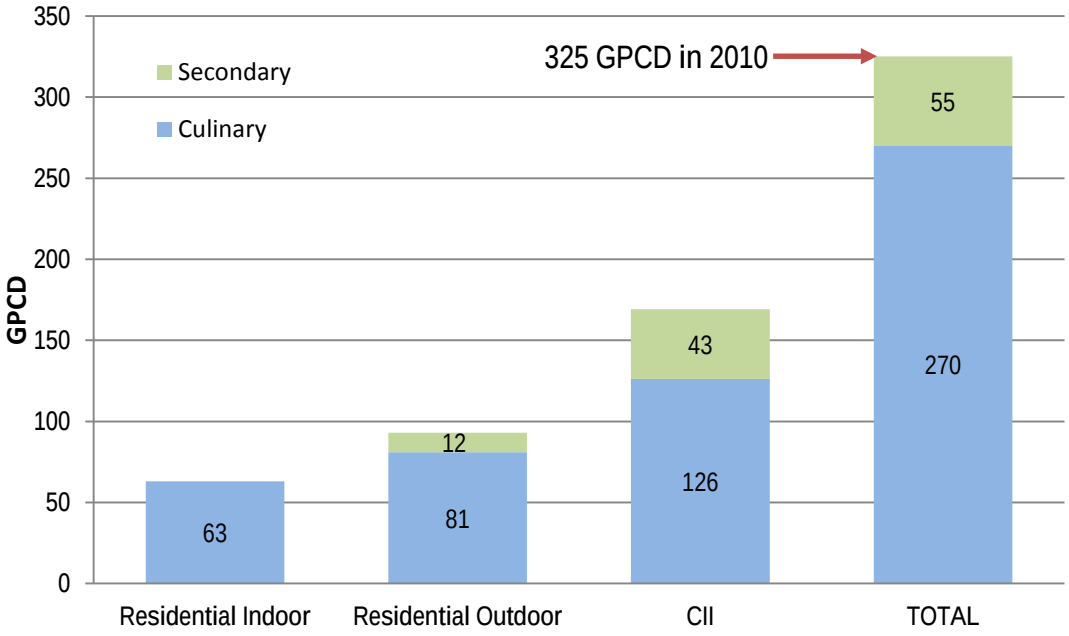
The following table provides a breakdown of residential water use for both outdoor and indoor use and Commercial, Industrial, and Institutional (CII) water use (based on 2010 GPCD). In 2010 the per capita water use in the WCWCD service area is 325 GPCD.

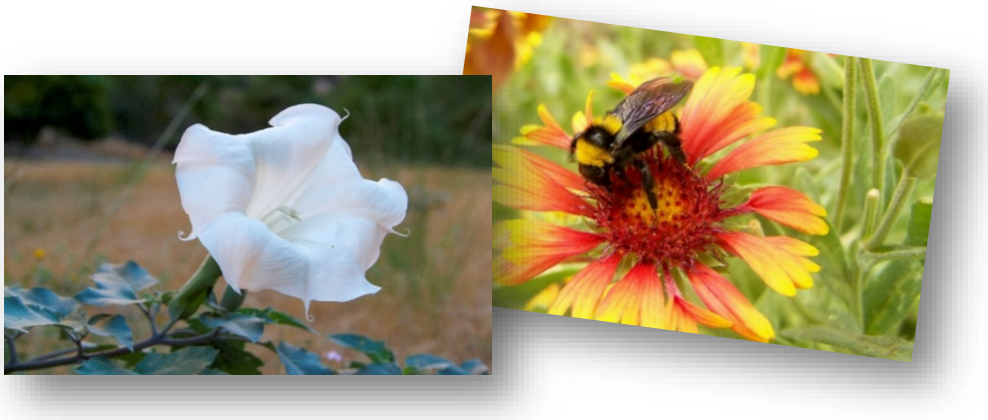
Table 3-2: Washington County's 2010 Water Use.

Water Use	Culinary Water Use	Secondary Water Use	Total Water Use
Residential - Indoor	63		63
Residential - Outdoor	81	12	93
Commercial	126	43	169
TOTAL	270	55	325

Figure 3-1 shows that 270 GPCD was culinary water and 55 GPCD was secondary water. Residential use contributed 156 GPCD, and CII use contributed 169 GPCD.

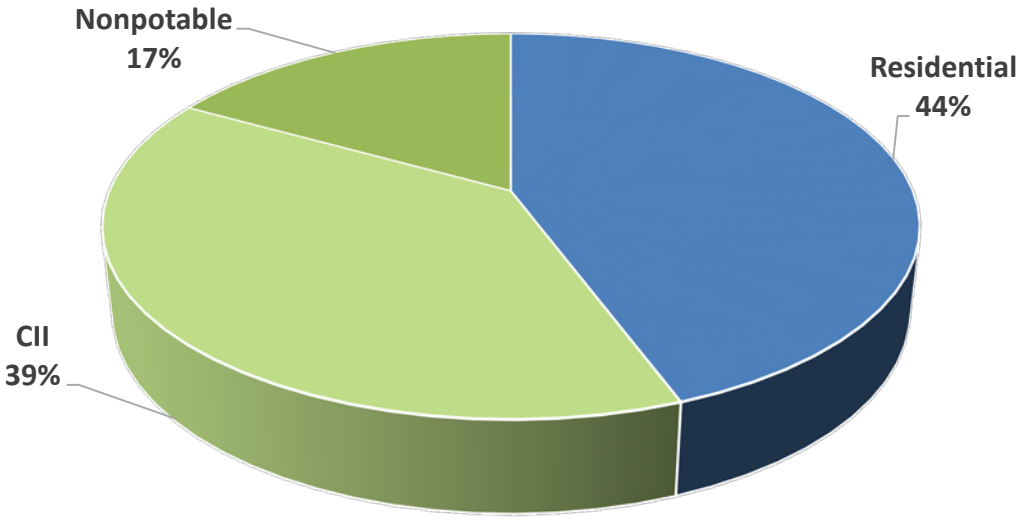
Figure 3-1. Gallons Per Capita Daily (GPCD) Water Use for 2010.





Analyzing water use further, **Figure 3-2** shows the breakdown of water use by group.

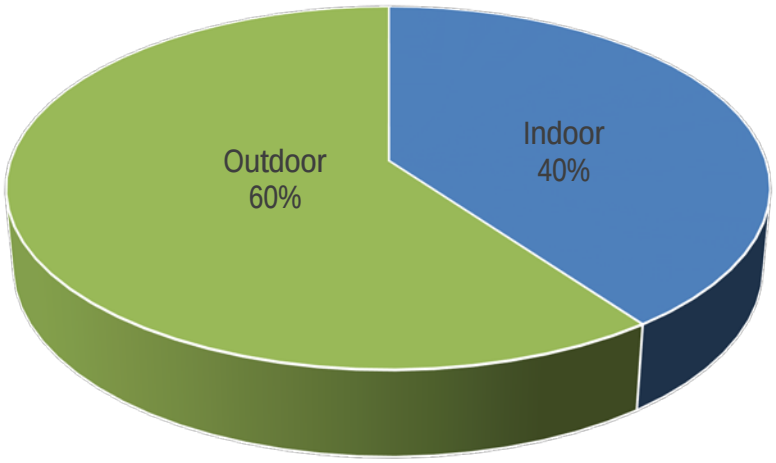
Figure 3-2: Water consumption by user group.



Notes:
1. Figure is based on 2010 water use data.
2. Secondary Use includes untreated water for outdoor irrigation use for residential single family, multifamily, second-home, commercial, industrial, and institutional customer categories.
3. Non-revenue water is NOT included in this figure.

Looking at where water is used overall, can help determine patterns of use. **Figure 3-3** shows the breakdown of water use into indoor and outdoor components. This breakdown is based on the assumption that water use during the months of December and January represent indoor water use since outdoor water use is at a minimum. While there may be minimal landscape watering in the winter, or leakage from irrigation systems, it is assumed that this is less than 5-10% of the average winter water use. This approach helps water providers understand historical use patterns and allows water conservation planning to focus on the area with the highest overall category of use. **Figure 3-3** Indoor use is approximately 33% of water consumption.

Figure 3-3: Washington County Single Family Water Use: Indoor vs. Outdoor



Note: Figure is based on 2010 water use data.

Factors Influencing Per Capita Use

Local climate, culture and economic makeup influence water consumption. The pioneer culture of home gardening has persevered over time. The warm climate in southwest Utah provides a long growing season for shade trees, home vegetable gardens and other landscaping. Precipitation is concentrated outside of much of the summer growing season. System demands in southwest Utah are increased by the growing season coupled with a high evapotranspiration rate and minimal offsetting precipitation.

The pleasant climate, plentiful recreational opportunities, and the scenic beauty of southwest Utah attract millions of tourists each year. During their stays, these tourists consume water and contribute to the calculated per capita usage in WCWCD. Washington County has a large tourism population associated with conventions, golfing, athletic events, and visits to nearby national parks and recreation areas. The world renowned Zion National Park is located in the county and the area is a gateway to Lake Powell, Bryce Canyon, and the Grand Staircase-Escalante National Monument. The average annual tourist visits is 5.6 million.

Dixie State University (DSU) and Dixie Applied Technology College (DXATC) are within WCWCD's service area. Some students at these two institutions are permanent residents of Washington County, and consequently are included in the population data for the county, but the many are not. In 2014, over 8,000 DSU students, or 36 percent, were not residents of Washington County. The net non-permanent student population for Washington County will inflate CII per capita water use compared to locations without student populations.

Although estimates of per capita water use only consider the permanent population, there are a number of part-time, second home owners that reside during the winter months in both districts. Second-home owners make up approximately 27 percent of Washington County's total population, (Washington County Assessor's Office) and most second-homes are within major city limits. While inside water use would be at a minimal for these nonpermanent residents, the landscape water use for their homes would have the same water demand as permanent residents. DWRe estimates that water use by second homes contributes 36.4 GPCD in WCWCD and 13.1 GPCD.

CHAPTER 4

WATER CONSERVATION: ACHIEVEMENTS AND CURRENT PROGRAMS

Conservation History

In response to the rapid population growth throughout Utah and in Washington County in particular, water conservation has been a hallmark of WCWCD's focus since 1993 when a Long Term Framework for Water Resource Management, Development, and Protection Plan was approved. The plan states: "The WCWCD shall develop a water conservation plan which promotes public education and information dissemination concerning water conservation; and promotes the adoption of technologies, practices, and devices which will yield improvements in the efficiency and management of water use."



Annual Events, such as Fall Festival and Water Fair, help educate residents about water conserving practices.

We have updated our Conservation Plan on a five-year basis as requested and are now coordinating with our member agencies, the State of Utah DWRe, and other water conservancy districts in maximizing and expanding all conservation efforts. Our overall campaign allows the

public to see and understand what they can do individually and collectively to help achieve conservation goals across the WCWCD service area and throughout Utah.

In 2010 and again in 2015, a detailed water conservation evaluation was conducted by Maddaus Water Management (MWM). The analysis reviewed the following:

- most recent water use data available at the customer level (billing data);
- evaluated existing water conservation measures;
- considered potential future water conservation measures based on experience in other parts of the country;
- developed alternative conservation programs;
- selected likely programs to be implemented in the future.

The analysis of potential conservation measures was performed using a conservation model developed by MWM that analyses water use at the end-use level and includes information on individual unit water savings, year of implementation, unit costs to customers and the utility, market penetration, and other factors. This complete evaluation is included in Appendix A.

In preparation of this 2015 Conservation Plan update MWM consulted with WCWCD staff, a municipality representative and county stakeholders. A total of 16 representatives formed the Conservation Workgroup. Together we completed a comprehensive technical analysis of potential conservation measures to:

1. Identify and evaluate current and new conservation measures that may be continued or implemented by the WCWCD to reduce future water demand and allow us to meet Utah's water conservation goal and the Governor's Roadmap of a 25 percent daily reduction in per capita water use by 2025 and 35 percent reduction by 2060.
2. Estimate the water savings of each potential measure and the costs to the WCWCD, the member agencies, and the public, if applicable.
3. Combine the conservation measures into increasingly more aggressive programs and evaluate the water savings and financial impacts of each alternative measure or program.
4. Encourage WCWCD to continue to build on and expand demand-management practices to promote conservation and reduce overall water use.

Figure 4-1 identifies key components to follow in promoting water conservation. It is a recommended strategy to use these components in combination.

Figure 4-1. Key Water Conservation Components.



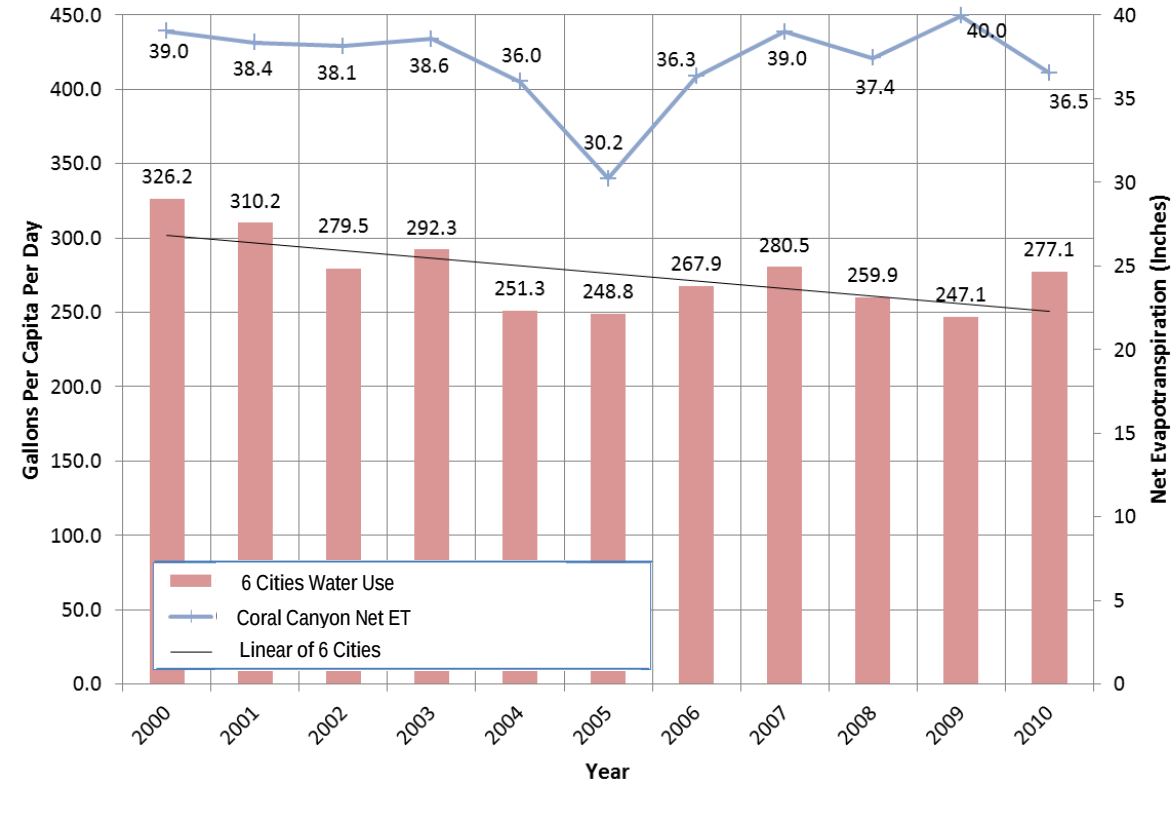
- **Water Pricing** – Tiered-rate structures charge higher rates as water use increases. These rates structures encourage efficiency, while ensuring the affordability of water for essential uses.
- **Incentives** – Incentives are tools that invite and encourage the community to participate in the conservation programs. The district has a number of programs critical to reaching our goals.
- **Regulations** – City and county governments have adopted a variety of land-use codes and water-use ordinances to promote the efficient and wise use of Washington County's water resources.
- **Education** – The district's public-education programs are designed to invite buy-in from the community and help residents understand that responsible water use is a critical choice when living in a desert environment.

These measures work with one another in a synergistic fashion to promote wise water use. The complex interrelated nature of these conservation programs makes it difficult to attribute specific GPCD reductions to any single measure, but the overall success demonstrates the cumulative result of efforts on every front.

Conservation Achievements

WCWCD is committed to water conservation, and according to state estimates Washington County has already achieved 26% reduction in total per capita usage in 2010 from 2000 baseline levels. The total per capita usage is comprised of residential, commercial, institutional, and industrial, including both indoor and outdoor usages. With the completion of the original conservation plan in 1996, conservation programs have been continued and added to annually.

Figure 4-2 Culinary Per Capita Water Use for 6 Cities in Washington County



As shown in **Figure 4-2,** total per capita water use decreased 26 percent in WCWCD's service area between 2000 and 2010. The overall culinary water conservation savings for WCWCD from 2000 to 2010 was determined by DWRe to be 15 percent utilizing actual data for the 6-cities between 2000 and 2010. Reduction in regional per capita water use can result from conservation actions, changes in housing density, housing types, landscaping, lot sizes, climate, water pricing, drought policies, regional economic conditions (e.g., recessions), percentage of non-permanent residents, hotel occupancy, and CII uses. Reference evapotranspiration ($ET_{o)}$ data were analyzed to help determine the effects weather may have had on water use in a particular year. High ET_o in hot and dry years could result in increased water demands for outdoor irrigation. The opposite is true for wet and cool years when water use can decline.

Achievements Based On Best Management Practices

The Utah DWRe provides water districts and agencies a list of recommended water conservation practices referred to as Best Management Practices (BMPs). In **Table 4-1**, the DWRe lists 14 BMPs to guide water agencies in conservation planning and success evaluation. These practices are outlined with a brief overview of how WCWCD board and staff have cooperated with and/or expanded on their recommendations since our initial Plan was submitted in 1996.

Table 4-1. Utah DWRe Best Management Practices

UTAH DIVISION OF WATER RESOURCES BEST MANAGEMENT PRACTICES	
➢ BMP 1 – Comprehensive Water Conservation Plans	➢ BMP 8 – Large Landscape Conservation Programs and Incentives
➢ BMP 2 – Universal Metering	➢ BMP 9 – Water Survey Programs for Residential Customers
➢ BMP 3 – Incentive Water Conservation Pricing	➢ BMP 10 – Plumbing Standards
➢ BMP 4 – Water Conservation Ordinances	➢ BMP 11 – School Education Programs
➢ BMP 5 – Water Conservation Coordinator	➢ BMP 12 – Conservation Programs for Commercial, Industrial and Institutional Customers
➢ BMP 6 – Public Information Program	➢ BMP 13 – Reclaimed Water
➢ BMP 7 – System Water Audits, Leak Detection and Repair	➢ BMP 14 – "Smart Controller" Technology

The following sections describe how WCWCD followed the DWRe's BMP outline to achieve our present conservation success and explains how the BMPs support our objectives for the coming years.

BMP 1: Comprehensive Water Conservation Plans. The adoption of our first formal Water Management and Conservation Plan ("Plan") in May 1996 demonstrated a new approach to managing water in terms of demand reduction. Conservation and demand reduction have been viable components in helping to meet water needs while maintaining the health of existing surface water and groundwater sources.

In preparation for the 2010 Plan update, WCWCD studied and implemented recommendations from a 2010 evaluation by MWM. Again, in preparation of this 2015 Conservation Plan update MWM consulted with WCWCD staff, county citizens and 18 representatives of large community organizations to form the Conservation Work Group. Together we completed a comprehensive technical analysis of potential conservation measures that will:

5. Identify and evaluate current and new conservation measures that may be continued or implemented by the WCWCD to reduce future water demand and allow us to meet Utah's water conservation goal and the Governor's Roadmap of a 25 percent daily reduction in per capita water use by 2025 and 35 percent reduction by 2060.
6. Estimate the water savings of each potential measure and the costs to the WCWCD, the member agencies, and the public, if applicable.
7. Combine the conservation measures into increasingly more aggressive programs and evaluate the water savings and financial impacts of each alternative measure or program.

We have updated our Conservation Plan on a five-year basis as requested and are now



Scenery at Red Hills Desert Garden

coordinating with our member agencies, the State of Utah DWRe, and other water conservancy districts in maximizing and expanding all conservation efforts. Our overall campaign allows the public to see and understand what they can do individually and collectively to help achieve conservation goals across the WCWCD service area and throughout Utah.

BMP 2: Universal Metering (Excessive Water Use Notification). Metering is the foundation of accurate measurement of demand-management programs. The district member

agencies are each working to fully meter all customer connections for each class of water in accordance with American Water Works Association Standards.
District members operate ongoing meter maintenance and replacement programs. Meters are read monthly and data is recorded on the basis of customer class, meter size, land use, and other pertinent variables. Most utilities monitor customer use to identify unusual water use, such as spikes in consumption due to leaks, and to notify customers of unusual water use activity. We are pushing forward to make this a district-wide reality.

WCWCD and its member agencies have a variety of active programs to more effectively account for the total water production and water sold – balancing production with sales.

BMP 3: Incentive Water Conservation Pricing. WCWCD and its partner cities use a tiered water rate schedule. Currently, with tiered water rates, some cities provide no water in the base rate. The WCWCD will continue to encourage all cities to implement rates that encourage conservation. Table 2.4 lists the present water rates for eight Washington County cities. WCWCD completes a water budget for each of its customers that are golf courses and charges a 50 percent surcharge for usage in excess of the budget amount.

WCWCD did away with its take or pay contracts. In these contracts municipalities were not billed for water used. The utility was billed for the water contracted to them whether they were able to sell it or not. This created a scenario where promoting conservation was detrimental to the municipality. Taking away these contracts and only billing municipalities for the water used, allowed the utilities to promote conservation without a penalty to them.

Non-Revenue Water. All water delivery systems experience losses. In the water industry these losses are known as non-revenue water or unaccounted-for water. These losses are predominantly due to leaks, variations in meter accuracy, and theft. Several tools have been instituted to measure and improve measurement and reduce system water losses. This category can also include water used for firefighting, parks, or other uses of water that is not sold.

Table 4-2. Washington County Cities Water Rates

Cities	Price* (per 1,000 gallons)
Ivins	$2.45
LaVerkin	$2.08
Hurricane	$2.19
Santa Clara	$2.07
St. George	$1.72
Toquerville	$3.93
Washington	$1.92
*Based on usage of 30,000 gallons usage in a 30-day period	

Table 4-2 lists the water rates of the cities a part of the regional water supply. Conservation pricing provides incentives to customers to reduce average or peak use, which is the amount used on especially hot days, high-demand times of day, or both. Such pricing includes:

Basic Rate. A monthly charge based on meter size and designed to recover the fixed cost of providing service. This includes the cost of meter reading, billing, accounting, collecting, debt service on bonds, depreciation, insurance, and other costs that do not vary with the amount of water delivered by the system. Although not all local cities include fixed costs in its base rate, doing so assures that conservation successes do not create revenue deficiencies. This rate does not include any water.

Usage Rate. The water customer is charged a unit price according to water usage for the month. Each unit of water is priced to encourage the user to reduce any inefficient use. Any fees collected from abuse of water usage could be allocated to conservation programs.

Base Sewer Charge According to Water Used. A volume charge for water and sewer service is based on metered water use on only commercial accounts. The volume charge is designed to recover all variable costs including energy for pumping, chemicals required for treatment, staff and laboratory fees and any other costs that vary with the amount of water delivered to the wastewater treatment plant.

Other optional rates may include:

- Seasonal rates. These rates are based on seasonal water use such as summer versus winter or excess-use surcharges to reduce peak demands during summer months.

The WCWCD will continue to encourage each community in Washington County

to make information available to every household concerning Peak Demand Periods and additional strategies the household can utilize to further reduce water use during those periods.

- Billing Usage Information. Many of our member cities include in the monthly billing statement a yearly comparison of customer water usage from month to month. This provides a tool for residents to detect leakage and be more aware of their ongoing water use and how to manage it better. We are encouraging updates of billing software so all cities are able to provide this information.

BMP 4: Water Conservation Ordinances. The success of the WCWCD Conservation Plan is partly dependent upon the water management and business practices of our individual member agencies. There are three key areas related to demand management that are the responsibility of the member agencies: metering, managing non-revenue water, and tiered water rates.

All municipal customers of the district have time-of-day watering restrictions to discourage excessive water use. Impact fees, applicable to all new development (new platted lots and building permits) within the service areas of municipal customers, are based on the size of the irrigable portion of the lot, with a pro rata increase for irrigated areas over a certain size (WCWCD 2008b).

BMP 5: Water Conservation Manager. A full-time employee, Julie Gillins was designated as Conservation Coordinator by the WCWCD in 1996. She sat on the committee lead by Utah DWRe personnel who coordinated Washington County's first Water Fair in 1995. Her position was made full-time in 2000 as the Conservation Manager and the responsibilities were largely expanded. Now with a MAPC degree in Communication, Julie serving as WCWCD conservation manager. In this position, she coordinates with other agencies and oversees a multitude of conservation programs and activities. Julie represents the WCWCD as a member of the Governor's Conservation Team on the "Slow the Flow" media campaign and coordinates with WCWCD's public information manager in its local campaign to support those messages. Through interfacing with a large number of citizens, local boards, and public entities, Julie creates awareness of incentive and/or volunteer water saving programs that benefit their financial bottom line. Julie chairs the 18-citizen WCWCD Conservation Work Group ("CWG"), which outlined goals to maximize current conservation efforts and discover new methods of saving water. Throughout the WCWCD communities, this department provides various programs to help fully utilize The Garden and other conservation amenities to promote public conservation education. With constant leadership we continue making great strides to highlight and expand the role of water-wise management with students, citizens, the business community, and visitors.

BMP 6: Public Information Programs.

The Garden (Water Conservation Demonstration Garden). The WCWCD, in partnership with other agencies, agreed that a demonstration garden would be an excellent educational tool

("The Garden"). Under the direction of a committee comprised from a representative from the WCWCD, St. George City, Utah State University (USU) Extension, and a private landscape architect, The Garden has been an educational resource to the community in the art and experience of water-efficient landscaping. The disciplines demonstrated at The Garden include proper soil composition and fertilization; understanding weather and climate; proven irrigation practices and technologies; plant design; and plant selection. There are four landscape themes demonstrated at The Garden: Desert Highlands, Urban Desert, Native Desert Shrublands, and Desert Oasis. The main structures in The Garden were completed in December 2003. In 2005, a part-time horticulturist was hired to oversee the maintenance and education components of the demonstration garden. In 2007, as The Garden was maintained and constantly updated requiring plant material be added and changed throughout the seasons of the year, this position was upgraded to full-time.

The Garden provides visitors with education through events, pamphlets, and marquees and other interactive activities. In 2009, 1,400 visitors were logged. This demonstration garden provides assistance to organizations such as USU Extension's Master Gardeners, Utah Nursery and Landscape Association, and local schools and garden clubs. This venue is becoming quite popular for weddings and other main events. There are two annual events held at The Garden, the Garden Fair and the Fall Festival co-sponsored by the City of St. George and the WCWCD.

Monthly workshops are provided appropriate to the season and community needs. These workshops are taught by certified local experts and are offered free of charge. The Garden serves as a resource for the community to become educated on alternatives to high-water-use landscapes.



Workshops on water efficient landscapes are offered monthly at each water-wise garden.

Red Hills Desert Garden. The WCWCD is required by federal law to assist in protecting endangered species in the Virgin River basin. By combining their efforts and maximizing resources, the City of St. George, the WCWCD, Red Cliff Desert Reserve and The Virgin River Resources Management and Recovery Program recently complete and dedicated The Red Hills Desert Garden. Here they have created a public education facility allowing visitors a rare view of endangered native and drought tolerant plants with a viewing gallery to observe a desert stream populated by fish native to the Virgin River. The public can experience the wonder and uniqueness of the three ecosystems of the Great Basin, Colorado Plateau and the Mojave Desert that all come together here in Washington County. With the completion of The Red Hills Desert Garden, the focus of the following years will be to increase public awareness of this resource and continue to implement educational venues for public participation. With ongoing activities, programs, events and the hope for an outdoor education center, The Red Hills Garden will serve as a desert-living and conservation resource for teachers, students, visitors and the general public for years to come.



Pathways through Red Hills Desert Garden, Utah's first desert conservation garden.

Utah Water-Wise Plant Tagging. The WCWCD contributed to Utah's Water-Wise Plant Tagging program. Representatives from several government and local organizations worked together to organize a list of ornamental trees, shrubs, herbaceous perennials, ornamental grasses, and ground covers that would meet the criteria listed below:



- water-wise
- adaptable to Utah's arid climate and cold winters
- available in the industry
- relatively easy to maintain in the landscape
- desirable landscape characteristics which remain desirable under limited water availability

The tagging process establishes that the plant requires water at most once every two weeks after establishment in order to maintain its aesthetic characteristics. The plant is identified with a generic, bright yellow tag indicating to the consumer that the plant is a water-wise plant. Participating nurseries and garden centers throughout the state will have these tagged plants available.

The program goals of this state-developed program are to assist Utah citizens in identifying water-wise plants for use in their region. An evaluation was not performed for this program in the Maddaus Report.

Governor's Conservation Team – Slow The Flow Media Campaign. The state-sponsored public education "Slow the Flow" campaign is supported by the District. Many of the District's conservation programs, incentives, and public education initiatives synergize with the state campaign to increase wise water use and achieve the Governor's accelerated water conservation target. The combination of water diversity and comprehensive conservation measures are both critically necessary to meet the demands of expanding population and visitor volume in Southern Utah.



As a member of the Governor's Water Conservation Team, coordination has be made with the State of Utah DWRe and other Districts to carry the "Slow the Flow" conservation campaign into our respective areas of responsibility. Our overall campaign educates the public to understand what they can do individually and specifically to help us achieve conservation goals across all the District's service areas. The District participates in the Governor's Conservation Team media campaign. The campaign started at the end of 2001 in the fourth year of a drought. The goal of the team is to coordinate the conservation message within each area and throughout the state to meet the state goal of 25% per capita daily water use reduction by 2025. The campaigns encourage a long-term water conservation ethic among Utah residents and visitors. The annual cost share of the program is $12,500 for the District, which is

pooled, with monies from the other members of the team. The District will continue supporting and assisting the Governor's Conservation Team to increase conservation attitudes throughout the state through a unified conservation message.

Booths and Public Events. The WCWCD participates in providing any organization booth with conservation information at public events and other venues that are compatible for collaboration. Tours of WCWCD facilities, regular outreach into the community via service organizations, landscape professionals, nurseries, homebuilders and business groups allow us to distribute information on a regular basis.

Local Media Campaign. A local media campaign was launched in 2000. Different mediums such as public events, print media, radio, etc., are used periodically to promote activities or programs on a regular basis. The goal of this program is to reach residents county-wide through varying media formats. The annual cost of the program is around $25,000. It has been a remarkable educational tool in bringing awareness of water issues, water-efficiency behaviors and water conservation programs in the community.

Public Outreach. The District participates in providing booths with conservation



Example of a Local Media Campaign Ad

information at most available public community events and attends meetings and smaller venues when requested or they are appropriate to the subject. For the evaluation of this program, it is combined with the Public Information Division.

EPA WaterSense Partner. In 2007 the district joined partnership with Environmental Protection Agency's WaterSense program. This partnership allows the district to use the creative material produced by WaterSense and to piggyback with the media events they generate. Some of these events include "Fix a Leak Week", "Shower Better" and "We're For Water".

BMP 7: System Water Audits, Leak Detection and Repair. AWWA's acceptable standard for unaccounted water in utilities is 15 percent or less. When the district implemented its System Audit and Loss Control program in 2011, it found as much as 35 percent loss in some systems. Implementing this program has allowed recovery of those losses to less than 9 percent

annually. Identifying the unaccounted water has minimized wasteful source water withdrawals. It has financially optimized revenue recovery and benefits operations by minimizing distribution system disruptions. Very important, this program has optimized supply efficiency and by generating reliable performance data and system integrity reduces potential for contamination. This program has established a protocol manual to measure accurately and balances each system water production and sales. Using these practices found in AWWA's Water Audits and Loss Control Programs Manual, the District has increased water accountability and reduced losses in its system.

BMP 8: Large Landscape Conservation Programs and Incentives.

Horticulture Classes, Training, and Awards

The goals in these programs include the encouragement of professionalism and increasing the landscape professional's knowledge of best management practices for water-efficient landscapes. It is estimated that a 5 percent drop in water demand can be achieved through proper landscape management practices.

In the past, the WCWCD has provided hosting of Irrigation Association certification testing. In 2003, the WCWCD partnered with Dixie Applied Technology College ("DXATC"), USU Extension, and St. George City to create a program to educate the landscape professional in water-efficient landscape management.

Currently, WCWCD supports Utah State in promoting and offering education through Qualified Water Efficient Landscapers (QWEL) certification. This program is also recognized by EPA WaterSense program. This allows certified landscapers to partner with the federal agency and locally this qualifies the landscaper to perform the work in irrigation upgrade rebate programs.

BMP 9: Water Survey Programs for Residential Customers. Water survey programs, known as Water Checks, offer a free sprinkler system evaluation and education materials to homeowners and multi-family developments. Since 2005, WCWCD has been offering a home visit which consists of a series of tests on the sprinkler system to analyze how efficiently the system is functioning and the application rate of water. From this evaluation the homeowner is given a suggested irrigation schedule and suggestions, if needed, to make the system more efficient.

BMP 10: Plumbing Standards. WCWCD has offered rebates for WaterSense labeled toilets to homes built in the year 2000 or older. In addition, a contribution is given to City of St. George to run the own toilet rebate program. Rebates for installation to any WaterSense Labeled plumbing fixture is offered to Commercial, Industrial and Institutional customers.

BMP 11: School Education Programs. The WCWCD promotes water education and conservation in all educational opportunities and participates in several outreach and education programs. In addition, District staff members serve as a resource for educators in elementary, secondary, and higher education. Other educational outreach endeavors commit only staff time and minimal District resources.

The major district sponsored program is the annual Water Fair presented to all fourth graders in Washington County which began in 1995. The fourth grade was selected to support the state's core water curriculum. Since the first fair, participation has expanded from less than 1,000 students to more than 1,800. The Water Fair is held at Dixie State College, where students are assigned to attend four of the 33 presentations available and compete in the Water Jeopardy contest. Local merchants contribute the prizes for the winning classes in the contest. The fair incorporates water education in the areas of water treatment, water properties, water infrastructure, water conservation, and source water protection. The cost of the Water Fair is approximately $2,000. Dixie State University ("DSU") contributes the use of the facility. Contribution requests are made to each participating city and donations are provided by local merchants for Water Jeopardy game prizes.



Noah Moses, of Utah Division of Water Rights, talks to students about water rights in Utah at an annual water fair for all Washington County fourth graders.

BMP 12: Conservation Programs for Commercial, Industrial and Institutional Customers. Rebates are offered to Commercial, Industrial and Institutional (CII) water users. Also, incentives are given to help to reduce water use in this sector where 51 percent of the county's water is used. Our Water Efficient Technology Assistance Program allows CII customers to implement water saving technology and receive rebates according to the water savings found through implementation of water efficient technology. Rebates for replacing

water-cooled machines with air-cooled or retrofitting plumbing fixtures with WaterSense labeled ones are included in the program. Free programs such as "Save the Towel" and "Water Upon Request" notification cards are available. In addition, the full cost of the device necessary to install pre-rinse spray valves is offered.

BMP 13: Secondary and/or Reclaimed Water.

Secondary Water Systems. Municipalities and WCWCD, pursuant to the RWSA, are maximizing the use of secondary water systems to serve new development, thus offsetting demands on culinary water sources. One conservation method that reduces irrigation water use is the conversion of open canals and flood irrigation to pipelines and pressurized systems. This reduces water losses from seepage and evaporation in secondary systems. The Toquerville Secondary Water System was the first open ditch system to be connected to a piped system. WCWCD purchased water rights from the Toquerville Irrigation Company's shareholders and converted the open-ditch irrigation system to a pressurized system which distributes irrigation water from Toquerville Springs to Toquerville residents. The Gunlock to Santa Clara pipeline has replaced four diversions and converted flood irrigation to a pressurized system. The pipeline delivers irrigation water to Ivins, Santa Clara, and the Shivwits Band of Paiute Indian Reservation. Also, WCWCD was instrumental in converting the largest and longest open canal system in the county, the St. George and Washington Canal system, from approximately 9 miles of open ditch to enclosed pipeline.

Telemetry Project. This project was implemented to minimize water loss, aid in water management, and enhance the accuracy of measuring water right allocations, a telemetry project that monitors diversions along the Santa Clara River and Virgin River has been implemented (WCWCD 2008b). The project monitors diversions along both rivers to minimize water loss and enhance the accuracy of measuring water right allocations.

Study on High Salinity in Water. The WCWCD is working with retired Brigham Young University professor and researcher Dr. Frank Williams in conducting research to identify plants and irrigation practices that are tolerant of high-salinity water. The purpose is to evaluate the use of Virgin River water in the establishment and management of ornamentals and other common varieties of horticultural plants in this area. The plants studied will be those commonly used in this area and thought to be salt tolerant. The study will evaluate the establishment of the plants in high-salinity water as well as the plants' ability to survive on minimal water use, thus establishing best management practices for landscapes using river water. Plant lists will also be developed for residents of Washington County to use. Plants will be rated from sensitive to tolerant in their reaction to the high salt content of the water.

The goal of the program is to evaluate methods and management practices and establish best management practices for ornamentals and other common plant material used in the area. This will be done by studying various planting methods to find what will best establish the plant.

Once the plants are established, they will continue to be evaluated on growth characteristics. The soil will also be monitored for accumulation of salts, and management practices will be developed to produce the best results. Special attention will be given to the various species of grasses that are believed to be well adapted to this area. Trees, shrubs, and other landscape plants will also be evaluated.

With the criteria developed, homeowners, and commercial landscapers can evaluate the varieties that will be best suited for the area, especially when using a secondary water source such as the Virgin River. The research done anticipates agriculture conversion of Virgin River water at the Washington Fields Diversion and use of the water in secondary water systems in Washington and St. George. Use of the water by St. George City on public parks, cemeteries, and other public areas has revealed that the water will not be suitable for some of the area's commonly used landscaping plants. Both salinity and the element boron appear to be an issue. It is also expected that, upon the development of proper management methods, the loss of trees, shrubs, and garden plants can be reduced from the 90 percent loss rate to a 5-10 percent loss rate. The project will be monitored for a period of three to five years in order to establish that the proper planting methods will continue to save water long after the establishment of the plants. At the conclusion of this study, the information collected will be published. This will be beneficial in demonstrating, with proper soil preparation, planting, and managed water use, that water of lower quality can be successfully utilized. A short list of recommended plants and their tolerance for low quality water will be developed for the area. This program was not evaluated in the MWM Report.

BMP 14: "Smart Controller" Technology.

SWAT Controller Rebates. Since 2002, WCWCD has offered rebates to large water users and homeowners who install smart controllers. Since that time municipalities, schools, churches and planned community develops have participated and approximately 100 homeowners have participated in this program.

Weather Station Link and Website. The WCWCD, USU, and St. George City have worked with Irrisoft to link existing weather stations in the county to one computer terminal. The weather station collects data and produces an evapotranspiration value known as ET. This ET value is then used by large water users, landscape professionals, and homeowners to gauge the irrigation needs of the landscape. A website has been created to disseminate the ET value county-wide through a website at www.dixiegardener.org.

The goal of this program is to educate both the homeowner and landscape professional on the water needs of the landscape plants. It is estimated that if correct irrigation principles can be implemented, water needs can be decreased by at least 30 percent. The WCWCD has taken over the hosting costs for the website, while USU Extension updates the website weekly. This program was not evaluated in the Maddaus Report.



This cactus displayed at the Red Hills Desert Garden which features nearly 5,000 water efficient plants.

CHAPTER 5

FUTURE: WATER DEMAND and WATER SUPPLIES

As Utah's southwestern population steadily continues to grow, demand for water will consequently increase, approaching an estimated need for 200,000 acre-feet per year by 2060. Increased conservation efforts are expected to reduce daily per capita usage, but the District must be capable of supplying enough water to meet Utah design standards for source sizing. With the history and calculations of population and per capita water use projections we can better predict future water demands for WCWCD.

By 2060, WCWCD's service population is anticipated to exceed 575,000. Population projections for WCWCD and the six largest cities in their service area are shown in **Table 5-1.**

Table 5-1. WCWCD Population Projections by Major City.

	Population					
City/District	2010	2020	2030	2040	2050	2060
Hurricane	13,300	18,950	27,020	35,800	45,510	56,020
Ivins	6,410	9,130	13,020	17,250	21,930	27,000
LaVerkin	4,060	5,780	8,250	10,930	13,890	17,100
Santa Clara	6,500	9,260	13,200	17,500	22,240	27,380
St. George	72,750	103,640	147,780	195,810	248,920	306,420
Washington	18,760	26,730	38,110	50,490	64,190	79,020
WCWCD	138,530	196,480	279,270	369,370	468,990	576,850
Annual Growth Rate	-	3.6%	3.6%	2.8%	2.4%	2.1%
Source: WNA 2015						

Population projections to 2060 for the Virgin River basin were provided by the State and applied to an estimated 2016 GPCD by customer category developed from 2010 customer category use and used in the DSS Model as a baseline demand. Then, plumbing code and conservation savings were estimated annually and applied to this baseline GPCD and demand in order to reduce projected GPCD levels. Population projections from the State and employment projections from the Governor's Office of Planning and Budget 2012 Baseline Projections Report were used to determine projected water demands to 2060 for WCWCD.

Plumbing code measures account for 32% of the future conservation potential achieved and are independent of any program; they are based on customers following applicable current

local, state and federal laws, building codes, and ordinances. As modeled by Maddaus Water Management, **Table 5-2** shows the population projection out to 2060 and baseline water demand.

Table 5-2. Historical and Projected Demographics and Baseline Demand

Year	Population	Employment	Projected Demand (MG)	Projected Demand with Plumbing Code (MG)	Projected GPCD	Projected GPCD with Plumbing Code
2020	196,478	109,376	22,801	22,747	317	316
2025	237,874	129,316	27,536	27,318	317	315
2030	279,270	149,256	32,267	31,834	317	313
2040	369,366	190,954	42,527	41,618	317	310
2050	468,987	236,376	53,855	52,382	317	309
2060	576,850	285,000	66,106	63,948	317	307

Notes:

1. The DSS Model's start year is 2016. This analysis assumes year 2016 GPCD represents baseline water use with a reduction due to projected plumbing code savings. Baseline GPCD is based on UDWR's GPCD population as well as use projections to 2060 for the Kanab/Virgin River Basin.
2. Secondary Use is included in demand estimates.
3. This projection assumes that the mix of potable (culinary) and secondary water demand is the same in the future as in the base years. This does not assume that new secondary systems would allow for the replacement of potable (culinary-grade) water used outdoors with secondary-grade water. Baseline demand projections assume no conservation of any type is implemented. Plumbing code only assumes that the national plumbing code is implemented over time.

Washington County population is projected to reach 576,850 by 2060. Per capita water use is expected to be 285 GPCD by the end of the study period (2060) with conservation. Thus water demand will approach 184,245 ac-ft per year in WCWCD's service area by 2060 (WNA 2015). The average annual growth rate in Washington County is projected to be 3.6 percent until 2030 when it is expected to gradually decrease.

The demand projections reflect average water use under average weather conditions and do NOT reflect drier and hotter drought conditions. Likewise, climate change (which might alter weather patterns), increased or decreased rainfall, and possible increased irrigation demand in the spring and fall (due to a warmer climate) have NOT been addressed in this analysis.

Table 5-3. Forecasted Total Demand for Future WCWCD M&I Water Use

	Population	Per Capita Use with Conservation (GPCD)	Total Projected Water Demand with Conservation (ac-ft/yr)
2010	138,530	325	50,380
2020	196,480	311	68,450
2030	279,270	295	92,220
2040	369,370	295	122,010
2050	468,990	295	154,940
2060	576,850	285	184,250

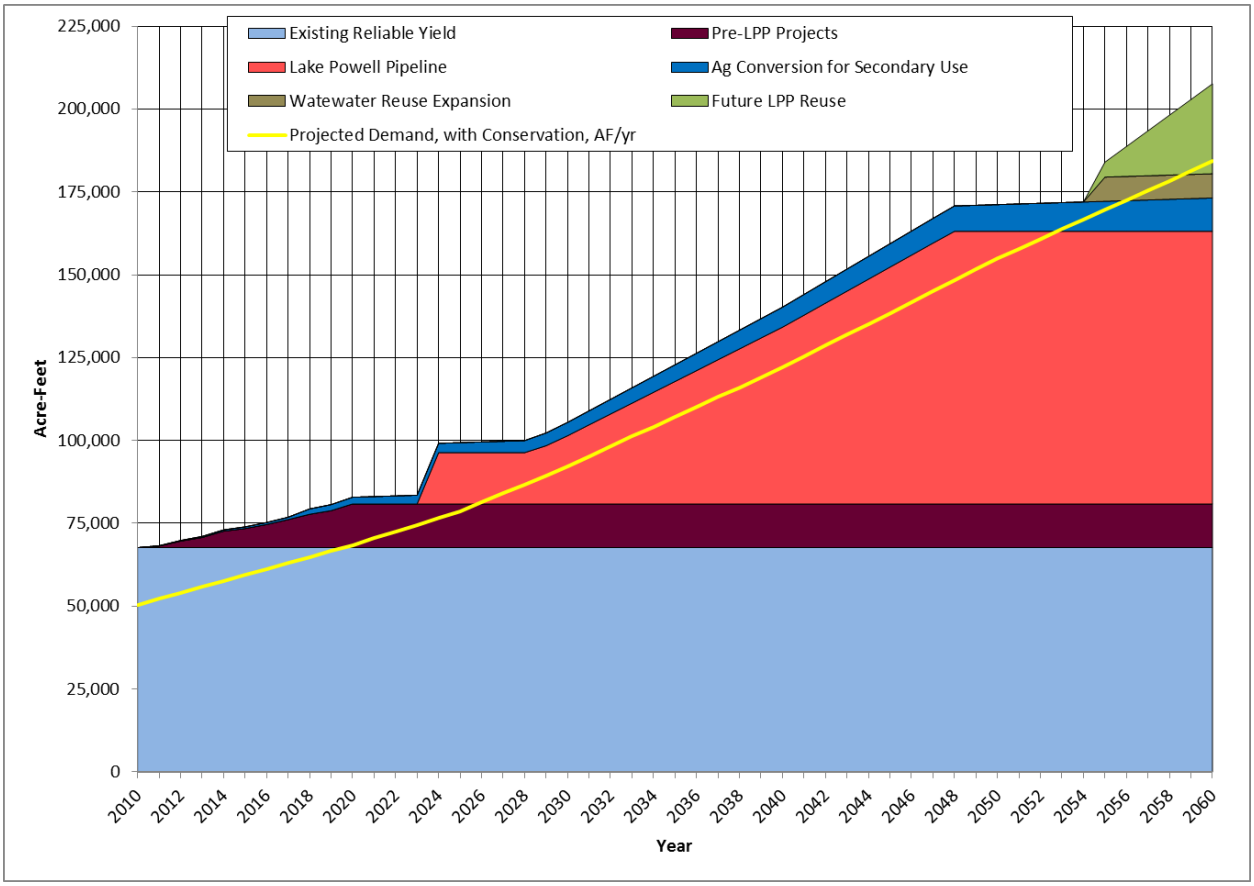
Source: WNA 2015.

This following section briefly describes water development projects being implemented or currently planned by WCWCD. **Figure 5-**1 shows the future demand and proposed water projects to meet the demand. The total yield of WCWCD culinary projects planned before bringing the LPP online is 13,670 ac-ft per year. The projects described in this figure are detailed below.



Like the Virgin River, this stream at the Red Hills Desert Garden contains many vital fish habitats.

Figure 5-1. Summary of WCWCD Water Supply and Demand Total with Conservation



More details regarding the yields of these supplies are summarized in **Table 5-4**. Specific assumptions used to develop the integrated water resources plan are presented in **Table 5-5**. The difference between the projected 2060 demand of 184,250 ac-ft per year and reliable supplies (67,676) is about 116,569 ac-ft per year. Ways to meet this projected demand are discussed below and include planned projects. The suggested order of implementation of all planned and potential projects is based on a comparison of conceptual unit cost, current status of project development, and preferences expressed by the WCWCD Board of Trustees during meetings held with presentations regarding the analyses completed for this plan.

When determining future water use, a percent of real water losses is calculated into the demand projection. This is known as Non-Revenue Water (or Unaccounted for Water). WCWCD system has an estimated 6 percent system loss, which is below the industry standard of 10 percent.

Table 5-4. Current and Future Projects Reliable Annual Yields.

Existing Project [1]	Reliable Culinary Quality Water Yield (ac-ft/yr)[2]	Reliable Secondary Quality Water Yield (ac-ft/yr)[2]
Quail Creek and Sand Hollow Reservoirs[3]	24,922	0
Sand Hollow No-Recharge Groundwater[4]	4,000	0
Cottam Well Field	875	0
Kayenta (Ence Wells) Water System[8]	730	0
Crystal Creek Pipeline	2,000	0
Toquerville Secondary Water System[5]	0	178
Ash Creek Pipeline[6]	2,840	0
Sand Hollow Recharge and Recovery[7]	3,000	0
Cottam Well Maximization	600	0
Sullivan Wells	750	0
Pintura Well	600	0
Diamond Valley Well	400	0
Westside Arsenic Treatment[9]	5,000	0
Maximize Existing Wastewater Reuse[8,10]	0	7,300
Agricultural Conversion from Development[8,11]	0	10,080
Lake Powell Pipeline	82,249	0
Potential Future LPP Reuse[8]	0	27,620
Other Suppliers	27,125	8,505
Total	155,091	53,683

Notes:

[1]Source of data: WCWCD 2014. Average yield with up to 10 percent shortage assumed to represent reliable yield for WCWCD projects.

[2]Culinary quality water was assumed to be able to meet culinary demands first, and then secondary demands with any portion of the culinary supply that is not fully utilized.

[3]Reliable yield model for Quail and Sand Hollow Reservoirs includes yields from Kolob and Meadow Hollow Reservoirs. Current supply from 50th percentile climate change scenario with 10% shortage (WNA 2015).

[4]Supply utilizes existing water rights and natural basin recharge.

[5]WNA 2015. Assumed reliable supplies are equivalent to current secondary water use.

[6] Ash Creek Pipeline yields 2,840 ac-ft/yr based on a 90% reliability level under the 50th percentile climate change scenario.

[7]Arsenic Treatment or blending and transmission upgrades must first occur.

[8]To be implemented post-Lake Powell Pipeline (Ence Well post-LPP portion equal to 480 ac-ft/yr)

[9]Includes Gunlock to Santa Clara Pipeline and Snow Canyon Wells. Moved to future reliable supply due to extent of treatment needed for culinary supply.

[10 See WNA 2015.

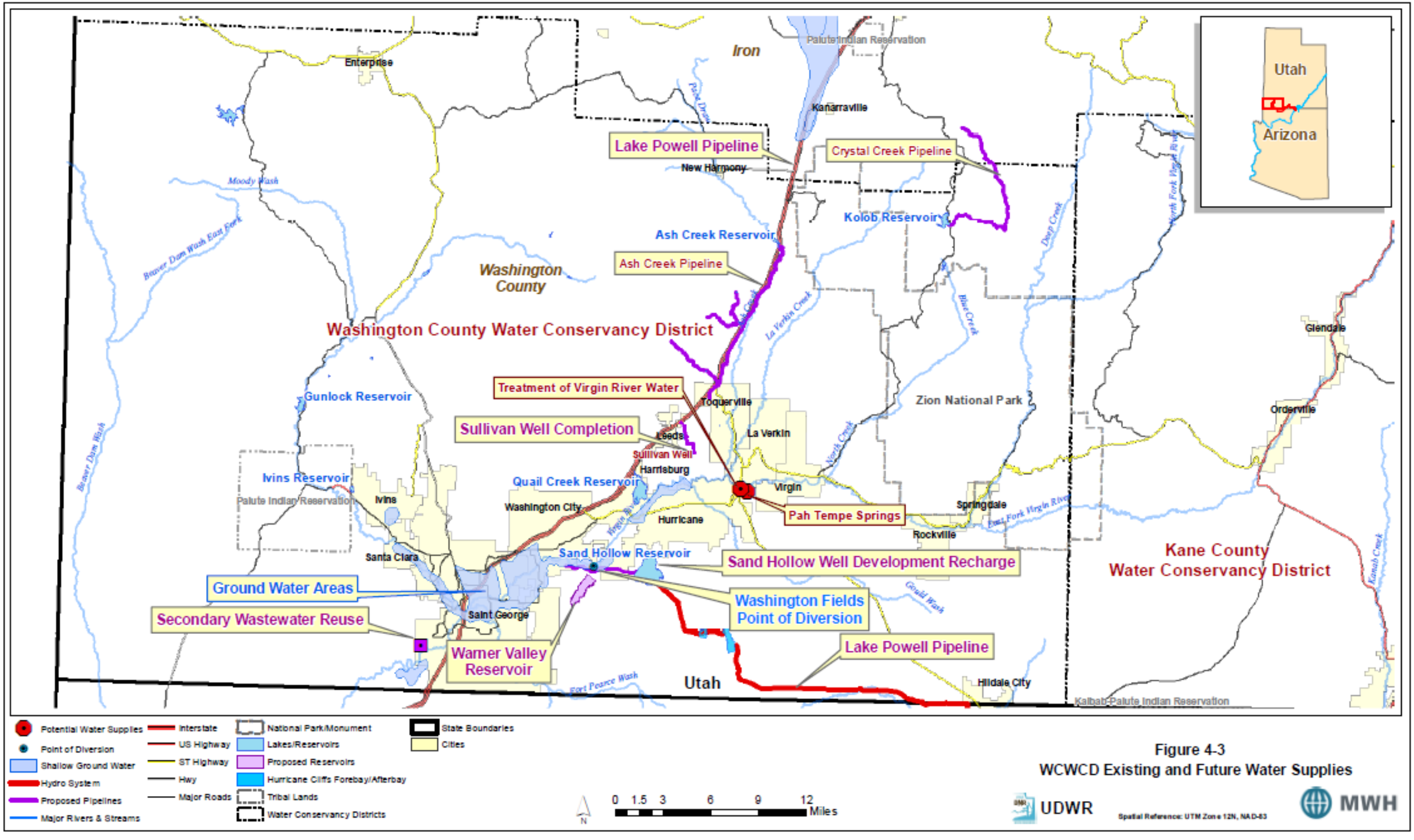
[11]The estimated supply is 12,880 ac-ft/yr with 90% reliability (WNA 2015). However, it was estimated that approximately 2,800 ac-ft/yr of this supply is currently in use and has been accounted for in the reliable secondary supply.

Table 5-5. WCWCD Integrated Water Resources Plan Data

Supply Source	Average Annual Yield in 2060 (ac-ft/yr)	Type of Supply (Culinary or Secondary)	Timing	Start Date	Comments
Existing Supplies	67,676[1]	Culinary and Secondary		-	Combined culinary and secondary supply.
Future Supplies					
Agricultural Conversions from Development	10,080[2]	Secondary	Begin when needed; phase in over time	2010	Consists of multiple projects and water rights changes. Linear annual increase to meet secondary demand; full yield requires Warner Valley Reservoir.
Ash Creek Pipeline and Well Improvements	13,670[4]	Culinary	As needed Pre-LPP, 480 ac-ft Kayenta Wells post-LPP	2010	Culinary supply indirectly by supplying secondary supply grade water to offset current culinary use.
Lake Powell Pipeline	82,249	Culinary	When needed	2024	Can be used to meet culinary and/or secondary supply as needed. 82,249 ac-ft/yr used in 2060.
Maximize Existing Wastewater Reuse Capacity of 10 mgd	7,300[3]	Secondary	When needed	2055	Treatment capacity and distribution system can be phased as needed to meet secondary demand; requires Warner Valley Reservoir.
Warner Valley Reservoir	-	Secondary	Need for secondary sources	2026	Storage needed for reuse and Virgin River water.
Future LPP Reuse	27,120[4]	Secondary	When needed	2055	Phased in as needed to meet secondary demand; requires Warner Valley Reservoir.

Notes:
[1]Includes WCWCD reliable water supply based on WCWCD 2014 which includes WCWCD existing projects and water uses.
[2]The estimated supply is 12,880 ac-ft/yr with 90% reliability (WNA 2015). However, it was estimated that approximately 2,800 ac-ft/yr of this supply is currently in use and has been accounted for in the reliable secondary supply. It was assumed that agricultural conversions from development would be developed moderately until Warner Valley Reservoir is available for storage.
[3] See WNA 2015.
[4] WCWCD 2014

Figure 5-2. Map of Existing and Future Water Projects



Culinary Water System Expansion

The Ash Creek Project is the first culinary water supply source because it makes culinary-grade quality water available that currently is used to meet secondary demands. Other future culinary supplies include well field expansions and upgrades.

Ash Creek Pipeline/Toquer Reservoir

The Ash Creek Project will be completed in the near term. A collection system is being planned and constructed to replace the current open ditches on Leap Creek (partially complete), Wet Sandy Creek (complete) and South Ash Creek (planned). Water will be carried from the existing points of diversion and the Ash Creek Reservoir to the proposed 3,640 ac-ft Toquer Reservoir near Anderson Junction. Water stored in the reservoir will be delivered through a pipeline to the Toquerville Secondary Water System, offsetting demand on the high quality Toquerville Spring water, thus maximizing its availability for culinary use. Water from the Ash Creek Pipeline also could be integrated into the Quail Creek Pipeline. Water developed by the Ash Creek Project would be a new water resource because the source water currently infiltrates into the ground to unknown locations. It has been assumed the Ash Creek Pipeline will be sized to meet full demands during the summer irrigation period, but yield will be limited by secondary demand levels. The simulated yield of the pipeline would be 2,840 ac-ft per year with 90 percent reliability according to the Virgin River Daily Simulation Model from 50th percentile climate change scenario results (WNA 2015). The supply is categorized as culinary supply due to offset of demand for culinary quality water. (See Figure 5-1.WCWCD Summary of Existing and Future Water Supply and Demand with Conservation.)

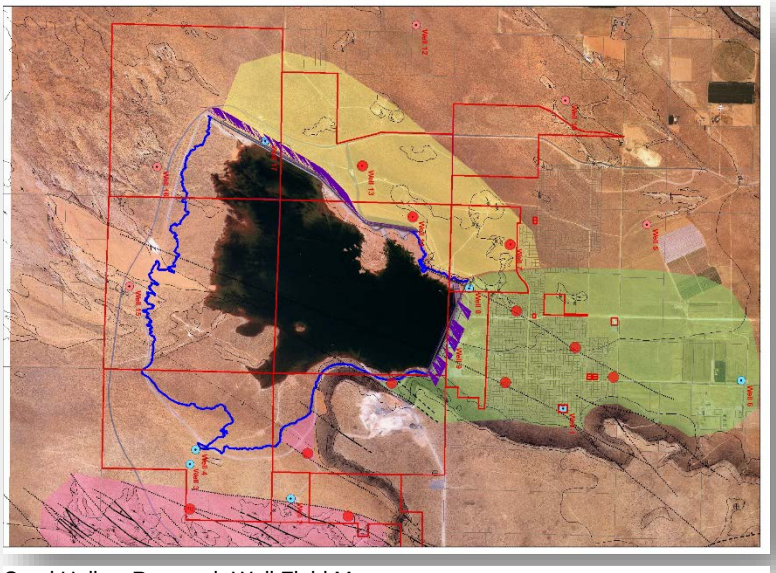


Toquer Reservoir site.

DRAFT

Well Field Expansions

Sand Hollow Recharge/Recovery. Additional local groundwater will be developed at the Sand Hollow well field to achieve the maximum allowable yield capacity, although the major portion of the recharged groundwater will be reserved as a drought buffer. The Sand Hollow recharge and recovery source will need arsenic treatment or blending and transmission upgrades for use as a culinary supply.



Sand Hollow Reservoir Well Field Map

Cottam Wells. The system will be optimized with additional wells for maximum yield over time.

Sullivan Well Field. The Sullivan Well field will be developed to tie into the Cottam well system or deliver to developments in the Leeds area in the future.

Ash Creek Recharge/Recovery and Toquer Wells. The first Toquer Well was drilled in September 2015. Other wells will be developed in the area to take advantage of existing water rights and aquifer recharge provided by the Ash Creek Project.

Pintura Wells, Diamond Valley Wells and Kayenta (Ence) Wells. The WCWCD is planning groundwater development in the Pintura area, along the Ash Creek Corridor and in Diamond Valley area, to be completed before construction of the Lake Powell Pipeline. Additional yield from the Kayenta (Ence) Well system is anticipated to be developed after the Lake Powell Pipeline.

Additional Conveyance Infrastructure

WCWCD anticipates completion of additional water supply pipelines that will not generate new yield, but will increase the flexibility of the water supply portfolio. For example, the Sand Hollow Regional Pipeline will distribute water taken out of the Sand Hollow well field. This

pipeline is part of a regional water supply project that will tie into existing water lines to provide water to the cities of St. George and Washington and will provide a redundant water supply to existing city facilities.

Warner Valley Reservoir

Warner Valley Reservoir will store water to serve secondary systems. A capacity of 45,000 ac-ft has been assumed based on preliminary planning work. The reservoir will store water diverted from the Virgin River at the Washington Fields Diversion, water from the St. George reuse plant and available water from the Gunlock to Santa Clara Pipeline. The reservoir will firm the yields from Virgin River diversions that may otherwise be lost downstream, facilitate use of reclaimed water and allow for blending of high TDS water with better quality water. The storage provided by Warner Valley Reservoir would be especially important in light of the anticipated reduced yields from the Virgin River caused by projected climate change (WNA 2015). Environmental review for the Warner Valley Reservoir has not yet formally commenced, so the project may be constructed prior to or after completion of the LPP.

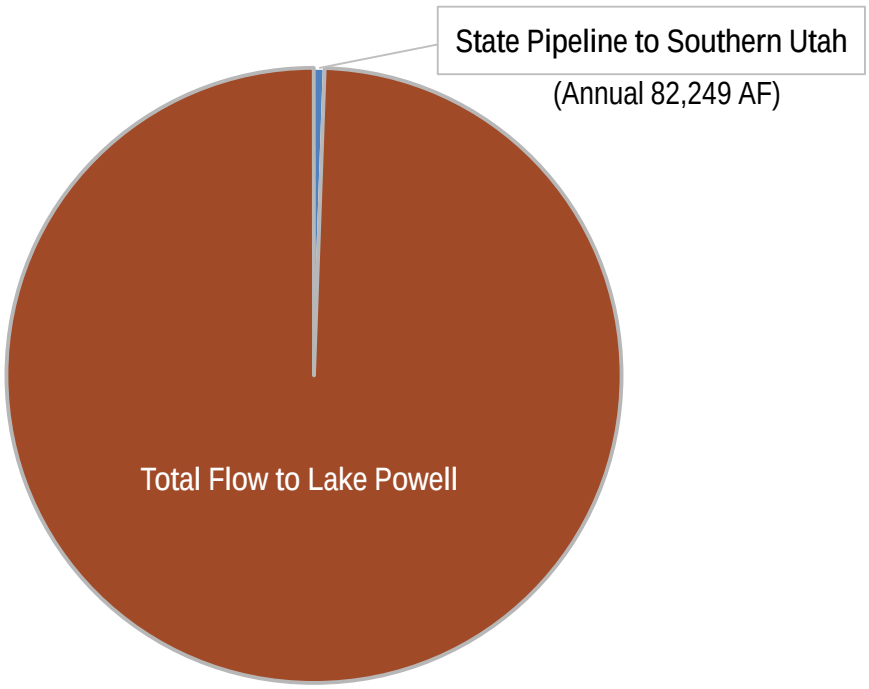


Red Hills Desert Garden Scenery

Lake Powell Pipeline (LPP)

Equally mindful of the need to diversify and enhance the state's water supplies, the 2006 Legislature approved the Lake Powell Pipeline Development Act. This significant legislation authorized the Utah Division of Water Resources to build a 140-mile pipeline from Lake Powell to deliver 5.8 percent of Utah's unused water share of the Colorado River, in accordance with the Colorado River Compact of 1922, to the southern portion of the state at Sand Hollow Reservoir. The legislation provides a second water resource for Washington County residents allowing for diversity, reliability, and an urgently needed supply of drinking water. Figure 5-3 illustrates the minimal impact of the pipeline on the Colorado River.

Figure 5-3. Lake Powell Pipeline's Impact on the Colorado River



WCWCD has requested the delivery of 82,249 ac-ft of water per year from the LPP project. Approximately 13,200 acre-feet of the LPP water would be diverted from the pipeline in Apple Valley and treated for future M&I use in the Apple Valley area. Approximately 69,000 acre-feet of the LPP water would flow into Sand Hollow Reservoir at full demand and use. The LPP water from Sand Hollow Reservoir would be treated and distributed to the District's municipal customers. Water from LPP is fully consumable so wastewater generated from LPP water use would be treated and stored for reuse in secondary supply systems.

CHAPTER 6
WATER CONSERVATION: RECOMMENDATIONS AND GOALS

Future Goals and Water Conservation Programs

Today and in the coming years, water conservation will continue to play an increasingly critical role in water resource planning and management. As Washington County's population and visitor volumes continue to increase and the moderate to severe drought remains constant, water demand challenges require immediate attention to sustain domestic, industrial, recreational and agricultural needs. Our goal and a strong commitment to increase efficient water use and reduce water waste has a direct impact on our ability to lower demand, maximize our limited water resources and protect our quality of life.

Projected future water conservation savings were determined through a detailed water conservation study, originally conducted for WCWCD by Maddaus Water Management in 2010 (MWM 2010b) and updated in 2015 (MWM 2015a). This analysis reviewed water use data (billing data), evaluated existing water conservation measures, considered potential future water conservation measures and selected a program considered likely to be implemented in the future. The analysis relied on a model developed by MWM that analyzes water use at the end-use level (e.g., individual appliances and fixtures) and considers factors such as individual unit water savings, year of implementation, unit costs, and market penetration. Meetings with local water user representatives were held to select preferred conservation measures.

Table 6-1. Future Reduction Goals for GPCD

Year	Percentage of Water Saved
2010	26%
2025	33%
2060	35%

WNA 2015.
Percent reduction in total per capita water use from 2000.

WCWCD is committed to water conservation, and according to state estimates has already achieved 26% reduction in total per capita usage in 2010 from 2000 baseline levels. Total daily per capita usage is comprised of residential, commercial, institutional, and industrial, including both indoor and outdoor usage. WCWCD is committed to achieving an additional 9% reduction in total per capita usage by 2060, for a total of 35% reduction. This chapter demonstrates how this goal is attainable and which reductions can be achieved with plumbing codes, the current conservation program, and implementation of more aggressive conservation measures.

Upon inspection of the overall list, the WCWCD Conservation Work Group (CWG) selected 28 conservation measures for evaluation in the DSS Model. Using these 28 measures, CWG, WCWCD staff and consultants selected the following conservation programs portfolio.

- Current Programs: Similar to existing conservation program which includes18 conservation measures
- 2015 Water Conservation Plan Update: Optimized to increase water savings and be cost-effective with 23 conservation measures (includes all current measures plus five new additional measures)

Details of the study and each of the conservation measures are included in MWM 2015. **Table 6-2** lists all program considered for evaluation.

Table 6-2. Conservation Measures Analyzed

General Measures	Residential Measures (Indoor)	Commercial Measures (Indoor)	Irrigation Measures (Outdoor)
Real Water Loss Reduction*	Distribute Retrofit Kits*	CII Surveys*	Irrigation Water Surveys (Water Checks)*
Conservation Pricing*	Single Family (SF) Water Surveys*	CII Rebates to Replace Inefficient Equipment*	Xeriscape Demonstration Gardens*
Public Information Program*	Toilet Leak Detection*	Replace Spray Nozzles*	Train Landscape Maintenance Workers*
Water Budgeting/Monitoring*	Multifamily Washer Rebate*	High Efficiency Urinal Rebate (<.5 gallon)*	Financial Incentives for Irrigation Upgrades*
Billing Report Educational Tool*	Require Efficient Toilets and Urinals	School Building Retrofit*	Smart Irrigation Controller Rebates*
Mobile Home Park Submetering	Washer Rebates for High Efficiency Machines (SF)	Install High Efficiency Fixtures in Government Buildings*	Rotating Sprinkler Nozzle Rebates*
Efficient Outdoor Use Education and Training Program*	High Efficiency Toilet (HET) Rebates*	High Efficiency Toilet (HET) Rebates*	Turf Removal
		Install or Rebate High Efficiency Faucets	
		Require Efficient Toilets and Urinals	

*Represents measures currently being offered and newly added.

Table 6-3 lists the measures currently offered and measure adopted for this conservation plan update.

Table 6-3. 2015 WCWCD Conservation Programs

Measure Name	Category	Current	2015
CII Rebates to Replace Inefficient Equipment	Commercial Measures (Indoor)	X	X
Conservation Pricing	General Measures	X	X
Distribute Retrofit Kits	Residential Measures (Indoor)	X	X
Efficient Outdoor Use Education and Training Program	General Measures	X	X
Financial Incentives for Irrigation Upgrades	Irrigation Measures (Outdoor)	X	X
High Efficiency Toilet (HET) Rebates	Residential Measures (Indoor), Commercial Measures (Indoor)	X	X
High Efficiency Urinal Rebate (<.5 gallon)	Commercial Measures (Indoor)	X	X
Irrigation Water Surveys (Water Checks)	Irrigation Measures (Outdoor)	X	X
Multifamily Washer Rebate	Residential Measures (Indoor)	X	X
Public Information Program	General Measures	X	X
Real Water Loss Reduction	General Measures	X	X
Replace Spray Nozzles	Commercial Measures (Indoor)	X	X
Rotating Sprinkler Nozzle Rebates	Irrigation Measures (Outdoor)	X	X
Single Family (SF) Water Surveys	Residential Measures (Indoor)	X	X
Smart Irrigation Controller Rebates	Irrigation Measures (Outdoor)	X	X
Toilet Leak Detection	Residential Measures (Indoor)	X	X
Train Landscape Maintenance Workers	Irrigation Measures (Outdoor)	X	X
Xeriscape Demonstration Gardens	Irrigation Measures (Outdoor)	X	X
Billing Report Educational Tool	General Measures		X
CII Surveys	Commercial Measures (Indoor)		X
Install High Efficiency Fixtures in Government Buildings	Commercial Measures (Indoor)		X
School Building Retrofit	Commercial Measures (Indoor)		X
Water Budgeting/Monitoring	General Measures		X

Five New Programs

The analysis presented adopting five new programs, the goals of 25 percent by 2025 and 35 percent by 2060 would be achieved. Information about these programs and how they could be offered are listed below.

Billing Report Educational Tool. This would target all customer classification. This education tool utilizes billing software to educate customer on water consumption and customized suggestions to save water. This could be managed by a comparison with each neighborhood and offer customer online access to their water use.

CII Surveys. This program will target commercial accounts with high water use. The program involves offering a free water survey to the customer to evaluate ways for the business to save water and money. It is assumed to reach the top five percent of high water using accounts by end of program.

Install High Efficiency Fixtures in Government Buildings. The target accounts for this program is commercial customers. The program provides rebates or grants to install high efficiency faucets, toilets, urinals, and showerheads in local and state government facilities.

School Building Retrofit. Institutional accounts would be targeted to run a program patterned after Eastern Municipal Water District (EMWD) Public School Retrofit Program. In this program the school receives a grant to replace fixtures and upgrade irrigation systems. More information about EMWD's program can be found in MWM's memo.

Water Budgeting/ Monitoring. This targets large landscape water users. The program provides a website giving feedback on irrigation water use (budget vs. actual) modeled after Municipal Water District of Orange County's Landscape Certification Program.

Conservation Savings

Using the programs listed above, **Table 6-3** summarizes the projected GPCD reductions and percent conservation anticipated with the selected measures. Results show that by 2060 WCWCD could reduce its 2010 GPCD levels by 11 percent by continuing to implement their current conservation Program A. By pursuing the more aggressive conservation Program B, 2010 GPCD levels would be reduced 12 percent by 2060. The estimated water savings include those anticipated from enforcement of current plumbing codes that require use of low-flow plumbing fixtures in new homes and remodels. The conservation savings shown in **Table 6-3** were factored into the demand projections used to compare future supply and demand in Chapter 5.

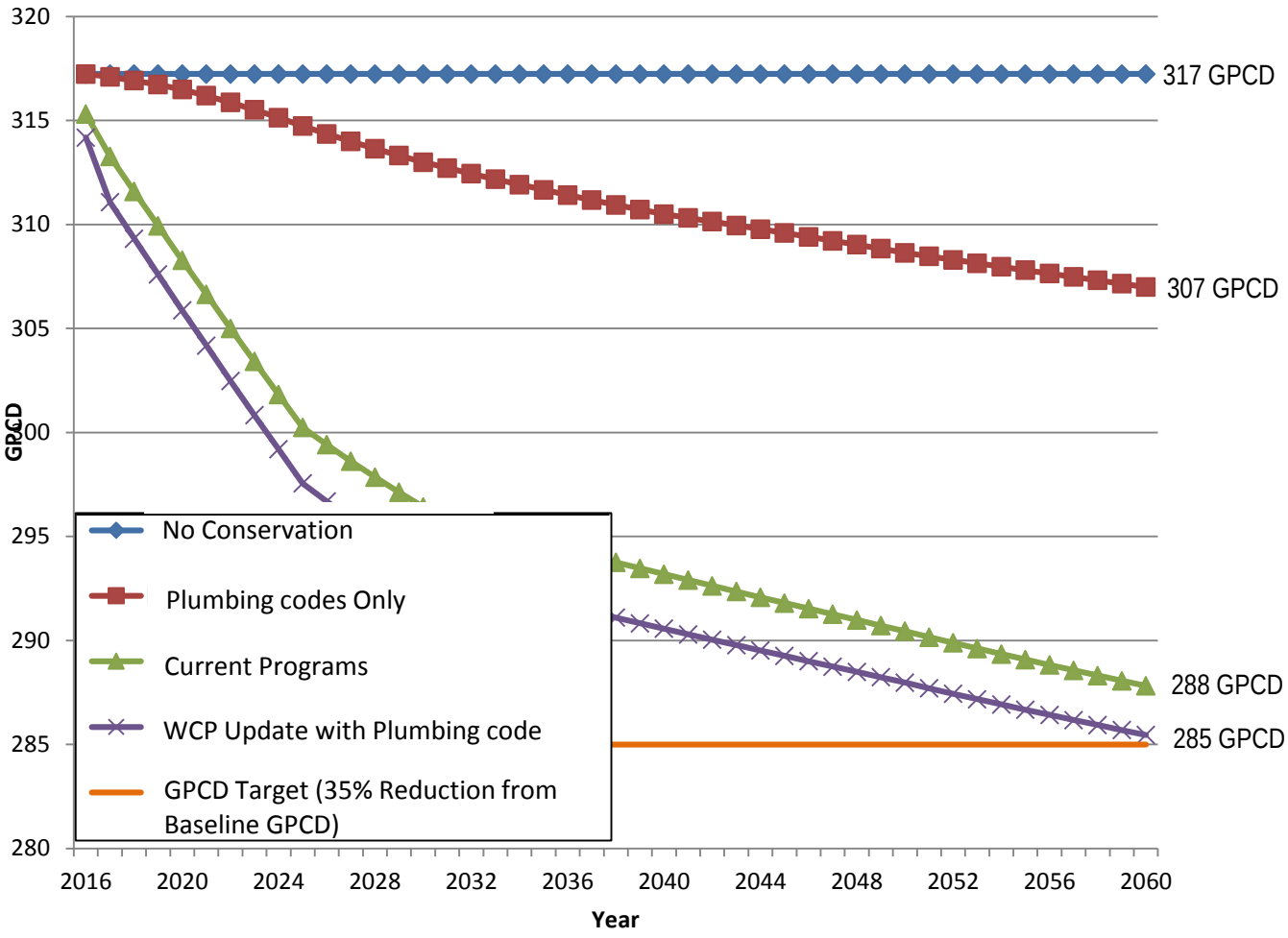
Table 6-3. Conservation Program Projected GPCD
Reduction Percentage to Year 2060

Year	Current Programs with Plumbing Code (GPCD)	2015 Programs with Plumbing Code (GPCD)	Current Programs with Plumbing Code (% Reduction)	2015 Programs with Plumbing Code (% Reduction)
2010	325	325	0%	0%
2020	308	306	-5%	-6%
2025	300	298	-8%	-8%
2030	296	294	-9%	-10%
2040	293	291	-10%	-10%
2050	290	288	-11%	-11%
2060	288	285	-11%	-12%

As previously shown in **Tables 6-1** and **6-3**, total per capita water use decreased 26 percent in WCWCD's service area between 2000 and 2010 (WNA 2015). The overall culinary water conservation savings for WCWCD from 2000 to 2010 was determined by DWRe to be 15 percent utilizing actual data for the 6-cities between 2000 and 2010 (WNA 2015). Reduction in regional per capita water use can result from conservation actions, changes in housing density, housing types, landscaping, lot sizes, climate, water pricing, drought policies, regional economic conditions (e.g., recessions), percentage of non-permanent residents, hotel occupancy, and CII uses. ET_o data were analyzed to help determine the effects weather may have had on water use in a particular

year. High ET_o in hot and dry years could result in increased water demands for outdoor irrigation. The opposite is true for wet and cool years when water use can decline.

Figure 6-1. Gallons Per Capita Daily Use Reduction By Scenario



Cost of Conservation

The evaluation analyzed the programs with a cost ratio benefit. **Table 6-4** illustrates the benefits of water savings and cost of implementing these programs.

Table 6-4 Conservation Program Cost Benefit Comparison

Conservation Program	Present Value of Water Savings	Present Value of Community Costs	Utility Cost of Water Saved ($/MG)*	Community Cost of Water Saved ($/MG)*	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio
Current Programs with Plumbing Code	$133,889,976	$38,589,697	$270/MG	$393/MG	5.1	3.7
2015 Programs with Plumbing Code	$155,723,518	$44,881,264	$283/MG	$397/MG	4.9	4.0

* Cost of water saved per unit volume = present value of costs (utility or community) divided by program water savings. Costs and savings are for the analysis period (years 2016-2060).

CHAPTER 7
CONCLUSION

Current Fiscal Operating Schedule

Funding will be a major consideration in implementing the conservation portion of the plan. The WCWCD is a local governmental entity with a property tax base and revenues from property taxes, hydroelectric power and water sales. This provides adequate monies for the cost of many programs. However, other sources must be found to assist in the funding of some of these conservation programs to expand the ability to fully fulfil the need and increase effectiveness. The following agencies should be considered in partnering in these programs:

- Utah State Division of Water Resources Conservation and Development Fund
- Permanent Community Impact Fund Board
- Special Improvement Districts
- Possible grants from the Bureau of Reclamation and other federal and state agencies
- Local Cities and Towns
- Private donors

Monitoring

Monitoring of progress will be necessary to determine the actual amount of water saved, its allocation and use to help identify the amount of reimbursement of up-front costs and to make adjustments to the plan where appropriate. This could be achieved through several actions:

Board Agenda. The District's Board of Directors should make the implementation of this plan an ongoing agenda item.

Public Information Program. The District should conduct an ongoing public information program regarding water management and conservation.

Semi-annual Report. A Semi-annual report of activities and progress toward recommended goals should be published by the District for public and agency review.

Committee. A committee comprised of a representative from each of the cities of the RWSA's to meet annually to review progress, adjust and set intermediate milestones to reach the identified goals of the adopted plan and provide a summary for the annual report.

WCWCD Board of Trustees Adoption of 2015 WCWCD Conservation Plan Update

WASHINGTON COUNTY
WATER CONSERVANCY DISTRICT

Resolution of the Board of Trustees

.

Whereas pursuant to Section 73-10-32, Utah Code Ann. (1953) (The Act"), Washington County Water Conservancy District prepared a Water Conservation Plan in 1996, prepared updates to the Plan in 2005, 2010 and has now prepared an additional update to its Plan as provided in attached Exhibit 1 (the "Updated Plan"); and,

Whereas Washington County Water Conservancy District has established in its Updated Plan a water conservation goal to reduce water use within its service area by twenty-five percent or more by 2025; and,

Whereas, Washington County Water Conservancy District has determined that achieving this goal will help sustain existing and future water supplies, providing an adequate water supply for future generations; and,

Whereas, the Updated Plan identifies existing and proposed water conservation measures and programs needed to continue making progress toward achieving our goal; and,

Whereas, pursuant to The Act, Washington County Water Conservancy District has held a public hearing, after reasonable and advance notice, for purposes of inviting and encouraging discussion and public comment on the Updated Plan;

NOW, THEREFORE, BE IT RESOLVED by the Board of Trustees of the Washington County Water Conservancy District:

1. Washington County Water Conservancy District has met the requirements of The Act in its preparation of the Updated Plan.
2. The General Manager is authorized and directed to cause a copy of the Updated Plan to be filed with the Utah Division of Water Resources and with all other persons or entities deemed appropriate.
3. This Resolution shall take effect immediately upon execution by an authorized member of the Board of Trustees.

PASSED, ADOPTED AND APPROVED this _____ day of _____, 2015.

_____
Ed Bowler, Chair of the Board of Trustees

ATTEST:

Secretary/Treasurer

Glossary

Acre-foot – a volumetric unit of water used in water supply planning, which is equivalent to water spread over an acre of area with a depth of 1 foot (325,851 gallons)

Annual Growth Rate – the yearly compounding increase in a value, used in this report to represent the yearly rate of growth for population projections

Aquifer – a groundwater-bearing geologic formation

Buy and Dry – the conversion of agricultural water rights for other uses, typically through purchase by municipal and industrial water providers, with a resulting dry-up of irrigated land

Conservation – reduction in per capita water use typically achieved through water savings measures such as water reuse, efficient lawn watering practices, and low flow water fixtures

Culinary Water – water supply that meets drinking water quality standards and can be used to meet all water demands (synonymous with potable water)

Decision Support System (DSS) – is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge to identify and solve problems and make decisions.

Diversion – a diversion changes the natural flow of water to another location by using dams, canals, or pipelines.

Groundwater – water contained in an aquifer, and sometimes extracted for water supply (typically extracted through a groundwater well)

Integrated Water Resources Plan – a balance of forecasted water demands and existing and future water supply projects, typically prepared for planning the timing and volume of future potential water supplies

Maximum Annual Supply – the yearly volume of water that could be delivered at the maximum daily flow rate of a given water supply

Maximum Contaminant Level (MCL) – the greatest level of a particular contaminant within a water source that is considered to be a threshold for making the water source available for beneficial use (e.g., a drinking water MCL for total dissolved solids)

Non-Potable Water – water supply that does not meet drinking water standards, which can be used to meet demands that do not require drinking water quality (e.g., irrigation and lawn watering) (synonymous with secondary water)

Per Capita Water Use – the average rate of water consumption per person, typically calculated in gallons per person per day

Permanent Population – the number of residents living in an area that occupy their residences year-round (i.e., not including tourists or part-time residents)

Potable Water – water supply that meets drinking water standards, which can be used to meet all water demands (synonymous with culinary water)

Prior Appropriation Doctrine – a water administration system typically used in the western United States, which prioritizes water rights by the date that the rights were first administered (i.e., through seniority of the rights)

Reliable Annual Supply – the annual volume of water that is readily available to meet peak demands (in this report, reliable supply is based on the Utah Division of Water Resources definition – the portion of the maximum potable water supply that can be used to meet annual water demands)

Second homes – owners reside in these homes part time usually during the winter months. These residents are not counted in Washington County‘s population records but their water use is added to the water use numbers ascribed to permanent residents.

Secondary Water – water supply that does not meet drinking water standards, which can be used to meet demands that do not require drinking water quality (e.g., irrigation and lawn watering) (synonymous with non-potable water)

Surface water – water in rivers, streams, creeks, and lakes is referred to as surface water. The Virgin River provides Washington County with surface water.

Sustainable Yield – the volume of groundwater that can be withdrawn from an aquifer on an average annual basis without depleting the long-term storage of the aquifer, which is generally equal to the amount of recharge to the aquifer

Water Reuse – the use of treated wastewater for a beneficial use, such as lawn and golf course irrigation or industrial water; potable water reuse refers to the use of treated wastewater to meet culinary demand

Yield – the amount of water can be delivered from a particular supply, typically given in terms of annual supply

Abbreviations and Acronyms

BOD	Biochemical oxygen demand
CFP	Capital Facilities Plan
CII	Commercial/Industrial/Institutional
DATC	Dixie Applied Technology Courses
DSS	Decision Support System
DWRe	Utah Division of Water Resources
DWRi	Utah Division of Water Rights
ET	Evapotranspiration
GOPB	Utah Governor's Office of Planning and Budget
GPCD	Gallons per capita per day
KCWCD	Kane County Water Conservancy District
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
MCL	Maximum contaminant level
MG	Million gallons
mgd	Million gallons per day
mg/l	Milligrams per liter
MWM	Maddaus Water Management
NEPA	National Environmental Policy Act
RWSA	Regional Water Supply Agreement
SITLA	Utah State Institutional Trust Lands Administration
SWAT	Smart Water Applied Technology
TDS	Total dissolved solids
TMDL	Total Maximum Daily Load
TSS	Total suspended solids

USGS	United States Geological Survey
WCWCD	Washington County Water Conservancy District
WCWMCP	Washington County Water Management and Conservation Plan
WECCO	Western Electrochemical Company

APPENDIX

Utah State Water Conservation Plan Ordinance Section 73-10-32

CWG Goals and Recommendations

Conservation Programs Detailed Through 2015

Conservation Programs Outlined through 2025 – Estimated Savings

Notice of Public Hearing Regarding 2015 Conservation Plan Update

Minutes of Public Hearing

Notice of Regular Meeting of WCWCD Board of Trustees Regarding Adoption of 2015 Conservation Plan Update

Written Comments Concerning 2015 WCWCD Water Conservation Plan Update

Lake Powell Pipeline Development Act

Glossary

Abbreviations/Acronyms