City of Fort Collins

2015 Water Efficiency Plan

City of Fort Collins

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ACRONYM LIST

AF	Acre Foot (equals 325,851 gallons)
AMFC	Advanced Meter Fort Collins
BFO	Budgeting for Outcomes
BMP	Best management practice(s)
C-BT	Colorado-Big Thompson
CAP	Climate Action Plan
CWCB	Colorado Water Conservation Board
ELCO	East Larimer County Water District
FCLWD	Fort Collins - Loveland Water District
GMA	Growth management area
GPCD	gallons per capita per day
LCU	Large commercial users
MG	Million gallons
MGD	Million gallons per day
NCWCD	Northern Colorado Water Conservancy District or “Northern Water”
NEPA	National Environmental Policy Act
NPIC	North Poudre Irrigation Company
PRPA	Platte River Power Authority
RWR	Raw water requirement; requirement to provide water for any new development that occurs within the Utilities water service area
SWSI	Colorado Water Conservation Board’s Statewide Water Supply Initiative
TAZ	Traffic analysis zone
WEP TAG	Water efficiency plan technical advisory group
WSDMP	Water Supply and Demand Management Policy, 2012
WSSC	Water Supply and Storage Company
WTF	Water Treatment facility
WFCWD	West Fort Collins Water District
WQA	Winter quarterly average (Dec, Jan and Feb use)

EXECUTIVE SUMMARY

The City of Fort Collins Utilities has a strong commitment to ensure the efficient use of its natural resources. The Utilities' Water Conservation Program is nearly 40 years in the making and has resulted in lower per capita water use, even as population has grown significantly. These programs have benefited the Utilities by delaying or avoiding significant capital costs and have benefited customers through reduced water bills. The additional benefits to the City and the community include development of a conservation ethic, demonstration of a commitment to sustainability, support of economic health, enhanced resilience during drought periods, preparation for potential effects of climate change, and provision of water for other beneficial purposes such as agriculture, ecosystem services, recreation, and aesthetics.

This Water Efficiency Plan (WEP) is an update to the Water Conservation Plan approved by the Colorado Water Conservation Board in 2010. "Water efficiency is doing more with less – not doing without" – the term "efficiency" has replaced "conservation" because efficiency includes conservation and is a more appropriate term for the range of tactics needed in Colorado.[1] The 2010 Plan set a goal of 140 gallon per capita per day (GPCD) by the year 2020. This updated Plan proposes a new goal of 130 GPCD by 2030. The GPCD in 2014, normalized to account for weather, was 143 (without weather-normalization, GPCD was 139); for reference, the normalized GPCD in 2001 was 198.

Efficiency and Conservation activities

Fort Collins Utilities has a robust water conservation program with activities that touch on many different uses and affect the entire community. The Water Conservation team will continue to build on existing programs and develop new approaches to conservation. Programs will be evaluated for effectiveness in water efficiency, customer service, and technical excellence. The overall mission is to cultivate a water efficient, adaptive, and knowledgeable customer base through education and cost-effective water efficiency programs while supporting the City's Strategic Plan and its social, environmental, and economic health.

The Water Conservation team has identified five key areas of opportunity for greater water efficiency:

- Leverage Advanced Meter Fort Collins data and capabilities
- Promote and support greater outdoor water efficiency
- Encourage greater integration of water efficiency into land use planning and building codes
- Expand commercial and industrial strategies
- Increase community water literacy

Actions will be guided by the following implementation principles:

- Employ sophisticated data-driven processes and decision-making
- Coordinate and support symbiotic efforts within Utilities and across the City
- Cultivate new and bolster existing community and statewide partnerships

[1] http://cwcb.state.co.us/water-management/waterEfficiency/Pages/main.aspx

Plan Development Process

The content and organization of this plan was developed using the Colorado Water Conservation Board's municipal water efficiency plan guidance document, as it is a state requirement to submit an updated Plan every 7 years. This plan was developed with input from the community and a technical advisory group: Water Efficiency Plan Technical Advisory Group (WEP TAG). The WEP TAG included Utilities and City staff as well as Water Board members. A draft of this WEP was presented to City Council at the October 13, 2015 work session and received positive feedback. Following this presentation, Water Conservation staff held a public comment period and performed additional outreach activities. This plan was approved and adopted by the Fort Collins City Council on March 1, 2016.

Note: this document includes several technical terms and abbreviations. An acronym list is provided after the table of contents for reference and a glossary is included at the end of the document to provide additional technical detail.

1.0 PROFILE OF EXISTING WATER SUPPLY SYSTEM

The City of Fort Collins is located 65 miles north of Denver in Larimer County, nestled between the Rocky Mountains foothills and the Eastern Plains of Colorado. Horsetooth Reservoir borders Fort Collins to the west and the Cache la Poudre River winds its way through north Fort Collins before reaching the South Platte River to the east of Greeley, CO.

The Fort Collins Utilities service area boundaries for water do not perfectly match the Fort Collins city limits.[2] Fort Collins-Loveland Water District (FCLWD) and East Larimer County Water District (ELCO) provide water to some areas within the city limits and will most likely serve additional city residents in the future.[3] Furthermore, Fort Collins Utilities provide water service to some customers beyond the city limits; this is primarily northwest of Fort Collins, including providing wholesale water to West Fort Collins Water District (WFCWD). Figure 1.1 shows the Utilities service area and the neighboring water district services areas with respect to the Fort Collins Growth Management Area (GMA) and the official city limits. Fort Collins Utilities currently serves about 75% of Fort Collins' residents and businesses.

Note that this Chapter contains an abbreviated set of information on the Water Supply System; for a more detailed account, see the City of Fort Collins' Water Supply and Demand Management (Policy) Report (dated April 2014)[4]. The updated Policy, which was approved by City Council in late 2012, serves as a guide for the Fort Collins Utilities to a sustainable and integrated approach to 1) ensuring an adequate, safe, and reliable supply of water for the beneficial use by customers and the community, and 2) managing the level of demand and the efficient use of a scarce and valuable resource consistent with the preferences of customers and in recognition of the region's semi-arid climate.

[2] Fort Collins Utilities is an enterprise and does not receive funds from the City of Fort Collins general fund. Water Conservation is entirely funded by the Water Fund.

[3] The Fort Collins Utilities service area is landlocked by neighboring water districts. There will be little new development and mostly re-development of existing properties within the service area boundaries. Most land available in Fort Collins for new development is outside of the water service area. This Plan only applies to the Utilities' water service area except where noted, such as collaboration with neighboring water districts.

[4] http://www.fcgov.com/utilities/what-we-do/water/water-supply-demand/

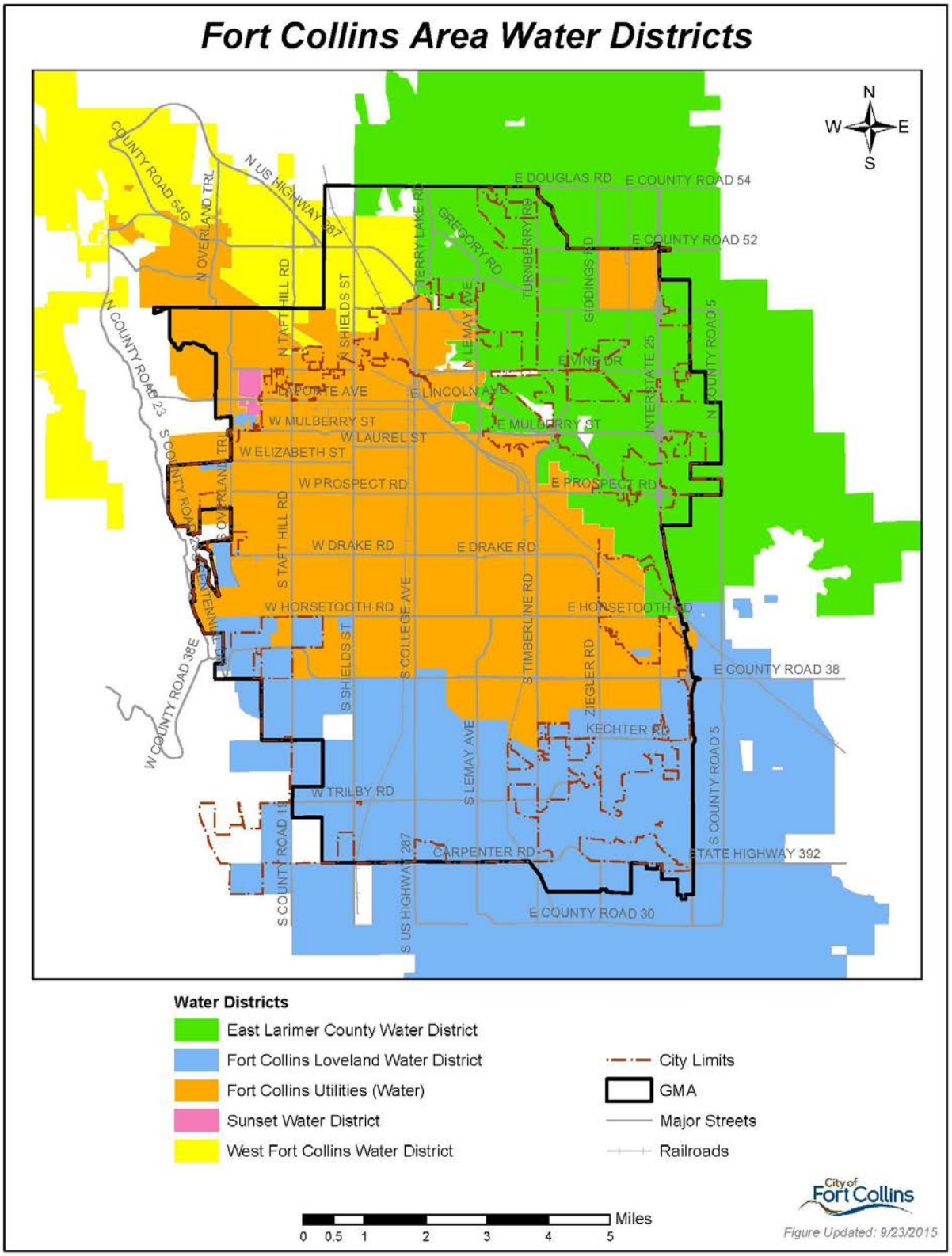


Figure 1.1: Water Service Area and surrounding Water District boundaries

1.1 OVERVIEW OF EXISTING WATER SUPPLY SYSTEM

The Fort Collins Utilities' water sources are surface supplies. The Utilities water supplies come from two major systems: the Cache la Poudre River (Poudre River) Basin and the Colorado-Big Thompson (C-BT) Project, often referred to as "Horsetooth Water".[5] The City's water supply and treatment system consists of several key facilities, which are illustrated in Figure 1.2 and include the Poudre River diversion structure and pipelines, Joe Wright Reservoir, Michigan Ditch, Horsetooth Reservoir, the Water Treatment Facility, the Mulberry Reclamation Facility, and the Drake Reclamation Facility.[6] Figure 1.2 includes Halligan Reservoir, which is currently owned by Fort Collins Utilities but operated by the North Poudre Irrigation Company (NPIC). A discussion of the Halligan Water Supply Storage Project is located in the "Storage" portion of the System Reliability section below. The City's Water system contains approximately 540 miles of pipeline and 34,298 connections. In addition to treated water, the City diverts about 3,000 to 4,000 acre-feet of raw water to irrigate City parks, golf courses, a cemetery, greenbelt areas, some school grounds, and for the purposes of meeting some contractual raw water delivery obligations. In 2014, the City of Fort Collins Utilities supplied 7.4 billion gallons of water to approximately 130,200 people.[7]

From the beginning of the City of Fort Collins Water Utility in the 1880s up to the early 1960s, the City depended primarily on direct flow rights to the Cache la Poudre River (Poudre River) to satisfy its water demands. Direct flow rights are water rights that can be taken for direct use, as opposed to storage rights that can be taken for later use. The first water right was obtained in 1889 and four other senior direct flow rights were obtained in the early 1900s; these currently allow the Utilities to divert an average of 11,300 acre-feet of raw water annually. In the late 1950s, the Utilities acquired its first 6,000 units of Colorado-Big Thompson (C-BT) Project water. To date, the Utilities owns about 18,855 units of CB-T water. In addition to these two major sources of water, the Utilities began to acquire shares of several local irrigation company stocks starting in the 1960s, in part to expand the Utilities' water supply portfolio and in part as developers turned over the water rights from lands they were building over in order to satisfy the raw water requirements for new development.[8]

[5] Horsetooth Reservoir borders the City of Fort Collins and is an East Slope terminal reservoir in the C-BT system. For more information on the Colorado-Big Thompson Project, which is operated and maintained by Northern Water and the U.S. Bureau of Reclamation, please see: http://www.northernwater.org/WaterProjects/C-BTProject.aspx

[6] The Water Treatment Facility chemically treats up to 87 MGD (million gallons per day). The Mulberry Water Reclamation Facility employs physical, biological, and chemical processes to treat up to 6 MGD. The Drake Water Reclamation Facility employs similar processes and treats up to 23 MGD of wastewater.

[7] One acre-foot of water is equivalent to 325, 851 gallons of water. 7.4 billion gallons of water is approximately equal to 22, 710 acre-feet of water.

[8] The use of "City" vs. "Utilities" may be confusing in this section. Nearly all water rights are in the name of the City of Fort Collins; however, the majority of the water rights are utilized and administered by Fort Collins Utilities. The Parks Department and the Natural Areas Department also use some of the water rights and are responsible for them. The districts (ELCO and FCLWD) serve some residents and businesses within the Fort Collins GMA, however, they each have their own water rights.

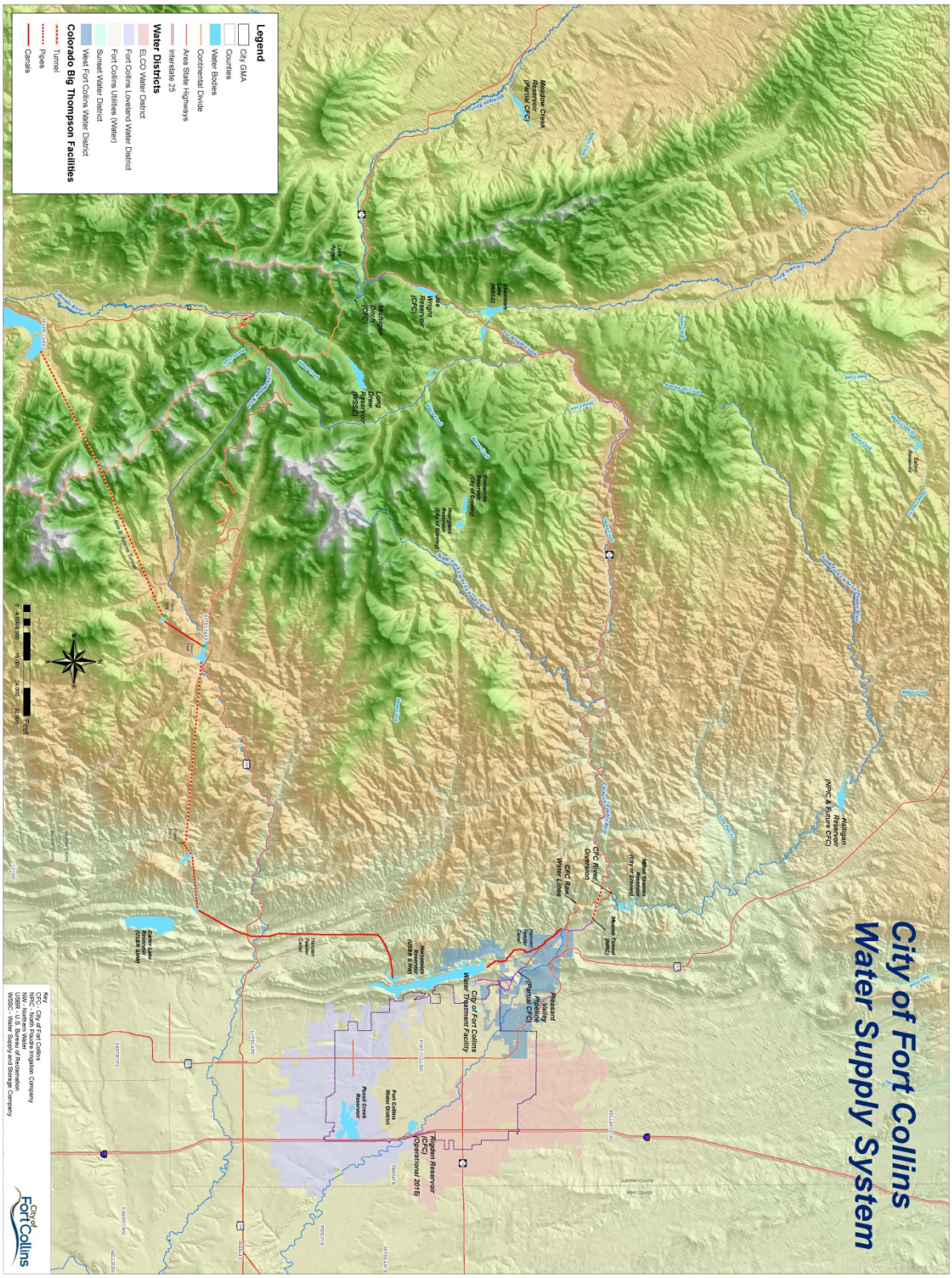


Figure 1.2 City of Fort Collins Utilities Water Supply System Map

Table 1.1 shows the average annual yield of the Utilities' various water sources. For more detailed information on each supply source, see Appendix A. The Utilities' average annual raw water yield as of 2014 is approximately 75,245 acre-feet, but the actual treatable average annual yield is closer to 55,000 acre-feet per year. The treatable water right yield is lower due to legal constraints, such as agricultural rights that have not been converted for municipal use, ditch losses, water right volumetric limitations and return flow obligations. The Utilities' modeling has shown that the current firm yield of its system is approximately 31,000 acre-feet per year.[9] During the summer months, however, much of the Utilities' water rights yield more water than the demands of the service area customers. Both the raw water yield and treatable yield are reduced in dry years, requiring more storage water to meet demands.

Table 1.1 Raw Water Yield in 2014

Source	acre-feet
Poudre River Direct Flow	11,300
Joe Wright-Michigan Ditch	5,500
Northern Water (CBT)	14,330
North Poudre Irrigation Company[10]	19,850
Pleasant Valley & Lake Canal Company	7,760
PRPA Reuse Plan	2,310
Southside Ditches[11]	10,760
Water Supply and Storage Company	2,240
Miscellaneous[12]	1,195
Average Raw Yield Total	**75,245**

Note: Yields are the approximate average annual yields and are not representative of a dry year conditions and do not reflect other constraints of the system.

[9] This assumes a 1-in-50 year drought; Firm yield is commonly determined by calculating the maximum constant annual demand (quantity of water) that can be met with the available supply during a specified multi-year hydrologic period.

[10] These sources are only partially available for municipal use.

[11] The Southside ditches refer to Arthur, Larimer No. 2, New Mercer, and Warren Lake irrigation companies.

[12] These are relatively small contributors to the overall raw yield and include shares in Chaffee Ditch, Boxelder Irrigation Ditch Company, Lake Canal Company, Louden Irrigating Canal and Reservoir Company.

Reusable Supplies:

An important part of the City's water supplies are sources that are reusable. Typically, this is water that is imported from another basin or comes from specific in-basin sources that may be totally consumed through succession of identified uses. For Fort Collins, this includes much of the Michigan Ditch and Joe Wright Reservoir water and portions of the Southside Ditches water that has been converted from agricultural use to municipal use.

A sizeable portion of the Utilities treated water supplies are reusable.[13] Much of this is used as part of a Reuse Plan which involves the City, Water Supply and Storage Company (WSSC) and Platte River Power Authority (PRPA) [14]. Reusable sources owned by the City and WSSC are used Utilities' customers and the reusable effluent is used by PRPA at their Rawhide Power Plant facility. In turn, PRPA provides Windy Gap water to the City.

Raw Water Requirements:

Developers are required to provide water for any new development that occurs within the Utilities water service area. The amount is determined by the Utilities; the developer is assessed a raw water requirement (RWR) for any new development that occurs within the service area. This practice originally began in the 1960s when two acre-feet per acre of land developed was required. Because water use varied considerably depending on the type of use for any given area, a study was done in 1983-84 to develop the existing method of assessing the RWRs, which attempts to more closely assess the requirements based on actual use.

The formula for residential development considers the density, and an estimate of indoor and outdoor use. The RWR is calculated by multiplying the water use estimate by a "water supply factor" that is used to reflect the variability in supply and demand from year to year as well as other unaccounted for water use.[15] Non-residential requirements are based on tap size. Water use is analyzed for all non-residential customers for a given tap size and the requirements are based on those results. Since there is a lot of variability within each tap size, a raw water surcharge is assessed for any annual use exceeding an annual allotment.[16]

Developers and builders may satisfy the RWR by either turning over water rights acceptable to the City or paying cash in-lieu-of the water rights. The City uses in-lieu payments to purchase additional water rights or implement other means of increasing the firm yield of the Utilities' water supply, such as developing storage capacity. The in-lieu fee is evaluated and, if needed, revised to reflect the costs associated with developing the required water supplies (e.g., market price of water rights).

[13] This refers to the total amount of water used, not to the total amount of water feasibly available in a given year.
[14] 2012 Water Supply and Demand Management Policy (2014 Report).
[15] The current water supply factor is 1.92. This equation is used to determine the residential RWR is as follows: RWR = 1.92 x [(.18 x Number of Dwelling Units) + (1.2 x Net Acres)]
[16] Requirements vary from .90 acre-feet for a 3/4 inch meter to 9.60 acre-feet for a 2-inch meter. For larger meters, the RWR is based on an estimate of water use.

1.2 WATER SUPPLY RELIABILITY

Fort Collins Utilities is responsible for providing an adequate and reliable supply of water to its customers. The planning criteria describe the water demand that can be reliably served under specified drought conditions and the margin of safety the Utilities should have in place to address unforeseen circumstances.[17] The three main planning criteria used to develop the City's water supply system are 1) the drought criterion, 2) the storage reserve factor and, 3) the planning demand level. These criteria determine the amount of water supplies and facilities the Utilities' needs (e.g., the amount of storage required) and should be conservative to account for inherent uncertainties in water supply planning.

Drought Criterion

The drought criterion states that in a 1-in-50 year drought the Utilities should be able to meet the planning demand level. This is an important criterion because not only will demands often be higher in drought periods due to less precipitation, water supply systems generally will also yield less water. The Utilities has used a 1-in-50 year drought criterion since the original 1988 Water Supply Policy.

Storage Reserve Factor

A storage reserve factor is a criterion to have a certain percent of annual demand in storage through the drought criterion (1-in-50 year drought). This storage reserve provides a short-term supply to address emergency situations, such as pipeline shutdowns (which can and have occurred during drought conditions). The Policy calls for a 20 percent storage reserve factor, which equates to about 3.5 months of winter supplies or about 1.5 months of summer supplies.

Planning Demand Level

The planning demand level is the amount of demand the water supply system should be developed to meet. Since acquiring water supplies takes many years, projecting future demands is required to determine which supplies and/or facilities need to be acquired. The planning demand level is measured in gallons per capita per day (GPCD) and is used along with projected population and projected large contractual use (LCU) needs to determine future demand levels; population projections will be discussed in detail in Section 2.4. The planning demand level is set higher than current use and current water conservation goals to account for uncertainties in water supply planning that might reduce the Utilities' water supply yield. The current Water Supply and Demand Management Policy set 150 GPCD as the planning demand level, which is the average of 2006-2011 water use.

Impacts of Climate Change

Climate change could significantly impact the reliability of the Utilities' supplies and/or the amount of water required to maintain existing landscapes. These changes may include reduced snow pack, earlier runoff, hotter and drier summers, and an increased recurrence of drought. A great deal of uncertainty exists related to current climate change projections along the Colorado Front Range and its impact on municipal water supply and demands. Current research indicates that changes in precipitation in this area are uncertain but that temperatures will increase and therefore it is likely that runoff will come

[17] Water Supply and Demand Management Policy Report (dated April 2014; approved by City Council in later 2012).

earlier and in a shorter amount of time, precipitation may come more often as rain rather than snow, and higher temperatures will increase outdoor demands and change growing seasons for existing landscapes. For additional information refer to the CWCB 2014 report "Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation". [18]

The Utilities' water supply planning criteria and assumptions are conservative in part to account for climate change based on the information to date. The City will continue to monitor climate change information and, if necessary, will revise its water supply planning criteria and assumptions to ensure future water supply reliability.

1.3 SUPPLY-SIDE LIMITATIONS AND FUTURE NEEDS

Table 1.2 lists the future water supply needs and challenges. The full use of the Utilities' water rights in a given year can be reduced by several physical and legal constraints. Legal challenges are related to Colorado water laws and the administration of water rights. Some of the agricultural water rights owned by the Utilities are not available for use because the shares need to be changed in Water Court to municipal use.

The Colorado Water Conservation Board's Statewide Supply Initiative (SWSI) predicts a significant gap between water supplies and water demands along Colorado's Front Range, starting in 2040 for the Northern region of the South Platter River Basin.[19] Fort Collins is a forward-thinking community and the Utilities has identified water supply needed through 2065. Two key solutions to ensuring a reliable supply system moving forward include storage development and water efficiency programs. Water that is conserved may only be used for other beneficial purposes or at other times of the year if storage is available for that unused water.

Table 1.2 Water Supply Limitations and Future Need

Future Need/Challenge	Yes	No
System is in a designated critical water supply shortage area	X	
System experiences frequent water supply shortages and/or supply emergencies		X
System has substantial real or apparent water losses		X
Experiencing high rates of population and demand growth		X
Planning substantial improvements or additions	X	
Increases to wastewater system capacity anticipated		X
Need additional drought reserves	X	
Drinking water quality issues		X

[18] http://cwcb.state.co.us/environment/climate-change/Pages/main.aspx

[19] Camp Dresser & McKee Inc. 2011. Colorado's Water Supply Future: Colorado Water Conservation Board 2010.

Storage Constraints

A primary physical constraint is the lack of storage capacity to manage and regulate the water rights owned by the City. Additional water storage capacity is critically needed to increase the yield and reliability of its water supply system. Operational storage is needed to meet return flow obligations inherent with converted irrigation shares and provide other operational flexibility, which has recently been met through the acquisition of Rigden Reservoir. Carryover storage is needed to capture water during wetter years for use during drier years and also provide a storage reserve for unexpected emergencies (e.g. a pipeline failure). Both types of storage are needed to increase the reliability and redundancy desired to meet the water needs of our customers.

While the Utilities do have some year-to-year "carryover" storage capacity, much of this is already allocated to meet return flow obligations and other contractual agreements. Northern Water does include some carryover storage in the CB-T system; however, it is also almost entirely allocated to meeting contractual obligations.[20] While the City owns shares of several ditch companies that do have storage, we do not have access to the storage systems. Acquiring storage in the Poudre Basin that meets the storage reserve would help diversify the City's water supply system, which is currently highly reliant on C-BT storage.

Planned Storage Improvements

In 2003 the City acquired Halligan Reservoir, located on the North Fork of the Poudre River approximately 25 miles northwest of Fort Collins, for carryover and vulnerability storage. With plans for its expansion, the City is currently going through the National Environmental Policy Act (NEPA) permitting process, including an analysis of potential environmental impacts, other storage options, and costs and benefits. In 2013, the City acquired an existing gravel pit storage facility located below the Drake Water Reclamation Facility. The gravel pit, now Rigden Reservoir, has been enlarged to 1,900 acre feet and is being used for operational storage. The reservoir began operation in 2015 and will increase the system's firm yield.

[20] Note that CB-T water is particularly valuable to the water supply portfolio because it can be stored within the C-BT reservoir system for use any time *within* a given water year.

2.0 PROFILE OF WATER DEMAND AND HISTORICAL DEMAND MANAGEMENT

The City of Fort Collins city limits do not perfectly coincide with the Utilities water service area. The information in Section 2.1 below describes the City of Fort Collins, rather than the service area, as the city limits are how this type of information is collected by the City Planning Department, the U.S. Census, and the American Community Survey. Information in Sections 2.2-2.4, however, will pertain to the Utilities' water service area.

2.1 DEMOGRAPHICS AND KEY CHARACTERISTICS OF THE SERVICE AREA

The City of Fort Collins is home to approximately 158,600 residents and 30,000 students as of 2015.[21] The average household size is 2.37 people, the median age is about 29 years old, and about 27% of households have at least one person under the age of 18. The average household income is about $72,000. As of the 2010 U.S. Census, about 55% of homes were owner-occupied, 57% of homes were single-family detached residences, and the median home value was $247,800. About 11% of the housing stock is estimated to be built prior to1960 and about 40% were built prior to 1980.[22]

The City of Fort Collins is home to two major public higher education institutions: Colorado State University and Front Range Community College. Fort Collins was once home to a wide swath of agricultural activity; however, much of this is now limited to the outskirts of the City or has moved outside of the City entirely. Several high-tech industries call Fort Collins home, including Hewlett Packard, Intel, Woodward Inc., and AMD, among others. In addition to the other major employers like the City Government and the colleges, there has been an increase in the areas of clean energy, bioscience, and agri-tech businesses. The City also enjoys a strong microbrewery industry alongside an Anheuser-Busch Brewery.[23]

2.2 HISTORICAL WATER DEMANDS

Up until the early 2000s, the Utilities' service area population growth was largely matched by an increase in total water demands. Like many other Colorado communities, the 2002-03 drought spurred the City of Fort Collins to rethink its water use. While the population continues to grow, water demands have exhibited a downward trend, as illustrated in Figure 2.1. From 2001 to 2014, the service area population increased by about 7% while the total treated water demand decreased by about 25%. Such reductions are a combined result of Utilities' customers being fully metered and adopting tiered/seasonal rate structures by 2003, as well as the robust water conservation program and the water conservation efforts by customers.

[21] As of 2014, the Utilities' service area provided treated water to about 130,200 residents.
[22] This paragraph contains information about the City of Fort Collins from three sources: the City Planning Department, the 2010 U.S. Census, and the 2013 American Community Survey.
[23] The Fort Collins AB Brewery is home to the world-famous Budweiser Clydesdales West Coast Team.

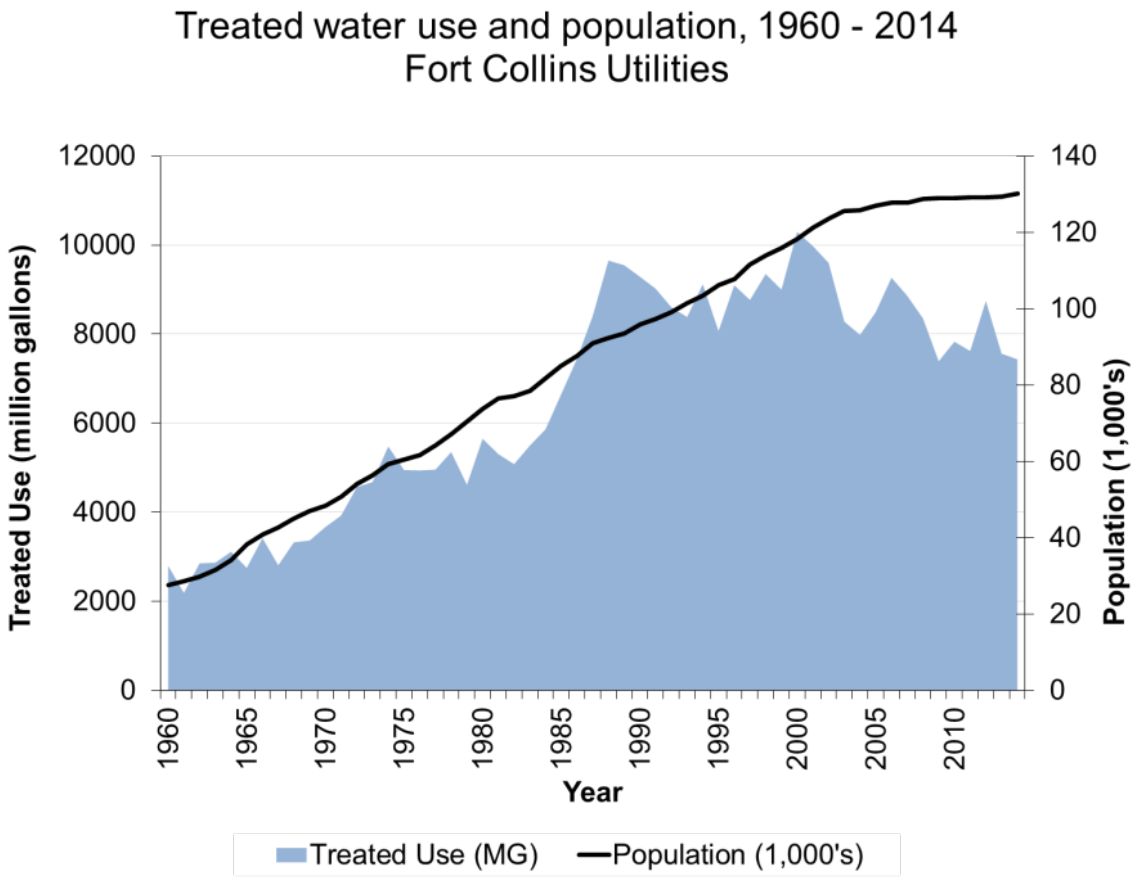


Figure 2.1 Treated water use and population

Daily water demand varies considerably throughout the year. Water use is fairly consistent throughout the winter months, then more than doubles in the summer months as customers increase use for landscapes and other seasonal purposes (e.g. pools). Figure 2.2 illustrates a five-year average of the daily treated water delivered from 2010-2014 along with details on the peak day for each year, which highlights how variable water demands can be in any given year.

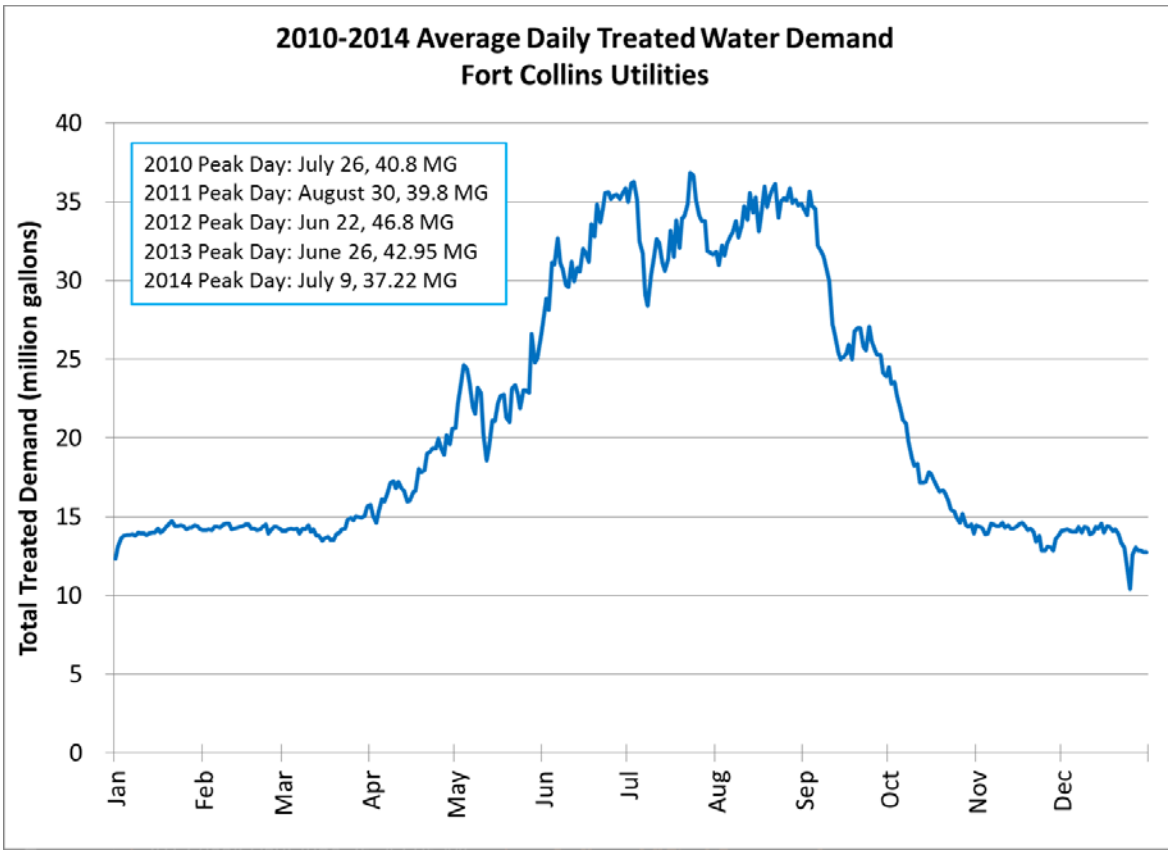


Figure 2.2 Average daily treated water demand

Fort Collins Utilities monitors treated water use by eight categories, as shown in Table 2.1. This table reports the annual use, number of accounts, average monthly use and water use by account, as of 2014. The majority of accounts are single-family residential accounts, however on a per account basis commercial customers use the most water. Recall that since the Utilities' water service area is different than the City limits; Outside City Customers refer to customers outside of the city limits but who are Utilities' customers. West Fort Collins Water District receives wholesale treated water from the Utilities, which is why they appear as one singular customer.

Table 2.1 Treated Water Use by Customer Category

	2014			
Customer Category	**Annual Water Use (MG)***	**Number of Accounts**	**Average Monthly Use (MG)***	**Average Annual Use per Account (gal)***
Single-Family	2,142	26,930	178.5	79,536
Duplex	120	1,226	10	97,750
Multi-Family	970	2,240	80.8	432,934
Commercial	2,972	2,222	247.7	1,337,765
City Government	107	225	8.9	475,830
West Fort Collins WD	140	1	11.7	140,000,000
Outside City Customers	280	1,454	23.3	192,751
Total	6,731	34,298	560.9	196,251

*Note: These numbers are rounded and are not exact. MG = million gallons.

As shown in Figure 2.3, residential categories collectively use the most water each year: about 47% on average, with about 32% attributable to single-family homes. The City government buildings and facilities only use about 1% of the treated water each year, outside City customer use about 4% and the Utilities delivers about 2% of the treated water to West Fort Collins Water District. System loss is discussed in greater detail below.

Commercial customers use about 39% of treated water, on average. Beyond the small, mid and large commercial customers, the City has identified a number of Key Accounts, who are businesses that are typically the largest water and energy users. The Utilities' Customer Accounts representatives work together with the Key Account customers to connect them to the appropriate experts, programs and services they need from the City of Fort Collins. These partnerships help customers achieve their sustainability goals as well as the goals set by the Energy Policy, Water Efficiency Plan and Climate Action Plan. The Customer Accounts team offers a customized and targeted approach to assist in accomplishing the goals set by these policies. Given the uniqueness of how each business utilizes water, the largest users can also apply for a custom water conservation rebate, up to $5,000, in addition to being encouraged to participate in our other rebate programs.

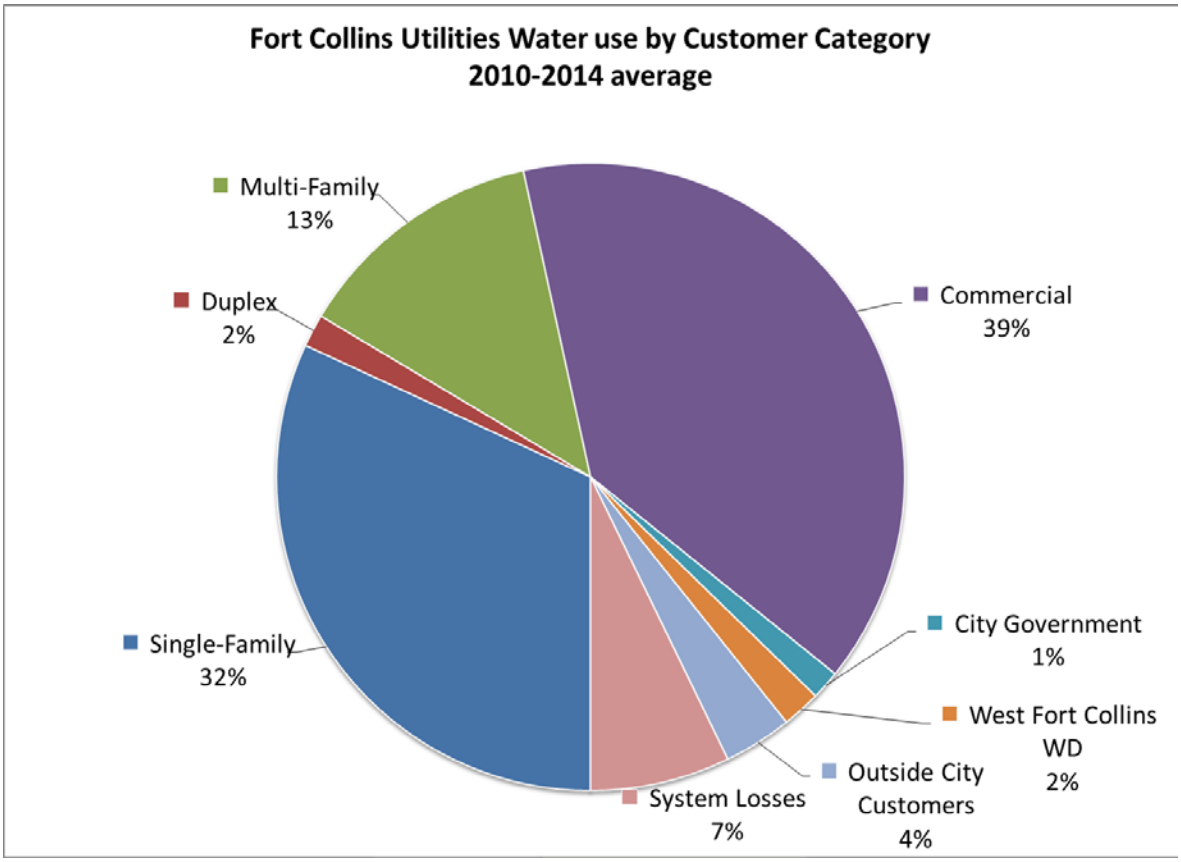


Figure 2.3 Water use by customer category, 2010-2014 average

2.2.1 GPCD: GALLONS CONSUMED PER PERSON PER DAY

Water consumption is often characterized by daily per person use, measured in gallons per capita per day (GPCD). This is calculated as total treated water use (total treated water that leaves the water treatment facility; includes all uses) divided by service area population and 365 days:

$$GPCD = \frac{total\ treated\ demand - LCU}{service\ area\ population * 365\ days}$$

These calculations exclude large contractual customers (LCU) and other sales or exchange arrangements to produce a value that is somewhat more comparable to other municipalities.[24]

Fort Collins Utilities also estimates a weather-normalized GPCD metric in order to control for the fluctuations associated with varying weather patterns. This normalized GPCD is approximately the GPCD

[24] While the use of GPCD for comparisons has long been an industry standard practice, there is evidence that it is a difficult indicator for individual water-users to relate their behaviors to, and the system-wide GPCD is a function of far more than a utility's water conservation and efficiency activities. More on this topic and recommended changes can be found in in Chapter 3.

that would have occurred if the weather conditions had been the average weather conditions for the region. This means that the actual GPCD is generally higher than the normalized GPCD when we have a relatively dry year and lower in a relatively wet year.

Demand levels have declined significantly over the last few decades, from around 230 GPCD in the early 1990s to about 200 GPCD before the drought year of 2002. Figure 2.4 shows actual GPCD and normalized GPCD from 2001 through 2014. To help illustrate the role that weather plays in our actual GPCD, the graph also includes annual precipitation and evapotranspiration for grass, both in inches.[25] In years where our region received less precipitation and the evapotranspiration rate was higher, actual per capita water use is higher. The average normalized use over 2002 to 2009 is 158 GPCD, approximately a 21% reduction in per capita water use from before 2002. The average normalized use from 2010 to 2014 is 146 GPCD, which is about a 27% reduction in per capita use from pre-2002. Since the 2002-03 drought, several factors have helped to reduce water use including, universal metering, conservation-oriented rate structures, more efficient plumbing standards, and our robust water efficiency and education programs.

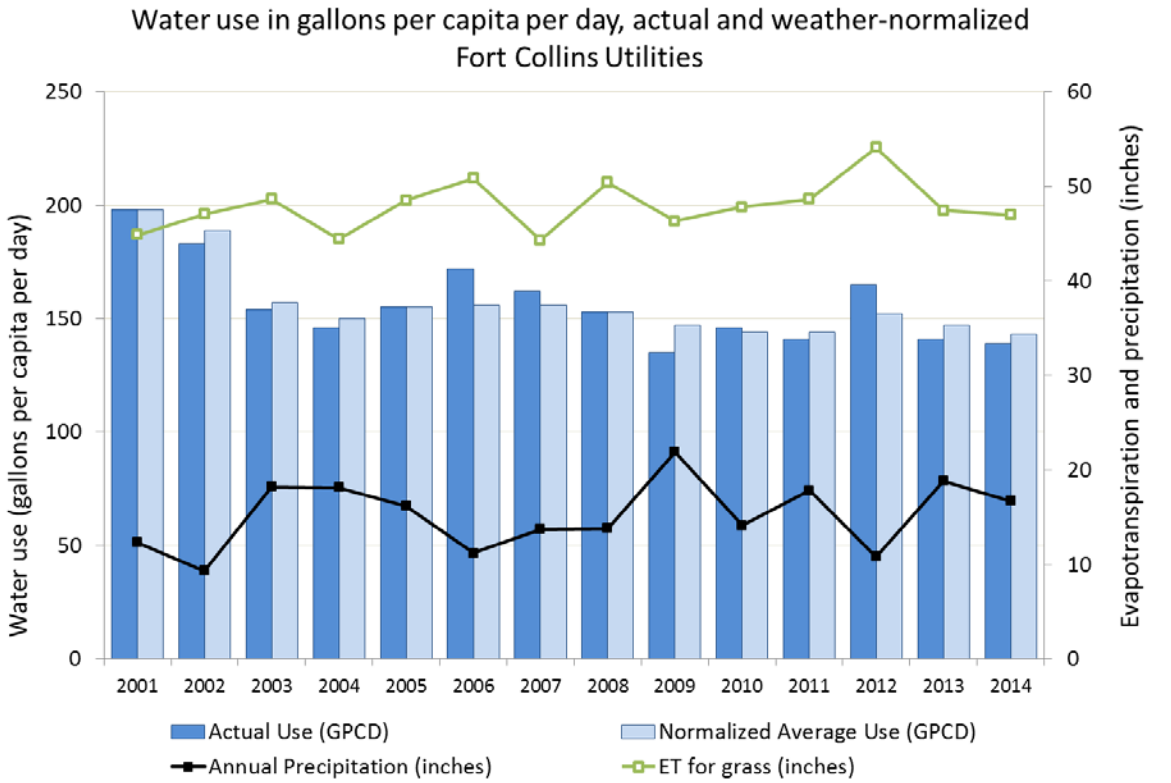
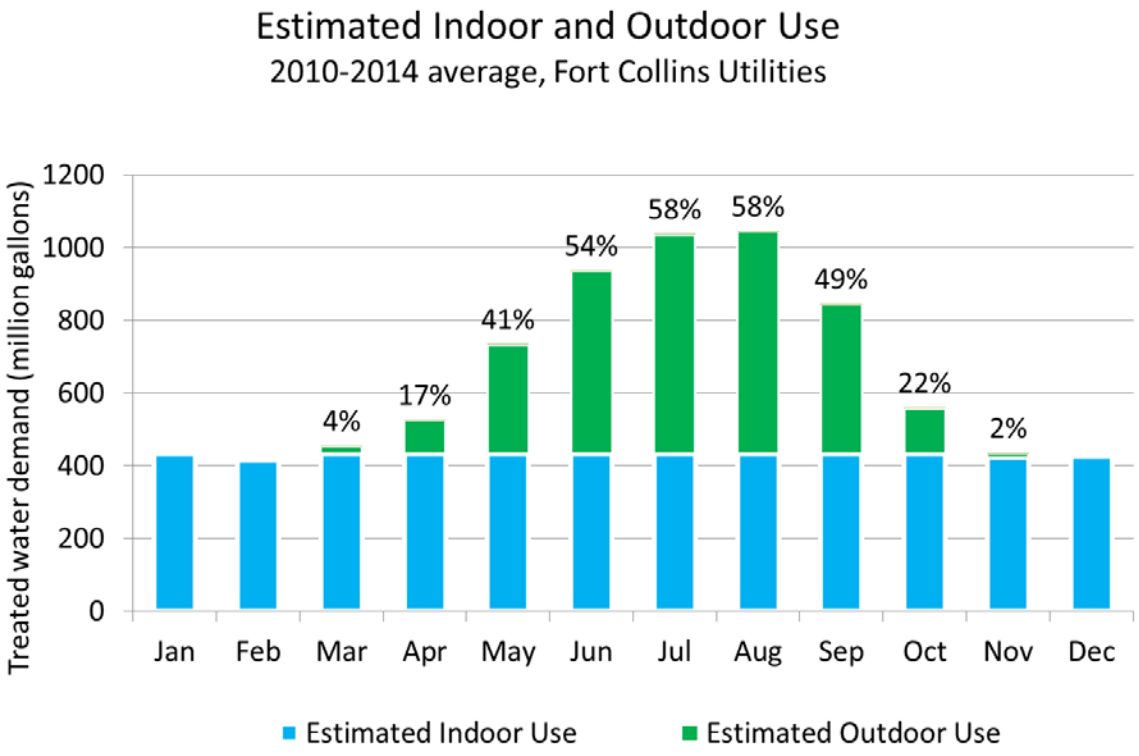


Figure 2.4 Water use in gallons per capita per day and weather data

[25] Evapotranspiration is often defined as the combination of the water lost (evaporate) to the atmosphere from the ground surface, evaporation from the capillary fringe of the groundwater table, along with the plant transpiration, which is evaporation of water from plant leaves. Evapotranspiration is affected by temperature, relative humidity, wind and air movement, soil moisture availability, and the type of plant. For more information see: http://water.usgs.gov/edu/watercycleevapotranspiration.html

Weather patterns mostly affect outdoor use of water. Figure 2.5illustrates an estimate of the portion of water demand that is utilized outdoors. A common method for estimating indoor versus outdoor use is to take the average of the demands in December through February and set this to be the estimate of average indoor demands and assume that no outdoor use occurs in those months. Then for months March through October, attribute any use above and beyond this average indoor use to be the estimated outdoor use portion. As shown in Figure 2.5, water use in the summer months can be up to almost two-thirds of total water demands.



Note: Indoor use from March to October is estimated to be the average of the winter months (Winter Quarterly Average), December through February.

Figure 2.5 Estimated indoor and outdoor use, 2010-2014 average

Fort Collins Utilities participated in a single-family end use study in 2012.[26] This study helped shed some light on how families are using water, through a small 88-household survey and analysis. In terms of outdoor use, many of the participating homes were estimated to be under-watering, relative to what was water needs estimated based on landscape area and weather information. However a minority of homes were over-watering and this excess was large enough to offset any under-watering by the other participating households. This highlights our need to provide improved programs and education to help our customers use the optimal amount of water for their landscape.

Since indoor use is less visible to the Utilities, how people allocate and use water indoors is more of a mystery. This 2012 study illustrated that there are still a significant number of low efficiency toilets and

[26] Study was conducted by Aquacraft Water Engineering and Management, Inc.

clothes washers in the housing stock, however the majority of participating homes had a high efficiency shower heads. The study also estimated that a significant amount of water is lost to leaks, which often go unnoticed by the residents. This highlights the need to utilize data available through the Advanced Meter Fort Collins (AMFC) program to help identify leaks and let our customers know so that they can address the problem and stop paying for lost water; we are piloting a Continuous Consumption program to meet this need, discussed further in Section 2.3.

As noted in Section 1.1, in addition to treated water the Utilities diverts about 3,000 to 4,000 acre-feet of raw water to irrigate City parks, golf courses, a cemetery, greenbelt areas, some school grounds, and for the purposes of meeting some contractual raw water delivery obligations.

2.2.2 SYSTEM WATER LOSS

Water losses in the Fort Collins Utilities' water system can occur in several locations:

- Between the points of diversion and the water treatment facility (e.g., from conveyance losses within the pipelines carrying water to the treatment facility)
- Within the water treatment facility (e.g., during filter backwash processes)
- Within the water distribution system between the water treatment facility and the meters of end users (e.g., from conveyance losses in the distribution pipe network)

Losses within the conveyance system that brings water to the treatment plant and within the water treatment plant itself are not fully quantified, but estimated at 3% of the annual diverted volume, when estimated from source to outlet of the treatment plant. Losses within the distribution system are estimated based on the difference between the amount of water treated at the treatment plant and the cumulative amount of water metered at end users. A summary of losses is provided in Table 2.2 below. These numbers represent estimates only and may reflect a number of factors. Fort Collins Utilities is currently exploring integration of the American Water Works Association's M36 methodology into its water loss management and tracking.

Table 2.2 System Water Loss Estimates

Loss Estimate (in Million Gallons)	**2010**	**2011**	**2012**	**2013**	**2014**
Treatment and Diversion to Treatment Conveyance Losses	242.2	235.7	270.8	233.8	230.0
Distribution Losses	426.5	462.1	695.1	534.9	705.7
Total	668.7	697.8	965.9	768.8	935.7
Distribution loss as percentage of total treated water	5.4%	6.1%	7.9%	7.1%	9.5%

2.3 PAST AND CURRENT DEMAND MANAGEMENT ACTIVITIES

Faced with a drought in 1977, the Utilities created a part-time water conservation position. In 1989 the position expanded to a full-time position. The first Water Demand Management Policy in 1992 lead to an expansion of conservation projects and increased educational and outreach efforts. The 1992 Policy set a conservation goal of 195 GPCD by the year 2020.

Prompted by the drought of 2002-03, Utilities made several efforts in 2003 to increase accountability and encourage the efficient use of water including fully metering every customer by, implementing a conservation-oriented rate structure – a tiered rate structure – with a seasonal component, initiating several new outreach and educational programs, and also developing the Utilities' first Water Supply Shortage Response Plan as guidance during drought and other emergency conditions.[27] The first joint Water Supply and Demand Management Policy was developed in 2003 and set a conservation goal of 185 GPCD by 2010.

The Utilities' Water Conservation program expanded again in 2010 with the development of a formal Water Conservation Plan. This plan set the current conservation goal of 140 GPCD by 2020. City Council approved the budget for additional programs and staff outlined in the plan starting with the 2010-2011 budgets. The plan was approved by the Colorado Water Conservation Board in early 2010. Note that conservation goals are purposely set lower than the Planning Demand Level discussed in Section 1.2, which is used for supply reliability planning.

2.3.1 CURRENT DEMAND MANAGEMENT ACTIVITIES

Table 2.3 is a list of the current demand management activities along with the initial year of implementation, if known. Note that many of our activities, programs, and regulations have substantially evolved over the years. For a description of each activity, see Appendix B, which also contains a table with participation levels from 2010 to 2014 for most of our current activities. This table does not contain participation counts for events.

[27] The Water Supply Shortage Response Plan contains certain restrictions on the use of City-treated water and other actions to be taken during a specified drought or water supply conditions.

Table 2.3 List of Current Water Conservation Activities

Foundational Activities	Educational Activities
Conservation-oriented rate structures (2003)	Business education programs (2004)
Continuous consumption program (2015)	Community education programs (1977)
Metering (2003)	Conservation kit giveaways (1990)
Monitor My Use (2014)	Conservation public information efforts (1977)
Online water use calculator (2012)	Home water reports (2014)
Seasonal rate structures (2003)	Hotel and restaurant conservation materials (2003)
Utility water loss program (1993)	K-12 education programs (1997)
Target Technical Assistance and Incentives	Watershed tours (2012)
Clothes washer rebates (2003)	Xeriscape Demonstration Garden (1986)
Commercial facility assessments (2004)	**Ordinances and Regulations**
Custom commercial rebates (2011)	Green building codes (2011)
Dishwasher rebates (2007)	Landscape and irrigation standards (1994)
Home efficiency audits (2009)	Parkway landscaping regulations (2013)
Home efficiency loans/ZILCH/on-bill financing (2010)	Plumbing standards (1978)
Irrigation equipment rebates	Restrictive covenants ordinance (2003)
Low income retrofit program (2007, w/ LCCC)	Soil amendment ordinance (2003)
Restaurant pre-rinse spray valve distribution (2011)	Wasting water ordinance (1917)
Showerhead rebates (2011)	Water efficiency upgrades at City buildings (2010)
Sprinkler system audits (1999)	Water supply and shortage response plan (2003)
Toilet/Urinal rebates (2010)	**Other Activities**
Xeriscape design/incentive program (2010)	Raw water for City irrigation, large customer reuse project (1985), backwash water recycling (2003)

2.4 DEMAND FORECASTS

Acquiring water supplies takes many years. In order to ensure a reliable water supply for customers in the future, the Utilities plan for future growth and water needs. The City's future municipal water demands are largely dependent on population growth and the rate of commercial and industrial development. The rate and pattern of population growth are also influenced by the future economy, land use policies, and development incentives, among other factors. As such, the Water Supply and Demand Management Policy Report (dated April 2014) takes the long view and identifies projected demands through 2050.

2.4.1 PLANNING HORIZON

The current Water Conservation Plan, developed in 2009, identified a 10-year planning horizon with a goal to update the plan in five years. This Water Efficiency Plan, to be submitted to the Colorado Water Conservation Board in 2017, takes the middle road and uses a 2030 planning horizon, with incremental goals leading up to the 2030 goal, as well as a goal to develop an updated plan no later than 2024 (seven years after this Plan's required submission year).

2.4.2 DEMAND PROJECTIONS

The Utilities estimates future water demands for a given year by first multiplying the projected population by the planning demand level (150 gallons per capita per day) multiplied by the number of calendar days, then projected large contractual use (LCU) is added to get the total projected water demand, as shown in the equation below. The Demand Planning Level is currently set at 150 gallons per capita per day, and is purposely set higher than conservation goals to provide a greater level of system reliability[28].

$$Total\ Demand = Projected\ Population\ \times 150\ gpcd \times 365\ days + Projected\ LCU$$

2.4.3 POPULATION PROJECTIONS

Given the differences between the Fort Collins Utilities water service area, the Fort Collins city limits, and the Fort Collins Growth Management Area, population projections were estimated using information from a Traffic Analysis Zone (TAZ) study developed for the City of Fort Collins and Larimer County. The TAZ information is based on City and County zoning designations, which dictate the type of development and thus population densities. The TAZ study makes population estimates based on projected new development and redevelopment in each zone. The population projections for this Plan were estimated by using the zones within the water service area. Note that, based on the TAZ study, it is anticipated that the Fort Collins Utilities' water service area will reach build-out near 2040, meaning that all vacant buildable land will be developed. After build-out, it is assumed that the water service area population will only grow via redevelopment, and therefore population growth in the service area is expected to eventually slow down. However, the Utilities currently has agreements to supply water to surrounding water districts. With these agreements in place and the potential for more in the future, the Utilities considers these possibilities in estimating future demand projections. Thus, the population projections used in this plan includes some of West Fort Collins Water District.[29]

[28] For more information on the Planning Demand Level, see Section 1.2.

[29] The estimates do not include some Fort Collins-Loveland Water District areas currently served by the Utility because these areas are served only in the sense that a) FCLWD purchases some excess capacity in our Water Treatment Facility, and b) there is an now terminated agreement whereby certain areas of development could meet raw water requirements either through the Utilities or the districts. If any of these areas are annexed by the City, then they would still have the option to make use of this option.

2.4.4 LARGE CONTRACTUAL USE

In addition to population-based water demands, the Utilities also has contractual obligations to provide water for the current and future demands of several large industrial water users. Large contractual use (LCU) is estimated separately from population-based water demand projections and is not included in the GPCD metric. The LCU projections are added to the overall projected demands, which are based on population projections and the water demand planning level set in the Water Supply and Demand Management Policy Report (dated April 2014). LCU is currently about 3,900 acre-feet per year of treated water. Additional raw water is provided to LCUs. Because of certain applications, a portion of the water supplied to LCUs must be sourced from reusable water rights. The future LCU is estimated to be about 8,000 acre-feet per year by 2050. This will require a mix of single use and reusable water sources.

Figure 2.6 illustrates the projected population for the water service area. This figure also illustrates the project water demands based on the historic Planning Demand Level and the current Planning Demand Level.[30] It is clear that conservation and efficiency activities, among other factors, have helped to reduce total water use as well as per capita water use; these reductions have lowered the planning demand level and helped to increase the reliability of the water supply system.

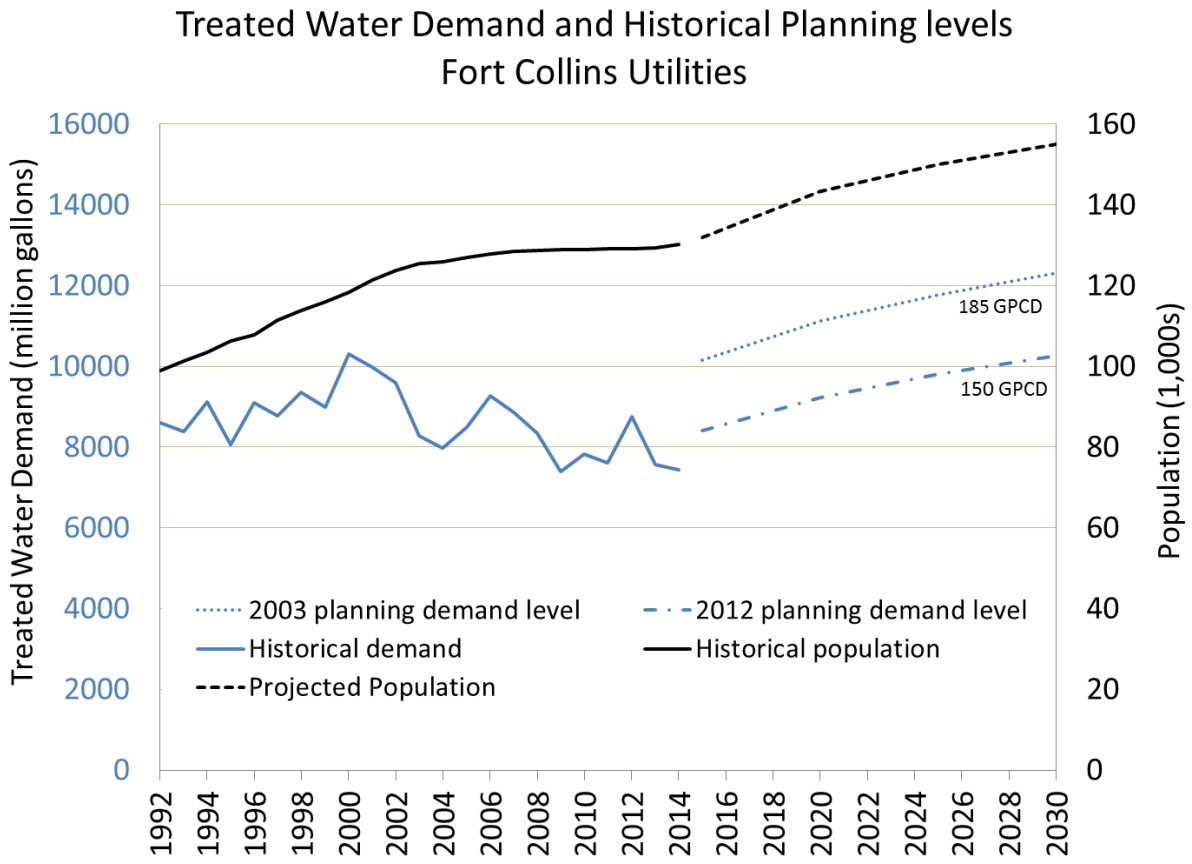


Figure 2.6 Treated water demand, historical planning levels, and population

[30] These estimates also incorporates an estimated 8% system water loss level.

3.0 INTEGRATED WATER SUPPLY AND DEMAND MANAGEMENT PLANNING

There are four main documents that provide direction and/or complement the Utilities' water efficiency efforts, listed below. Along with the most recent Water Conservation Plan of 2010, these documents helped to develop this updated Water Efficiency Plan and will also guide our ultimate implementation moving forward.

- The City of Fort Collins Strategic Plan (2015-16)[31]: this document is a result of a planning process incorporating input from citizens, businesses, City Council, and City staff. It identifies the City's seven key outcome areas as well as several strategic objectives in each area; these are to guide the work in all City service areas. Water efficiency aligns very strongly with Objectives 4.8, 4.7 and 4.6, it also touches on several other objectives detailed in Appendix C.

- The Water Supply and Demand Management Policy (2012)[32]: this is the guiding document for water supply and demand management activities. The objective is to provide a sustainable and integrated approach to 1) ensuring an adequate, safe, and reliable supply of water for the beneficial use by customers and the community, and 2) managing the level of demand and the efficient use of a scarce and valuable resource consistent with the preference of Water Utility customers and in recognition of the region's semi-arid climate. The original water supply-focused policy was developed and approved in 1988; it was updated in 2003 and again in 2012, with the most up-to-date report published in 2014. This Policy defers to the latest Water Efficiency Plan to set the efficiency goals.

- 2015 Climate Action Plan Framework: The CAP provides a high level framework to set Fort Collins on the path to achieve carbon emissions reduction objectives as requested by Council, but will not determine future implementation details. Implementation details will be developed as strategies and tactics are considered on a case-by-case basis, and will be brought forward to Council for approval prior to implementation. The two main strategic initiatives that involve water are: 1) Water and Land Use, and 2) Preparation, Adaptation, and Resilience.

- The Water Supply Shortage Response Plan (2014)[33]: this document identifies the restrictions and requirements intended to achieve progressively higher levels of water savings under various projected water shortage conditions. The original plan was approved by City Council in 2003 and an update was approved in 2014.

[31] The City's Strategic Plan can be found at: http://www.fcgov.com/citymanager/pdf/strategic-plan-2015.pdf

[32] Though a more extensive report was developed and dated April 2014. See the City's Water Supply and Demand page: http://www.fcgov.com/utilities/what-we-do/water/water-supply-demand

[33] http://www.fcgov.com/utilities/img/site_specific/uploads/ORDINANCE_NUMBER_088_July_2014_Water_Supply_Shortage_Response_Plan.pdf

3.1 WATER EFFICIENCY AND WATER SUPPLY PLANNING

In planning for a reliable, secure, and sustainable water future, the Utilities employs an integrated resource planning strategy that utilizes a portfolio-based approach to meeting future demands and is guided by the documents described in Section 3.0 above. In most years, the City of Fort Collins Utilities has the benefit of having a plentiful level of water supplies that ensure sufficient supplies above the reliability criteria discussed in Section 1.2. The Utilities' water supplies are expected to support projected changes to demand under a combined strategy of a) increased long-term storage and, b) continued water efficiency efforts. This diversified approach will reduce water demand, improve system reliability, and enhance community resilience to drought and climate change. These two strategies need to be undertaken collectively; either on their own will be significantly less effective without the other.

Expanded water efficiency measures are cost-effective means to water supplies that can be utilized for several beneficial purposes. Conserved water can be stored for periods of drought, leased for agriculture, and used for beneficial environmental enhancement efforts such as in-stream flow programs. Increased storage provides a physical location for conserved water and enables Fort Collins to take full advantage of savings achieved by customers. See Section 1.3 for more information on the role of storage in our supply and demand management planning.

3.1.1 BENEFITS OF WATER EFFICIENCY

In addition to being a key part of the integrated resource management process, water efficiency programs also:

Foster a conservation ethic and reduce waste: the success of this Plan depends on the cooperation and support of the Water Utility customers and the City of Fort Collins community. Instilling a conservation ethic is an important foundation to changing habits and attitudes toward water use. The power of the individual in conservation makes a big difference in protecting quality of life, including our environment today and for generations to come. Our average use, calculated as gallons per capita per day (GPCD), has declined significantly. For example, in 2001 the GPCD was 198, whereas in 2014 it was 143. Several conservation-based efforts took place on the heels of the 2002-03 drought which have helped to support a sustained reduction in use; these include full metering, conservation-oriented rate structures, seasonal rate structures, expanded targeted industry outreach, the restrictive covenants ordinance, conservation kit giveaways, clothes washer rebates, and more.

Demonstrate a commitment to sustainability: The City aims to be leaders in this effort. The City approved the Climate Action Plan Framework in 2015 and previously approved an Action Plan for Sustainability in 2004, and an Environmental Policy in 2009 that outline the ways the City itself will reduce its environmental impact (this includes a commitment to identifying and implementing effective ways to conserve natural resources). To bring the global concept of sustainability to action at the local level, sustainability advocates use the triple bottom line in decision-making. Essentially, that means projects are evaluated based on their social, economic and environmental impacts. Rather than make decisions on the basis of profit or the economic bottom line, three bottom lines (social, economic, and environmental) are considered. For the City, it means creating an optimal mix of resource efficiency, cost effectiveness and employee well-being in daily City operations. One example of a goal is to reduce municipal operations water irrigation and increase efficiency per acre, as well as to reduce indoor use by

20% by 2020.[34] City buildings are required to achieve LEED "Gold" certification. Also, several areas of City grounds have been renovated with low water using landscape materials and some weather sensors have been added to the irrigation systems. The City Parks system is regularly audited; the majority of the Parks irrigation systems uses 95% or less of the water needed, based on the turf and plant requirements.

Provide water for multiple beneficial purposes: Conservation efforts can help to provide more water for beneficial uses beyond normal municipal purposes. For example, the area around Fort Collins continues to be a productive agricultural area, which in addition to representing economic activity, also provide significant open space outside of Fort Collins that is desired by many residents. When possible, making some of the City's surplus water available for these purposes provides supplemental revenue for the Utility and its customers. The potential environmental benefits of conserved water are also important. These include providing additional flow for the local stream systems, in-stream flow programs, improvements in water quality, improvements in aquatic and riparian ecosystems, enhanced recreational opportunities, and aesthetics, among other benefits.

Enhance resilience during drought periods: Conservation and efficiency efforts can help to develop a community and landscape that is more resilient to drought conditions. Through support of drought planning and implementation of proactive mitigation efforts, the actions proposed in this Plan can help to reduce vulnerability, protect economic health, and ease the effect of drought on individuals, businesses, and landscapes.

Prepare for climate change: Climate change may have significant impacts on both water demands and water supplies in the time frame of this plan. It is anticipated that climate change in the Mountain West will likely include the following changes: Increased evapotranspiration rates, increasing the water required to maintain the landscaping; more frequent dry spells and a longer growing season; increased variability in seasonal snow pack; earlier spring snowmelt and runoff; changes in the distribution of precipitation throughout a given year. These changes are expected to accelerate over the decades ahead and impacts may depend largely on factors such as population growth, economic growth and technological changes. Utilities will likely face significant challenges in the years ahead managing both water demands and water supplies. With many uncertainties regarding both water supply and demand, it is prudent to prepare for a wide range of conditions in the future. One example of the importance of efficiency efforts is that without conservation and/or significant changes in landscaping choices, outdoor water use will likely increase over the coming decades as customers strive to maintain their landscapes in a hotter and longer growing season. Furthermore, an approach that also includes planning for adequate reservoir capacity to help balance the swing in supplies available between wet and dry periods

[34] http://www.fcgov.com/sustainability/goals.php

Reduce costs:

- Direct utility costs: Efficiency programs decrease water and wastewater treatment costs as it reduces the amount of chemicals and energy used to produce, deliver, and heat water.
- Customer costs: water bill, but also the cost of energy to heat water, and landscape related costs including the cost to maintain, like labor costs, fertilizer and other landscape-related product costs.[35]
- Long-term costs: decisions about water supplies, treatment/distribution capacity needs, storage facilities are all made in consideration of projected water demand and peak capacity.

In addition to these savings, Fort Collins Utilities has benefited financially from conservation in two notable ways:

- Halligan Water Supply Storage project size: The original Halligan Reservoir enlargement planned allotment for Fort Collins was 12,000 acre-feet, which was in part based on the 2003 planning demand level of 185 GPCD. Among other factors considered in the permitting process, the role of conservation and the downward trend in GPCD (current planning demand level = 150 GPCD) resulted in revising the enlargement downward to only 8,125 acre-feet, which is approximately a 68% reduction and represents a $6.1M savings in project costs.

- Extra Water Treatment Facility capacity: A Water Treatment Facility (WTF) is designed for peak demand. The Fort Collins WTF was last expanded in 1999, prior to the significant increase in conservation efforts prompted by the 2002-03 drought. The total WTF treatment capacity of 87 MGD is estimated to be *at least* 23% larger than the expected build out in 2035 peak demand (~ 20 MGD). In 2013, the City of Fort Collins Utilities entered into an agreement with Fort Collins-Loveland Water District to sell FCLWD up to 5 million gallons per day (MGD) in excess water treatment capacity. The financial benefits of this agreement include the associated plant investment fee of $12.6M and a treatment charge of about $2 per thousand gallons.[36]

- Delay of capital expansion projects: Decreased wastewater flows have delayed the expansions of the Drake Water Reclamation Facility treatment capacity from 2010 to 2028.

[35] These costs may also represent larger environmental costs as run-off from landscapes can affect water quality and ecosystem health.

[36] In addition to the benefits to the City of Fort Collins Utilities, Fort Collins-Loveland Water District will be able to defer expansion of their current treatment facility and/or construction of a new water treatment facility. Additional information on this agreement can be found in the City of Fort Collins City Council agenda and materials from the October 1st, 2013 regular City Council meeting.

3.2 WATER EFFICIENCY GOALS

The WEP's overarching goal, which tracks from previous goals, is to reduce water demand to 130 GPCD by 2030. During the development of this updated Plan, however, it became clear that a single, system-wide metric of water use doesn't resonate with and isn't meaningful for customers. During the public comment period Water Conservation staff often saw that the GPCD metric was confusing. For example, it was unclear which water uses (residential, commercial, the Utilities' largest users, etc.) were involved in its calculation. The exact definition/equation of a utility's GPCD is a common issue for other entities and therefore can complicate and limit the ability to compare across utilities. Furthermore, a system-wide GPCD isn't a direct measure of the progress and effectiveness of the Water Conservation team's activities.

It was also unclear how an individual's water use (as seen on their bill) related to a GPCD goal. For most residential customers, on average, their individual GPCD or even GPHD (gallons per household her day) are much lower than the system-wide GPCD; however, during the summer irrigation months, it may be significantly higher. For customers in multi-family or multi-business units that are not sub-metered, there is no way to connect to the single system-wide goal. The community's feedback raised the question of the appropriateness of a GPCD goal, as well as the question of the best way to structure goals to motivate lasting change and communicate water efficiency progress.

Amy Vickers & Associates, Mary Wyatt Tiger and Shadi Eskaf confirm these broad issues: "…estimates of [GPCD] are not comparable to each other when the types of data used to compute GPCD differ. While average single-family water use metrics reflect a relatively small number of types of indoor and outdoor end uses of water that are common to most single-family homes, an average water use metric for an entire city reflects thousands of different types of water-using activities […] Furthermore, a system-wide average neglects the nuances of individual customer behavior and is not specific enough to detect some significant changes in water use behavior." in the 2013 American Water Works Association report: *A Guide to Customer Water-Use Indicators for Conservation and Financial Planning*.

For this WEP, a long-term goal of 130 gpcd by 2030 will remain. GPCD is still an industry standard and still a means to compare progress over time for the Fort Collins Utilities system overall. In the coming years, staff will work to evolve the metrics and indicators by which we judge water conservation/efficiency progress. The ultimate version of the goal definitions and structure will be subject to analysis and research and will be reflected in the next update of the Utilities' Water Efficiency Plan. Currently, staff recommends moving toward measurement and tracking of:

- Volume of water saved. This will be evaluated based on tracking conservation and efficiency programs. This is being added in part because City and Utility leadership have asked for clearer metrics related to Water Conservation programs. This metric provides good clarity and is a more direct measurement of the impact of Water Conservation programs.
- Program participation. This will be tracked by programs and events. This will give a measure of how many customers we're reaching.
- Residential water use indicators defined using measures of the amount of water delivered to residential customers and the service area population. This will likely be further broken down by type of residence (single-family, duplex, multi-family).
- Commercial sector indicators. These indicators will be based on industry-specific standards and set in partnership with the local commercial sector.

An updated Water Efficiency Plan will be developed no later than 2024 (7 years from the anticipated CWCB 2017 submission date). Figure 3.1 illustrates the projected water demand level if the 130 GPCD by 2030 goal is met, the current 140 GPCD by 2020 goal in the 2010 Water Conservation Plan, and the current 150 GPCD Planning Demand Level used in water supply reliability planning, along with historical and projected population. Figure 3.2 is a graph of GPCD levels, rather than total volume. This figure shows the historical GPCD levels along with our goal level and the projected trend in use that will achieve that goal. Chapter 4 describes the strategies for achieving this goal.

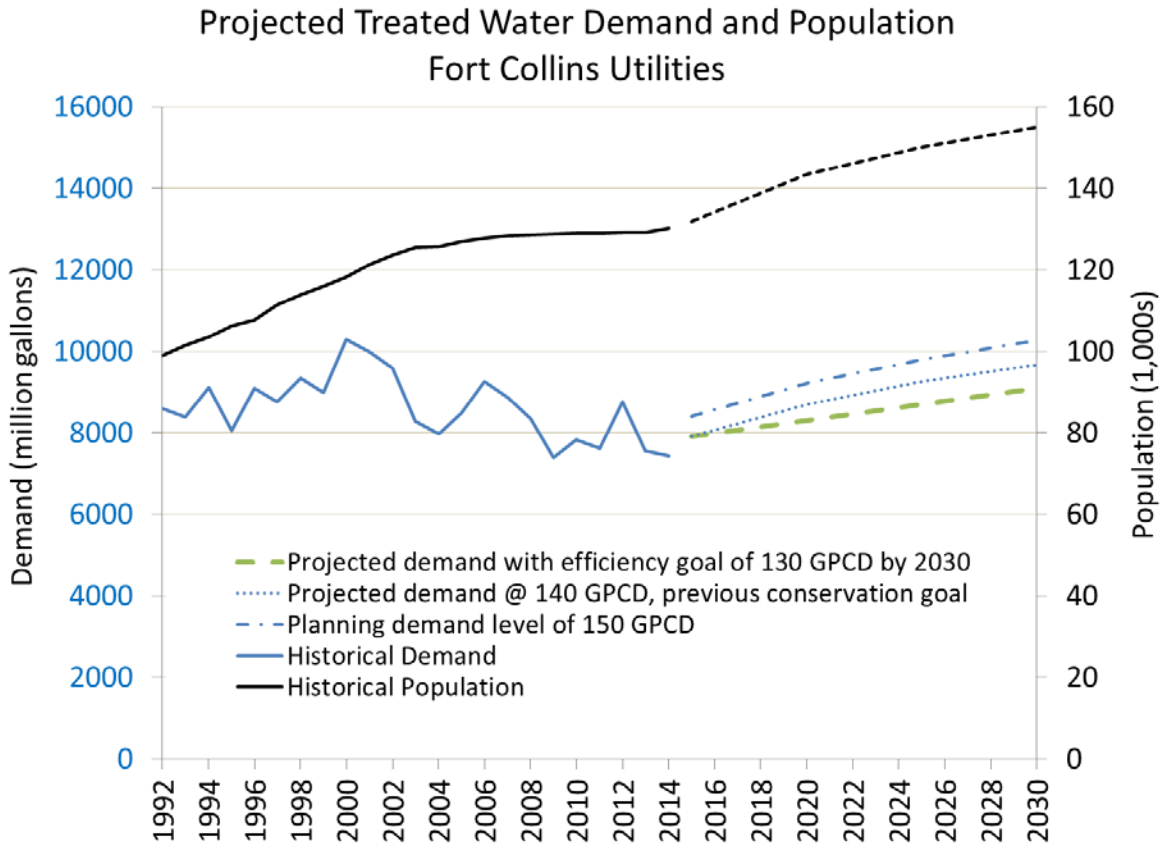


Figure 3.1 Water efficiency goal, demand and population

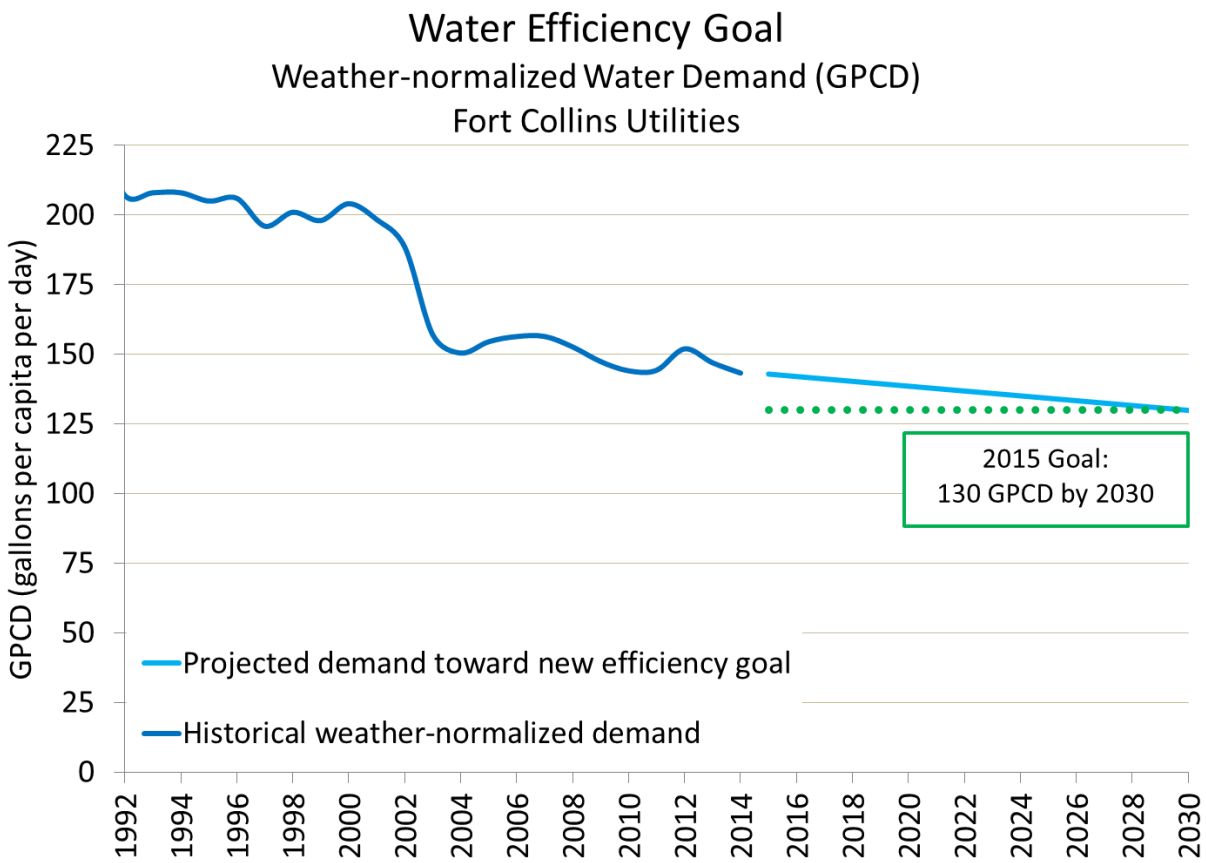


Figure 3.2 Historical GPCD and New Efficiency Goal

4.0 SELECTION OF WATER EFFICIENCY ACTIVITIES

The Utilities Water Conservation Team uses its mission and three overarching objectives to select the programs, projects, and approaches used in our daily efforts. These will ultimately guide our path to achieving our water efficiency goal of 130 GPCD by 2030 and align our work and efforts with those of the Utilities, the City and the State.

Water Conservation Team Mission: Cultivate a water efficient, adaptive, and knowledgeable customer base through education and cost-effective water efficiency programs while supporting the City's strategic plan and its social, environmental, and economic health.

Water Conservation Team Objectives:

- Water Efficiency and Conservation – provide water for beneficial purposes while reducing unnecessary use and waste.
- Customer Service – provide exceptional service for an exceptional community
- Technical Support – provide technical expertise to customers and City staff

4.1 SUMMARY OF SELECTION PROCESS

4.1.1 SELECTION PROCESS AND CRITERIA

Fort Collins has a robust water conservation approach with a number of conservation activities that have been implemented for years. We intend to continue the water efficiency activities, in some form, within our current portfolio of programs. These programs are likely to evolve over the years and the exact specifics of each are subject to change as a result of changing legislation, regulations, technology, customer preferences, appliance/fixture saturation rate, and Utilities/City plans. For example, the state of Colorado has passed legislation (Senate Bill 14-103) that mandates that any plumbing figure sold in the state must meet WaterSense standards by September 2016; this includes lavatory faucets, toilets, urinals, and showerheads. This change will likely affect our current approach to incentivizing customers to swap out old efficient fixtures for new, efficient ones.

In addition to a review of our existing activities, new and innovative activities were researched. Potential activities were identified from a number of sources including the Colorado Water Conservation Board's technical resources, the Colorado WaterWise Guidebook of Best Practices for Municipal Water Conservation in Colorado[37], a broad literature review, exploration of other utility case studies, and input from Utility staff, the City of Fort Collins Water Board, the community, the Water Conservation staff, and a Water Efficiency Plan Technical Advisory Group, consisting of several City departments as well as community members. This process not only identified activities, but also processes and tools that have the potential to help improve all activities.

The activities identified in this plan represent the best choices at the time. Technology, regulations, efficiency standards, market saturation, customer preferences and other factors are likely to change before this plan is updated and are sure to change during the course of the planning horizon (2030). We will continue to monitor the effectiveness and appropriateness of current activities while also exploring

[37] http://cwcb.state.co.us/technical-resources/best-management-practices/Pages/main.aspx

new programs. The City of Fort Collins utilizes a two-year budgeting cycle called Budgeting for Outcomes, which determines funding for Water Efficiency activities by, in part, evaluating the proposed activities against the City's strategic outcomes. We are therefore potentially constrained in terms of the activities we can undertake; the funding must be available and approved by City Council.

4.1.2 PRIORITIZATION PROCESS

Each of the potential activities will be prioritized using the following qualitative screening criteria.

- Program Effectiveness: This combines the estimated water savings with the estimated program costs: How effective is the activities in terms of gallons of water saved per program dollar spent?
- Staff Resources: How labor- and time-intensive is the program? Do we have the staff resources to properly support, monitor and evaluate the program?
- Customer Preferences: Does this activity meet the needs and wants of the Utility water service area customers? Does this activity support the social and economic health of our customers?
- Participation Level and Reach: How many customers could be impacted by this program? What types of customers does it reach? Is it engaging previously unengaged customers?
- Alignment with other Utility and City objectives: Does this program support activities in other areas of the Utility and the City? Does it help achieve Utility and City strategic objectives?

4.1.3 POTENTIAL NEW DEMAND MANAGEMENT ACTIVITIES

In addition to continuing the existing set of water conservation and efficiency activities listed in Section 2.3 and described in greater detail in Appendix B, we identified five areas of opportunity for developing new programs and approaches. Each highlights an area with great potential to expand and increase water efficiency and great potential to better meet the needs of our customers. Each of these areas also supports specific strategic outcomes and objectives in the City's Strategic Plan; these are listed in Appendix C. In this process we also identified three implementation principles that will guide the development of any new programs and strategies; these are detailed in Section 5.1.

Areas of Opportunity

- Leverage Advanced Meter Fort Collins data and capabilities
- Promote and support greater outdoor water efficiency
- Encourage greater integration of water efficiency into land use planning and building codes
- Expand commercial and industrial sector strategies
- Increase community water literacy

Table 4.1 highlights a few benefits of each identified area, a few potential activities that fall into each area, as well as a brief description of an existing practice within the area.

Table 4.1 Areas of Opportunity

Leverage Advanced Meter Fort Collins data and capabilities		
Aligns with City Plan Strategic Objectives: 3.9, 4.6, 4.7, 4.8, 7.9, 7.10		
Benefits • Increased customer understanding of water use • Greater connectivity to customers • Increased customer benefits through web portal information and tools • Less confusion and fewer bill surprises	Potential Activities • Monitor My Use & High Bill/Use Alerts • Improved leak detection • Near real-time identification of savings and inefficiencies • Craft easy-to-understand, targeted water-savings actions based on data and use patterns	Example: The continuous consumption uses AMI data to detect likely leaks; we alert homeowners so that they can fix the leak and avoid damage and high bills. In 2015 we reached out to 980 customers.
Promote and support greater outdoor water efficiency		
Aligns with City Plan Strategic Objectives: 1.11, 4.6, 4.7, 4.8, 7.5		
Benefits • Reduced peak season and peak day demands, which impact system capacity needs and long-term planning • Customer benefits through lower bills, increased aesthetics and home value • Fewer wasting water issues/complaints	Potential Activities • Residential and Commercial sprinkler audit programs • Xeriscape Incentive Program • Customer and Contractor training series • Interactive demonstrations • Educational Water budget tool	Example: In 2014 we provided over 400 sprinkler system audits, with an estimated potential savings of 30MG. The cost-effectiveness of this program is about $1.20 per 1,000 gallons saved.
Encourage greater integration of water efficiency into land use planning and building codes		
Aligns with City Plan Strategic Objectives: 1.3, 1.11, 3.7, 4.7, 4.8		
Benefits • Increased efficiency of development • New development will lead by example • Less waste from pursuing retrofits of new development • Reduced impact of population growth	Example Activities • Landscape requirements and incentives for new development • Contractor education and trainings • New and re-development plan review requirements • Require WaterSense appliances and fixtures	Example: Beginning in 2012, the City's Green Building Code mandates WaterSense toilets and other fixtures in residential and commercial facilities; this is estimated to save between 20-25% annually.

Expand commercial and industrial sector strategies		
Aligns with City Plan Strategic Objectives: 3.5, 3.6, 4.7, 4.8, 5.10		
Benefits • Increased water savings due to scale of projects • Enhanced business partnerships • Support ClimateWise program • Enable greater economic health	Example Activities • Custom commercial rebate program • Benchmarking • Targeted industry-specific campaigns and outreach • Address tenant/owner incentive misalignment	Example: In 2013 the custom commercial program helped replace two pools filters, which are estimated to have nearly 800,000 gallons per year.
Increase community water literacy		
Aligns with City Plan Strategic Objectives: 4.6, 4.7, 4.8, 7.4		
Benefits • Customer has greater understanding of role in the water system • Increased customer understanding and support of Utilities' actions and decisions • Increased cooperation during difficult conditions	Example Activities • Improved and expanded messaging strategies • Identify new approaches to education and outreach • Develop innovative methods to strengthen K-12 water literacy curriculum	Example: In 2014 we began providing Home Water Report to select customers; these display usage information, comparisions to similar homes, and provide efficiency tips. Households receiving the reports reduced their use by 2%.

We also highlight a few other promising areas, in addition to our current program and the types of activities identified in the Strategic Objectives sections, that we plan to explore in the coming years. Many of these overlap with several of the Areas of Opportunity or warranted some additional explanation, and thus are discussed in greater detail below.

- Rate Structures: Prices send a value signal to customers and help customers determine how they value using water. Rate structures are also designed to cover the cost of providing service.[38] Therefore it is important to balance both sides. Along with the Finance team, we intend to explore new means of incentivizing the efficient use of water while supporting revenue requirements.

- New and Re-Development Incentives & Requirements: There are a variety of decisions made throughout the development and re-development process. We aim to further explore and support ordinances or regulations like low water use landscape requirements, tap fees and incentive programs that are more aligned to encouraged efficiency from the start, irrigation taps/requirements, greywater ordinances and systems, and more.

[38] This includes operational costs (like treatment costs), maintenance costs, and capital costs.

- M36 Audit & Other Leak Monitoring Initiatives: A significant way to reduce water loss, reduce bills and repair expenses, is a robust portfolio of leak detection, monitoring, and notification initiatives, including those that address leaks within our distribution system, private property leaks that occur prior to the meter and result in non-revenue waste, and continue to expand and enhance our beyond-the-meter Continuous Consumption Program. The Utilities is also in the process of incorporating the American Water Works Association's M36 Audit process to ensure "the accountable and efficient management of water supplies" by the Utilities.[39]

- Rebate and Incentive Programs: We aim to ensure that the rebate level is based upon data-driven estimates of the water savings that results from the appliance, fixture, or technology change. This process will also include an approach to phase out or adjust program specifications once Colorado becomes a WaterSense state in September 2016. We also want to expand the reach of our programs to help more customers, either through community partnerships or new approaches to outreach and marketing. We will explore how to reach more low-income or otherwise disadvantaged/at-risk households, rental units, and multi-family units.[40]

[39] The M36 represents a National standardized approach to water supply system audits that accounts for all water. http://www.awwa.org/portals/0/files/publications/documents/toc/m36ed3.pdf http://oawwa.org/SDWA%20Presentations/2013/Water%20Audit%20Presentation,%20November%204,%202013.pdf

[40] While this is titled "Rebates and Incentive programs", efforts to reach underserved populations may also include expansion of direct-install programs like our current partnership with the Larimer County Conservation Corps (LCCC).

5.0 IMPLEMENTATION AND MONITORING

5.1 IMPLEMENTATION

The following principles serve as guidance to implementing existing and new activities. We believe these principles will help to improve effectiveness of our programs, help to achieve our water efficiency goals, and keep our actions in alignment with our overall mission. These principles are also in alignment with several Strategic Objectives in the City Plan, including 3.9, 7.4, 7.5, 7.10, and 7.11. These are further described in Appendix C.

Employ sophisticated data-driven processes and decision-making

Benefits

- Decisions supported by data
- Improved accuracy of water savings estimates
- Increased overall portfolio effectiveness
- Increased program savings and reach through use of behavioral science principles

Example Actions

- Targeted and tailored programs
- Marketing and Communications
- Streamlined, consistent program tracking and reporting
- Develop and monitor targeted metrics to support targeted goals

Cultivate new and bolster existing community and statewide partnerships

Benefits

- Greater trust in the Utilities
- Expanded capacity and reach through project partners
- Support economic health
- Stronger network of conservation partners

Example Actions

- Expand conservation support for nearby water districts
- Expand work with higher education institutions
- Increase public-private projects, like an industry-specific water efficiency conference
- Participate in and contribute to statewide conservation efforts, (e.g. Colorado WaterWise, Colorado Foundation for Water Education)

Coordinate and support symbiotic efforts within Utilities and across the City

Benefits

- Improved consistency and reduced redundancy across City efforts
- Simplified processes for customers
- Greater synergies in the water-energy nexus space

Example Actions

- Resource Conservation unification in Utilities
- Collaborate with efforts of Environmental Services, Planning, Natural Areas, Community Engagement, Nature in the City, Housing and Development, Parks, among others
- Partnerships with the neighboring water districts.

5.1.1 EVALUATION AND DEVELOPMENT

Each year existing activities will be evaluated and adjusted to ensure that they are performing well – both internally and externally – and that they are meeting our goals and objectives. Any new programs will be subject to a holistic vetting process, by bringing in internal stakeholders from other areas of the Utilities and the City to ensure consideration of multiple viewpoints and create organization-wide awareness and support for the new program.

Part of the support for existing new program development will stem from the Utilities' new Program Management Office, which is tasked with launching Utilities activities in a way that is well planned, well-resourced and sustainable. New programs will be developed through a process that includes several key stages. New programs will need clearly stated goals and objectives. Models will be developed to test the viability of the proposed program in meeting water savings and other goals. These models will likely lay the groundwork for metrics that will measure the effectiveness of the programs. Once a proposed process starts to become clear, risk assessment and a business case will be developed to strengthen and validate the proposed conservation program or activity. Proposed processes will be mapped and documented and roles of staff will be assigned. Internal and external stakeholders will be engaged to ensure consideration of multiple viewpoints, create organization-wise awareness and support for the new program, and to make sure the program is supported by our customers.

The programs that ultimately are implemented will be a function of the budgeting process. The City of Fort Collins uses a Budgeting for Outcomes (BFO) approach, which is based on the premise of prioritizing funding for results, rather than focusing on funding inputs and costs. This method shifts the focus from paying for costs to buying results, and emphasizes accountability, innovation, and partnerships. This is a two-year cycle, with the next preparation phase starting in 2016 for the 2017-18 budget cycle. In order to fund new water efficiency programs, we will need to show that the program can deliver results. These results most importantly include improved water efficiency and sustained water savings.

5.2 MONITORING

We cannot monitor or improve what we do not measure. The benefits of monitoring include:

- Feedback as to whether or not conservation activities are affecting change.
- Identification of programs that might not be cost-effective relative to other programs or to developing new supply.
- Clarity of alignment with goals and if a given program warrants expansion, modification or termination.
- Improvement of modeling of supply needs.
- Illustration of savings by various customer segments
- Tracking of participation based on customer class and other factors to help verify programs are accessible to all types of customers
- Prioritization of program development funding and expansion

While the main goal of this plan is identified in terms of GPCD (a common metric used throughout the water industry that captures community water use changes at a high level) we intend to also focus on more specific and targeted measures. This is further discussed in Chapter 3.

In addition to what is discussed in Chapter 3, tracking measures may include but are not limited to:

- Water savings estimates with breakdowns by seasonal vs. baseline, consumptive vs. non-consumptive, treated vs. raw
- Direct and indirect energy savings associated with water saved
- Landscape changes, including the amount of irrigated landscape; annual amount of audited landscape
- Total participation in programs and events, number of new participants, types of participants – including type of customer based on customer class, sociodemographic categories, geographic location, etc.
- Customer use of the Monitor My Use web portal, mobile, and other online tools and alerts
- How effectively events, educational and informational strategies lead customers to participate in a program; if participation in one program leads to participation in other programs

6.0 CHAPTER 6: ADOPTION, PUBLIC REVIEW AND FORMAL APPROVAL

6.1 ADOPTION OF NEW POLICY

6.1.1 ON OCTOBER 13, 2015, THE CITY OF FORT COLLINS CITY COUNCIL REVIEWED THIS DOCUMENT DURING A WORK SESSION. THE PUBLIC COMMENT PERIOD WAS THEN OPEN FROM NOVEMBER 2, 2015 TO JANUARY 15, 2016. ON MARCH 1, 2016 THE CITY OF FORT COLLINS CITY COUNCIL APPROVED AND ADOPTED THIS PLAN.

6.2 PUBLIC REVIEW PROCESS

Community Leader Involvement in Efficiency Plan Development: Communication with community leaders was a critical component for soliciting ideas and developing consensus to support public review process and the Efficiency Plan as a whole.

A Technical Advisory Group was convened with the purpose of exploring options for conservation and issues related to conservation. The group included Water Board members and Utilities' staff as well as staff from the City of Fort Collins' Environmental Services Department:

- Adam Jokerst, Water Resources Engineer
- Alexander Maas, Water Board Member
- Brett Bovee, Water Board Member
- Carol Webb, Water Resources and Treatment Operations Manager
- Donnie Dustin, Water Resources Manager
- Josh Birks, Economic Health Director
- Katy Bigner, Environmental Planner
- Lance Smith, Strategic Financial Planning Manager
- Laurie D'Audney, Water Conservation Manager (retired)
- Lea Pace, Water Conservation Intern
- Lisa Rosintoski, Utilities Customer Connections Manger
- Michelle Finchum, Community Engagement Specialist
- Peter Mayer, Water DM
- Randy Reuscher, Utility Rate Analyst
- Rebecca Hill, Water Board Member
- Renee Davis, Water Conservation Specialist
- Steve Malers, Water Board Chair
- Tiana Smith, Customer Accounts Manager
- Tim Buchanan, City Forester

This group met for seven meetings, with each meeting focusing on a specific topic. The topics were:

- Meeting 1: Water supply & storage; potential water efficiency goals
- Meeting 2: Scenarios based on water efficiency goals
- Meeting 3: Commercial impacts; current and potential conservation activities
- Meeting 4: Revenue effects from lower demand
- Meeting 5: Tree and landscape impacts; landscape survey results
- Meeting 6: Scenarios based on water efficiency goals, identification of conservation activities.
- Meeting 7: Continued identification and discussion of conservation activities.

The Technical Advisory Group not only heard for expert City staff, but also provided input on potential metrics and possible conservation activities. A member of this group also instigated the creation of a figure to help the public understand where water is used and possible points of improved efficiency.

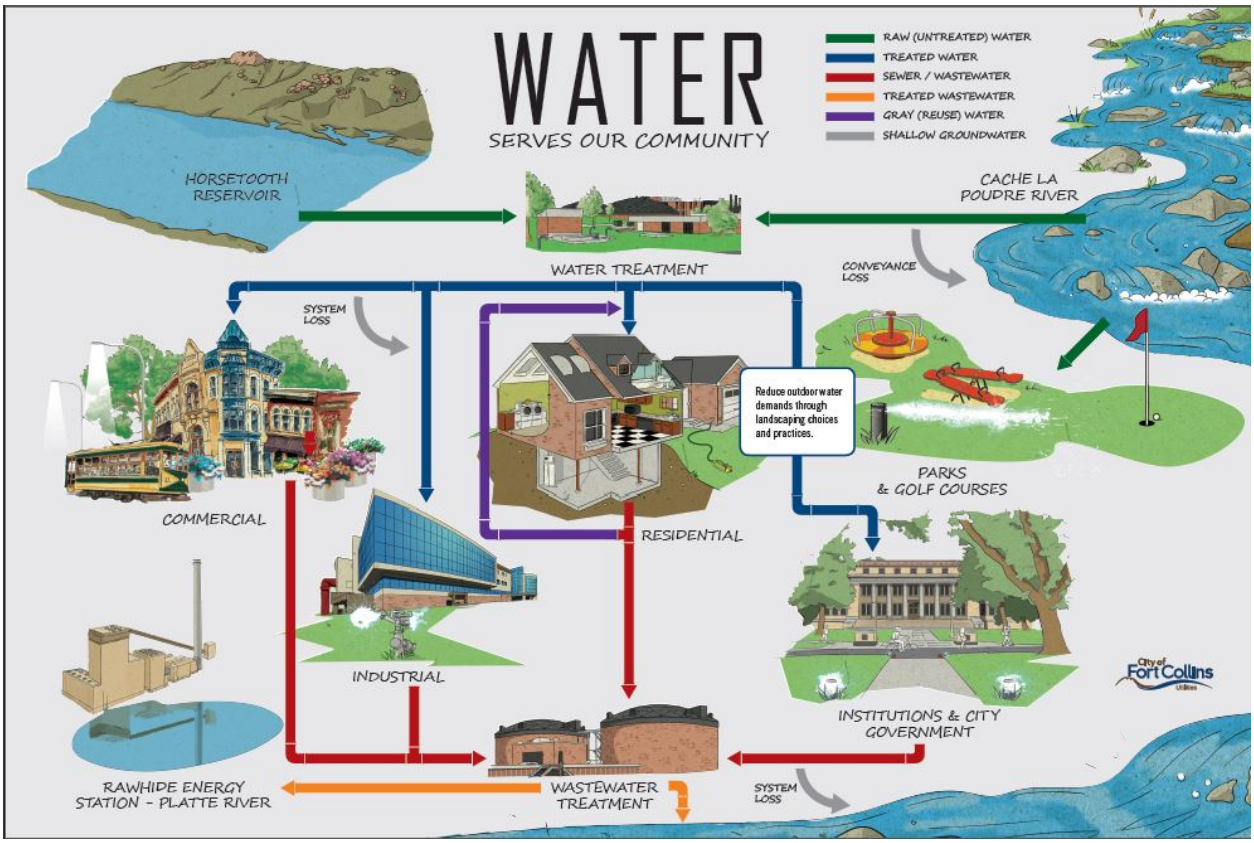


Figure 3 Diagram of Water Sources, Key Infrastructure and Customers

Public Engagement

Communication with the public was done through several channels. The public comment period was open from November 2, 2015 to January 15, 2016. This involved a survey and public comment forum on a Utilities website with the draft of the Plan. Posters were hung around town and we ran social media ads to encourage visits to the website. 11 people provided extensive comments via the online forum.

398 unique people visited the website during this period, though social media had thousands of impressions on viewers so thousands of people are at least aware that the Plan is being updated.

Planners worked in collaboration with CSU's Center for Public Deliberation at a community issues forum in April 2015. This meeting had diverse topics on the agenda and as such provided broad outreach. This was a good chance to engage beyond the usual water-focused audiences.

The Coloradoan, the local Fort Collins newspaper, published the article "Rate changes among water conservation strategies" on November 15, 2015. This article detailed the various approaches to water conservation in the draft Water Efficiency Plan. It also encouraged readers to learn more and provide input during the public comment period. 12 people commented on the Plan through the Coloradoan online comment forum.

The public was also engaged through presentations to various city advisory boards. This effort connected the plan to the public through board members as well as City departments that have a stakeholder role. Boards visited include:

- Water Board work session, April 2, 2015 and October 1, 2015
- Energy Board work session, June 4, 2015
- Planning and Zoning work session, June 5, 2015
- Parks and Recreation Board, June 24, 2015.
- Natural Resources Advisory Board, July 15, 2015 and October 21, 2015.

In addition, we reached out to Economic Advisory Commission and the Land Conservation Stewardship Board. These boards felt our plan was outside their scope, but expressed that if Council directed, they would welcome a presentation.

Local business groups and organizations were also targeted for outreach.

- Associated Landscape Contractors of Colorado, September 10, 2015
- Rocky Mountain Fly Casters, a local chapter of Trout Unlimited, September 16, 2015
- Save the Poudre, October 1, 2015.
    - Save the Poudre member Gary Wockner provided a formal public comment memo to City Council on January 15, 2016.
- Key Accounts semi-annual meeting, November 4, 2015. A follow-up email encouraged commercial and industrial Utilities customers to visit the website and take part in the public comment period.
- Poudre Heritage Alliance, November 18, 2015. An electronic copy of presentation was made available to the group with a request to distribute to their board.
- Downtown Development Authority, materials requested for the January 20, 2016 in lieu of a presentation (presentation originally scheduled for their December 10 meeting, but would have had to have been pushed to a meeting beyond the March City Council session).
- Northern Colorado Home Builders Association's newsletter carried information and a link to the online survey.
- Odell Brewing Company, January 13, 2016
- State Senator Kefalas, January 22, 2016

6.3 6.3 LOCAL ADOPTION AND STATE APPROVAL PROCESSES

6.3.1 THIS PLAN WILL BE PRESENTED AT A FORT COLLINS CITY COUNCIL WORK SESSION IN OCTOBER 2015 AND AGAIN AT A REGULAR SESSION IN MARCH OF 2016. AT THE REGULAR SESSION, FORT COLLINS CITY COUNCIL ADOPTED THE PLAN. FURTHER SUPPORT FROM CITY COUNCIL WAS DEMONSTRATED IN THE 2016 BUDGETING PROCESS WHEN THE COUNCIL PRIORITIZED ADDING ADDITIONAL STAFF. THE PLAN WAS SENT TO CWCB FOR APPROVAL IN JANUARY 2017.

6.4 6.4 PERIODIC REVIEW AND UPDATE

Progress towards the 130 gpcd by 2030 goal will be monitored annually. The water efficiency plan will be reviewed annually during the drafting of Water Conservation's annual report. This report is submitted to Fort Collins Utilities' Water Board for review. An updated water efficiency plan will be developed no later than 2024 (7 years from the anticipated CWCB 2017 submission date).

GLOSSARY

1-in-50 Year Drought Criterion - criterion adopted in the current Water Supply and Demand Management Policy that defines the level of risk for the City's water supply system; a drought is a period of below average runoff that can last one or more years and is often measured by its duration, average annual shortage and cumulative deficit below the average; a 1-in-50 drought corresponds to a dry period that is likely to occur, on average, once every 50 years; although the Poudre River Basin has several drought periods in its recorded history, it is difficult to assess whether any of these droughts were equal in magnitude to a 1-in-50 drought; the 1985 Drought Study developed the 1-in-50 drought used in assessing the Utilities water supply system; this drought period is six years long and has a cumulative deficit of 550,000 acre-feet, which represents annual river volumes that are about 70% of the long-term average for the Poudre River; see also "Statistically Based Drought Analysis"

Acre-Foot or Acre-Feet (AF) - volume of water equal to about 326,000 gallons; one acre-foot can supply around three to four single family homes in Fort Collins per year; for storage comparison the maximum volume of Horsetooth Reservoir is about 157,000 acre-feet

Active Capacity - the usable capacity of a reservoir for storage and regulation of inflows and releases that does not include any capacity below the reservoir's lowest outlet (which is known as dead capacity)

Carryover - used in reference to storage; it is the ability to save water in storage for use at a later time, most notably in following years

Colorado-Big Thompson (CBT) Project - a Bureau of Reclamation project that brings water from the Colorado River basin to the east side of the continental divide via a tunnel and the Big Thompson River to several locations including Horsetooth Reservoir; operated by the Northern Colorado Water Conservancy District (or Northern Water); Fort Collins Utilities currently owns 18,855 units of the 310,000 total units in the CBT project

Direct Flow Rights - water rights that can be taken for direct use, as opposed to storage rights that can be taken for later use; see also "Senior Water Rights"

Drought Criterion - The drought criterion states that in a 1-in-50 year drought the Utilities should be able to meet the planning demand level. This is an important criterion because not only will demands often be higher in drought periods due to less precipitation, water supply systems generally will also yield less water. The Utilities has used a 1-in-50 year drought criterion since the original 1988 Water Supply Policy.

ELCO - short for East Larimer County Water District

Evapotranspiration - the combination of the water lost (evaporate) to the atmosphere from the ground surface, evaporation from the capillary fringe of the groundwater table, along with the plant transpiration, which is evaporation of water from plant leaves. Evapotranspiration is affected by temperature, relative humidity, wind and air movement, soil moisture availability, and the type of plant. For more information see: http://water.usgs.gov/edu/watercycleevapotranspiration.html

FCLWD - short for Fort Collins-Loveland Water District

Firm Yield - a measure of the ability of a water supply system to meet water demands through a series of drought years; for the Fort Collins Utilities, this means being able to meet the planning demand level and storage reserve factor through the 1-in-50 year drought criterion; see also "1-in-50 Year Drought Criterion", "planning demand level" and "storage reserve factor"

GMA – short for Growth Management Area, which is the planned boundary of the City of Fort Collins' future City limits

GPCD - short for gallons per capita per day; a measurement of municipal water use; for the Fort Collins Utilities, GPCD is calculated based on the total annual treated water produced at the Water Treatment Facility for use by all Water Utility customers (minus large contractual customers and other sales or exchange agreements) divided by the estimated population of the Water Utility's service area and 365 days

Legal Return Flows or Return Flow Obligations - refers to legal requirements when changing water rights from agricultural to municipal use; this process requires obtaining a decree from Colorado Water Court that involves detailed analysis of the historic agricultural water use, including the water diversions, amount used by the crops, and the return flow patterns of the water not used by the crops; terms in the decree to prevent municipalities from taking more water than was historically taken and replacing return flows in the right amount, location and time to prevent injury to other water rights

LiDar: This is a remote sensing technology that can be used in large-scale landscape analysis.

Northern Water or NCWCD - short for Northern Colorado Water Conservancy District (NCWCD); Northern Water operates the Colorado-Big Thompson (CBT) Project and is involved in several other regional water projects on behalf of their participants; see also "Colorado-Big Thompson (CBT) Project"

NPIC - short for North Poudre Irrigation Company; an irrigation company that supplies water to farmers north of Fort Collins and is the owner of all water currently stored in Halligan Reservoir

Planning Demand Level - level of water use (demand) in GPCD used for water supply planning purposes that is a factor in determining the amount of water supplies and/or facilities needed; see also "GPCD"

RWR – short for Raw Water Requirements, which requires new development to turn in water rights or cash-in-lieu of water rights to support the water needs of that development; cash is used to increase the firm yield and long-term reliability of the Utilities' supply system (e.g., purchase additional storage capacity)

Senior Water Rights - refers to Colorado water law's use of the "prior appropriation" or priority system, which dictates that in times of short supply, earlier water rights decrees (senior rights) will get their water before others (junior rights) can begin to use water, often described as "first in time, first in right"

Storage Reserve Factor - refers to a commonly used engineering principle in designing water supply systems to address short-term supply interruptions; as defined in the Water Supply and Demand Management Policy, the storage reserve factor incorporates having 20 percent of annual demands in storage through the 1-in-50 drought which equates to about 3.5 months of winter (indoor) demands or 1.5 month of summer demands

Water Rights Portfolio - the mix of water rights owned by a water supplier; typically includes water for direct use, as well as for storage for later use; for the Fort Collins Utilities, includes City owned water rights, owned and/or converted shares in agricultural rights, storage rights at Joe Wright Reservoir, and ownership in the CBT project

WSDMP - short for Water Supply & Demand Management Policy, which provides Fort Collins Utilities guidance in balancing water supplies and demands

Yield or Water Rights Yield - refers to the amount of water that is produced from a water right; the yield of water rights vary from year to year depending on the amount of water available (i.e., low or high river runoff) and the priority of the water right; see also "Firm Yield" and "Senior Water Rights".

APPENDIX A: MATERIALS RELATED TO CHAPTER 1

The following are descriptions of the various water supplies currently in the Utilities water supply portfolio:

Poudre River Basin Water Rights:

- Senior Direct Flow Decrees: The City has five very senior direct flow decrees on the Poudre River that are available to the City most of the time. Only in very severe dry periods are the diversions limited.
- Junior Direct Flow Decrees: These junior rights are only in priority during the peak runoff period when most of the other rights on the Poudre River have been satisfied. In dry years, the City may not be able to divert anything under these rights.
- Pleasant Valley and Lake Canal Shares: The City owns a substantial portion of the shares in this mutual irrigation company. The amount of water the City is entitled to divert to meet treated water demands depends on the number of shares the City designates for such use and which priorities owned by the irrigation company are in priority during the season.
- Southside Ditches: The City owns shares of stock in the Arthur, Larimer No. 2, New Mercer and Warren Lake irrigation companies, often referred to as the Southside Ditches. With 13 separate priorities, yields vary considerably from year to year. Much of the yield comes from a couple of large junior rights and normally only yields during the high runoff months of May and June.
- Michigan Ditch and Joe Wright Reservoir System: This system consists of a ditch that diverts water from the Michigan River drainage across the divide into the Poudre River Basin, Joe Wright Reservoir and storage capacity in Meadow Creek Reservoir. Joe Wright Reservoir includes about 6,500 acre-feet of active storage and is the only storage facility owned and operated by the City. There are usually periods during the peak runoff season in which the reservoir is full and Michigan Ditch water is available if it can be taken directly to meet demands. Joe Wright Reservoir is used primarily to regulate the annual Michigan Ditch flows and has limited carryover capacity to provide drought protection for the City. The City also has storage capacity in Meadow Creek Reservoir, which is used to release water to downstream senior rights on the Michigan River.
- Water Supply and Storage Company Shares**:** The City owns about 27 shares in this irrigation company. Since the City-owned shares are not presently decreed for municipal use, this water is usually rented back for agricultural use.

Colorado-Big Thompson Water System:

- Horsetooth Reservoir: Water from Horsetooth Reservoir, a part of the C-BT Project, can be delivered to the City's water treatment facility or to the Poudre River. The following sources are available for use from Horsetooth Reservoir.
- Windy Gap Water**:** The City receives Windy Gap water from Platte River Power Authority (PRPA) as payment for 4,200 acre-feet of reusable effluent made available to PRPA by the City. The reusable effluent is the result of a Reuse Plan that involves the City, PRPA, and the Water Supply and Storage Company (WSSC). The 4,200 acre-feet of Windy Gap water is dedicated for large contractual use that requires reusable water. As part of the Reuse Plan, the City is required to deliver 1,890 acre-feet of single use water to the WSSC.
- North Poudre Irrigation Company (NPIC) Shares**:** The City currently owns about 3,564 shares of NPIC. Each share consists of native water supply (which is primarily decreed for agricultural use)

and 4 units of C-BT water. Unless the agricultural portion of each share is changed for municipal purposes, the City can only use the C-BT portion of the shares to meet treated water demands.

- West Fort Collins Water District (WFCWD) Water**:** Through an agreement with the WFCWD, the City provides treated water to their customers and in return, gets reimbursed with an equivalent amount of C-BT water. In recent years, the amount transferred to the City has been about 500 acre-feet each year.

APPENDIX B: MATERIALS RELATED TO CHAPTER 2

Table: Collected Service Area Trends, 2001-2014

Year	Service Area Population	Annual Water Use (MG)	Average Day Use (MGD)	Actual Use (GPCD)	Normalized Average Use (GPCD)	Peak Day Use (MGD)	Actual Peak Day Use (GPCD)	1 in 50 Normalized Peak Day Use	Annual Precipitation (inches)	ETos Grass Tot (in)
2001	121,300	9,978	27.3	198	198	55.8	428	503	12.3	45
2002	123,700	9,599	26.2	183	189	51.4	378	411	9.3	47
2003	125,500	8,280	22.6	154	157	46.9	346	383	18.2	49
2004	125,800	7,984	21.8	146	150	42.3	307	327	18.1	44
2005	126,900	8,497	23.3	155	155	50.1	365	363	16.2	49
2006	127,800	9,268	25.4	172	156	48.9	353	350	11.2	51
2007	128,400	8,860	24.2	162	156	47.5	342	356	13.7	44
2008	128,700	8,352	22.8	153	153	44.3	321	333	13.8	50
2009	128,900	7,391	20.2	135	147	37.1	265	304	21.9	46
2010	129,000	7,830	21.4	146	144	40.8	295	323	14.1	48
2011	129,100	7,621	20.8	141	144	39.7	285	289	17.8	49
2012	129,200	8,757	23.9	165	152	46.8	342	315	10.8	54
2013	129,300	7,560	20.7	141	147	43	312	303	18.8	47
2014	130,200	7,437	20.4	139	143	37.2	269	288	16.7	47

The following are descriptions of the Current Water Conservation Program Activities, along with the first year of full implementation.

Foundational Activities

- Conservation-oriented rate structures (2003) – Tiered rates (increasing block rate structure). There are currently three tiers for residential single-family and duplex customers, one tier for multi-family units, and two tiers and commercial customers.[41]
- Continuous Consumption program (2015): this program developed a data query that checks the meter data for meter readings that have continuously remained above zero for 72 hours. Customers with the highest continuous flow rates are contacted to make them aware of the continuous consumption and the likely leak. Staff troubleshoots with the customer to try to find the source of continuous use.
- Metering (2003): Commercial and multi-family units have been metered for decades; the Utilities fully metered residential customers by 2003. The Utilities transitioned to advanced metering infrastructure (AMI) in 2014, known as Advanced Meter Fort Collins (AMFC) The data resolution is hourly intervals for water and 15-minute intervals for electric.
- Monitor My Use (2014): this web-based portal was developed to provide customers near-real time access to their historical and current electric and water usage and costs. The portal also provides comparisons to the previous bill period, and illustrates which tier you are currently in. There are alert-based features that a customer can use to provide automatic notifications when they reach a certain usage level or cost level.[42] A mobile version was launched in December 2014.
- Online water use calculator (2012): Customers can use an online calculator with their household parameters and historic water consumption to identify ways to improve efficiency and reduce use.[43]
- Seasonal rate structures (2003): Multi-family and commercial customers face higher rates from May through October.
- Utility water loss program (1993): Sonar equipment is used to listen for leaks in the water mains and pinpoint their locations. Crews monitor water leaks on an ongoing basis, with a two-year cycle to survey all water mains. Catching leaks before they have surfaced saves water and costs of excavation and repairs, and supports the wasting water ordinance.

[41] For the most current residential rates see: http://www.fcgov.com/utilities/residential/rates/water. Multi-family units are often not sub-metered and instead have a base charge which varies by the number of dwelling units. Commercial customers' rates are based on the size of the meter; this includes the base charge, the volumetric charge, and the volume above which customers face the second-tier rates. See http://www.fcgov.com/utilities/business/manage-your-account/rates/water for the most current rates.

[42] This tool is only available for residential customers. Commercial customers currently have access to a different tool called MV Web and the Utilities is exploring new methods and systems to address commercial customers' needs.

[43] Currently, the Utilities' website provides a link to the following website developed by the Alliance for Water Efficiency: http://www.home-water-works.org/

Targeted Technical Assistance and Incentives

- Commercial custom rebates (2011): offered for any technology (e.g. cooling tower conductivity control, leak detection and repair, fixture replacement, etc.) that has a documented water savings from the current equipment.
- Commercial facility assessments (2004): facility audits are performed to assess water and energy use and make recommendations for improved efficiency. During these assessments, low-flow aerators are installed at no cost to the business.
- Home efficiency audits (2009): residential customers are offered an energy and water audit of their home to identify equipment and actions that can improve efficiency for a small fee. Faucet aerators and showerheads are installed at the time of the audit.
- Home efficiency loans/on-bill financing (2010): this program offers a low cost, no-money-down financing option for up to 20 years. Loans are conveniently repaid by the customer through their monthly utility bill.
- Indoor Appliance and Fixture Rebates (residential and commercial):
    - Clothes Washer (2003): Available for eligible EnergyStar labeled clothes washers.
    - Dishwasher (started 2007): Available for eligible EnergyStar labeled dishwashers.
    - Toilet (2010): Available for eligible WaterSense labeled toilets and urinals.[44]
    - Showerhead (2011): Available for eligible WaterSense labeled showerheads.
    - Outdoor Equipment Rebates (residential and commercial):
    - Sensors (rain, soil moisture), high-efficiency nozzles, pressure-reducing heads, pressure regulators, and smart irrigation controllers
- Low income retrofit program (2007): provides low income single- and multi-family households with toilet, showerhead and faucet aerator retrofits. This work is often done in partnership with Larimer County Conservation Corps.
- Restaurant pre-rinse spray valve distribution (started 2011): low flow pre-rinse spray valves (to rinse trays of dishes prior to washing them) are installed at no charge for restaurants and other food service operations.
- Sprinkler system audits (1999): audits are offered to homeowners and homeowner associations to help them improve sprinkler system efficiency.
- Xeriscape design/incentive program (2010): provides homeowners a one-on-one consultation with a landscape design professional for a small fee.

[44] The toilet rebate program also includes a mandatory toilet recycling component. The porcelain from recycled toilets is used by the Streets Department as a road base.
http://www.fcgov.com/utilities/residential/conserve/water-efficiency/toilet-rebates/toilet-recycling

Educational Activities

- Business education programs (2004): Programs are offered to commercial customers on a variety of environmental topics, including water conservation. Staff provides newsletters, mailings, meetings and seminars on topics of interest to specific businesses, such as restaurants, hotels, car washes, landscapers, and key accounts.
- Community education programs (1977)[45]: These programs include the Educators' workshops, contractor trainings, and partnerships to put on other events like the Residential Environmental Program Series. The Utilities also conducts educational programs about Xeriscape landscaping, watering techniques and practices and general water conservation. A daily Lawn Watering Guide is published in the Fort Collins Coloradoan and on the City's website during the watering season.
- Conservation kit giveaways (1990): Free conservation kits with indoor and/or outdoor water-saving devices and information are offered periodically to customers during events.
- Conservation public information efforts (1977): Information is disseminated via bill inserts, bus benches, billboards, events, newspaper articles, TV and radio announcements, Utilities website information, social media, and more. The team also serves as technical experts to help commercial customers with water use or billing questions. Displays are set up at several community events including the Sustainable Living Fair, Harvest Festival, Business Innovation Fair and many others.
- Home Water Reports (2014): These reports are delivered to a portion of customers on a bi-monthly basis. The reports provide households with information on their current water use and comparisons to historical use as well as similar households' use.[46]
- Hotel and restaurant conservation material distribution (2003): A three-card set is available for hotels and other lodging establishments to inform guests about importance of water conservation to our area and to encourage the reuse of towels and linens. Tent cards are available for restaurants telling customers that "water is served upon request."
- K-12 education programs (1977): Presentations and hands-on activities are provided to school classes on water topics, including the history of water in Fort Collins, water use and conservation, water chemistry and watersheds. Fort Collins Utilities is a co-sponsor of the annual Children's Water Festival.
- Watershed tours (2012): Educational bus tours of the Utilities' Cache la Poudre watershed; involves information about drinking water, protection of water resources, water quality, and managing urban watersheds.
- Xeriscape Demonstration Garden (1986): Staff oversees maintenance of the City's Xeriscape Demonstration Garden and provides tours at organized events and upon request. We are also partnering to support various demonstration gardens and other events at the Gardens on Spring Creek.[47]

[45] http://www.fcgov.com/utilities/community-education

[46] The Utilities implements a similar program (Home Energy Reports) for electric customers.

[47] http://www.fcgov.com/gardens/

Ordinances and Regulations

- Green building codes (2011)[48]: Existing building codes include many elements that support green building; the code green amendments represent the next steps along the path of integrating green building practices into mainstream construction. These codes include a requirement for bathroom and kitchen faucet aerators, showerheads and toilets to not exceed the flow rates of WaterSense labeled fixtures.
- Landscape and irrigation standards (1994) - New development landscape and irrigation plans are reviewed for compliance with the Land Use Code's water conservation standards. As part of these standards, a rain shut-off device and a post-installation audit are required for commercial sprinkler systems.
- Parkway landscaping regulations (2013)[49] – The City updated the Streetscape Standards to include more flexibility to xeriscape the parkway, the strip of land between a residential street and the sidewalk.
- Plumbing standards (1978): All construction within the City of Fort Collins shall comply with the most recent International Plumbing Code, among other codes and standards.[50]
- Restrictive covenants ordinance (2003) – City Code prohibits homeowner association covenants from banning the use of Xeriscape or requiring a percentage of landscape area to be planted with turf, if the homeowner owns the property and pays for the water that irrigations the landscape.
- Soil amendment ordinance (2003): requires builders to amend the soil for new landscapes.
- Wasting water ordinance (1917) – staff enforces the section of the City Code that prohibits wasting water. Wasting water complaints are investigated. Complaints are used as an education tool, but enforcement by ticketing is also an option.[51]
- Water efficiency upgrades at City buildings (2010): The City is committed to building new City buildings to the LEED standards; including water efficiency upgrades. Audits are conducted at existing City facilities and upgraded water-efficient indoor fixtures and sprinkler system equipment are installed. The City has a sustainability goal to reduce municipal building water use (normalized to account for weather conditions), by 20% by 2020.[52]
- Water Supply Shortage Response Plan (2003): This plan has a series of measures to be enacted, including water restrictions, for various levels of water shortage.[53]

[48] http://www.fcgov.com/enviro/green-building.php
[49] http://www.fcgov.com/planning/streetscapedesign.php
[50] http://www.fcgov.com/building/codes.php

[51] City Ordinance No. 089, last updated in 2014.
[52] http://www.fcgov.com/sustainability/goals.php
[53] City Ordinance No. 088, last updated in 2014.

Other Activities

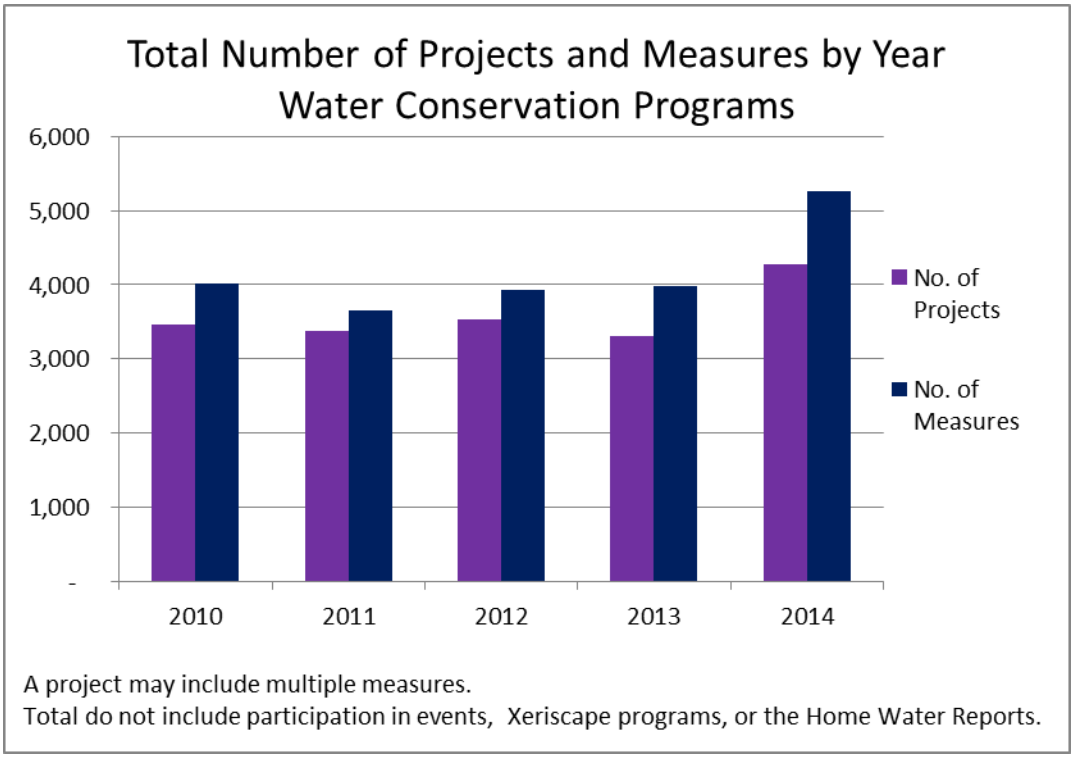
- Backwash water recycling (2003): Backwash water recycling equipment at the water treatment facility treats backwash water and recycles it to the beginning of the treatment process.
- Large customer reuse (1985) – Treated wastewater from the Drake Water Reclamation Facility is pumped to Rawhide Power Plant for landscaping and cooling water.
- Raw water for City irrigation: Raw water is used to irrigate the majority of the City's parks, cemeteries, and golf courses.[54]

Program Participation 2010-2014 (does not include event attendance)

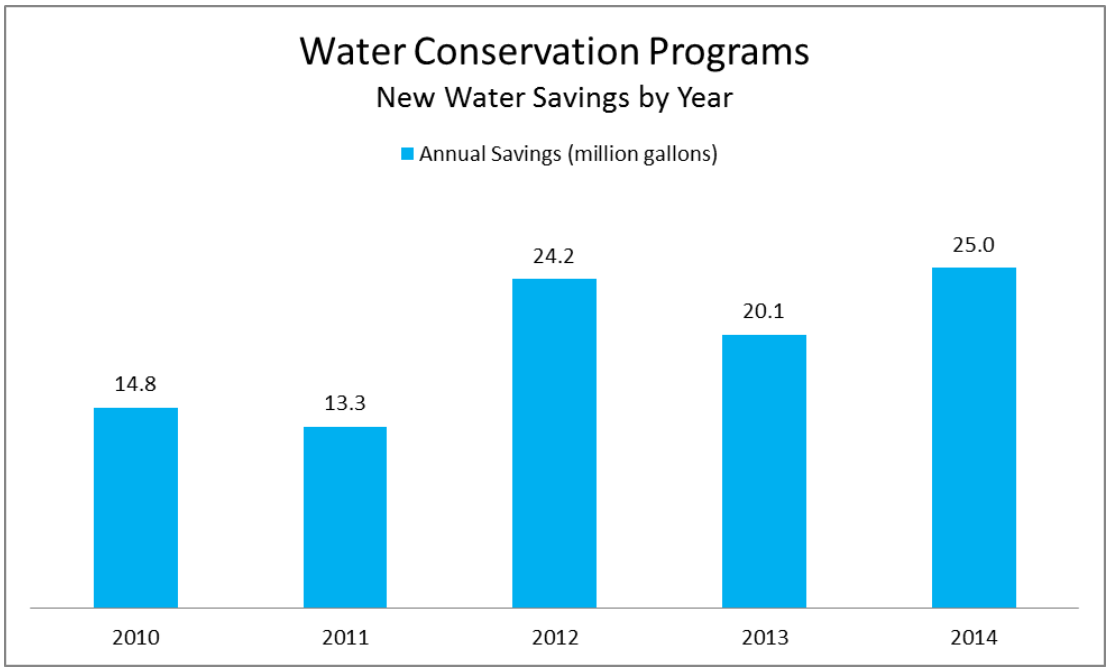
Program	2010	2011	2012	2013	2014
Clothes Washers	1249	1366	993	971	1058
Commercial Clothes Washer	--	--	0	1	0
Commercial Dishwasher	--	--	0	1	0
Commercial Facility Water Assessments	81	77	93	268	281
Commercial Kitchen Info Program	--	--	32 nozzles, 72 aerators	16 rebates, 79 items	--
Commercial Restroom	--	1	4 rebates; 443 items	16 rebates; 79 items	27 rebates; 249 items
Commercial Sprinkler Audits	2	1	0	0	0
Commercial Sprinkler Equipment	--	15	56 rebates; 964 items	35 rebates; 2266 items	12 rebates; 165 items
Custom Commercial Rebate	--	2	1	3 rebates; 14 items	0
Dishwasher	780	880	635	648	787
ELCO Audits	--	--	42	48	68
FCLWD Audits	112	82	67	94	97
Garden-in-a-box	--	68	63	74	--
HOA Sprinkler Audits	5	12	14	13	11
Home Efficiency Audits	466	519	592	683	662
Home efficiency loans/On-bill Financing	13	6	5	0	7
Home Water Reports	--	--	--	--	10,000
Irrigation Plan Review	11	42	44	49	69
Irrigation Site Inspection	21	24	28	34	52
Landscape Plan Reviews	29	49	54	73	59
Low Income Retrofit Program	--	250 homes	275 homes	275 homes	482 homes
Residential Sprinkler Audits	449	331	232	394	232
Residential Sprinkler Equipment	164	118	137 rebates; 170 items	108 rebates; 880 items	97 rebates; 135 items
Residential Toilet	479	573	912	651	1004
Showerhead	--	21	27	25	73
Xeriscape Design Clinic/Assistance	55	50	37	--	46

[54] Many of these properties have only ever been irrigated with raw water, thus the "start" date varies.

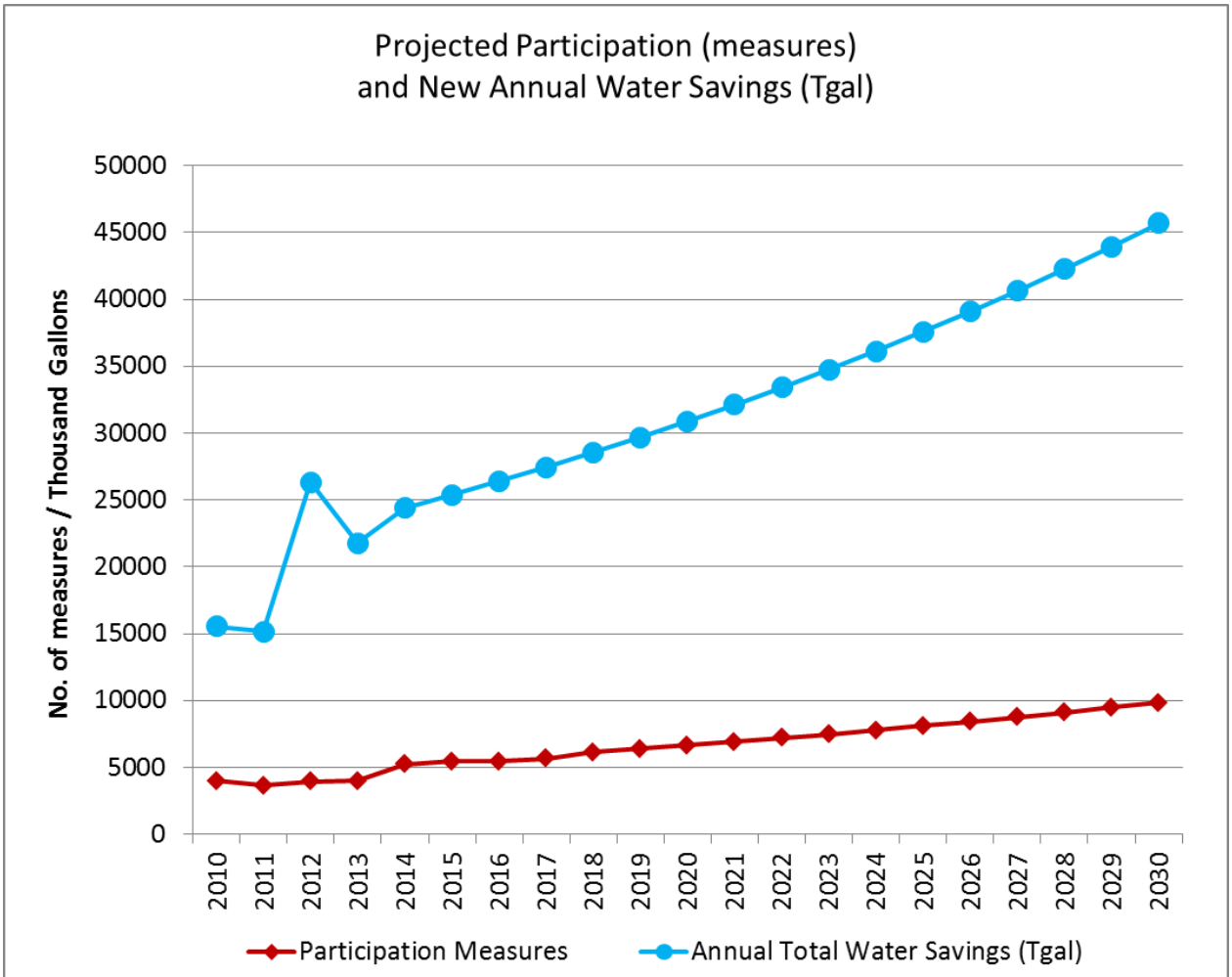
Below is a graph of the total number of projects and measures by year from 2010 to 2014.



Below is a graph of the estimated new annual water savings in million gallons. These totals do not reflect savings from Xeriscape programs, Home Water Reports, or events.



See below for a graph of projected participation (where participation here means total number of measures) and annual new water savings in thousand gallons, where the savings includes customer water use reductions as well as savings from treated less water and avoiding losses throughout the distribution system.



Estimates use 2014 numbers as the base, and assume a linear growth of measures of 4% each year
Estimates do not include Home Water Reports, xeriscape programs, or events.
The jump in water savings from 2011 to 2012 reflects several new rebate offerings launched in 2012.

APPENDIX C: MATERIALS RELATED TO CHAPTER 3

Water Efficiency and Conservation Activities and related actions support the following Strategic Objectives from the City's 2015-16 Strategic Plan.[55]

City of Fort Collins Strategic Objectives most relevant to Water Conservation Activities	
Key Strategic Outcome: Environmental Health	
	4.1: Improve and protect wildlife habitat and the ecosystems of the Poudre River and other urban streams.
	4.2: Achieve environmental goals using the Sustainability Assessment framework.
	4.6 Engage citizens in ways to educate and change behavior toward more sustainable living practices.
	4.7: Increase the community's resiliency and preparedness for changes in climate, weather and resource availability.
	4.8: Protect and monitor water quality, and implement appropriate conservation efforts and long-term water storage capability.
Key Strategic Outcome: Economic Health	
	3.5: Sustain high water quality to support the community and water-dependent businesses.
	3.6: Maintain utility systems and services; infrastructure integrity; and stable, competitive rates.
	3.7: Support sustainable infill and redevelopment to meet climate action strategies.
	3.9: Provide transparent, predictable and efficient processes for citizens and businesses interacting with the City.
Key Strategic Outcome: Community and Neighborhood Livability	
	1.3: Direct and guide growth in the community through appropriate planning, annexation, land use and development review processes.
	1.11: Maintain and enhance attractive neighborhoods through City services, innovative enforcement techniques, and voluntary compliance with City codes and regulations.
Key Strategic Outcome: Safe Community	
	5.10: Provide a high-quality, sustainable water supply that meets or exceeds all public health standards and supports a healthy and safe community.
Key Strategic Outcome: High Performing Government	
	7.4 Strengthen methods of public engagement and reach all segments of the community.
	7.6: Enhance the use of performance metrics to assess results.
	7.9: Improve productivity, efficiency, effectiveness, customer service and citizen satisfaction in all areas of the municipal organization.
	7.10: Implement leading-edge and innovative practices that drive performance excellence and quality improvements across all Service Areas.
	7.11: Proactively influence policy at other levels of government regulation.

[55] http://www.fcgov.com/citymanager/pdf/strategic-plan-2015.pdf