Final
City of Brighton

Water Conservation Plan Update

December 2016

Brighton℠

Prepared by:
Sustainable Practices
Swarthmore, PA

Funded by a generous grant from the Colorado Water Conservation Board

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Brighton

500 South 4th Avenue Brighton, CO 80601

January 31, 2018

Mr. Kevin Reidy
Colorado Water Conservation Board
1313 Sherman St., Rm. 721
Denver, CI 80203

RE: City of Brighton 2016 Water Conservation Plan
Letter of Additional Explanation

Dear Mr. Reidy,

The City of Brighton completed its Water Conservation Plan Update in December 2016. This Plan, which was partially funded by the CWCB through its Water Efficiency Grant Fund, was developed in a manner consistent with the regulations that were in place at the time the work was scoped and initiated in the fourth quarter of 2015. However, the CWCB water conservation planning requirements changed between the time that the City's Plan was scoped and initiated, and the time that CWCB received the City's Final Plan approved by City Council.

Of specific note is the 2016 update to the CRS 37-60-126 that water conservation plans include a consideration and discussion of "best management practices for water demand management, water efficiency, and water conservation that may be implemented through land use planning efforts." This point was made in your letter to the City dated December 27, 2016.

The letter from CWCB also indicated that although the Final Plan content included language that linked water efficiency and water conservation best management practices with new development plan review and new park and open space planning, additional language was desired to more directly link selected water conservation programs with land use planning. Without this language, the CWCB provided the City with a "Conditional Approval" of our Plan.

The change requested by the CWCB is not considered substantial, and that it is procedurally both time consuming and expensive for the City to reopen the Final Plan, it was agreed last week during our conference call that this Letter of Additional Explanation would effectively amend the CWCB record related to the City's file and allow the Final Plan to receive "Full Approval."

To address the CWCB comment requesting additional information clarifying the link between the City's water efficiency and water conservation programs, and land use planning efforts, the following information is provided regarding the City's current policies and the City's efforts which are being implemented regarding irrigation and development standards, as well as, those that are intend to be implemented later in 2018.

- Currently, most of our water efficiency efforts center on City Parks, not residential developments or HOA maintained landscape.

- The Parks Department has adopted standards and specification for the installation of City facilities. This includes soil amendment requirements, connection to Brighton's Toro Sentinel Irrigation Control System, and turf type requirements based upon anticipated use; sporting fields, etc.

- Recently, the Parks department has installed a weather station that links to the Parks Irrigation Control System computer. The Irrigation Control system automatically shuts down sprinkler systems in the event of wet weather. All City managed irrigation systems are connected to the Irrigation Control system.

- In 2018, the City is reviewing and updating our Land Use Planning Document, which is one of the City's planning efforts that governing future land use planning requirements. Previously updated in 2012, the Utilities Department along with members of the Community Development Planning Staff and the Parks Department are jointly undertaking the project.

- Our team will be looking at including more water efficiency planning for new development within the Land Use Planning Document. Best management practices related to requiring soil amendments for all residential and commercial construction; installing smart controllers on irrigation systems for all commercial and HOA managed properties; and encouraging xeriscape plant material in residential and commercial landscapes are some of the candidates being considered.

Brighton has seen substantial growth in recent years, the Land Use Planning Document is being developed with an eye toward the appropriate management of water resources and water utility funding. It is anticipated that the combination of improved plan review procedures that include the Utilities Department (which are contained in the 2016 Final Plan), and enhanced land use planning that considers water resources management through water demand management, water conservation and water use efficiency best management practices, will create a long-term link between the water utility and future City growth.

We request that the CWCB consider this Letter of Additional Explanation as a fulfillment of the informational request documented in its December 27, 2016, and provide the City with a notice of Full Approval at your earliest convenience.

As always, the City is most appreciative of the CWCB and its staff, and we hope that this letter will provide your organization with the information requested such that the final resolution to this issue may be forthcoming. Please do not hesitate to contact me with any questions or concerns that you may have.

Respectfully,

Dawn M. Hessheimer

Dawn M. Hessheimer
Water Resources Specialist

Cc: Tracy Bouvette, Stainable Practices

Purpose and Framework of the Plan

The Water Conservation Plan will be prepared using the State's Water Efficiency Plan Guidance Document and the related Water Conservation Plan Template, to the extent that these references are relevant to the City's circumstances and situation given the nature of its service population and geography. The Plan will also utilize the Southeastern Colorado Water Conservancy District's water conservation best management practices (BMP) tool box to help develop an appropriate framework within which water conservation measures and programs can be assessed and considered. Finally, the City filed a Water Conservation Plan under the 2004 Water Conservation Act in 2007, such that this Plan will serve as an update to that Plan.

As with any Water Conservation Plan, it is anticipated to be a living document that is used to guide and direct the real time allocation of resources related to the improvements of local water use efficiency for the management of City infrastructure and customer demands. In that past planning efforts were amended and revised to allow for implementation that leveraged new and improved data collection and program understanding, this Plan may also be amended and revised as it is implemented. This in no way compromises or lessens the relevance and importance of this planning effort, it simply defines the context through which Plan implementation will occur.

The specific components of the updated water conservation plan will include the following:

- Updating the profile of the existing water supply system
- Updating the characterization of current and future water demands including the characterization of non-revenue water and real water loss
- Developing water conservation goals that are consistent with the needs of the City and the available resources
- Integrating updated planning and water efficiency benefits and goals with future water supply needs
- Identifying, evaluating and selecting new and/or continued water conservation programs – for local implementation
- Developing the implementation and monitoring tasks needed to track costs and benefits of implemented water conservation and water efficiency programs

Organizational Background and Overview of Water Supply

The City of Brighton (hereafter the City) as of the end of 2015 serves about 37,500 citizens distributed over a 27-square mile service area (See Figure 1). The City owns and operates both a potable and non-potable water delivery system, which utilize both groundwater and surface water supplies. The potable system is comprised of 11 South Platte and BeeBe Draw production wells that feed 2 water treatment plants along with a treated water inconnect with a neighboring community (i.e., Westminster). The non-potable system is comprised of 2 ditch systems that provide water for irrigation purposes to selected locations within the City's service area. The non-potable system can also use the unused portion of the City's groundwater rights. The focus of the water conservation plan update will be on the potable system.

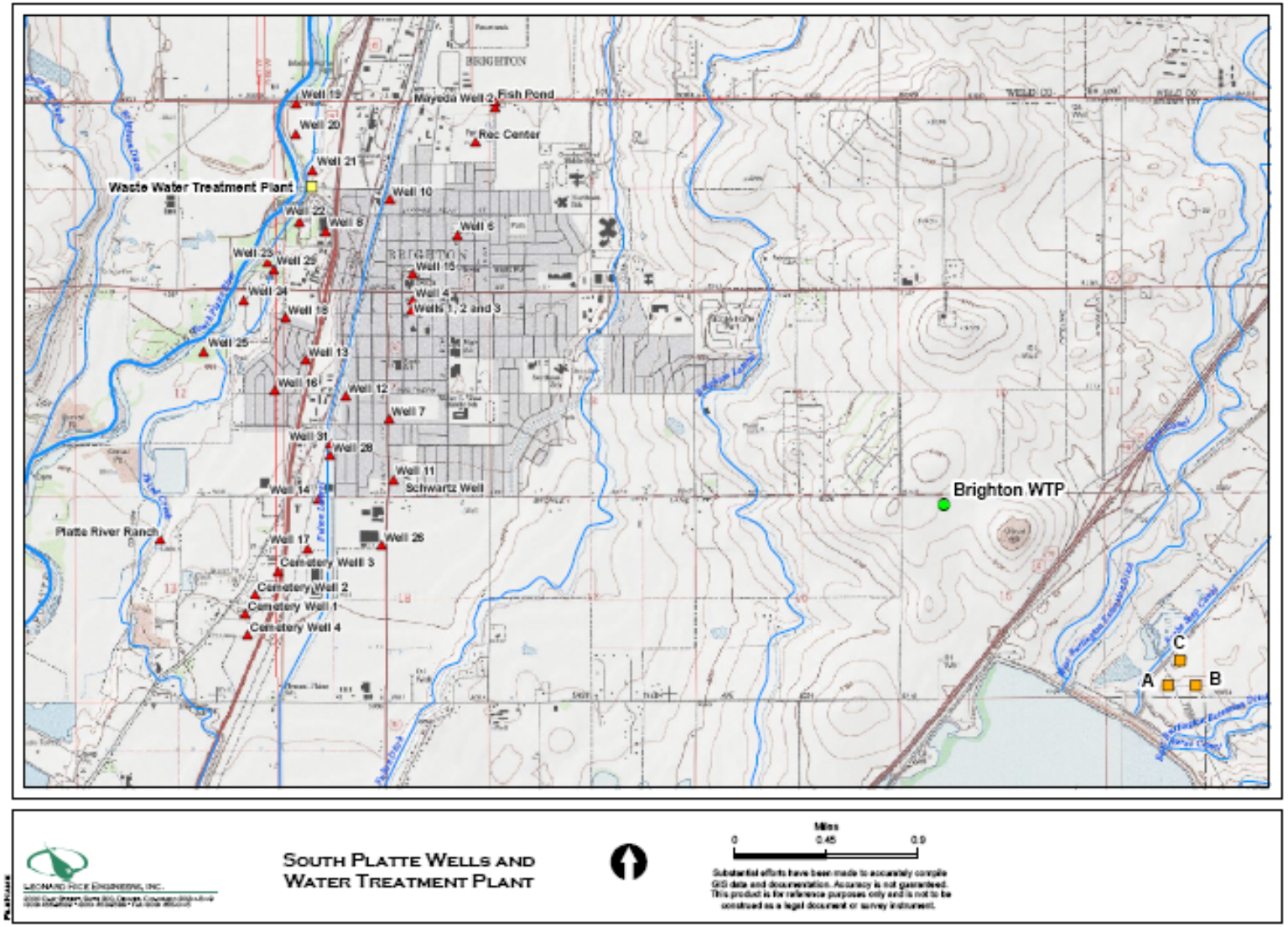
Groundwater produced from the 11 wells owned and operated by the City is pumped to one of two water treatment plants for filtration and disinfection prior to distribution. Groundwater production occurs from two separate tributary aquifer systems – the South Platte and the Beebe Draw. Studies conducted by the City in 2007 indicate that the sustainable annual yield of the current South Platte and Beebe Draw production wells is about 4,500 acre-feet per year and about 900 acre-feet per year, respectively.

The City supplements the groundwater supply with treated water provided by interconnection with the City of Westminster. This has proven to be an economical and reliable source of potable water since 2010. The interconnection with Westminster provides a steady supply of about 51 million gallons per month, with little seasonal variation[1]. To this point, the groundwater sources utilized by the City to meet customer demand vary considerably based on seasonal demand, since the Westminster supply is consistent from month to month and meets only a portion of the overall Brighton needs.

Groundwater produced by the City from the South Platte and Beebe Draw alluvium is considered tributary groundwater and must therefore be augmented to offset depletions that occur out of priority. In general, the City is allowed return flow credits for about 95% of wintertime use of the tributary groundwater, since most of the treated water used by the community during this time is returned to the river through

[1] Westminster reduced the volume of water provided through the interconnect for a few months in Spring of 2013 in response to drought conditions (see Figure 3 on page 13), but has typically provided about 51 million gallons per month through the interconnect to the City since operations began.

Figure 1 – Brighton Service Area and Well Fields



One of two local wastewater treatment plants where it is treated and ultimately discharged back into the South Platte or the BeeBe Draw Alluvium. The City is, therefore, required to augment tributary groundwater that is consumed during the year by using ditch water that the City has acquired. The ditch water is used either directly or it is stored in reservoirs for later release.

The City operates two water treatment plants for purposes of creating potable supply from the tributary groundwater wells. One treatment facility uses reverse osmosis (RO) to treat the raw water produced from the South Platte wells; whereas the Beebe Draw well water is treated using a green sand filtration system. Both treatment systems generate waste streams associated with typical water treatment operations. The RO system generates a concentrate, which in 2013, was about 20% of the well-water influent to the treatment system. The green sand water treatment facility requires regular filter back washing to maintain filter efficiency and effectiveness. Back wash water in 2013 required about 8% of the production of the Beebe Wells.

The RO concentrate is returned to the river under a separate discharge permit via the City's storm water system such that the City receives return flow credits for this waste stream.

Table 1 presents a summary of the potable water system treated water production and use (shown as total treated water sold) over the last 8 years. As indicated in Table 1, the City's total annual water use (as production) from 2008 through 2015 averaged approximately 1.7

Table 1
Summary of Treated Water Production, Water Sold and Non-Revenue Water
(in thousands of gallons)

	Total Treated Water Production	Westminster Interconnect Supply	Total Treated Water Sold	Non-Revenue Water[2]	Population Served[1]	Total Retail Water Sold[2] (AF)
2008	1,767,704	0	1,535,064	232,640	33,328	4,711
2009	1,580,042	0	1,359,267	220,775	33,436	4,171
2010	1,788,940	286,093	1,677,428	252,273	33,544	4,716
2011	1,722,089	632,719	1,695,942	184,345	33,710	4,719
2012	1,951,260	632,197	1,947,344	256,176	35,098	5,207
2013	1,610,138	537,235	1,541,354	173,856	35,719	4,408
2014	1,647,878	642,953	1,584,289	173,017	36,765	4,526
2015	1,684,767	633,382	1,498,699	186,068	37,500	4,599

[1] – Population represents total population in the City's service area at the end of the calendar year.
[2] – Non-revenue water includes all unbilled municipal water accounts. Total Treated Water sold also includes all unbilled municipal water accounts for completeness, since the unbilled accounts are metered and read.

billion gallons annually (or about 5,200 acre feet (AF)); and total water sold was about 1.5 billion gallons annually (or about 4,600 AF). The City is a "covered entity" as defined in CRS 37-60-126[2].

Based on the total production and total retail water sold, the City does not have adequate yield from their groundwater supplies to meet current customer demand, in that the combined yield of the South Platte and Beebe Draw wells is about 5,400 AF, whereas the amount of water that must be produced by the well fields to meet the average production demand of 5,200 AF, including reject, is about 6,300 AF. For this reason, the interconnection with Westminster, which provides about 2,000 AF of potable supplies annually, is vital to the City's current water supply portfolio.

Brighton experienced rapid population growth through much of the early part of the century. According to the 2000 census, the population in the City's service area was 20,905 people. The 2010 census showed a population of 33,354. Most of this 60% increase occurred prior to 2007. Since the end of 2010, the population has grown nearly 12%, with the current population topping 37,500. Growth is expected to continue over the planning horizon, such that by 2020, the City population is expected to top 41,500. As the City's population grows, the City will be required to leverage the benefits of water conservation and water use efficiency to balance customer demands with the available water supplies through the combination of the City's well fields and the Westminster interconnect.

Also shown in Table 1 is the City's non-revenue water, which is calculated as the difference between total water produced and total water sold. Non-revenue water includes the vast majority of municipal water use since the City historically has not billed itself for water[3]. Non-revenue water has averaged about 210 million gallons per year since 2008, which represents about 12% of treated water production. Although the City reports water loss to the state engineer annually in fulfillment of Paragraph 39 of the 2000CW202 decree, the City has not utilized the American Water Works Association M-36 best management practice methodologies to establish its treated water loss accounting or water loss management programs. A more detailed discussion of the City's non-revenue water and its water loss management programs will be provided later in this Plan.

[2] See Appendix A for the current CRS 37-60-126.
[3] The City first started billing itself for water use at new connections starting in 2013. All City water accounts that pre-date 2013 are not billed to the City but are metered and tracked.

Customer Categories and Water Use Characteristics

The City has tracked individual customer categories of water use for decades, including residential, commercial and municipal[4]. However, the City, like many other progressive municipalities, has upgraded and changed billing systems and methodologies over the years, which complicates the tracking of customers in a consistent manner over the long term. To this point, it will be vital that the City is vigilant in its current and future tracking of consistent customer classes, such that water conservation and water supply planning can be supported with reliable and accurate customer data.

Over the past 8 years, since the last Water Conservation Plan was prepared, the City has changed billing platforms twice. Every effort has been made to provide a consistent tracking of customer water use classifications and accounting in this Plan, including the following issues:

- Henderson was brought into the City's service area, and its three customer classes – schools, residential and commercial customers - were split into the City's accounts accordingly.
- The City has long lumped school water use into commercial water use in its data summaries even though schools are tracked separately. For the purposes of this Plan, and since the City has the data to differentiate school from commercial accounts, school water use has been listed separately[5].
- The City does not charge for municipal water use, except for a small number of accounts that have been created since the summer of 2013. Both non-charged and charged municipal water accounts are tracked in this Plan.
- Water uses that are tracked under the "other" account include bulk water sales (for example, for construction), and commercial outside the City limits water sales.

Table 2 presents the water use by customer type for each of the past 8 years.

Based on the information provided in Table 2, the following observation can be made:

- Residential customers constitute about 53% of total customer water deliveries and commercial sales are about 24%.

[4] Tracking individual customer categories has included tracking both the number of customers in each category and the total water deliveries in each category on a monthly basis.
[5] Note that schools were tracked separately until October 2014 when changes to the City's billing software altered this practice and schools were no longer tracked separately.

- Municipal water deliveries that are not charged for account for about 8% of water production.
- Irrigation only accounts (which are constitute about 8% of total water production.

Table 2
Summary of Water Use by Customer Category
(use in thousands of gallons)

	Residential	Commercial	Irrigation Only	Schools	Municipal	Municipal (Uncharged)	Other
Total Annual Use							
2008	951,168	394,669	132,689	56,118	-	126,963	420
2009	831,984	380,316	104,065	42,669	-	108,536	233
2010	926,939	414,308	132,769	57,680	-	140,761	4,971
2011	926,128	413,043	142,120	50,621	-	158,198	5,832
2012	1,036,694	436,127	160,372	61,188	-	250,608	2,355
2013	884,269	385,732	110,365	39,263	61	105,072	16,593
2014	868,315	405,073	133,661	46,333	1,013	109,428	20,466
2015	885,044	414,063	151,927	46,987	-	135,665	679
Number of Accounts[6]							
2008	8,312	626	94	34	-	88	14
2009	8,360	636	97	34	-	93	14
2010	8,420	656	99	35	-	97	14
2011	8,497	670	100	38	-	105	14
2012	8,550	678	100	38	-	110	14
2013	8,665	688	102	37	0	111	14
2014	8,805	708	105	37	3	113	14
2015[7]	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Water use by the City's customers as a total use has not increased along with population. The highest demand year, which was 2012, occurred with a population that is about 7% less than the current population. Yet, 2012 had the highest water use in each of the customer categories

[6] Number of Accounts as recorded is the average number of account connections per customer category based on measured monthly number of connections per calendar year.
[7] The City's billing software was changed between October and November 2014. After October 2014, it was no longer possible to track customer connections in a manner consistent with the previous accounting procedures.

except "other." This observation points to the expectation that water use fluctuates significantly with seasonal demands, such that future water conservation programs should address outdoor water use in some fashion as a means to control summer time peak demand, which is one of the limiting factors of the current infrastructure.

Per Capita Water Use

The per capita water use in the City based on both system wide (total) and residential only water use is presented in Table 3. As indicated in this table, per capita water use increases based on annual evapotranspiration, given that the hottest year during the last 8 was 2012, which coincides with the highest per person water use, both for system-wide use and residential only use. This correlation is further indicated in the graph presented in Figure 2.

Table 3
Per Capita Water Use (gallons per person per day (gpcd)) and Annual Evapotranspiration

	System-Wide Per Capita Water Use (gpcd)[8]	Residential Per Capita Water Use (gpcd)[9]	Annual Evapotranspiration (inches/yr)[10]
2008	126.2	78.2	36.25
2009	111.4	68.2	35.79
2010	125.5	75.7	36.90
2011	125.0	75.3	36.60
2012	132.4	80.9	38.75
2013	110.2	67.8	36.90
2014	109.9	64.7	36.51
2015	109.5	64.7	36.75

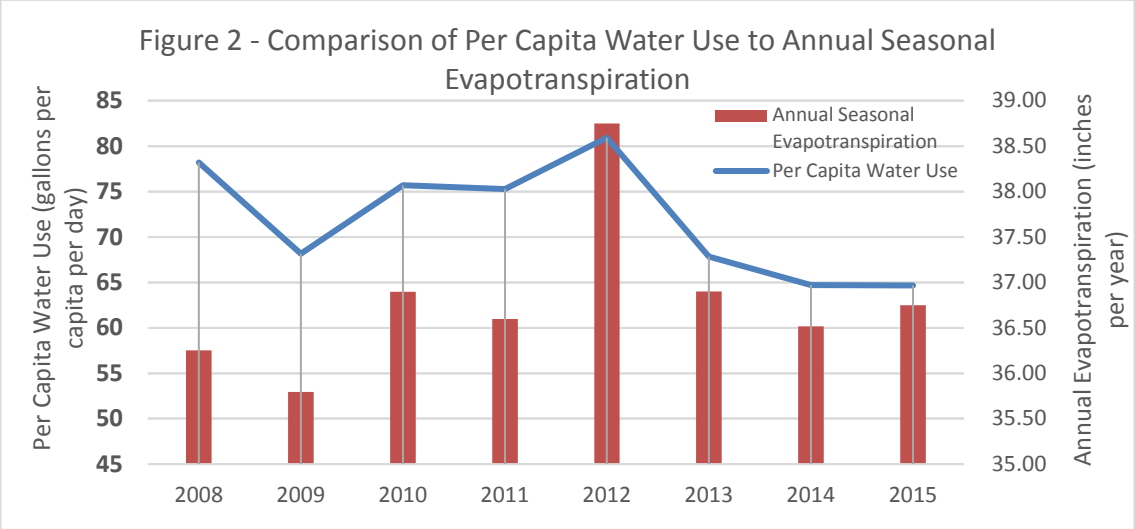
Also illustrated in the Figure 2 graph is that per capita water use over the last 8 years has dropped for years with like evapotranspiration (e.g., 2010 versus 2013). This reduction of may be attributable to numerous factors; however, with weather conditions being consistent a reduction in per capita water use of about 10% was realized from 2010 to 2013. This occurrence will be further explored in the remaining part of this section.

Wintertime Use and Passive Savings

Another key characteristic of residential customer water use that is relevant to the water conservation planning effort, and the understanding of trends in customer water use, is the change of wintertime water use per connection. It has been shown by the CWCB (2011), that

[8] Estimated dividing total annual water produced by year end population.
[9] Estimated dividing total annual residential water sold by year end population.
[10] Estimated for period April to September of each year using the Blaney-Criddle methodology using average monthly temperatures provided by the US Weather Service for Brighton, CO.

passive water conservation measures, meaning those activities that occur organically as customers update and replace less efficient toilets, washing machines, and dish washers, will reduce indoor water use over time independent of active water conservation programs sponsored and supported by the City.



To this point, tracking wintertime water use per connection provides the City with insight into changing customer water use trends, especially with respect to residential customers.

Table 4 presents how wintertime per connection water use has changed over the period from 2008 to 2015, based on average per connection use per day based on usage in January, February and March of each year.

Table 4
Average Daily Wintertime Water Use Per Connection (gallons per day)

	Residential	Commercial	Schools
2008	144	1,178	277
2009	137	1,215	291
2010	143	1,191	293
2011	143	1,154	357
2012	152	1,167	339
2013	161	1,198	269
2014	140	1,104	349
2015[11]	n/a	n/a	n/a

[11] See footnote 4

Based on these numbers, residential and school per connection wintertime use is trending slightly upward since 2008; whereas commercial per connection use is trending downward over the past 6 to 7 years. The upward trend in residential use may relate to differences in housing stock, as new homes are constructed and occupied with larger floor plans and indoor water use. Estimates of passive savings made by the CWCB for the period 2008 to 2015 are in the range of 2 to 3.5 percent reduction of indoor water use; whereas, the City of Brighton has seen an increase, at least through 2013, in the neighborhood of 10%. Note if the average number of persons per residence is 2.4 persons (based on population data available from the City) then the per capita residential wintertime water use is about 58 gallons per day per person.

School use has also increased, during a period when the number of schools has increased by about 10%. It is possible that the increase in per school water use relates to the initial use of water in new schools associated with the establishment of landscape and/or construction needs, even during winter months. In addition, the Brighton School District has grown considerably in not only class sizes but also longer school days, which may influence typical wintertime water use per school. Another possibility is that the majority of the increase occur after 2010, which is when the City inherited the Henderson service area. The Henderson schools may have a somewhat different pattern of water use than the Brighton school attributing to the observed per connection increase.

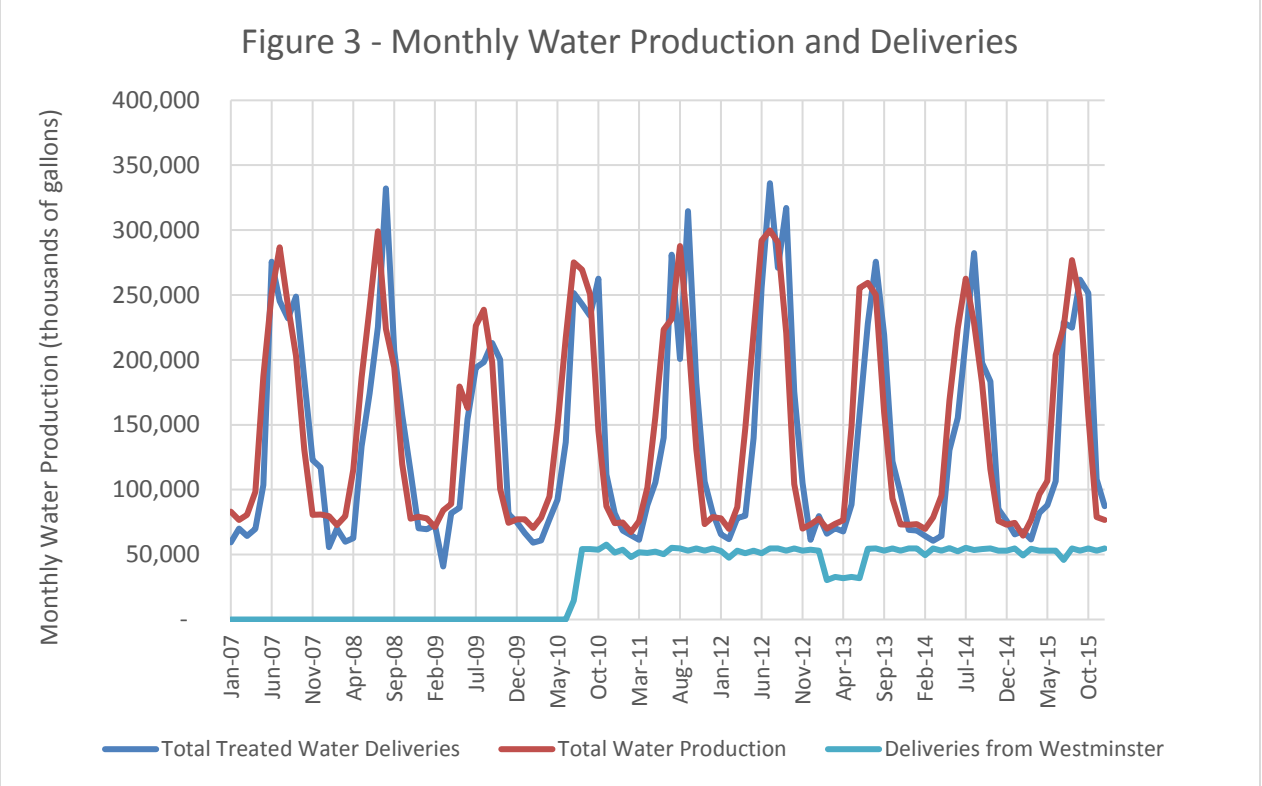
Commercial per connection water use decreases are difficult to characterize without additional information. Although more commercial connections exist over time as the City grows, new connections may relate to smaller commercial facilities, customer visits per commercial connection may have decreased, commercial customers may have changed their water use behaviors, and some other factors may be at play. Nonetheless, commercial customer water use has decreased per connection in the winter months over the last 8 years.

It is noteworthy that the City may benefit in the future from the more explicit parsing of commercial customer water use into more discrete groups of "like" users (e.g., multi-family residential, HOAs, small commercial, etc.). Having this information will allow the City to better assess and track customer water use behaviors and thus improve its planning and forecasting efforts.

Monthly Water Production Variability and Implications for Future Water Conservation

The City's customer water demand, and therefore production and treatment rates, vary daily and monthly in accordance with indoor and outdoor watering needs. The City's treatment facilities are rated at a daily capacity of about 11.1 million gallons per day (mgd). In combination with the water deliveries from Westminster (1.8 mgd), the City can deliver daily summertime peak use of about 12.9 mgd. The City has experienced daily peak demand over 11 mgd in the past.

Figure 3 presents the monthly fluctuation of water production[12] and total water sold for the City for the period 2008 through 2015.



Important observation related to the data presented in this figure are as follows:

- There is a clear seasonality in the City's water production and water use. Typical peak monthly summertime production is about 4 times higher than wintertime production

[12] Total water production is the amount of potable water placed into distribution for customer water use and municipal use including the potable water deliveries from Westminster.

in. **Demand is even more skewed with increases in the area of 4 to nearly 7 times greater comparing summer to winter.**

- The amount of total water sold (blue line) exceeds the amount of water production (red line) during peak demand periods in many summer months. Although the total water sold is typically measured the month after the water is produced (meaning that June water production should be compared to July readings of water sold), the peaks in water sold should not exceed water production. This points to a potential issue with either water treatment master metering or customer water billings or both.
- The Westminster interconnect is shown to be placed in service in the summer of 2010, and it has been a very consistent water source, varying only slightly except for a five-month period in 2013 when drought conditions persisted requiring a temporary reduction in the interconnect flows.

Water Use Variability

The variability of the different customer water use from month to month, per connection, illustrates which customers contribute most to the seasonal variability. Table 5 presents these data.

Table 5
Monthly Per Connection Water Use Statistics by Customer Category[13]
(1,000 gallons per month)

	Residential	Commercial	Irrigation Only	Schools	Municipal (charged)	Municipal (uncharged)	Other
Monthly Average	8.96	50.59	107.27	40.87	23.89	116.22	43.27
Standard Deviation	5.00	17.41	121.08	35.37	39.97	126.83	77.65
Coefficient of Variance	0.56	0.34	1.13	0.87	1.67	1.09	1.79

Based on these data, the following observations are noteworthy with respect to ongoing and future water conservation programs that the City may consider:

i) The municipal (uncharged) and irrigation only customers are the largest individual water users, as a class of customers, served by the City. In addition, the municipal accounts and the irrigation only accounts indicate a substantial amount of variation (represented by a coefficient of variation greater than one), which is indicative of

[13] For the period 2008 through 2014

significant seasonal water use. Since these customers utilize substantial amounts of City water and have large seasonal water use, it may make sense for the City to direct future water conservation programs at these customers to help reduce summertime peak day demand.

ii) Customers in the "Other" category demonstrate the largest variability in monthly water use, but this is more related to variations in construction needs than seasonal water uses.

iii) Commercial and residential customers constitute the vast majority of the City's water customers (see Table 2). For this reason, these customers utilize the majority of the total water sales by the City. However, the variability of the water use by these customers reflect less seasonal use than those customer classes with greater variability as discussed above. Although indoor water conservation programs targeted at toilet replacements are popular and provide for some water savings, this program has only reached about 2 to 3 percent of the residential water customers over an 8-year period. The washing machine rebate has been more popular reaching about 5% of the residential customers. Future water conservation planning related to these customers should consider those measures and programs, such as water rate structures and water waste restrictions, that have a broader reach – including both indoor and outdoor uses.

iv) Schools may also have the ability to realize some water use savings, in part due to the variability of their use which indicates that there is more seasonality to the way that water is utilized than occurs with residential and commercial customers. In that schools are institutions, changing the way that the facility operates may be more difficult than for some other customers; however, water use efficiency improvement for these large water users may be worthwhile.

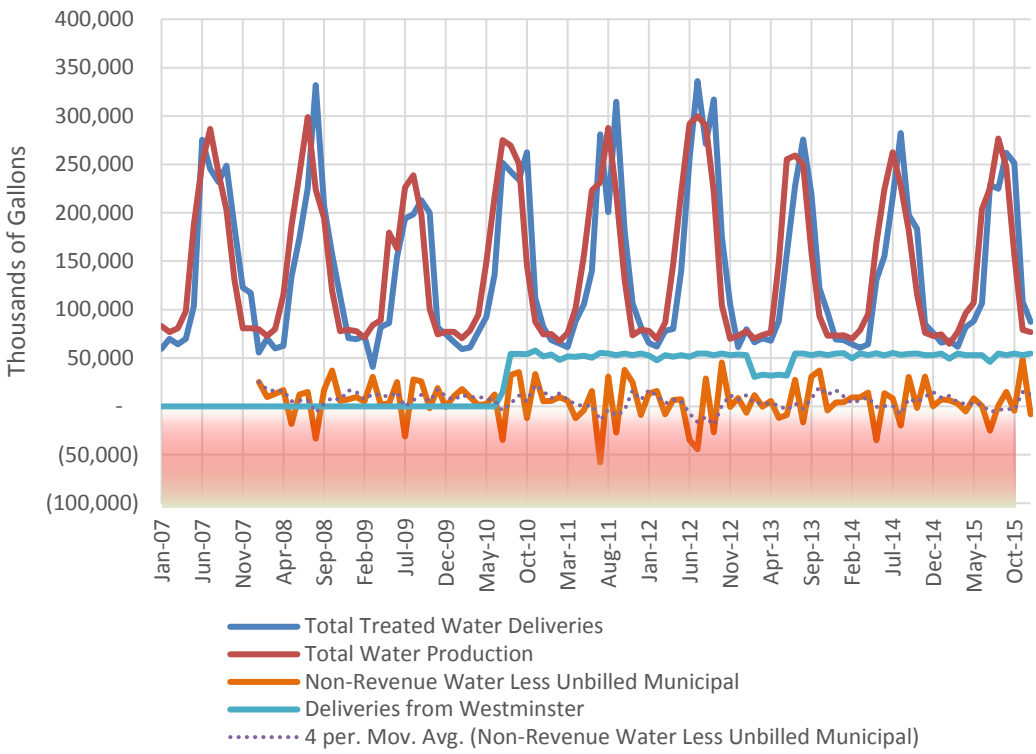
Non-Revenue Water and Water Loss (Treated Water System)

It is important within the framework of this Plan to understand that the current state of the science in the United States regarding water utility water loss management is rapidly changing as improvements in data collection, accounting methods, and metering support vastly improve utility operations. To this point, the City of Brighton, just like most other utilities of its size, will have the option to consider methods to improve system wide treated water loss management as new infrastructure, improved metering, and enhanced water accounting practices are established and implemented. The discussions provided below focus on presenting the currently available data using the American Water Works Association's (AWWA's) M-36 Water Audits and Loss Control Programs methodologies as a means to estimate ongoing water loss and identify areas of potential improvement for City consideration.

As indicated earlier in this Plan (see Table 1), non-revenue water for the City's treated water system has averaged about 210 million gallons annually over the past 8 years, which results in lost water sales revenue of about $1.3 million per year using current commercial rates for combined indoor and outdoor use (see Appendix C). Of this amount, roughly 70% (or about $930,000) is attributed to unbilled municipal uses, such that real and apparent water losses total about 70 million gallons per year (at a cost of about $400,000).

Noteworthy is that non-revenue water less unbilled municipal usage[14] often indicates that the City is selling more water than it is producing, as indicated in Figure 4. As shown in this figure, there are periods of time when over four months or more (shown as the 4-month rolling average in the figure below), non-revenue water less unbilled municipal use is negative.

Figure 4 - Non-Revenue Water Less Unbilled Municipal Use



[14] Non-revenue water less known/authorized unbilled water should equate to the combination of real and apparent water loss for the City. Apparent water loss includes theft, systematic data handling errors, and customer metering inaccuracies. Real water loss is just that, water that is physically lost from the system due to leaks and spills.

For this reason, the actual real and apparent water loss for the City <u>may be greater</u> than the estimate of approximately 70 million gallons per year based on a number of observations as follows.

i) Having negative water loss for multiple months (especially when the months fluctuate from positive to negative as seen in City's data) most often relates to issues with master meter reading accuracy. Master meter calibration is a standard operating procedure conducted by municipalities and water utilities; however, recent industry research has shown that calibration methods often do not assess as broad a range of operating conditions as will be experienced in the field, including reverse flow situations. To this point, the City will likely consider enhancing its current master meter calibration methods to address issues raised by recent industry research.

ii) Negative water loss may also indicate that there is a difference between the date of the production meter reading and the customer meter readings, or that customer meter reading occurs over a number of days or weeks, versus the production meter reading which is an instantaneous reading obtained in a single moment. This kind of fluctuation is not unusual, and may contribute to why water loss accounting requires long-term assessments of one year, or more, to characterize water loss as opposed to one month. Therefore, the City is urged to continue to track non-revenue water monthly and make comparisons over yearly trends, on an ongoing basis.

iii) According to the AWWA standard metrics, the City's unavoidable water loss[15], based on miles of distribution pipe, system pressures, number of customer connections and length of service lines, should be in the range of 85 million gallons, which is 20% greater than what the City currently measures.

Given that the City observes significant water loss fluctuations from positive to negative with substantial periods of time when water loss is estimated to be negative, and that the City does not have an aggressive water loss control program in place based on newly developed industry standards embodied by AWWA M-36, it is likely that current water loss is greater than the City's current estimates. This means that lost water sales revenues are potentially, and even likely, underestimated based on available industry standards.

The City should consider measures and programs to enhance and improve its water loss control efforts, including:

[15] Unavoidable water loss includes background leakage (which is unreported and undetectable), undetected leakage and reported leakage.

- more rigorous master meter calibration and assessments (e.g., over a broader set of flow ranges including reverse flow conditions),
- improved data collection evaluations (e.g., electronic data collection to reduce systematic and data handling errors that may be occurring), and
- improved field monitoring programs (e.g., expanded meter testing and replacement programs that include unbilled municipal accounts, and continuing to read the unbilled meters in a manner consistent with the meter readings of all other City water customers).

Ongoing Water Conservation and the City's Planning Approach

Water conservation planning and implementation by the City has progressed through a number of stages in recent years. This occurred in part due the preparation and implementation of the City's 2008 Water Conservation Plan, which helped to focus the local water conservation programs on customer demand management and more efficient City facility uses. As part of the implementation of the City's approved Water Conservation Plan, CWCB provided grant funding to support water audits and retrofitting of Brighton commercial and municipal facilities. As a result of this grant, the City upgraded its municipal building's toilets and faucet aerators, and showerheads and faucet aerators in its swimming pool, as well as installed dozens of high efficiency showerheads and faucet aerators in various commercial buildings. In addition, one elderly care facility received high efficiency toilets for installation in common areas.

Since then, the City has focused on implementing various customer wise water use incentives that have evolved based on customer interest, funding availability and effectiveness of the program.

Currently the City's biggest water conservation project has been the WaterSmart pilot program. The City received a CWCB grant to track water use for 4,000 residential accounts and send bi-monthly reports on customer's water usage, offering suggestions for improved water use efficiency based the household specific water use data[16]. The implementation of this Plan update will include an assessment of the effectiveness of the WaterSmart pilot program. The City also has been funding the following programs:

- Garden-in-the-Box has been funded for each of the last three years to support the use of native and Xeric landscapes.
- Center for ReSource Conservation was contracted to conduct two water conservation seminars for customers in each of the past three years.
- Low flow toilet and HE washing machine rebate programs have been conducted since 2007, with the exception of 2011. Since 2007, 235 low flow toilets (1.6 gallons per flush (gpf) or lower) and 477 HE washing machines have been installed in conjunction with the City's rebate program.
- Educational outreach events are sponsored including the City's EcoFair, Culturefest, and other K-12 programs.

[16] To date, approximately 3,500 residential customers are in the program. In 2016, the program was extended to all 9,000 residential customers.

Although the exact water demand reductions that have been realized as a result of these various measures and programs have not been explicitly measured by the City due to the various challenges with tracking specific water use behaviors for individual appliances within private homes, reasonable estimates of reduced water use can be made for some of the City's programs. For example, the 235 low flow toilets were placed in 201 homes since 2007. Assuming that the first 62 toilets were 1.6 gpf and the remaining 173 toilets were 1.28 gpf, and that 2.4 persons reside in each home on average, using the toilet on average 3.2 times per day, the total reduced water use from a 3.5 gpf toilet would be on the order of about 3,200 gallons per day, or just over 1.2 million gallons per year (adjusted for more than one toilet in about 14% of the homes that received the rebate).

Washing machine savings for new machines using 18 gallons per load versus 42 gallons per load for older models assuming 6 loads per week per home in 477 homes would result in a water demand reduction of just under 10,000 gallons per day or about 3.6 million gallons in a year.

The cost of these rebates to the City are $100 per toilet and $125 per HE washing machine. At this current rate, the City has spent approximately $83,000 in rebates to reduce customer demand by about 15 AF, which pens out to a cost of about $5,600 per acre foot for reduced water supply, not including inefficiencies due to distribution leaks. Including distribution losses, the City has reduced water demand to the system by perhaps 17 AF, at a cost of about $5,000 per acre foot.

An important recent addition to the City's programs supporting improved customer water use efficiency is that in 2015 the City adopted increased water rates for high water-use customers both with and without irrigation accounts based on significant increases in per thousand-gallon water costs (see Appendix C). Residential rates begin at $2.65 per thousand gallons and increase to $4.46 per thousand if use is greater than 3,000 gallons in a month, which is a 68% increase over the base water rate. Inclining block rates for the City continue up to $6.05 per thousand (or another 60% over the base rate of $2.65) for use greater than 40,000 gallons per month. "Irrigation Only" rates for commercial, industrial, schools, mixed use, and municipal customers is currently set at $8.10 per thousand gallons to encourage more efficient water use by the City's largest outdoor users.

Given these recent occurrences, this Plan update will hinge on continued improvements to data collection, assessment and management, improvements to City water loss control and leak mitigation programs, and more integration of water use efficiency with management of City water resources within the constraints and practicalities of being a shallow groundwater user in the South Platte River basin below Denver.

Future Water Demands

Estimating future water demands for the City is instructive for a few reasons. First, it is important from a policy point of view to characterize the potential impact of future water conservation programs. This can be attempted by comparing expected changes to future water demands with and without proposed future water conservation programs. Second, estimating future water demands may give rise to understanding the importance and need for future water conservation programs, since the City has limits on its current water infrastructure and water supply portfolio. Finally, it is valuable for the City to understand the variability of the expected water use, looking at both average and above average water demands based on past water use patterns.

Estimating future water demand involved characterizing the per connection water use in the past – both with respect to average use and the amount of variability in any given month – and using these data in combination with expected population growth as predicted by the City, to predict average and dry year water use during and at the end of the planning horizon (i.e., for the years 2020 and 2023). The methodology used and the results of the estimation effort are provided in Appendix B.

Based on the results of the analyses presented in Appendix B, future water demand is summarized in Table 6. Table 6 shows not only the predicted water demand, but the water production necessary based on the current level of water loss[17].

Table 6
Estimated Future Water Demand and Total Production for Average and Dry Conditions[18] (in acre-feet)

		Total Water Demand		Total Water Production	
	Population	Average	Dry Year	Average	Dry Year
2020	41,600	5,810	7,370	6,450	8,180
2023	44,400	6,140	7,780	6,815	8,635

Imbedded within the estimates of predicted future water demand and total water production are the City's ongoing water conservation programs, since past water use per connection varied in response to ongoing water conservation programs, as well as seasonal

[17] Based on an average annual water loss since 2010 of 4.1%.
[18] Average conditions by definition occur 50% of the time (meaning that these demands will be exceeded 5 out of every ten years). Dry condition demands occur 10% of the time (meaning that these demands will be exceeded 1 out of every ten years).

impacts and other factors. Future water conservation programs will be evaluated based on expected reductions in the demands listed in Table 6.

City Budgets for Capital Improvement, Water Loss Management and Water Conservation

The City water utility operates based on water sales, tap fees and other miscellaneous revenue; balanced with the costs of personal and purchased services, operating expenses, capital outlay and the cost of debt service. Of particular importance to the water conservation planning effort is how changes in water demand effect both the revenue and cost side of the utility's operating budgets. Reduced water sales can reduce water sales revenue if water rates are not adjusted accordingly. Reduced water production can reduce operating expenses, and in some cases delay capital outlay and therefore reduce or delay debt service. Therefore, the effects of water conservation now and into the future are important to many aspects of utility budgeting and planning.

Table 7
Summary of Water Utility Budget Details 2014-2016
(in millions of dollars)

	Water Sales Revenue	Operating Expenses	Capital Outlay	Debt Service
2014	8.45	1.54	0.20	1.78
2015	9.18	1.63	22.72	1.77
2016	10.77	5.04	2.99	1.76

Table 7 summarizes the key budget details for the water utility over the past 3 years.

During this period of time, the budget for the water conservation program, including chiefly the cost for rebates, education, Garden in the Box and the WaterSmart pilot, has been on average $40,000 (which is an 8-fold increase over the 2011 budget), with expenditures in the range of $20,000 to $25,000 each year.

Meter repair and replacement in the last three years varied from about $25,000 to $85,000 per year[19]. Expenditures related to specific water loss management related tasks and improvements, on the other hand, were not explicitly documented. Nor does the City maintain a record of the cost for leak repairs. Overall water system repair and maintenance costs are typically in the $50,000 per year range, which along with meter repair and maintenance, are contained in the water utility distribution system operations budget which is between $120,000 to $175,000 per year. This budget includes vehicle maintenance and fuel, training, operating supplies and software maintenance.

In the future, the City may want to consider making selected improvements to how expenses are tracked with respect to water loss management activities including, but not limited to, leak detection, leak repair, hydrant and distribution system exercising, customer meter repair and replacement, and master metering. The City may also wish to consider tracking work orders related to leak detections and leak repairs.

[19] Note that the City is currently funding replacement of customer meter registers to facilitate drive-by meter reading (replacing touch pad reading) at a cost of about $350,000 per year over 10 years.

Water Conservation Goals

The City of Brighton has numerous reasons to move forward with an aggressive water conservation program. Past efforts by the City have produced water demand reductions in the range of $5,000 per acre-foot, which is substantially less than the cost of new potable water supplies. In addition, the City's new aggressive water rates are expected to have a substantial impact on outdoor water use due to the financially impactful nature of the current treated water pricing structure, which impacts irrigation only customers and other customers with substantial seasonal use.

Additionally, the City expects its population to continue to increase within its service area, contributing to an increased annual total water production of about 430 million gallons (about 1,300 acre-feet) on average from 2014 to 2023, which is a 26% increase above current levels.

The potential goals for future water conservation within the City will include finding ways to shave off summer demands to address the peak day limits of the City's current water treatment facility, and to reduce overall annual demand. Therefore, the City's goals for water conservation include:

- Continuing to reduce per capita residential water use by up to 10% on average over the next seven to ten years (which is a per capita reduction of between 6.2 and 7.4 gallons per person per day amounting to 100 to 120 million gallons from residential accounts);
- Reduce per connection summertime peak water use, especially as it relates to outdoor and other seasonal uses, by 15% over the next seven to ten years (which amounts to about a 30 million gallon reduction from just schools and irrigation only accounts); and
- Improving the characterization and tracking of non-revenue water, with the intention to reduce real and apparent water losses by between 25 and 35% percent over the next seven to ten years (which may be as large as 30 million gallons).

Combined, achieving these goals would approximately offset a portion of the increased demand associated with expected growth, or reduce 2023 demands by about 180 million gallons or about 550 AF.

Identification and Evaluation of Candidate Water Conservation Measures and Programs

Identification

Identifying candidate water conservation and efficiency measures and programs has its roots in three key resource areas. First is the State of Colorado Revised Statute 37-60-126 (4)(a) which addresses water conservation planning for municipal water providers (see Appendix A). This statute is directly applicable to the City[20] and as such it requires that "at a minimum, [the planning entities must] consider" a list of water-saving measures and program types that may be used by a water provider for water conservation and improved water use efficiency. The second is the CWCB's Municipal Water Efficiency Plan Guidance Document which outlines the process for the development of a municipal water conservation plan, and provides guidance on the identification and evaluation of alternative water conservation measures and programs. Finally, the Southeastern Colorado Water Conservancy District's (SECWCD's) Best Management Practices (BMP) Tool Box is a web-based water conservation planning tool that contains a wide variety of relevant information regarding BMPs that water utilities can use to improve water use efficiency and support smart water use. The Tool Box contains categories of measures and programs that address the five different operational areas that all water utilities conduct - **system wide management, water production and treatment, water distribution, delivery of water to customers and customer demand management**. This Plan will utilize all three of these resources to identify, evaluate and select appropriate water conservation measures and programs for the City of Brighton to implement.

Table 8 presents a discussion of how each of the State's "must be considered" water conservation measures and programs were considered and incorporated into the City's evaluation of candidate water conservation and water use efficiency programs. In general, the City is faced with continued growth, which will bring with it challenges in both total water production and summertime peak demand. Therefore, the City will consider numerous customer demand management techniques that may provide some benefit in terms of both indoor and outdoor water use reductions. In addition, the City is looking to improve its overall water management programs that will improve its ability to track use, maintain appropriate levels of water sales revenue, and reduce water loss.

[20] The City of Brighton is currently a covered entity under the definition provided by statute (see Appendix A), for the City retail water demand exceeds 2,000 acre-feet of water for municipal and industrial uses. As a covered entity, the City is required to create and maintain an approved water conservation plan on file with the CWCB.

Table 8
Review of State Required Measures and Programs for Consideration Under CRS 30-67-126 (4)(a)

Number	Measure or Program	Relevance	Applicability/Potential for City Consideration	Status for Further Evaluation
I	Water-efficient fixtures and appliances, including toilets, urinals, clothes washers, showerheads, and faucet aerators	The City will benefit from customers installing and using more water efficient fixtures and appliances	Customers of all types will replace aging water using fixtures and appliances with more efficient models creating water demand reductions over the planning period. Brighton could benefit from expanding its Rules and Regulations to address new construction indoor plumbing fixtures (including retrofits) however the State is currently moving forward with this effort. More customer education related to indoor water efficiency will be considered (see Number VI below).	No further evaluation necessary
II	Low water use landscapes, drought-resistant vegetation, removal of phreatophytes, and efficient irrigation	The City has issues with peak summertime demand, especially from irrigation only customers, municipal customers and residential and commercial customers with seasonal use.	The City will consider efforts to improve the planting of low water use landscapes in its parks and open spaces, especially with respect to new parks and open spaces that will occurr as new development occurs in the City's service area. In addition, that City will find ways (e.g., Garden in the Box) to promote Xeriscape and native plant materials with its educational programs/materials.	Include for further evaluation
III	Water-efficient industrial and commercial water-using processes	Although the City has a few dozen industrial and commercial customers that utilize large amounts of water, there are few, if any, opportunities to implement demand reduction programs.	The City has many commercial customers which includes bars and restaurants, as well as shops and institutions (e.g., hospitals and schools). There are also some industrial users and comercial laundries. These facilities may benefit from improved water use efficiency; however the cost for new commercial equipment is beyond the scope of this planning effort at this time. Tthe City will consider opportunities to partner with the school district to improve institutional water use.	Include for further evaluation
IV	Water reuse systems	The City does not have water available for reuse.		No further evaluation necessary
V	Distribution system leak identification and repair	The City has numerous opportunties to improve its water loss management system (see Section on Non-Revenue Water).	The City has a number of opportunities to improve the accuracy of its measurements to support a better understanding of water loss. Potential areas of improvement include: • Testing master meters over wider range of operational conditions including reverse flow • Improved customer water use tracking including improving or replacing the current billing system • Conducting annual system wide audits in a manner consistent with the AWWA M-36 Standard • Improve or expand testing and monitoring of unbilled municipal water meters and connections • Look for improvements to data collection and handling systems (e.g., AMI)	Include for further evaluation

Table 8 (continued)
Review of State Required Measures and Programs for Consideration Under CRS 30-67-126 (4)(a)

Number	Measure or Program	Relevance	Applicability	Status for Further Evaluation
VI	Dissemination of information regarding water use efficiency measures, including by public education, customer water use audits, and water-saving demonstrations	The City has always sought to support customer educational programs.	The City will continue its efforts to educate and to diseminate water education information through local and regional programs. The City will also utilize programs such as the WaterSmart residential customer data management program to support more hands-on customer education and support.	Include for further evaluation
VII	Water rate structures and billing systems designed to encourage water use efficiency in a fiscally responsible manner	The City has implemented recent water increases that include inclining block rates for all residential customers and substantial increases for irrigation only customers.	Brighton will continue to work toward water rate structures that incentivize outdoor water demand reductions and reduced seasonal water use. The City will also consider striving toward rates that reflect the true cost of water including those costs associated with acquiring new water supplies and expanding and maintaining current infrastructure.	Include for further evaluation
VIII	Regulatory measures designed to encourage water conservation	The City currently does not have a water waste ordinance.	The City will consider enhancing its current Drought Management Plan by formalizing water waste restrictions, as well as creating mechanisms to temporarily raise water rates in times of emergency and to levey fines to water wasters.	Include for further evaluation
IX	Incentives to implement water conservation techniques, including rebates to customers to encourage the installation of water conservation measures	Past customer rebate programs have been successful in creating cost effective demand reductions.	The City will consider continuing its rebate programs for high efficiency washing machines and toilets, and will consider continuing its demonstration programs such as Garden-in-the-Box.	Include for further evaluation

Table 9 (presented on the following page) lists the sets of tasks that the City will consider for each specific objective that is of a high priority to the City, and how the tasks are related to each of the State requirements and to utility operational areas.

A Note Regarding Water Waste and Drought Management

The City created a Drought Management Plan (DMP) in March 2013 (see Appendix D). The DMP identifies drought response triggers and messaging programs that the City would implement to reduce customer water demand depending on the drought stage (i.e., Stage 1, 2 or 3). Mandatory watering restrictions would be implemented as a result of increasingly higher (or more dry) drought conditions. The DMP also references water waste concepts including time of day watering restrictions, swimming pool filling and operational restrictions, overspray restrictions, and excess runoff restrictions. During Stage 3 drought, all outdoor water use is prohibited.

Although these programs are expected to support reduced customer water use, no linkage currently exists between two important areas – the loss of water sales revenue during advanced stages of drought when outdoor use is curtailed or prohibited, and the uses of fines to address violations of the DMP defined watering restrictions and requirements. To this point, the City should consider formalizing its water waste requirements and should evaluate mechanisms to temporarily increase water rates during periods of extreme drought and to assess and levy fines on customers that do not adhere to the City's requirements regarding water wasting.

Discussion

Water conservation activities have been substantially supported in the past by the City and the water utility; however, the combination of expected future growth and limited available new water resources generates even more support and interest across organizational boundaries – engaging the water utility, City finance, City planning, and City management. To this end, implementation of future water conservation activities will require the engagement of many departments within City operations such that programmatic improvements can be managed and integrated into the various components of City business allowing real, measurable demand reductions to occur.

To this point, the evaluation of those objectives and tasks listed in Table 9 begins with how monitoring and verification of water conservation programs will occur such that accurate and timely data collection supports decision making and policy development. For this reason, the

Table 9 – Listing of Water Conservation Tasks for Consideration by the City			
Tasks for City Consideration Related to Specific Objectives		**State Requirement**	**Utility Business Area**
Reduce Summertime Peak Water Use			
	Maintain aggressive water rate structures that support efficient water use and discourage over- and wasteful-water use	VII	System Wide Management, Customer Demand Management
	Develop and implement plan review procedures to include the water utility and establish standards for new irrigation systems (e.g., sprinkler heads) and plant materials (e.g., Xeric and/or native plantings)	II	System Wide Management, Customer Demand Management
	Enhance and expand current Water Waste Ordinance and Drought Management Plan to support more aggressive customer water use efficiencies especially during periods of water scarcity	VIII	System Wide Management, Customer Demand Management
	Utilize WaterSmart dash board to support customer self-tracking of water use	VI	Customer Demand Management
	Support additional conversions of athletic fields to non-potable irrigation systems, including metering	n/a	Water Production and Treatment, Delivery of Water to Customers
Improve Water Loss Management			
	Evaluate/Test large meters on unbilled municipal connections and read these meters monthly	V	Delivery of Water to Customer
	Expand existing master meter testing program to include broader range of flows and reverse flow conditions	V	Water Production and Treatment
	Develop detailed schematic of current water system piping preceding the water distribution system including location of wells, diversions, master meters, connections, and other appurtenances prior to elevated storage after treatment.	V	Water Production and Treatment
	Upgrade billing software (and data collection and processing software) to improve the accuracy and parsing of customer water use by category and sub-category, as well as customer class[21]	III, V, VII	System Wide Management, Delivery of Water to Customers
	Continue upgrading customer meter registers to support ongoing and future AMR/AMI[22]	V, VII	System Wide Management, Delivery of Water to Customers
	Conduct Annual System-Wide Water Audits using AWWA M-36 Methodology	V	System Wide Management
Customer Assessment, Incentives and Support			
	Offer water audits to irrigation only customers	VI	Customer Demand Management
	Partner with schools to support student-lead water audits for school's indoor and outdoor uses	I, II, VI	Customer Demand Management
	Utilize AMR (including untapped AMR technology) to track customer water use and savings, in part to assess impacts of audits, rebates and education	I, II, VII, IX	System Wide Management, Customer Demand Management
	Continue to support WaterSmart program to encourage residential customer tracking and adjustments of individual water use	VI	Customer Demand Management
	Continue rebates and promotions (e.g., Garden-in-the-Box)	IX	Customer Demand Management

[21] Customer class is used for assigning water rates, whereas customer category relates to the type of business and/or customer (e.g., single-family residential, commercial, etc.)

[22] AMR/AMI – automated meter reading equipment and technology; advanced meter reading equipment and technology

Table 9 – Listing of Water Conservation Tasks for Consideration by the City (continued)			
Tasks for City Consideration Related to Specific Objectives		**State Requirement**	**Utility Business Area**
Education			
	Continue K-12 Education with EcoFair, Culture Fest, etc.	VI	Customer Demand Management
	Continue CRC Seminars and Workshops with follow-up	VI	Customer Demand Management

City will make its highest priorities those tasks that lead to achieving measurable results that align with the objectives and the stated goals of the program. In addition, it is the City's intent to implement all those tasks listed in Table 9 given the needs of the community and the organization. However, funding and other limitations may influence the timing and extent to which each of the proposed tasks can be implemented. These limitations will be discussed further in the implementation plan, which follows.

Notwithstanding budgetary and other limitations, the top priorities for water conservation within the City include the following tasks:

- Upgrading the billing software to improve the accuracy and parsing of customer water use;
- Continuing to upgrade the City's AMR through replacement of customer meter registers to enable better, more efficient data collection;
- Improve program for testing of master meters on wells, treatment facilities and interconnects to include a broader range of operational flows and for reverse flow conditions[23]; and
- Improve meter testing and reading on municipal accounts that are currently unbilled.

As the City moves forward with these initiatives, to allow for the better tracking of system wide water use, as well as measuring customer water use by category, subcategory, and individually, other programs will continue. The other continuing programs include:

- Maintain aggressive water rate structures that support efficient water use and discourage overuse and wasteful practices;
- Expand the use of the WaterSmart dash board to support customer self-tracking of water use and encourage more efficient individual water use behavior;

[23] This task will need to be combined with the development of a detailed schematic of the current water system equipment, facilities, and metering locations for those areas prior to the customer distribution system such that the data obtained from the master meters, tank head readings, and production well readings can be assimilated into a robust data assessment to support more rigorous water loss management.

- Begin tracking water loss through the use of the AWWA M-36 procedures and protocols;
- Continuing to provide rebates to residential customers for replacement of inefficient clothes washers and toilets;
- Sponsor Garden-in-the Box Xeric planting programs, or similar, to encourage the use of native and low-water use plantings in residential settings; and
- Support residential and commercial customer educational programs including:
    - Water conservation seminars and follow-up conducted by the Center for Resource Conservation (CRC); and
    - K-12 educational programs through local and regional fairs.

Finally, the City has the need and desire to more thoroughly address those key objectives listed in Table 9 – namely to reduce summertime peak water use, improve water loss management, and provide customer assessments, incentives and support to realize more water use efficiencies. To address these issues, the City will look to implement the following program enhancements depending on available funding, policy protocols, and community support.

- Develop and implement plan review procedures including water utility review of new developments such that standards for new park and open space planting materials and irrigation practices can be established and enforced;
- Expand and enhance the City's water waste ordinance and Drought Management Plan to include linkages between drought responses, temporary water rate increases, financial penalties and enforcement actions, as appropriate;
- Continue to support the conversation of athletic field irrigation to non-potable water away from the potable water system;
- Offer to partner with public and private schools to support student-led water audits for both indoor and outdoor water use, and to develop programs to facilitate behavioral and structure changes in the participating schools to reduce demand; and
- Offer outdoor water audits to irrigation only accounts to identify areas for improved efficiency and water savings.

Implementation Plan

Selection and Timing of Water Conservation Efforts

Based on the needs of the City and its customers, Brighton will implement those selected water conservation and water use efficiency programs listed in Table 10, with the intention of achieving the water conservation goals listed previously. Implementation will occur over a number of years as ongoing programs are continued and new programs are phased in. Funding levels are always a consideration, as operating expenses and water sales income change seasonally and from year to year. However, the programs that have been selected for implementation are those that the City believes are best for the organization in the short-term and mid-term; helping to improve processes, enhance business practices, and support customer needs.

The focus of the implementation plan is on the short-term (i.e., the 1 to 2-year planning horizon), for during this period it is possible to identify expenditures that can be used to implement selected measures and programs without substantial uncertainty. Planning on expenditures that may occur 3 to 5 years into the future is more difficult. To this point, the implementation plan provides a detailed accounting of planned expenditures for those programs selected for implementation in the short-term. Costs included for implementation 3-years and further out are less certain but are provided to support planning and assessment as the Plan moves forward.

In general, the highest priorities for the City in the short-term, aside from continuing those programs that have proven to be successful in the past, are to improve data accuracy and collection techniques such that water loss reductions and changes in customer water demand can be measured and verified. To this point, the first tasks that require attention will include:

- Installing a new billing system
- Testing and replacement (and consistent reading) of unbilled municipal connection water meters
- Revising the testing methodologies for City master meters
- Creating a reliable schematic of the City's production and treatment facilities, with particular attention to the location of meters

Once these tasks have been completed, the AWWA M-36 water loss assessment (see Appendix E) can be more reliably conducted, helping the City to more accurately characterize non-revenue water, and real and apparent water loss. The other new programs listed in Table 10 may also move forward once the resources needed within the water utility and other participating City departments are available and engaged.

Table 10
Selected Water Conservation Measures and Programs for Implementation

Selected Measure/Program	Implementation Tasks	Status	Timeframe	City Entity(ies)[24]	External Costs
Summertime Peak Water Use Reduction					
Maintain aggressive water rate structures that support efficient water use and discourage over- and wasteful-water use					
	Continue with current rates	Current Program	Ongoing	Finance and Water Utility	none
	Update water rates as needed	Update	1-3 years	Finance and Water Utility	
Develop and implement plan review procedures to include the water utility and establish standards for new irrigation systems (e.g., sprinkler heads) and plant materials (e.g., Xeric and/or native plantings)[25]					
	Develop standardize practices for new park and open space related to new development	New Program	1-3 years	Parks, Planning and Water Utility	$20,000
	Establish new plan review process to include the water utility	New Program	1-3 years	Parks, Planning and Water Utility	$20,000
	Implement new plan review process	New Program	3-7 years	Parks, Planning and Water Utility	$10,000/yr
Enhance and expand current Water Waste Ordinance and Drought Management Plan to support more aggressive customer water use efficiencies especially during periods of water scarcity					
	Create drought related temporary rates	Revision/Enhancement	2-3 years	Finance and Water Utility	none
	Create fines for non-compliance with drought requirements and water wasting	Revision/Enhancement	2-3 years	Finance and Water Utility	none
Utilize WaterSmart dash board to support customer self-tracking of water use					
	Continue with current residential program to include 4,500 customers	Current Program	Ongoing	Finance and Water Utility	CWCB Grant
	Expand to include all residential customers (10,200 by 2023)	Revision/Enhancement	1-2 years	Finance and Water Utility	CWCB Grant
	Expand to include all commercial customers	Revision/Enhancement	3-5 years	Finance and Water Utility	CWCB Grant
Support additional conversions of athletic fields to non-potable irrigation systems, including metering					
	Continue current program	Current Program	Ongoing	Parks and Water Utility	CIP Funding
	Expand current program	Expand to new properties	2-5 years	Parks and Water Utility	CIP Funding

[24] The listing of City entities involved assumes that City Manager and Legal Services are involved in all measures and programs to the extent required and needed.
[25] Assumes that a consultant will be hired to support development and implementation of the new plan review process.

Table 10
Selected Water Conservation Measures and Programs for Implementation (continued)

Selected Measure/Program	Implementation Tasks	Status	Timeframe	City Entity(ies)[23]	External Costs
Water Loss Management					
Improve Data Collection and Data Accuracy					
	Upgrade billing software (and data collection and processing software) to improve the accuracy and parsing of customer water use by category and sub-category, as well as customer class	Current Program	Ongoing	Finance and Water Utility	$85,000
	Evaluate/test large meters on unbilled municipal connections and read these meters monthly	Revision/Enhancement	1 year	Parks and Water Utility	$5,000 for testing existing meters
	Expand existing master meter testing program to include broader range of flows and reverse flow conditions	Revision/Enhancement	Ongoing	Water Utility	None unless meters require replacement
	Continue upgrading customer meter registers to support ongoing and future AMR/AMI	Current Program	Ongoing	Finance and Water Utility	CIP Funding
Improve Mapping of the Production and Treatment System					
	Develop detailed schematic of current water system piping preceding the water distribution system including location of wells, diversions, master meters, connections, and other appurtenances prior to elevated storage after treatment.	New Project (one time effort with occasional updates)	1 year	Water Utility	None
Improve Methodology to Characterize Non-Revenue Water and Real and Apparent Water Loss					
	Conduct Annual System-Wide Water Audits using AWWA M-36 Methodology (see Appendix E for methodology)	New Program	Annually	Finance and Water Utility	None

Table 10
Selected Water Conservation Measures and Programs for Implementation (continued)

Selected Measure/Program	Implementation Tasks	Status	Timeframe	City Entity(ies)[23]	External Costs
Other Customer Assessments, Incentives and Support					
Expanded Technical Support and Training					
	Offer water audits to irrigation only customers	New Program	3-5 years	Parks and Water Utility	$5,000/year
	Partner with schools to support student-lead water audits for school's indoor and outdoor uses	New Program	3-5 years	Water Utility	$15,000/year
Rebates and Promotional Programs					
	Continue rebates for high efficiency toilets and washing machines	Current Programs	Ongoing	Water Utility	$30,000/year
	Continue Garden-in-the-Box Xeric and native planting program	Current Programs	Ongoing	Water Utility	$2,000/year
Improved Data Tracking and Assessment					
	Improve tracking of customers that participate in City rebates and promotional programs, and audits, seminars, and workshops.	Revision/Enhancement	Ongoing	Finance and Water Utility	None
	Continue to support WaterSmart program to encourage residential customer tracking and adjustments of individual water use	Current Programs	Ongoing	Finance and Water Utility	None
	Utilize AMR (including untapped AMR technology) to track customer water use and savings, in part to assess impacts of audits, rebates and education	Revision/Enhancement	Ongoing	Finance and Water Utility	None
Other Educational Efforts					
	Continue K-12 Education with EcoFair, Culture Fest, etc.	Current Programs	Ongoing	Parks and Water Utility	$3,000/year
	Continue CRC Seminars and Workshops with follow-up	Current Programs	Ongoing	Water Utility	$2,500/ year

Impact of Water Conservation on Future Water Sales and Use

Water Sales Revenue

The City is understandably concerned with future cash flow and sustainability of financial resources. To this point, water conservation which occurs without consideration of the impacts of reduced customer demand on water sales revenue does not support responsible business practices. However, future growth will provide the City with options for revenue generation, as will the continued use of aggressive water rate structures, both of which can offset revenue impacts of reduced customer water demand. In addition, there is the potential for increased operating efficiencies as the City reduces treated water losses through the implementation of a more rigorous water loss management program. Improved efficiencies will decrease the per volume cost of producing treated water, thereby increasing marginal costs of treated water delivery to the City's customers, thus improving profit margin for the City, which can in turn support required infrastructure investment and debt service.

In 2015, the City sold about 4,600 AF of water through retail sales. With all things remaining the same regarding customer water use and behaviors, the City expects to have retail sales for an average water year of about 6,140 AF in 2023 based purely on growth. This represents an increase of over 1,500 AF in 8 years. Based on the water conservation goals presented previously, customer demand reductions are targeted for about a 460 AF reduction, with an additional 90 AF coming from improvements in water loss management. Therefore, with future water conservation impacts considered, the City will still see an increase of water sales by over 20% (for an average year), or about $2.4 million, without accounting for the impact of any water rate increases, new water taps or impact fees.

Water Use Reductions

The programs that the City has selected to implement will help to reduce water production and treatment by the City, and to reduce customer demand including during summertime peak water use periods, are intended to reduce system wide demand by 550 AF on average by 2023. As indicated earlier, it is anticipated that the reduction in system wide demand will come about by a reduction in water loss by about 90 AF and a reduction in future customer demand by about 460 AF. Additional detail related to how these reductions will occur, and may affect overall water demand, are presented below.

The City's efforts to better characterize water loss through the application of the AWWA M-36 methodology will likely increase the amount of non-revenue water measured by the City in the short-term, as the reasons for the City's current periods of negative non-revenue water

are better understood and rectified as more robust data are collected and assessed. The best management practices (BMPs) that the City will use to better characterize non-revenue water will not cause water loss to increase, but may have the effect of increasing the amount of non-revenue water measured by the City as unbilled municipal meters and master meters are made more accurate. Once this occurs, the City will have the tools to understand more definitively the nature of its non-revenue water as well as its apparent and real water loses, which in turn will allow the City to make better informed decisions on improving its water loss management – including for example, what resources to commit to maintaining valves and hydrants, etc.

In the short-term, non-revenue water may increase as periods of negative non-revenue water are reversed. The City can then better characterize apparent and real water losses, and make appropriate investments such that real and apparent water loss is reduced by perhaps 90 AF per average year by the end of the planning period.

Concurrently, the City will implement programs to support summertime peak demand management programs as well as overall customer water use efficiency programs. These proposed programs will be implemented across all components of utility operations including overall system wide management, water production and treatment, delivery of water to customers and customer demand management. The estimated reductions associated with each objective are listed below:

- Customer incentives/rebates – 15 AF (based on past rebate effectiveness and reach)
- Other residential customer reductions related to enrollment in Water Smart program, City education and outreach programs (to keep water conservation in the minds of its customers), more deliberate water waste ordinance, improved customer metering, and the impact of other technical assistance and education efforts (workshops, seminars, outdoor audits) – 170 AF (associated with all future residential water use reductions of 5% based on current per connection average use rates)
- Water rate increases and continued use of aggressive inclining block rates – 250 AF (associated with all future residential and commercial water use reductions of 5% based on current per connection average use rates)
- New development plan review process – 20 AF (associated with new development irrigation only taps operating 15% below current irrigation only per connection average use rates)
- Student-led school audits and school water use efficiency improvements – 25 AF (associated with existing schools reducing water use by 15% of current school per connection average use rates)

Table 11 presents a summary of the estimated impacts of the proposed water conservation programs on future water production and demand based on the forecasted demands presented in Table 6, assuming 11% non-revenue water remains consistent into the future before the City realizes the 90 AF of treated water loss reductions. Note that water demand reductions are estimated to increase by approximately 25% during dry weather conditions based on expectations that the City will increase its messaging related to water savings and implement drought related restrictions and increased water waste penalties.

Table 11
Effect of Proposed Water Conservation on Future Water Demands and Water Placed into Distribution (acre-feet)

	Water to Distribution (without conservation)		Water to Distribution (with conservation including 90 AF decrease in water loss)		Customer Water Demand (without conservation)		Customer Water Demand (with conservation)	
	Average	Dry Conditions	Average	Dry Conditions	Average	Dry Conditions	Average	Dry Conditions
2015[26]	5,170	n/a	5,170	n/a	4,600	n/a	4,600	n/a
2020	6,450	8,180	6,045	7,690	5,810	7,370	5,470	6,945
2023	6,815	8,635	6,245	7,945	6,140	7,780	5,660	7,180

Plan Monitoring and Assessment

Many of the measures and programs that have been selected for implementation have imbedded within them data collection and evaluation BMPs that constitute plan monitoring and assessment practices. For example, the goal associated with reductions in system wide water loss will be assessed through the deliberate use of the AWWA M-36 water accounting methodology described in Appendix E. Similarly, the goal associated with reduced summertime water demand will be characterized and tracked as customer water use and total distribution system demands are measured monthly in keeping with current business practices.

However, the effectiveness of other measures and programs that the City implements will require more selective parsing of the available data associated with tracking sets of like

[26] Note that water to distribution and customer water demand are reported for 2015 in the column for average even though the year was slightly wetter than average based on evapotranspiration calculated annually over the study period (2008-2015) (see Table 3).

customer groups – new versus old irrigation only accounts, residential customers that have used incentives versus those that do not, etc. Control groups may need to be established to distinguish between types of housing stock (e.g., age, lot size) and type of incentives. As more water conservation programs are placed into practice, additional data collection and assessment will be needed (e.g., tracking individual school use).

A summary of the data collection and assessment that will occur to monitor and assess the benefits of the various selected measures and programs is presented in Table 12.

Note that one of the metrics that is recommended for collection and tracking relates to the highest water users in each customer category. These water users represent not only those customers that use the most water, but they may also provide insight into those customers that are paying the highest water rates (if they are in the highest tier of the inclining block rate). High water use customers may also be the most effected by emergency drought restrictions, such that special notices may be appropriate as part of the City's efforts to warn customers about potential fines and rate increases, if those are implemented in the future.

Table 12
Summary of Monitoring and Assessment Related Data Collection

Type of Data	Timing			Uses		
	Hourly	Daily	Monthly	Distribution System Water Loss Metrics[1]	Summertime Demand Reduction	Customer Demand Management[2]
Water from Production Wells		x	x	x		
Water from Westminster Interconnection		x	x	x		
Water to Distribution from Treatment		x	x	x		
Metered Customer Water Use			x	x	x	
Metered Unbilled Water Use			x	x	x	
Unmetered Authorized Water Use (line flushing, street cleaning, etc.)			x	x	x	
Estimates of Other Authorized or Known Uses (e.g., losses due to leaks, line flushing, etc.)			x	x	x	
Number of Leaks Found/Repaired			x	x	x	
Individual and Categorized Water Customer Water Use (through tracking of financial data)			x		x	x
Customer High Use Accounts Identified and Tracked Individually			x		x	x
Number of Rebates Provided including tracking Customer Information			x		x	x
Number of Other Incentives Provided including tracking Customer Information			x		x	x
Workshop and Seminar Attendee Lists	as needed				x	x
AMR Data Mining for Audited Customers	as needed				x	x

[1] Includes: (all are monthly) water to distribution, water sold, non-revenue water, authorized unbilled consumption, estimated apparent losses, estimated current monthly water loss (see Appendix E for the calculation method)

[2] Includes: (all are monthly) water sold per single residential connection, water sold per multi-tap residential connection, water sold per commercial connection, number of connections, highest water use connections (top 50)

Updating the Plan

The City's Water Conservation Plan Update will be reviewed and updated informally throughout the planning period (i.e., until the end of 2023). The City may choose to formally update the Plan whenever it is valuable to the organization dependent on financial needs, and/or substantial changes to its current operating conditions. At the very least, the Plan will be updated in 7 years, or by the end of 2023.

Plan Public Review and Comment

The City's Water Conservation Update has undergone public review in accordance with the requirements of the State regulations for a period of 60 days – from September 28, 2016 to November 28, 2016 (accounting for the weekend). A notice of the public review was printed in the local newspaper (see Appendix F). A copy of the final draft Plan was made available to the public at the City's offices and online. Public comments were received and the comment and the responses are noted in Appendix F.

Appendix A – CRS 37-60-126

C.R.S. 37-60-126

COLORADO REVISED STATUTES

*** This document reflects changes current through all laws passed at the First Regular Session
of the Sixty-Ninth General Assembly of the State of Colorado (2013) ***

TITLE 37. WATER AND IRRIGATION
WATER CONSERVATION BOARD AND COMPACTS
ARTICLE 60.COLORADO WATER CONSERVATION BOARD
PART 1. GENERAL PROVISIONS

C.R.S. 37-60-126 (2013)

37-60-126. Water conservation and drought mitigation planning - programs - relationship to state assistance for water facilities - guidelines - water efficiency grant program - repeal

(1) As used in this section and section 37-60-126.5, unless the context otherwise requires:

(a) "Agency" means a public or private entity whose primary purpose includes the promotion of water resource conservation.

(b) "Covered entity" means each municipality, agency, utility, including any privately owned utility, or other publicly owned entity with a legal obligation to supply, distribute, or otherwise provide water at retail to domestic, commercial, industrial, or public facility customers, and that has a total demand for such customers of two thousand acre-feet or more.

(c) "Grant program" means the water efficiency grant program established pursuant to subsection (12) of this section.

(d) "Office" means the office of water conservation and drought planning created in section 37-60-124.

(e) "Plan elements" means those components of water conservation plans that address water-saving measures and programs, implementation review, water-saving goals, and the actions a covered entity shall take to develop, implement, monitor, review, and revise its water conservation plan.

(f) "Public facility" means any facility operated by an instrument of government for the benefit of the public, including, but not limited to, a government building; park or other recreational facility; school, college, university, or other educational institution; highway; hospital; or stadium.

(g) "Water conservation" means water use efficiency, wise water use, water transmission and distribution system efficiency, and supply substitution. The objective of water conservation is a long-term increase in the productive use of water supply in order to satisfy water supply needs without compromising desired water services.

(h) "Water conservation plan", "water use efficiency plan", or "plan" means a plan adopted in accordance with this section.

(i) "Water-saving measures and programs" includes a device, a practice, hardware, or

equipment that reduces water demands and a program that uses a combination of measures and incentives that allow for an increase in the productive use of a local water supply.

(2) (a) Each covered entity shall, subject to section 37-60-127, develop, adopt, make publicly available, and implement a plan pursuant to which such covered entity shall encourage its domestic, commercial, industrial, and public facility customers to use water more efficiently. Any state or local governmental entity that is not a covered entity may develop, adopt, make publicly available, and implement such a plan.

(b) The office shall review previously submitted conservation plans to evaluate their consistency with the provisions of this section and the guidelines established pursuant to paragraph (a) of subsection (7) of this section.

(c) On and after July 1, 2006, a covered entity that seeks financial assistance from either the board or the Colorado water resources and power development authority shall submit to the board a new or revised plan to meet water conservation goals adopted by the covered entity, in accordance with this section, for the board's approval prior to the release of new loan proceeds.

(3) The manner in which the covered entity develops, adopts, makes publicly available, and implements a plan established pursuant to subsection (2) of this section shall be determined by the covered entity in accordance with this section. The plan shall be accompanied by a schedule for its implementation. The plans and schedules shall be provided to the office within ninety days after their adoption. For those entities seeking financial assistance, the office shall then notify the covered entity and the appropriate financing authority that the plan has been reviewed and whether the plan has been approved in accordance with this section.

(4) A plan developed by a covered entity pursuant to subsection (2) of this section shall, at a minimum, include a full evaluation of the following plan elements:

(a) The water-saving measures and programs to be used by the covered entity for water conservation. In developing these measures and programs, each covered entity shall, at a minimum, consider the following:

(I) Water-efficient fixtures and appliances, including toilets, urinals, clothes washers, showerheads, and faucet aerators;

(II) Low water use landscapes, drought-resistant vegetation, removal of phreatophytes, and efficient irrigation;

(III) Water-efficient industrial and commercial water-using processes;

(IV) Water reuse systems;

(V) Distribution system leak identification and repair;

(VI) Dissemination of information regarding water use efficiency measures, including by public education, customer water use audits, and water-saving demonstrations;

(VII) (A) Water rate structures and billing systems designed to encourage water use efficiency in a fiscally responsible manner.

(B) The department of local affairs may provide technical assistance to covered entities that are local governments to implement water billing systems that show customer water

usage and that implement tiered billing systems.

(VIII) Regulatory measures designed to encourage water conservation;

(IX) Incentives to implement water conservation techniques, including rebates to customers to encourage the installation of water conservation measures;

(b) A section stating the covered entity's best judgment of the role of water conservation plans in the covered entity's water supply planning;

(c) The steps the covered entity used to develop, and will use to implement, monitor, review, and revise, its water conservation plan;

(d) The time period, not to exceed seven years, after which the covered entity will review and update its adopted plan; and

(e) Either as a percentage or in acre-foot increments, an estimate of the amount of water that has been saved through a previously implemented conservation plan and an estimate of the amount of water that will be saved through conservation when the plan is implemented.

(4.5) (a) On an annual basis starting no later than June 30, 2014, covered entities shall report water use and conservation data, to be used for statewide water supply planning, following board guidelines pursuant to paragraph (b) of this subsection (4.5), to the board by the end of the second quarter of each year for the previous calendar year.

(b) No later than February 1, 2012, the board shall adopt guidelines regarding the reporting of water use and conservation data by covered entities and shall provide a report to the senate agriculture and natural resources committee and the house of representatives agriculture, livestock, and natural resources committee, or their successor committees, regarding the guidelines. These guidelines shall:

(I) Be adopted pursuant to the board's public participation process and shall include outreach to stakeholders from water providers with geographic and demographic diversity, nongovernmental organizations, and water conservation professionals; and

(II) Include clear descriptions of: Categories of customers, uses, and measurements; how guidelines will be implemented; and how data will be reported to the board.

(c) (I) No later than February 1, 2019, the board shall report to the senate agriculture and natural resources committee and the house of representatives agriculture, livestock, and natural resources committee, or their successor committees, on the guidelines and data collected by the board under the guidelines.

(II) This paragraph (c) is repealed, effective July 1, 2020.

(5) Each covered entity and other state or local governmental entity that adopts a plan shall follow the entity's rules, codes, or ordinances to make the draft plan available for public review and comment. If there are no rules, codes, or ordinances governing the entity's public planning process, then each entity shall publish a draft plan, give public notice of the plan, make such plan publicly available, and solicit comments from the public for a period of not less than sixty days after the date on which the draft plan is made publicly available. Reference shall be made in the public notice to the elements of a plan that have already been implemented.

(6) The board is hereby authorized to recommend the appropriation and expenditure of

revenues as are necessary from the unobligated balance of the five percent share of the severance tax operational fund designated for use by the board for the purpose of the office providing assistance to covered entities to develop water conservation plans that meet the provisions of this section.

(7) (a) The board shall adopt guidelines for the office to review water conservation plans submitted by covered entities and other state or local governmental entities. The guidelines shall define the method for submitting plans to the office, the methods for office review and approval of the plans, and the interest rate surcharge provided for in paragraph (a) of subsection (9) of this section.

(b) If no other applicable guidelines exist as of June 1, 2007, the board shall adopt guidelines by July 31, 2007, for the office to use in reviewing applications submitted by covered entities, other state or local governmental entities, and agencies for grants from the grant program and from the grant program established in section 37-60-126.5 (3). The guidelines shall establish deadlines and procedures for covered entities, other state or local governmental entities, and agencies to follow in applying for grants and the criteria to be used by the office and the board in prioritizing and awarding grants.

(8) A covered entity may at any time adopt changes to an approved plan in accordance with this section after notifying and receiving concurrence from the office. If the proposed changes are major, the covered entity shall give public notice of the changes, make the changes available in draft form, and provide the public an opportunity to comment on such changes before adopting them in accordance with subsection (5) of this section.

(9) (a) Neither the board nor the Colorado water resources and power development authority shall release grant or loan proceeds to a covered entity unless the covered entity provides a copy of the water conservation plan adopted pursuant to this section; except that the board or the authority may release the grant or loan proceeds notwithstanding a covered entity's failure to comply with the reporting requirements of subsection (4.5) of this section or if the board or the authority, as applicable, determines that an unforseen emergency exists in relation to the covered entity's loan application, in which case the board or the authority, as applicable, may impose a grant or loan surcharge upon the covered entity that may be rebated or reduced if the covered entity submits and adopts a plan in compliance with this section in a timely manner as determined by the board or the authority, as applicable.

(b) The board and the Colorado water resources and power development authority, to which any covered entity has applied for financial assistance for the construction of a water diversion, storage, conveyance, water treatment, or wastewater treatment facility, shall consider any water conservation plan filed pursuant to this section in determining whether to render financial assistance to such entity. Such consideration shall be carried out within the discretion accorded the board and the Colorado water resources and power development authority pursuant to which such board and authority render such financial assistance to such covered entity.

(c) The board and the Colorado water resources and power development authority may enter into a memorandum of understanding with each other for the purposes of avoiding delay in the processing of applications for financial assistance covered by this section and avoiding duplication in the consideration required by this subsection (9).

(10) Repealed.

(11) (a) Any section of a restrictive covenant or of the declaration, bylaws, or rules and regulations of a common interest community, all as defined in section 38-33.3-103, C.R.S., that prohibits or limits xeriscape, prohibits or limits the installation or use of drought-

tolerant vegetative landscapes, or requires cultivated vegetation to consist wholly or partially of turf grass is hereby declared contrary to public policy and, on that basis, is unenforceable. This paragraph (a) does not prohibit common interest communities from adopting and enforcing design or aesthetic guidelines or rules that require drought-tolerant vegetative landscapes or regulate the type, number, and placement of drought-tolerant plantings and hardscapes that may be installed on the unit owner's property or property for which the unit owner is responsible.

(b) As used in this subsection (11):

(I) "Executive board policy or practice" includes any additional procedural step or burden, financial or otherwise, placed on a unit owner who seeks approval for a landscaping change by the executive board of a unit owners' association, as defined in section 38-33.3-103, C.R.S., and not included in the existing declaration or bylaws of the association. An "executive board policy or practice" includes, without limitation, the requirement of:

(A) An architect's stamp;

(B) Preapproval by an architect or landscape architect retained by the executive board;

(C) An analysis of water usage under the proposed new landscape plan or a history of water usage under the unit owner's existing landscape plan; and

(D) The adoption of a landscaping change fee.

(II) "Restrictive covenant" means any covenant, restriction, bylaw, executive board policy or practice, or condition applicable to real property for the purpose of controlling land use, but does not include any covenant, restriction, or condition imposed on such real property by any governmental entity.

(II.5) "Turf" means a covering of mowed vegetation, usually turf grass, growing intimately with an upper soil stratum of intermingled roots and stems.

(III) "Turf grass" means continuous plant coverage consisting of nonnative grasses or grasses that have not been hybridized for arid conditions which, when regularly mowed, form a dense growth of leaf blades and roots.

(IV) "Xeriscape" means the application of the principles of landscape planning and design, soil analysis and improvement, appropriate plant selection, limitation of turf area, use of mulches, irrigation efficiency, and appropriate maintenance that results in water use efficiency and water-saving practices.

(c) Nothing in this subsection (11) precludes the executive board of a common interest community from taking enforcement action against a unit owner who allows his or her existing landscaping to die or go dormant; except that:

(I) No enforcement action shall require that a unit owner water in violation of water use restrictions declared by the jurisdiction in which the common interest community is located, in which case the unit owner shall water his or her landscaping appropriately but not in excess of any watering restrictions imposed by the water provider for the common interest community;

(II) Enforcement shall be consistent within the community and not arbitrary or capricious; and

(III) In any enforcement action in which the existing turf grass is dead or dormant due to

insufficient watering, the unit owner shall be allowed a reasonable and practical opportunity, as defined by the association's executive board, with consideration of applicable local growing seasons or practical limitations, to reseed and revive turf grass before being required to replace it with new sod.

(d) This subsection (11) does not supersede any subdivision regulation of a county, city and county, or other municipality.

(12) (a) (I) There is hereby created the water efficiency grant program for purposes of providing state funding to aid in the planning and implementation of water conservation plans developed in accordance with the requirements of this section and to promote the benefits of water efficiency. The board is authorized to distribute grants to covered entities, other state or local governmental entities, and agencies in accordance with its guidelines from the moneys transferred to and appropriated from the water efficiency grant program cash fund, which is hereby created in the state treasury.

(II) Moneys in the water efficiency grant program cash fund are hereby continuously appropriated to the board for the purposes of this subsection (12) and shall be available for use until the programs and projects financed using the grants have been completed.

(III) For each fiscal year beginning on or after July 1, 2010, the general assembly shall appropriate from the fund to the board up to five hundred thousand dollars annually for the purpose of providing grants to covered entities, other state and local governmental entities, and agencies in accordance with this subsection (12). Commencing July 1, 2008, the general assembly shall also appropriate from the fund to the board fifty thousand dollars each fiscal year to cover the costs associated with the administration of the grant program and the requirements of section 37-60-124. Moneys appropriated pursuant to this subparagraph (III) shall remain available until expended or until June 30, 2020, whichever occurs first.

(IV) Any moneys remaining in the fund on June 30, 2020, shall be transferred to the severance tax operational fund described in section 39-29-109 (2) (b), C.R.S.

(b) Any covered entity or state or local governmental entity that has adopted a water conservation plan and that supplies, distributes, or otherwise provides water at retail to customers may apply for a grant to aid in the implementation of the water efficiency goals of the plan. Any agency may apply for a grant to fund outreach or education programs aimed at demonstrating the benefits of water efficiency. The office shall review the applications and make recommendations to the board regarding the awarding and distribution of grants to applicants who satisfy the criteria outlined in this subsection (12) and the guidelines developed pursuant to subsection (7) of this section.

(c) This subsection (12) is repealed, effective July 1, 2020.

HISTORY: Source: L. 91: Entire section added, p. 2023, § 4, effective June 4.L. 99: (10) repealed, p. 25, § 3, effective March 5.L. 2003: (4)(g) amended and (11) added, p. 1368, § 4, effective April 25.L. 2004: Entire section amended, p. 1779, § 3, effective August 4.L. 2005: (11) amended, p. 1372, § 1, effective June 6; (1), (2)(b), and (7) amended and (12) added, p. 1481, § 1, effective June 7.L. 2007: (1)(a), (2)(a), (5), (7), and (12) amended, p. 1890, § 1, effective June 1.L. 2008: IP(4) amended, p. 1575, § 30, effective May 29; (12)(a) amended, p. 1873, § 14, effective June 2.L. 2009: (12)(a) amended, (HB 09-1017), ch. 297, p. 1593, § 1, effective May 21; (9)(a) amended, (SB 09-106), ch. 386, p. 2091, § 3, effective July 1.L. 2010: (4)(a)(I) and (9)(a) amended and (4.5) added, (HB 10-1051), ch. 378, p. 1772, § 1, effective June 7; (12)(a)(III), (12)(a)(IV), and (12)(c) amended, (SB 10-025), ch. 379, p. 1774, § 1, effective June 7.L. 2013: (11)(a), (11)(b)(III), IP(11)(c), (11)(c)(I), and (11)(c)(III) amended and (11)(b)(II.5) and (11)(d)

added, (SB 13-183), ch. 187, p. 756, § 1, effective May 10; (6) and (12)(a)(IV) amended, (SB 13-181), ch. 209, p. 873, § 24, effective May 13.

Editor's note: Subsection (12) was originally enacted as subsection (13) in House Bill 05-1254 but was renumbered on revision for ease of location.

Cross references: (1) In 1991, this entire section was added by the "Water Conservation Act of 1991". For the short title and the legislative declaration, see sections 1 and 2 of chapter 328, Session Laws of Colorado 1991.

(2) For the legislative declaration contained in the 2004 act amending this section, see section 1 of chapter 373, Session Laws of Colorado 2004.

Appendix B – Future Water Demand Calculations

Appendix B – Finished Water Demand Forecast

The forecast of future demand for the City of Brighton was developed based on the characteristic parameters of mean and standard deviation for monthly water use normalized per connection for each of the seven customer types – residential, commercial, irrigation only, schools, municipal, uncharged municipal and other (which consists of a selected group of sales related to construction water use). The characteristic parameters were developed for each month of the calendar year based on data obtained from the City for the period January 2008 through December 2014[1].

The characteristic parameters for monthly water demands per active connection, as presented in Table B-1, were used to estimate average and dry conditions water demand for each month in 2020 and 2023 based on predicted increases in customer connections over this same time period. Increases in customer connections were developed based on historic trends correlating changes in the City's population to customer connections. Table B-2 provides the listing of past and predicted taps for each of the customer types.

Average future monthly demand was calculated using the product of average monthly demand per active connection type from Table B-1 and the number of expected connections by customer type from Table B-2. Monthly demand was then summed to estimate average annual demand for each of the two target years in the future 2020 and 2023.

Note that increases in customer connections were developed as follows:

> Residential – in 2010 and 2014, the ratio of residential connections to population served was 0.25 and 0.24, respectively, indicating a trend toward less dense housing. It is anticipated that this trend will continue such that for 2020 and 2023, residential customers were estimated using a ratio of 0.23. Future residential use was thus increased based on projected future population (provided by City Planning) and the persons per connection to estimate expected increases in residential connections.
>
> Commercial – commercial connections grew at a rate of just less than 2% per year from 2010 to 2014. Therefore, an increase of about 2% per year was used to estimate the number of connections in 2020 and 2023.
>
> Irrigation only (and billed Municipal accounts) – Although the City has substantially increased the cost of water provided to irrigation only accounts to greater than $8 per thousand gallons, new developments are required to install parks and open space in compliance with local building ordinances. Given that the residential growth is expected to continue, both

[1] The City changed billing software at the beginning of this period and in October 2014, such that use of per connection data prior to and after the period from 2008 through 2014 was not possible since accounting practices segregating customer use categories changed with the different billing software platforms. For this reason, customer connection for November and December 2014 were estimated based on trends observed during the first 10 months of 2014.

irrigation only accounts and billed municipal accounts are expected to increase at a ratio roughly equivalent to the increase in population[2].

Municipal – the City has stopped issuing taps for uncharged municipal uses, such that only chargeable municipal taps will increase in the future (see above). The growth in billed municipal connections is estimated to occur in conjunction with the growth in the City's population.

Schools – in the past new schools have been built at a rate of about 2 per year, such that this trend is expected to continue to serve the growing population of the City.

Other – other connections are expected to remain the same into the future.

Average demand represents the demand expected for average conditions, which has a 50% chance of being exceeded, or may be exceeded in 5 out of every 10 years[3]. As a means to better characterize the impact, and therefore potential benefit of proposed water conservation programs, it is helpful to estimate demand under above average conditions. For the purposes of this Plan, above average conditions are those demands that have a 10% chance of being exceeded[4], or may be exceeded in one 1 out of every 10 years. For above average years, future monthly demand was calculated by using the product of the same numbers listed in the paragraph above, except that the average monthly demand per active connection was increased by the standard deviation for the monthly demand per active connection multiplied by 1.2817 (which is the factor that adjusts the mean to the 90% percentile assuming that average monthly water demand is normally distributed).

The results of the forecasting calculations are presented in Table B-3.

[2] The ratio of irrigation only accounts to residential accounts was about 85:1 and 84:1 in 2010 and 2014, respectively. A ratio of 80:1 for irrigation only accounts to estimated future residential accounts was used in this forecast for the years 2020 and 2023.

[33] Note that the average and dry year demand forecasts for the two future years – 2020 and 2023 – are based on the assumption that future customer water use per tap will remain the same as current per tap water use. This includes the assumption that future irrigation only and municipal parks will continue to plant and irrigate high water use grasses and trees as opposed to Xeric and/or native plantings. Future water conservation programs by the City may therefore consider altering current City community planning policies to promote the installation of more efficient planting materials and irrigation strategies.

[4] Above average years may occur as a result of dry periods, higher than normal irrigation requirement, changes in local uses, or for other reasons.

Table B-1 – Monthly Water Demand per Active Connection (based on data from 2008 to 2014)

Normalized Past Demand		(in thousands of gallons)										
Mean	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Residential[1]	4.63	4.50	3.97	5.18	7.49	11.16	15.56	16.61	15.41	11.50	6.56	5.15
Commercial[2]	35.93	34.43	35.14	38.16	44.56	55.17	72.57	76.67	72.66	62.26	42.96	36.15
Irrigation	1.85	(0.01)	0.61	3.48	55.42	162.27	255.47	295.59	284.42	180.30	46.08	1.77
Schools	23.66	27.17	26.96	31.50	93.46	151.21	204.40	265.90	250.30	195.67	85.65	32.56
Muni (Charged)					6.50	18.47	28.12	91.61	36.74	23.15	0.33	0.17
Muni (Uncharged)	39.6	37.84	35.87	35.87	74.32	131.33	314.75	221.58	226.56	162.15	68.08	36.50
Other	27.4	41.42	9.12	10.50	54.08	15.00	78.03	83.08	75.65	60.29	37.57	27.14
Standard Deviation												
Residential[1]	0.42	0.48	1.00	0.81	1.53	2.52	2.14	3.42	3.27	2.71	0.79	0.45
Commercial[2]	3.23	4.02	3.39	5.13	5.80	9.63	6.42	12.55	11.97	11.93	5.40	5.27
Irrigation	2.41	0.32	1.19	3.35	29.99	48.93	30.59	65.44	67.54	52.46	29.26	2.33
Schools	3.44	4.96	6.99	6.42	33.35	78.34	49.27	74.69	62.18	76.78	16.89	5.43
Muni (Charged)								86.50	8.89			
Muni (Uncharged)	6.71	14.15	9.10	11.20	32.37	52.38	303.75	41.08	63.24	64.33	26.18	13.99
Other	32.73	91.90	10.99	11.52	106.33	38.84	101.80	89.22	142.60	100.80	34.85	40.46

Notes – [1] Residential includes Brighton (reduced rate and residential) plus Henderson residential; [2] Commercial includes commercial less Henderson residential and schools

Table B-2 – Listing of Average Annual Customer Connections - Past and Projected for the Future

	Population	Residential	Commercial	Irrigation Only	Schools	Municipal (charged)	Municipal (uncharged)	Other
2010	33,544	8,420	656	99	35	0	97	14
2014	36,765	8,805	708	105	37	3	113	14
2020	41,600	9,600	792	120	43	6	113	14
2023	44,400	10,200	838	128	46	8	113	14

Table B-3 – Forecasted Annual Water Demand

	Average Conditions (million gallons)	Above Average Conditions (million gallons)	Average Conditions (acre-feet)	Above Average Conditions (acre-feet)
2020	1,890	2,400	5,810	7,370
2023	2,000	2,530	6,140	7,780

Appendix C – City of Brighton Current Water Rates

CITY OF BRIGHTON - UTILITIES RATES
Effective January 1, 2016

		Monthly Fixed Charge	+	Volume Charge Per 1,000 gallons
WATER MONTHLY FIXED CHARGE:				
Residential		15.00		
Commercial, Municipal Potable, Municipal Non-Potable, Industrial, Mixed Use, Bulk, Schools				
3/4" Meter		15.00		
1" Meter		24.90		
1 1/2" Meter		49.50		
2" Meter		79.50		
3" Meter		149.50		
4" Meter		249.00		
6" Meter		495.00		
CONTRACT WATER SURCHARGE Effective June 1, 2015				
3/4" Meter		4.60		
1" Meter		7.68		
1 1/2" Meter		15.32		
2" Meter		24.52		
3" Meter		46.00		
4" Meter		76.68		
6" Meter		153.32		
WATER MONTHLY VOLUME CHARGE:				
Residential and Residential Irrigation	0 to 3,000 gallons			2.80
	3,001 to 15,000 gallons			4.80
	15,001 to 25,000 gallons			5.18
	25,001 to 40,000 gallons			5.60
	40,001 gallons and above			6.50
Multi Family Residential (Apartments) Indoor Only or Indoor and Outdoor Use Combined	0 to 40,000 gallons			5.25
	40,001 gallons and above			6.50
Multi Family Irrigation Only	0 to 40,000 gallons			5.25
	40,001 gallons and above			8.55
Commercial, Industrial, Schools, Mixed Use, Municipal Potable - Indoor Only	per 1,000 gallons			4.98
Commercial, Industrial, Schools, Mixed Use, Municipal Potable -Indoor & Outdoor Combined	per 1,000 gallons			6.30
Commercial, Industrial, Schools, Mixed Use, Municipal Potable - Outdoor Only	per 1,000 gallons			8.55
Bulk-Hydrants	per 1,000 gallons			8.55
Non-Potable Irrigation	per 1,000 gallons			3.24
SEWER MONTHLY FIXED CHARGE:				
Residential		10.95		
Commercial, Industrial, Mixed use, Schools				
3/4" Meter		19.85		
1" Meter		46.91		
1 1/2" Meter		114.99		
2" Meter		208.39		
3" Meter		437.75		
4" Meter		792.00		
6" Meter		2,136.39		
SEWER MONTHLY VOLUME CHARGE:				
Residential (min. 5,000 max. 15,000)				4.58
Commercial, Industrial, Schools, Mixed Use				5.62
Commercial Actual				5.62
Municipal				4.58
Non-Metered Residential				24.39
Non-Metered Multi-family (* # of dwellings)				24.39
Non-Metered Commercial:				49.66

NOTE: The monthly sewer volume charge will be a flat rate based on the monthly WATER USAGE for the December, January & February bills. The correction is effective on the May bills and will remain at that rate until the following May when the new average is calculated.

STORM DRAINAGE FIXED CHARGE:		
Resident	4.00	
Multi Family Residential (Apartments)	5.10	
Commercial, Mixed Use, Industrial, Schools	11.38	

Appendix D – City of Brighton Drought Management Plan

Drought Management Plan

March 2013

Utilities Department – Water Resources Division
in conjunction with the
Drought Management Advisory Committee

Contents

Preface

The City of Brighton is responsible for providing and maintaining a safe and sustainable water supply to its customers.

Brighton is situated in a semi-arid region with significant competition for limited water supplies. Drought can have significant impacts on the ability of Front Range communities to procure water to meet the needs of its customers.

Drought is an inevitable feature of any environment. In the Front Range, including Brighton, drought can cause serious water shortages that can impact the lives of its many citizens. Water shortages can impact the health and safety, the economic well-being, and individual lifestyles of customers.

In order to be prepared for water supply shortages, the City through the Drought Management Advisory Committee and its Utilities Department – Water Resources Division has created this proactive Drought Management Plan to set the goals and actions to be taken in a given water supply shortage event.

The number one priority set by the Drought Management Advisory Committee is to protect the health and safety of the City's customers. Drinking water, hygiene, and fire protection are the basic human needs that must be provided for at all times. Other uses may be restricted in order to provide for these most basic services. Economic needs follow as the next priority usage with individual lifestyle a valued final priority.

The following Drought Management Plan incorporates concrete mathematical models to set consumption goals and the action plan to meet those goals.

Chapter 1: Introduction

While there are varying definitions of what a **drought** is, for the purposes of the City of Brighton as a municipal public water supply provider, it may be simply defined as *a period of abnormally dry weather, either in the surrounding area or in the mountains, long enough and serious enough to impact the City's ability to supply water to its customers*.

Drought is a condition that impacts every climate on Earth on a recurring basis. However, because of the Colorado Front Range's semi-arid climate, even small droughts can have serious impacts on water supply in the region and the City of Brighton itself. The Colorado Office of Emergency Management's Natural Hazards Mitigation Plan lists Adams County has having a high drought hazard ranking. Only flooding was given similarly high ranking.

Like most natural disasters, drought is difficult to predict. Droughts do not typically have a defined beginning or end. They can occur locally, regionally, or statewide; quickly or slowly; and they can last for a season or for many years. Because of the unpredictable nature of drought, it is imperative for the City to plan ahead for inevitable water supply shortages and to also have a plan that is flexible enough to meet the differing characteristics of individual drought conditions.

The primary objectives of municipal drought planning are to preserve essential public services and minimize adverse affects of a water supply shortage on public health and safety, economic activity, environmental resources, and individual lifestyles. There is a two stage approach to proactively mitigate the impacts of a drought. **Water conservation planning** is the first piece of drought planning. Water conservation planning, and the implementation of the plan, allows the City to use existing resources more efficiently on a long-term basis. Efficient use of water in day-to-day activities saves water that can be set aside to make the City's overall water portfolio more reliable and less prone to impacts from a water supply shortage -- as long as the water savings is not used for additional growth of water customers. **Drought management planning** focuses on the more immediate emergency management needs of a drought including specific mitigation and response strategies to allow for short-term relief during a water supply shortage. These response strategies may include watering restrictions on certain types of uses and changes in water supply operations to maximize the water available for essential uses.

Chapter 2: Drought Management Advisory Committee

Drought Management Advisory Committee (DMAC)

In order to make this Drought Management Plan as realistic, practical, and achievable as possible, major stakeholders within the City participated in this effort through an interactive and collaborative process. The Utilities Department thanks them for their time and input.

The following Departments participated in the Drought Management Advisory Committee:

- The City Manager's Office
- Utilities
- Public Information Office
- Community Development
- Parks and Recreation
- Streets and Fleet
- Police Department
- Emergency Management Office
- Economic Development
- Budget and Policy
- Greater Brighton Fire District

DMAC Objectives

The Brighton Drought Index and associated water-usage reduction goals are mathematically-based, concrete numbers. The goals that are provided must be met if the City's water supply is to be adequately protected. The path to meet those goals and ultimately preserve the City's water supply is less concrete. The DMAC, through its participation and comments on this document, has set the principles that will guide the City through varying levels of water supply emergencies and has set the concrete steps that will be taken at each emergency level.

The DMAC set the follow mission statement:

"The Drought Management Advisory Committee strives to protect the City's water supply for the benefit of its customers by setting priority uses and response strategies for times of water shortage."

The DMAC set the following priorities from most critical to less critical:

- Public Health and Safety (i.e.: Fire Protection, Personal Hygiene, Drinking Water)
- Economic Activity
- Environmental Resources
- Individual Lifestyle

Chapter 3: Existing System

History

The City has an older distribution system with infrastructure in old town over a hundred years old. The system as a whole, though, is relatively new. The essential components of the existing water system came online in the following years:

- Reverse Osmosis Treatment Plant (South Platte Wells Treatment): 1993
- Green Sand Plant (Beebe Wells Treatment): 2002
- 124th Avenue Reservoir: 2005
- Ken Mitchell Reservoir: 2007
- City's first decreed augmentation plan: 2007

Brighton experienced rapid growth through much of the early 2000s. From the 2000 census, the population was 20,905 people. The 2010 census shows a population of 33,352. Most of this 60% increase occurred prior to 2007. Additionally, the huge number of newer homes that were constructed during this time period typically have different water usage requirements than older construction.

Because the augmentation system was not fully operational until 2007 and the population was in flux up until 2007, calculations of average usage and water requirements throughout the Drought Management Plan calculations are based on a time period of 2007-2011.

Customers

The City of Brighton services approximately 10,100 accounts (based on 2011 records) over a 25 square mile area. The existing service area includes the area between the South Platte River to just east of I-76 and is bounded to the north by Weld County Road 6 (Crown Prince Boulevard) and extends down to 112th Avenue.

The City's utility customer base is broken down into the following categories:

- Residential
- Commercial
- Municipal
- Irrigation
- Schools
- Bulk

The majority of the City's water accounts are residential (See Figure 1); however, residential usage only makes up approximately 50% of the City's total annual usage (See Figure 2). Commercial, irrigation, and municipal categories take up a much larger portion of the City's usage when looked at in terms of actual gallons of usage.

When the categories are viewed on a per account basis, municipal, irrigation only, and school accounts use the most water per account (See Figure 3). It should be noted that the irrigation category includes taps that have been specifically designated as irrigation taps. The other remaining categories have, in some cases, significant outdoor watering use that has not been separated out because of available data due to limitations of metering.

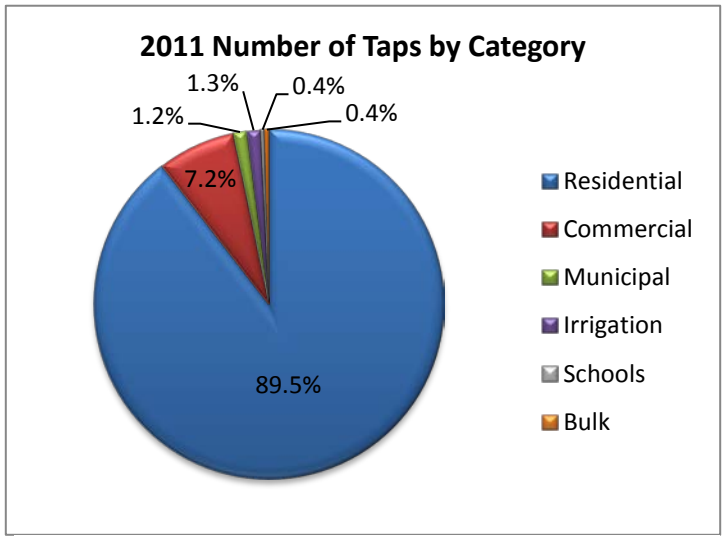


Figure 2: 2011 Number of Taps by Category

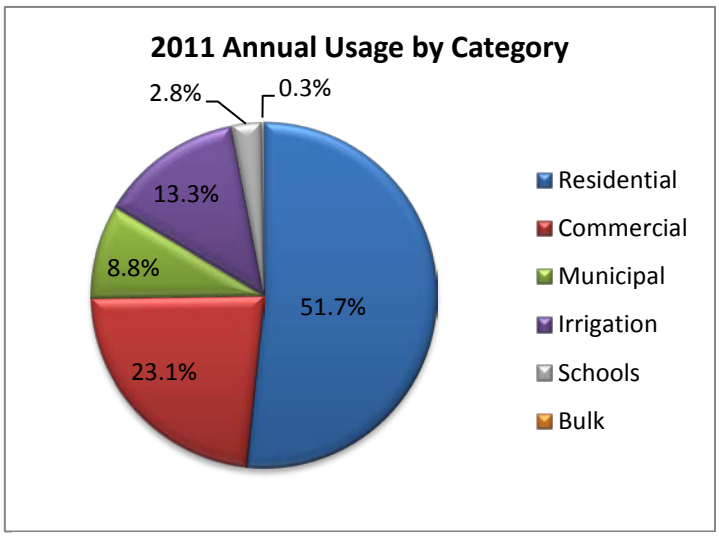


Figure 1: 2011 Annual Usage by Category

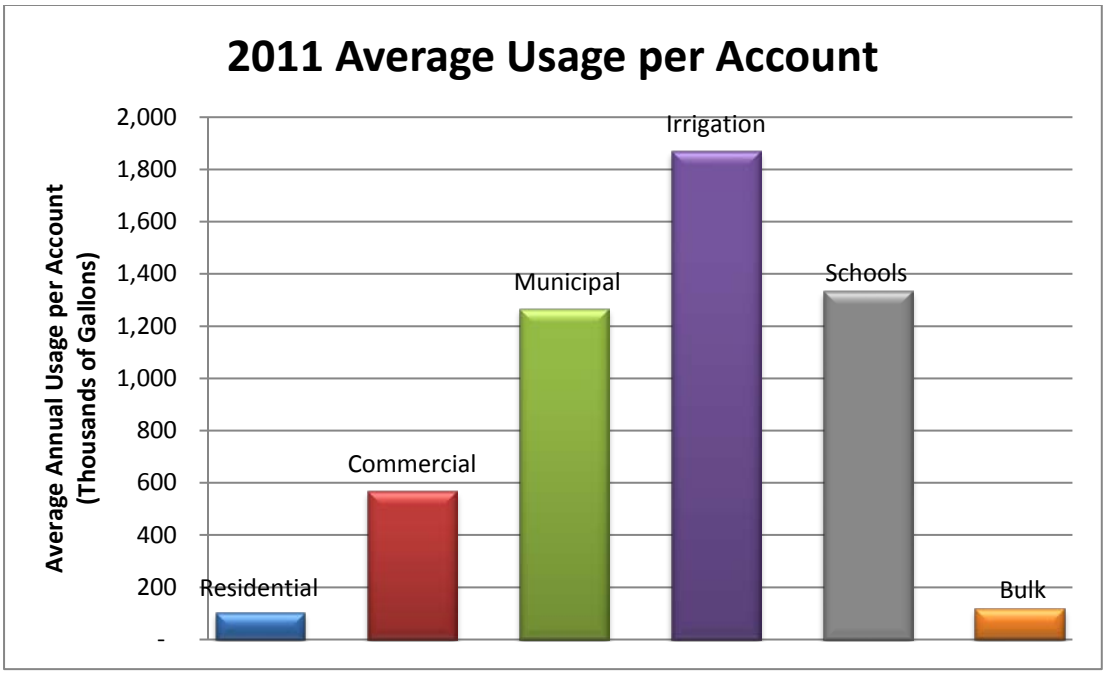


Figure 3: Usage per Account

Residential
- Number of Accounts: 9054
- Total Annual Usage per Category: **926,128,000 gallons**
- Annual Usage per Account: 102,000 gallons

Commercial
- Number of Accounts: 730
- Total Annual Usage per Category: **414,257,000 gallons**
- Annual Usage per Account: 567,000 gallons

Municipal
- Number of Accounts: 144
- Total Annual Usage per Category: **158,198,000 gallons**
- Annual Usage per Account: 1,266,000 gallons

Irrigation
- Number of Accounts: 109
- Total Annual Usage per Category: **239,129,000 gallons**
- Annual Usage per Account: 1,868,000 gallons

Schools
- Number of Accounts: 38
- Total Annual Usage per Category: **50,619,000 gallons**
- Annual Usage per Account: 1,332,000 gallons

Bulk
- Number of Accounts: 6
- Total Annual Usage per Category: **4,598,000 gallons**
- Annual Usage per Account: 118,000 gallons

Definitions of Water Supply Types

Brighton has two different types of water supplies: **municipal supply** and **augmentation supply**. Both supplies are separate from each other and are used for different purposes and are of different water qualities.

Municipal Supply

The City's municipal supply is the water that is physically treated and sent to the distribution system for consumption by its customers. Approximately two-thirds of the City's water supply comes from **alluvial wells**[1]. Brighton also purchases treated water through agreements with other organizations to make up the other one-third of required demand supply (based on 2011 supply and demand numbers).

The City operates two different well fields: the South Platte Well Field and the Beebe Draw Well Field. These are both alluvial well fields which means they are relatively shallow wells that are impacted by local weather and also are hydraulically connected to surface waters. As their names suggest, the South Platte Well Field aquifer is tributary to the South Platte River, and the Beebe Draw Well Field aquifer is tributary to the Beebe Draw.

The South Platte Well Field is the larger of the two well fields and provides about 55% of annual finished water that the City produces. The Beebe Draw Well Field is primarily used for peaking in summertime months and provides about 15% of annual finished water that the City produces. The remainder of the City's municipal supply is provided via purchased treated water from other water providers.

The City operates two water treatment plants. One is the Reverse Osmosis Treatment Plant (RO Plant) that is designed to treat water from the South Platte alluvial aquifer. It has a treatment capacity of 6.9 million gallons per day (MGD). The second is the Green Sand Plant that is designed to treat water from the Beebe Draw alluvial aquifer that has somewhat different water chemistry. It has a maximum plant capacity of 4 MGD. An additional 1.8 to 2.2 MGD of treated water supply is available for purchase from other organizations.

The City experiences a significant swing in wintertime and summertime usage primarily due to increased irrigation usage in the summer. Average wintertime demands on the system are approximately 2.6 MGD. Summertime peak daily usage to date is 11.4 MGD, a more than 4-fold increase from typical wintertime usage.

Augmentation Supply

Colorado Water Law

Colorado has a complex water law system that was established since even before Colorado became a state in the 1800s. The system is simply summarized by the phrase "first in time, first in right".

In order to legally claim a water right, the water right must be adjudicated in Colorado's Water Court and given an appropriation date. The appropriation date is the date that the entity first used or stated

[1] **Alluvial wells** are shallow wells that are directly tributary to a surface body of water. This is as opposed to deep aquifer wells that are hydraulically separated from surface water by impervious layers of rock and soil between the surface waters and the deep well aquifers.

its intent to use a particular water right. When there is a limited water supply, the entities with the most senior (or older) appropriation date have the right to take their water right before others with more junior (or newer) appropriation dates. For example, using arbitrary numbers, suppose there were 30 cfs at a point on the river. Farmer 1 has a water right for 40 cfs with an appropriation date of 1910. Farmer 2 has a water right for 40 cfs with an appropriation date of 1885. Because Farmer 2 has the senior appropriation date, he will have the first right to the 30 cfs in the river. If Farmer 1 was using that water before it made it to Farmer 2, Farmer 2 would put a **call** on the river via the Water Commissioner. This call would force Farmer 1 to let the water go downstream to Farmer 2.

Brighton's Augmentation System

The aquifers that the City utilizes for its municipal supply are tributary to the South Platte River or the Beebe Draw system and so are subject to the appropriation date system. The City's wells all have adjudicated appropriation dates, but they are relatively junior rights. The City must pump its wells on most days to keep up with demand, but because the water is taken out of priority much of the time, the City must put other water back in the river to replace what has been taken from the aquifer. This water is replaced through the City's Augmentation System.

It can take months and even years for the impacts of the City's pumping to impact the river. Very generally speaking, the peak of the impacts occurs around 6 months after the well has been pumped. Therefore, the bulk of augmentation for current pumping will not have to be paid back to the river until approximately 6 months from the time of pumping. This is called the well's *lagged depletion* of the river. The high pumping rates seen in the summer months that make up the significant portion of annual pumping then have to be paid back to the river the following year and, in smaller amounts, in many subsequent years after the well has been pumped.

The City utilizes a portfolio of reservoir and ditch rights to augment for depletions caused by the pumping of its alluvial wells. These replacements are mandated by court decree and must be made to continue the operation of the City's wells. As a result of using ditch rights, the City is also required to make return flows that would have historically been left in the river system as a result of irrigation practices and ditch uses. For simplicity in this document, all water that must be replaced to the river, including well augmentation and return flow requirements, are included under augmentation supply.

The City's augmentation supply sources include two storage facilities: Ken Mitchell – Erger's Complex and 124th Reservoir. The City also owns storage rights in Barr Lake. To compliment these storage facilities, the City also owns shares of the Fulton Ditch, Burlington and Wellington Ditch Companies, the Brighton Lateral, and the Farmers Reservoir and Irrigation Company (FRICO).

Ditches typically run in the summer during irrigation season. The credits received for ditch shares can either be used directly to offset current augmentation requirements or can be stored for use when the ditches are offline. The City's reservoirs allow the City to store water that is available in the summer months for use later in the winter when the ditches aren't running. They also provide a buffer against

drought conditions with **carry-over storage**[2]. In the case of this drought management plan, the target carry-over volume was set to provide a buffer in storage to allow for the most basic services of essential indoor uses and fire protection in extreme drought situations.

Typically, Brighton reservoirs fill during the spring runoff and then through the summer when ditches are operational. These reservoirs are used exclusively for augmentation and, at this point, are not treated for potable water consumption. Because of the lagged depletion of the City's wells, the high pumping rates seen in summer months cause significant impacts to augmentation storage going into the following calendar year. Therefore, when planning ahead, current pumping rates must be forecasted forward to know how much augmentation water will be required to replace the pumped water. Assumed carryover water that will be available for future seasons must then be current and forecasted storage minus forecasted augmentation rates plus predicted ditch supply available for storage.

In addition to ditch and reservoir supplies, the City also utilizes other sources of water that return back to the river as a part of its ongoing activities. These include system losses from the distribution system, lawn irrigation return flows (LIRFs), wastewater plant effluent, RO Plant effluent, and fully consumable water leases from other organizations.

Wastewater Plant Effluent

Wastewater is sent either to the City of Brighton Wastewater Treatment plant or the Lochbuie Wastewater Treatment Plant through a collection system containing 775,000 miles of pipe. Brighton is also beginning to buy into the new North Metro Plant, owned and operated by Metro Wastewater Reclamation District. That plant is expected to be completed in 2016 with the City of Brighton buying into a small share of the plant incrementally through 2035. The flows leaving the plants and being returned to the river are claimed as a source of augmentation supply as well.

RO Plant Effluent

The RO Plant produces a waste stream as a part of its operations. This water is transported out to the river and is then claimed as an augmentation supply.

Lawn Irrigation Return Flows (LIRFs)

A significant portion of water delivered to customers does not go back to any of the wastewater plants. A large portion of it, particularly in the summertime, is put out onto lawns for irrigation. A small portion of that water surface flows back out to the river. The majority of it infiltrates into the ground and makes its way back to the river via sub-surface flows. The City claims a portion of these flows as an augmentation supply as it is allowed through its decrees.

System Loss Credits

Treated water is delivered to the distribution system for consumption. The City owns and maintains approximately 1,010,000 miles of water distribution and transmission lines. The City's system, like all systems, leaks to some extent. This water that leaks from the system makes its way back to the river

[2] **Carry-over storage** is a volume of storage that is captured at one time in the year for use in subsequent seasons or years. The minimum carry-over storage volume is the volume that is maintained at all times as a buffer for emergency situations.

through sub-surface flows. Leaks from the distribution system are calculated annually and a percentage of that lost water is claimed as an augmentation supply.

Chapter 4: Drought Vulnerability

Brighton's water system is relatively complex. With its first reservoir not coming online until 2005, the augmentation system has not been run in its existing form through a significant drought. In reviewing a drought scenario, multiple factors have to be taken into account. Is the drought impacting municipal supplies differently than augmentation supplies? Is the drought more problematic in the Beebe Draw Basin or in the South Platte Basin? Is there some combination thereof?

Municipal Supply

Wells are the primary source of water for the City's municipal supply; however, Brighton also purchases treated water to supplement its well supply. This supplemental supply makes up approximately one third of the City's municipal water supply annually. Per previously made agreements, the entities providing treated water to the City can limit treated water flow to Brighton if the providing entity has physical constraints preventing it from providing the water. Depending on the severity of the drought or other physical constraint, the supplying entities could completely shut down that water supply to Brighton.

A shutdown of the treated water supply stream would force the City to rely more heavily on its wells. In the winter this is not typically an issue as long as adequate augmentation supplies are available to offset the increased pumping. If the supply stream were shutdown during the hot summer months, it would significantly impact the City's ability to provide for the increased usage related to the irrigation demands seen in the summertime months.

Wells make up the other two-thirds of the City's average-year municipal supply. These are entirely alluvial wells, and as such, they are more susceptible to variations in aquifer depths related to drought conditions. Droughts that occur locally around the City of Brighton with below average rainfall, low relative humidity, high winds, and/or high temperatures will cause aquifer levels to drop and decrease the amount of water available for pumping. On top of dwindling supplies, these kinds of drought conditions in and around Brighton tend to increase irrigation demands and consequently total demand on the system.

Aquifer levels could drop in a drought scenario, decreasing the water that is available to treat. Increased demand and lower aquifer levels puts a much heavier load on mechanical and electrical equipment. This increased demand makes it more likely to have critical component failure at a critical time. Reduced water supply and/or critical component failure can prevent the City from producing enough water to meet demand. Additionally, it is fairly certain that if a regional drought is in progress, the City's treated water supply providers would reduce or completely shut off transmission of treated water to the City.

Figure 4 shows maximum available supply when aquifer levels, treatment and distribution systems, and contract water are all unimpeded. It also shows the City's maximum daily demand seen to date that was set in the summer of 2012.

The average annual municipal supply usage from 2007-2011 is 1,735 million gallons. Appendix E: Monthly Municipal Demand 2007-2011 shows monthly demand from 2007-2011 along with averages and annual totals of demand.

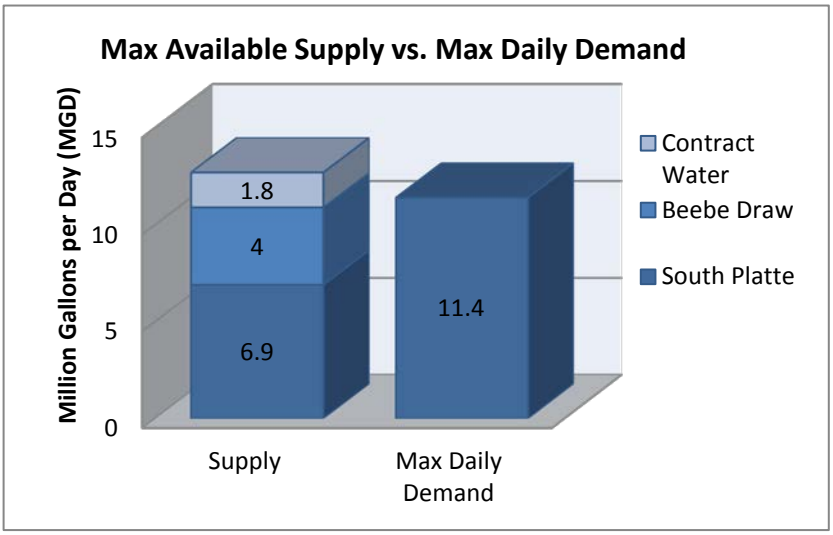


Figure 4: Maximum Available Supply vs. Maximum Daily Demand

Augmentation Supply

The augmentation supply is operated via the City's reservoirs and its portfolio of ditch shares and, to a lesser extent, some operational losses. The augmentation supply is impacted by the "call" on the river. If the ditches or reservoirs are not in priority on the river, the City is impacted in multiple ways. First, it is not able to divert water off of the river to store or to use for direct augmentation. In addition, the City must replace water to the river caused by the depletion of its wells that are also out of priority.

The augmentation supply is impacted by local weather conditions in that hot, dry, and/or windy conditions can cause increased evaporation off of reservoir supplies. Drought conditions on the plains cause an increased demand on river and ditch supplies since people are pulling more water from a more limited supply and because the dry ground causes greater losses as the water is transported from the mountains out to the plains and into the individual ditches. These circumstances will cause limits to be placed on our own diversions.

The augmentation supply is also impacted by the snowpack and runoff in the mountains. Often, the City is able to fill reservoir supplies in the spring when the call is off of the river and large flows are making their way from the mountains and out into the plains. By filling the City's reservoirs in the spring runoff, ditch rights can be used for direct augmentation requirements. The less spring runoff that is available, the less likely the City will be able to fill its reservoirs and be prepared for the following winter season.

Multiple factors must be taken into account when forecasting augmentation supply. This is discussed further in the Brighton Drought Index section below.

Chapter 5: Drought Classification

Brighton Drought Index

Because the City's water supply is impacted by multiple factors including mountain weather patterns, runoff, local weather conditions, local water supply, and aquifer condition to name a few, a local drought index that is specific to the City of Brighton was developed. This index is called the Brighton Drought Index (BDI).

The BDI has three levels from zero to two plus an emergency drought stage as shown below:

A Stage 3 Drought is an emergency situation that will be managed based on the severity of the water shortage emergency. It is likely that all outdoor and non-essential usage would be eliminated in favor of ensuring public health and safety activities; however, management of the drought will be based on the seriousness of the emergency. Drought Stage 3 has not been included in the Drought Response Strategy Matrix as it is anticipated to be a fluid emergency situation where decisions will be made in response to the emergency conditions presented.

How is the BDI Calculated?

The BDI is derived from two models: the Augmentation Supply Model and the Potable Water Supply Model. The more stringent drought stage required by either the Augmentation Supply Model or the Potable Water Supply Model will apply. For instance, if the Augmentation Supply Model projects

needing a Stage 2 Drought declaration in order to keep augmentation supplies above critical levels and the Potable Water Supply Model showed that there were no drought stage required, the City would declare a Stage 2 Drought Warning in order to keep augmentation supplies at a reliable level.

Augmentation Supply Model

The Augmentation Supply Model takes into account previous and predicted deductions from our water supply including previous and predicted pumping rates and the associated lagged depletions to the river, return flow requirements for purchased potable water, return flow requirements for other entities based on agreements, and winter and summer return flow requirements based on our usage of ditch shares. It then takes into account previous and predicted water credits including RO Plant effluent, South Platte Wastewater Treatment Plant effluent, Lochbuie Wastewater Treatment Plant effluent, Barr Lake allocations, system loss return flows, LIRFs, leased fully consumable water from other entities, and credits from our ditch and reservoir shares.

Additionally a minimum carry-over supply volume was calculated. This is the volume of water that the City would need to supply its customers with the most basic services including indoor critical uses and fire protection only for one year. This is a buffer that must be maintained to ensure reliability of the system through more severe scenarios.

All of these factors are compiled and a base line analysis of predicted reservoir levels is created assuming no drought restrictions are in place. If the predicted reservoir level model shows the reservoir storage dropping below the critical carry-over storage amount, the drought stage that can maintain the carry-over volume is declared. See the example reservoir storage model graph on the next page. The example reservoir storage model graph shows that a Phase 2 Drought declaration would be required to keep reservoir storage above required levels.

The Potable Water Supply Model takes into account production capacity with a factor of safety and compares that production capacity to previous and predicted demands. The predicted demands take both predicted temperature and precipitation into account for the next 10 day period. If, at any time, demand is anticipated to be greater than production capacity (with an appropriate factor of safety included), then the appropriate drought stage will be declared to reduce demand below production capacity. Demand must always be below production capacity with a factor of safety.

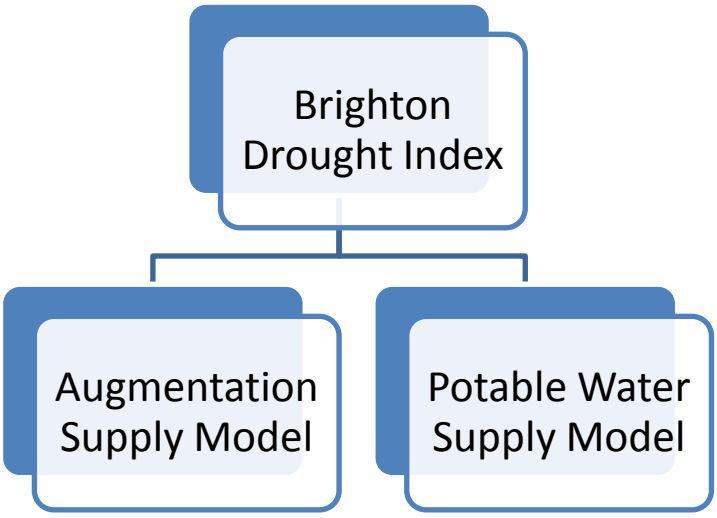
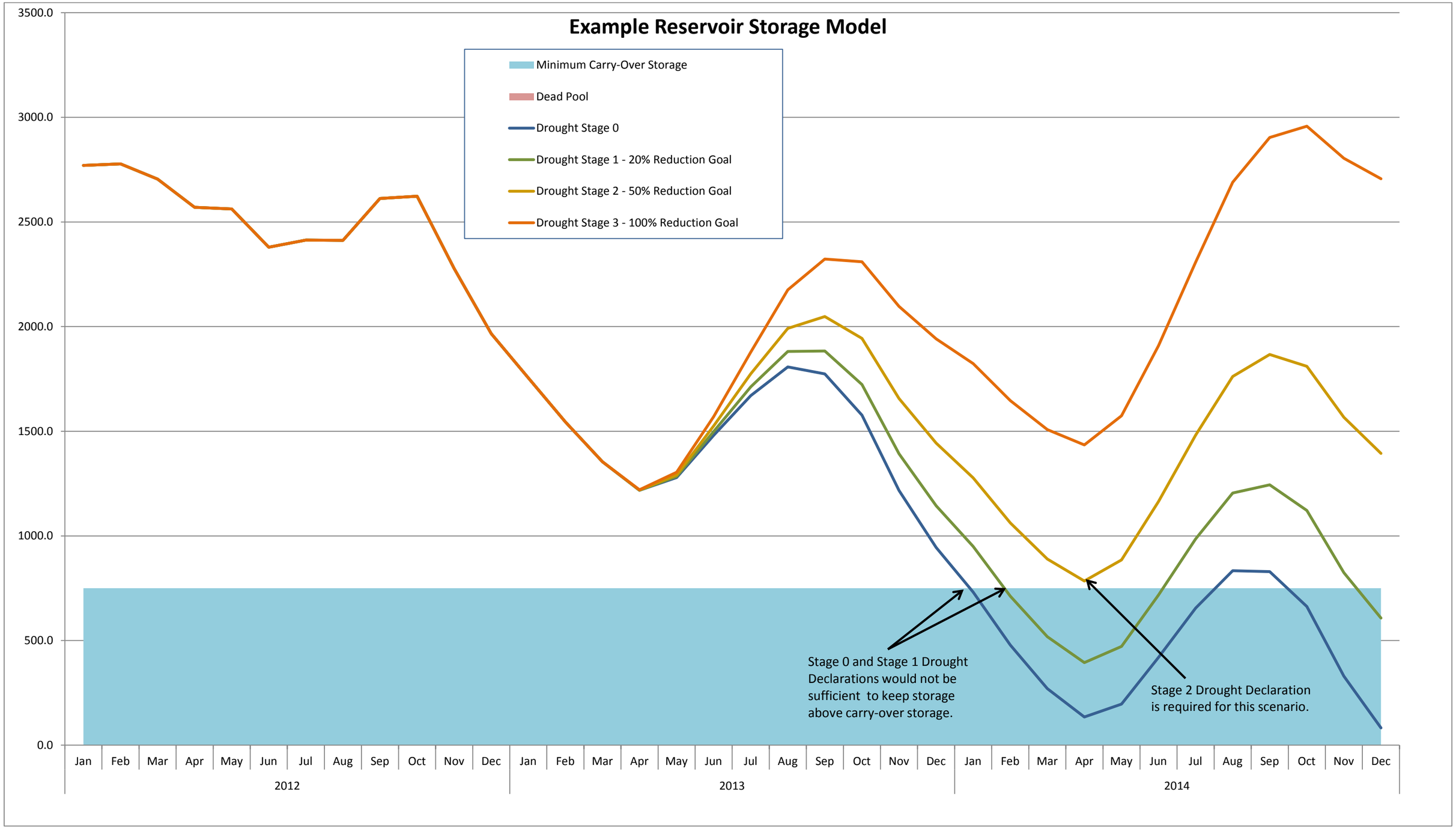


Figure 5: Models Contributing to the Brighton Drought Index (BDI)


Example Reservoir Storage Model
Minimum Carry-Over Storage
Dead Pool
Drought Stage 0
Drought Stage 1 - 20% Reduction Goal
Drought Stage 2 - 50% Reduction Goal
Drought Stage 3 - 100% Reduction Goal
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2012
2013
2014
Stage 0 and Stage 1 Drought Declarations would not be sufficient to keep storage above carry-over storage.
Stage 2 Drought Declaration is required for this scenario.

Chapter 6: Drought Response Strategy

Because the City's water supply is finite there are few significant changes that can be made to extend water supplies on the supply side. Some operational modifications can be made depending on the type of drought and the specific circumstances of the situation. Some of these might include:

- Rotating well pumping as capacity is available to allow the aquifer to recover from heavy pumping at a given location.
- Lease augmentation water from other organizations if possible and appropriate.
- Fully utilize all Beebe Well Field supplies annually since carry-over storage in Barr Lake is not possible currently.

Because most supply-side management strategies involve balancing finite supplies with little real ability to create additional supplies during an emergency, the primary focus for the drought response strategy has to then focus on ways to reduce consumption.

Because the system has not been tested through a drought scenario, a literature review was completed that looked at the impact of municipal drought restrictions on actual water usage. It was found that, generally speaking, voluntary measures are not effective at reducing water usage; however, mandatory outdoor watering restrictions do reduce water consumption. The following table summarizes the results of the literature review and is used as the basis for determining what kind of water reduction will be seen with various mandatory watering restrictions.

Drought Restriction	**% Reduction in Water Usage from Average**
Limit watering to every third day	10%
Limit watering to two days per week	20%
Limit watering to one day per week	50%

This, of course, is only an estimate from analyses of other organizations' activities and results. How Brighton's system will react to mandatory restrictions is dependent on many factors including enforcement, previous and ongoing water conservation activities, and types of customers served. Because the City has not had a serious drought with its existing system and with its existing population, it is difficult to gauge the exact percentage reductions without testing the restrictions in a real-world scenario. Without this system-specific information, the above percent reduction values are assumed and should be modified as data becomes available.

The Drought Response Matrix shown in Appendix A of this Drought Management Plan shows the drought response strategies that will be required at each Drought Stage. The Drought Response Matrix shows the specific activities that will be restricted and at what drought stage they will be restricted. The DMAC collaboratively guided the final form and content of this matrix with the goal of maximizing the beneficial use of our existing supplies while ensuring water supply availability for critical uses.

Chapter 7: Conclusion

A drought is a natural disaster, and just like a flood or a tornado, a drought cannot be entirely predicted either in timing or in magnitude. The City of Brighton believes that in order to be proactively prepared for the common, but potentially devastating, natural disaster, it must have a pre-described and pre-approved plan to manage droughts of various levels.

The City's Water Resources Division has developed the Brighton Drought Index that is a mathematically-based model designed to give concrete guidance on the appropriate drought stage to declare.

The DMAC has collaboratively determined the response strategies outlined in this plan with the goal of maximizing beneficial uses while ensuring a sustainable water supply is available for essential functions such as critical indoor uses and fire protection. These strategies are based on the drought stage goals in reduction in water usage.

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Appendix A

Drought Response Matrix

Table 1: General Drought Impact Overview

	Water Usage Goals	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Standard Water Conservation Goals	See Fine Schedule	NONE	NONE	NONE	See Rate Tables	Standard Water Conservation Outreach	NONE	NONE	NONE
Drought Stage 1 (20%)	Reduce outdoor water usage by 20%	See Fine Schedule	15% reduction in water plant demand, Relative decrease in augmentation demand, Increased staffing demand	Public relations issues, Park signage, Minor impact to landscape	Reduction in operating revenues, Use of reserves	See Rate Tables	KBRI Broadcasting, Message Boards, Press Releases, Increased Water Conservation Outreach, Social Media, Direct Mailers, Webpage Alerts, Brighton Alert, Hard Copy Literature/CDs	NONE	Minor, if any	Minor
Drought Stage 2 (50%)	Reduce outdoor water usage by 50%	See Fine Schedule	37.5% reduction in water plant demand, Relative decrease in augmentation demand, Increase in sewer backups/water line breaks with tree roots, Water quality/storm drainage issue, Increased staffing demand	Public relations issues, Park signage, Significant impact to landscape	Significant reduction in operation revenues, Impact to debt service	See Rate Tables	KBRI Broadcasting, Message Boards, Press Releases, Increased Water Conservation Outreach, Social Media, Direct Mailers, Webpage Alerts, Brighton Alert, Hard Copy Literature/CDs, Possible reverse 911, Community meetings, HOA meetings, Color coded signage	Limited Training, Possible increased fire risk with dry landscaping	No turf installation at new sites.	Possibly stressed landscaping, Increased water rates
Emergency Drought Scenario (To be managed based on emergency conditions. Consider formal declaration of a state of emergency and opening EOC.)	Variable depending on scenario. Probable goal to reduce outdoor water usage by 100%	See Fine Schedule	Probable Impacts: 75% reduction in plant demand, Relative decrease in augmentation demand if all outdoor usage is eliminated, Increases in sewer backups/water line breaks with tree roots, Increased staffing demand	Public relations issues, Park signage, Loss of turf, trees, other landscaping probable	Probable issues: Drastic reduction in operating revenues which will impact debt service, Park revenue impact with closed facilities	See Rate Tables	KBRI Broadcasting, Message Boards, Press Releases, Increased Water Conservation Outreach, Social Media, Direct Mailers, Webpage Alerts, Brighton Alert, Hard Copy Literature/CDs, possible reverse 911, community meetings, HOA meetings, Color coded signage	Limited Training, Possible increased fire risk with very dry landscaping	No turf installation at new sites. No construction watering.	Possibly stressed landscaping, Limitations with private pools, Increased water rates

Table 2: Residential Uses (Including HOA's and Public Spaces maintained by HOA's)

Turf Watering	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Community Development Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Standard Water Conservation. Voluntary watering restrictions	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Mandatory watering restrictions. Two days per week per updated calendar. Variance must be applied for in writing within 15 days of notice of watering restrictions.	See Fine Schedule, Water Department Patrol	Relative reduction in Water Plant demand and augmentation demand, Iincreased staffing demand, Alert HOAs	Public Relations Issues, Park Signage	Reduction in Utilities revenues	See Rate Tables	See Table 1.	NONE	NONE	Increased fees for usage beyond base rate. Mandatory watering restrictions
Drought Stage 2 (50%)	Mandatory watering restrictions. One day per week per updated calendar. Variance must be applied for in writing within 15 days of notice of watering restrictions.	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant demand and augmentation demand, Increased staffing demand, Alert HOAs	Public Relations Issues, Park Signage	Significant reduction in Utilities revenues, Impact to debt service	See Rate Tables	See Table 1.	Dry grass may increase fire risk.	Possibly decreased property values if grass is dormant.	Increased fees for usage beyond base rate. Mandatory watering requirements. Turf may go dormant.

Tree and Shrubs, Vegetable Garden, Decorative Garden Watering	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Standard Voluntary Conservation.	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Mandatory Conservation, Limited Watering 2 days per week	See Fine Schedule, Water Department Patrol	Relative reduction in Water Plant demand and augmentation demand, Increased staffing demand	Public Relations Issues, Park Signage	Reduction in Utilities revenues, Impact to debt service	See Rate Tables	See Table 1.	NONE	NONE	Increased fees for usage beyond base rate. Mandatory watering restrictions
Drought Stage 2 (50%)	Mandatory Conservation, Limited Hand Watering 1 days per week	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand	Public Relations Issues, Park Signage	Significant reduction in Utilities revenues, Impact to debt service	See Rate Tables	See Table 1.	Dry landscaping may increase fire risk.	Possibly decreased property values if landscaping struggling	Increased fees for usage beyond base rate. Mandatory watering restrictions. Landscaping may be negatively impacted.

Private Swimming Pools & Hottubs (Residential, HOA, Apartments)	**Action**	**Enforcement**	**Utilities Operational Impact**	**Parks Operational Impact**	**Revenue Impact**	**Rates Modification**	**Public Information**	**Fire Fighting Activities**	**Comm Dev/Economic Dev. Impact**	**Customer Impacts**
Drought Stage 0 (0%)	Use of private pools allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Use of private pools allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Use of private pools allowed	See Fine Schedule, Water Department Patrol, PD assistance	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE

Ornamental Fountains and Water Displays	**Action**	**Enforcement**	**Utilities Operational Impact**	**Parks Operational Impact**	**Revenue Impact**	**Rates Modification**	**Public Information**	**Fire Fighting Activities**	**Comm Dev/Economic Dev. Impact**	**Customer Impacts**
Drought Stage 0 (0%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Use not allowed.	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand	Public Relations Issues, Park Signage	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	NONE	Possibly decreased property values	Loss of Use of Private Property

Power Washing and Residential Car Washing	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Not Allowed	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand	NONE	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	NONE	NONE	Will not be able to power wash or wash cars at home.

Sod Permits	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Permits Available from April 15 to May 21 and then again Sept. 1 to Oct. 31	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Permits Available from April 15 to May 21 and then again Sept. 1 to Oct. 31	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Sod permits will not be granted	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand, Increased storm water issues while soil is uncovered.	NONE	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	NONE	Additional bonding requirements will be necessary for new construction	Will be required to get bonding to get CO for new construction. May have dirt in yard until landscaping can be installed. Loss of prpoerty value.

Table 3: Commercial Uses										
	Action	**Enforcement**	**Utilities Operational Impact**	**Parks Operational Impact**	**Revenue Impact**	**Rates Modification**	**Public Information**	**Fire Fighting Activities**	**Comm Dev/Economic Dev. Impact**	**Customer Impacts**
Turf Watering	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential
Tree and Shrub Watering	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential
Decorative/Flower Landscaping	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential
Commercial Swimming Pools	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential
Ornamental Fountains and Water Displays	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential
Sod Permits	Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential	Same as Residential		Same as Residential	Same as Residential

Median Watering	**Action**	**Enforcement**	**Utilities Operational Impact**	**Parks Operational Impact**	**Revenue Impact**	**Rates Modification**	**Public Information**	**Fire Fighting Activities**	**Comm Dev/Economic Dev. Impact**	**Customer Impacts**
Drought Stage 0 (0%)	Allowed.	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	20% reduction from average usage required	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	Increased fees for usage beyond base rate. Mandatory watering restrictions
Drought Stage 2 (50%)	50% reduction from average usage required	See Fine Schedule, Water Department Patrol, PD assistance	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand, Increased storm water issues while soil is uncovered.	NONE	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	Dry landscaping may increase fire risk.	Possible decrease in property values with dry medians.	Increased fees for usage beyond base rate. Mandatory watering restrictions. Landscaping may be negatively impacted.

Power Washing and Commercial Car Washing	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Allowed	See Fine Schedule, Water Department Patrol, PD assistance, Educational outreach as necessary	Educational outreach to specific customers	NONE	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	NONE	NONE	Decreased ability to clean via power washing or car washing.

Construction Watering	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	See Fine Schedule, Water Department Patrol	NONE	NONE	NONE	See Rate Tables	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	No new permits. Sources outside the City supplies allowed.	See Fine Schedule, Water Department Patrol, PD assistance, Educational outreach as necessary	Relative reduction in Water Plant Demand and augmentation demand, Increased staffing demand, Extra caution in insuring construction is completed to standard	NONE	Reduction in Utilities Revenue	See Rate Tables	See Table 1.	NONE	No new construction watering permits will be available.	Will not be able to get a construction watering permit.

Table 4: Municipal & Fire District Uses

City Parks and Facilities	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Standard Water Conservation Activities	NONE	NONE	NONE	NONE	NONE	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Reduce usage by 20% of average. See Parks and Recreation Drought Management Plan	NONE	Relative reduction in Water Plant demand and augmentation demand, increased staffing demand	See Parks and Recreation Drought Management Plan	NONE	NONE	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Reduce usage by 50% of average. See Parks and Recreation Drought Management Plan	NONE	Relative reduction in Water Plant Demand and augmentation demand	See Parks and Recreation Drought Management Plan	NONE	NONE	See Table 1.	Dry landscaping may increase fire risk	NONE	Decreased availability for open space/parks for recreation

Car Washing	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	NONE	NONE	NONE	NONE	NONE	See Table 1.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	NONE	NONE	NONE	NONE	NONE	See Table 1.	NONE	NONE	NONE
Drought Stage 2 (50%)	Limited to uses required for preservation of public health and safety	NONE	Relative reduction in Water Plant Demand and augmentation demand, Limit equipment/vehicle washing	Limit equipment/vehicle washing	NONE	NONE	See Table 1.	NONE	NONE	NONE

Construction Water	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	NONE	NONE	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	NONE	Relative reduction in Water Plant demand and augmentation demand, increased staffing demand	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 2 (50%)	No new permits. Sources from outside City supplies are allowed.	NONE	Relative reduction in Water Plant Demand and augmentation demand	NONE	NONE	NONE	See above.	NONE	May impact construction projects servicing new developments	NONE

Fire Hydrants	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	No Change	NONE	NONE	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 1 (20%)	Limit all unnecessary uses.	NONE	Relative reduction in Water Plant demand and augmentation demand	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 2 (50%)	Eliminate all non-essential uses except for public health and safety. Required flushing and fire protection permitted. Limited street sweeping. All other non-essential activities not allowed.	NONE	Relative reduction in Water Plant Demand and augmentation demand	NONE	MINIMAL	NONE	See above.	NONE	NONE	NONE

Fire Department Training	Action	Enforcement	Utilities Operational Impact	Parks Operational Impact	Revenue Impact	Rates Modification	Public Information	Fire Fighting Activities	Comm Dev/Economic Dev. Impact	Customer Impacts
Drought Stage 0 (0%)	Allowed	NONE	NONE	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 1 (20%)	Allowed	NONE	NONE	NONE	NONE	NONE	See above.	NONE	NONE	NONE
Drought Stage 2 (50%)	Restricted to activities mandatory for public health and safety	NONE	Relative reduction in Water Plant Demand and augmentation demand, increased staffing demand	NONE	MINIMAL	NONE	See above.	Restricted to activities mandatory for public health and safety	NONE	NONE

Note: The following watering rules apply at all drought stages:

- Irrigation is prohibited between November 1st and April 1st, except for trees and bushes.
- Irrigation is prohibited between the hours of 10:00 am and 6:00 pm, daily, to reduce the effects of evaporative losses.
- Wasting of water is never allowed. Any outdoor water that is not being beneficially used constitutes water waste. This can include excessive overspray of sprinklers on to adjacent hardscape or excessive watering that leads to runoff from the vegetated area.

Appendix B

Sample Public Drought Campaign Pre-Scripted Messages

These Pre-Scripted Messages may be modified to fit with existing circumstances.

City of Brighton Declares a Stage 1 Drought

For Immediate Release

-Date-

As a result of (excessively dry conditions/increased drought conditions/unusually high demand/other), the City of Brighton has declared a Stage 1 Drought warning.

What does this mean for our water customers?

The City's goal in declaring a Stage 1 Drought is to reduce the total demand on our potable supplies by 20%. This reduction is required to ensure consistent and reliable supplies.

Mandatory Watering Restrictions

Per the City of Brighton Drought Management Plan, a Stage 1 Drought requires mandatory watering restrictions for all water customers. Watering will be limited to two times per week as noted on the attached watering calendar.

Watering of gardens, trees, and shrubs is allowed on an as-needed basis.

A variance can be applied for in extreme cases where landscaped areas are large or irrigation zoning requirements make watering of a site impractical with twice a week watering. A variance must be applied for in writing within 15 days of receiving this notice.

For those properties that qualify for the variance, over-all watering must be reduced by 20% by reduction in time watered or other proposed methodology. The reduction will be based on the most recent average water consumption rates available for that month.

Sod Permits

Sod Permits will continue to be available between April 15th and May 21st and again from September 1st to October 21st.

Because of the high-water demand of new sod and/or seed, particularly during the hot summertime weather, sod permits *cannot* be issued in June, July, or August. During allowed times, sod permits can be obtained at the City's One Stop on the 1st floor of City Hall at 500 South 4th Avenue. This permit will allow for daily watering of new sod/seed for 10 days in order to establish the new turf.

Water Waste

Please keep in mind that water waste is not allowed within the City's service area. Water waste can occur by overspray of sprinklers on to hardscaped areas, excessive watering resulting in runoff from vegetated areas, and any other non-beneficial uses.

Our Commitment

The City of Brighton Water Resources Division is dedicated to providing a quality, sustainable water

supply to its customers. We value the communities support in this endeavor and welcome calls with questions and concerns.

If you have comments or concerns, please contact the Utility Department Water Resources Division at (303) 655-2129. Find contact information and additional water conservation information at our website at www.brightonco.gov.

City of Brighton Declares a Stage 2 Drought

For Immediate Release

-Date-

As a result of (excessively dry conditions/increased drought conditions/unusually high demand/other), the City of Brighton has declared a Stage 2 Drought warning.

What does this mean for our water customers?

A Stage 2 Drought warning is established based on City projections of existing and future water supplies. A Stage 2 Drought is a significant drought condition requiring significant cut-backs in outdoor water usage across the City. The City's goal in declaring a Stage 2 Drought is to reduce outdoor water demand by 50%. This reduction is required to ensure consistent and reliable supplies.

Mandatory Watering Restrictions

Per the City of Brighton Drought Management Plan, a Stage 2 Drought requires mandatory watering restrictions for all water customers. Turf watering will be limited to one time per week as noted on the attached watering calendar.

Watering of gardens, trees, and shrubs is allowed on an as-needed basis.

A variance can be applied for in extreme cases where landscaped areas are large or irrigation zoning requirements make watering of a site impractical with twice a week watering. A variance must be applied for in writing within 15 days of receiving this notice.

For those properties that qualify for the variance, over-all watering must be reduced by 50% by reduction in time watered or other proposed methodology. The reduction will be based on the most recent average water consumption rates available for that month.

Sod Permits

Because of the high-water demand of new sod and/or seed, particularly during the hot summertime weather, sod permits *cannot* be issued at this time. Sod permits will not be available until the Phase 2 Drought warning has been lifted and the next available installation season is occurring.

Water Waste

Please keep in mind that water waste is not allowed within the City's service area. Water waste can occur by overspray of sprinklers on to hardscaped areas, excessive watering resulting in runoff from vegetated areas.

Swimming Pools and Outdoor Water Features

All private swimming pools, either personal or owned by an HOA, will not be allowed to operate. No water consumption for these purposes will be allowed. City Swimming Pools will be available for use.

Our Commitment

The City of Brighton Water Resources Division is dedicated to providing a quality, sustainable water supply to its customers. We value the communities support in this endeavor and welcome calls with questions and concerns.

If you have comments or concerns, please contact the Utility Department Water Resources Division at (303) 655-2129. Find contact information and additional water conservation information at our website at www.brightonco.gov.

City of Brighton Declares a Stage 3 Emergency Drought

For Immediate Release

-Date-

As a result of (excessively dry conditions/increased drought conditions/unusually high demand/other), the City of Brighton has declared a Stage 3 Emergency Drought Warning. A Stage 3 Drought is an emergency situation. Water reserves have been depleted and significant measures are required in order to preserve essential functions such as indoor water usage and fire protection.

What does this mean for our water customers?
A Stage 3 Drought Warning is established based on City projections of existing and future water supplies. A Stage 3 Drought is an *emergency condition* requiring elimination of all outdoor and non-essential water usage throughout the City. These mandatory restrictions are in place to preserve essential functions for health and safety including essential indoor uses and fire protection.

Mandatory Restrictions
No outdoor water use of any kind is permitted. This includes watering of trees, shrubs, and gardens. All non-essential indoor uses should be curtailed where possible.

Sod Permits
Because of the high-water demand of new sod and/or seed, particularly during the hot summertime weather, sod permits *cannot* be issued at this time. Sod permits will not be available until the Phase 3 Drought warning has been lifted and the next available installation season is occurring.

Water Waste
Please keep in mind that water waste is not allowed within the City's service area. Water waste can occur by overspray of sprinklers on to hardscaped areas, excessive watering resulting in runoff from vegetated areas.

Swimming Pools and Outdoor Water Features
All private swimming pools, either personal or owned by an HOA, will not be allowed to operate. No water consumption for these purposes will be allowed. All City swimming pools will be closed until the Stage 3 Drought warning has been lifted.

Car Washing

Private car washing will not be allowed. Commercial carwashes adhering to strict water consumption guidelines may continue operation.

Your Parks
You may notice your local park is dry. This emergency situation requires all outdoor water usage be eliminated. The City appreciates your help in keeping foot traffic off of sodded areas to prevent damage to the stressed sod.

Our Commitment

The City is experiencing extreme weather and water supply conditions during this time. We value the communities continued support through these extreme conditions and welcome calls with questions or concerns.

Please contact the Utility Department Water Resources Division at (303) 655-2129. Find contact information and additional water conservation information at our website at www.brightonco.gov.

Appendix C

Example Summary Accounting

														What Would Demand Be at Each Stage?					**Which Drought Stage to Declare?**			
Date	**Beebe Capacity**	**South Platte Capacity**	**Westy Capacity**	**Total Capacity**		**Factor of Safety**	**Available Capacity**		**Temperature Prediction (From NOAA)**	**% Chance of Precip > 60%**	**Projected Weekly Avg Demand**	**Actual Demand**	**Modeled Demand**			**Stage 0**	**Stage 1**	**Stage 2**	**Stage 3**			**Stage 0**	**Stage 1**	**Stage 2**	**Stage 3**
	(MGD)	**(MGD)**	**(MGD)**	**(MGD)**					**(°F)**	**(Y/N)**	**(MGD)**	**(MGD)**	**(MGD)**			**100%**	**90%**	**60%**	**5%**			**100%**	**90%**	**60%**	**5%**
19-May	1.05	6.60	1.80	9.45		15%	8.03		57		2.24	6.27	6.27			6.27	5.90	4.80	2.78			OK	OK	OK	OK
20-May	1.05	6.60	1.80	9.45		15%	8.03		76		5.92	7.06	7.06			7.06	6.61	5.28	2.82			OK	OK	OK	OK
21-May	1.05	6.60	1.80	9.45		15%	8.03		88		8.24	8.33	8.33			8.33	7.76	6.04	2.89			Not Enough	OK	OK	OK
22-May	1.05	6.60	1.80	9.45		15%	8.03		93		9.21	8.38	8.38			8.38	7.80	6.07	2.89			Not Enough	OK	OK	OK
23-May	1.05	6.60	1.80	9.45		15%	8.03		69		4.56	6.93	6.93			6.93	6.50	5.20	2.82			OK	OK	OK	OK
24-May	1.05	6.60	1.80	9.45		15%	8.03		68		4.37	5.56	5.56			5.56	5.26	4.38	2.75			OK	OK	OK	OK
25-May	1.05	6.60	1.80	9.45		15%	8.03		75		5.73	6.56	6.56			6.56	6.16	4.98	2.80			OK	OK	OK	OK
26-May	1.05	6.60	1.80	9.45		15%	8.03		92		9.02	6.92	6.92			6.92	6.49	5.19	2.82			OK	OK	OK	OK
27-May	1.05	6.60	1.80	9.45		15%	8.03		74		5.53	7.48	7.48			7.48	6.99	5.53	2.84			OK	OK	OK	OK
28-May	1.05	6.60	1.80	9.45		15%	8.03		77		6.11	8.29	8.29			8.29	7.72	6.01	2.88			Not Enough	OK	OK	OK
29-May	1.05	6.60	1.80	9.45		15%	8.03		81		6.89	8.38	8.38			8.38	7.80	6.07	2.89			Not Enough	OK	OK	OK
30-May	1.05	6.60	1.80	9.45		15%	8.03		85		7.66	8.43	8.43			8.43	7.85	6.10	2.89			Not Enough	OK	OK	OK
31-May	1.05	6.60	1.80	9.45		15%	8.03		75		5.73	8.18	8.18			8.18	7.62	5.95	2.88			Not Enough	OK	OK	OK
1-Jun	1.05	6.60	1.80	9.45		15%	8.03		83		7.27	9.00	9.00			9.00	8.36	6.44	2.92			Not Enough	Not Enough	OK	OK
2-Jun	1.05	6.60	1.80	9.45		15%	8.03		87		8.05	7.58	7.58			7.58	7.08	5.59	2.85			OK	OK	OK	OK
3-Jun	1.05	6.60	1.80	9.45		15%	8.03		90		8.63	8.41	8.41			8.41	7.83	6.09	2.89			Not Enough	OK	OK	OK
4-Jun	1.05	6.60	1.80	9.45		15%	8.03		94		9.40	9.22	9.22			9.22	8.56	6.57	2.93			Not Enough	Not Enough	OK	OK
5-Jun	1.05	6.60	1.80	9.45		15%	8.03		86		7.85	8.39	8.39			8.39	7.81	6.07	2.89			Not Enough	OK	OK	OK
6-Jun	1.05	6.60	1.80	9.45		15%	8.03		91		8.82	9.34	9.34			9.34	8.67	6.64	2.94			Not Enough	Not Enough	OK	OK
7-Jun	1.05	6.60	1.80	9.45		15%	8.03		86		7.85	8.33	8.33			8.33	7.76	6.04	2.89			Not Enough	OK	OK	OK
8-Jun	1.05	6.60	1.80	9.45		15%	8.03		89		8.43	9.44	9.44			9.44	8.76	6.70	2.94			Not Enough	Not Enough	OK	OK
9-Jun	1.05	6.60	1.80	9.45		15%	8.03		95		9.60		9.60			9.47	8.78	6.72	2.94			Not Enough	Not Enough	OK	OK
10-Jun	1.05	6.60	1.80	9.45		15%	8.03		75		5.73		5.73			9.29	8.62	6.61	2.93			Not Enough	Not Enough	OK	OK
11-Jun	1.05	6.60	1.80	9.45		15%	8.03		75		5.73		5.73			9.61	8.91	6.81	2.95			Not Enough	Not Enough	OK	OK
12-Jun	1.05	6.60	1.80	9.45		15%	8.03		78		6.31		6.31			9.43	8.74	6.70	2.94			Not Enough	Not Enough	OK	OK

Appendix C 1: Example Potable Water Supply Model

****This appendix is not included in final version for security reasons****

Appendix D

Key Water System Components

Appendix E

Monthly Municipal Demand 2007-2011

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007	82.58	78.26	79.33	105.30	186.73	253.14	286.83	239.57	198.46	130.79	78.43	78.97	**1798.39**
2008	79.32	73.29	79.67	118.44	186.49	246.80	303.12	240.04	195.27	118.11	77.47	79.69	**1797.72**
2009	80.03	70.24	85.56	87.20	181.80	162.71	225.78	238.94	196.54	95.39	74.42	76.49	**1575.10**
2010	77.85	69.72	79.43	95.85	150.99	220.83	256.61	263.73	246.10	146.81	72.13	73.31	**1753.36**
2011	74.99	67.34	80.66	102.21	157.73	247.10	230.22	286.97	219.53	130.63	73.55	79.84	**1750.75**
Max	82.58	78.26	85.56	118.44	186.73	253.14	303.12	286.97	246.10	146.81	78.43	79.84	**1798.39**
Min	74.99	67.34	79.33	87.20	150.99	162.71	225.78	238.94	195.27	95.39	72.13	73.31	**1575.10**
Std Dev.	2.80	4.20	2.64	11.60	17.07	37.57	34.08	21.28	21.90	19.13	2.67	2.78	**92.34**
Average	78.95	71.77	80.93	101.80	172.75	226.12	260.51	253.85	211.18	124.35	75.20	77.66	**1735.06**

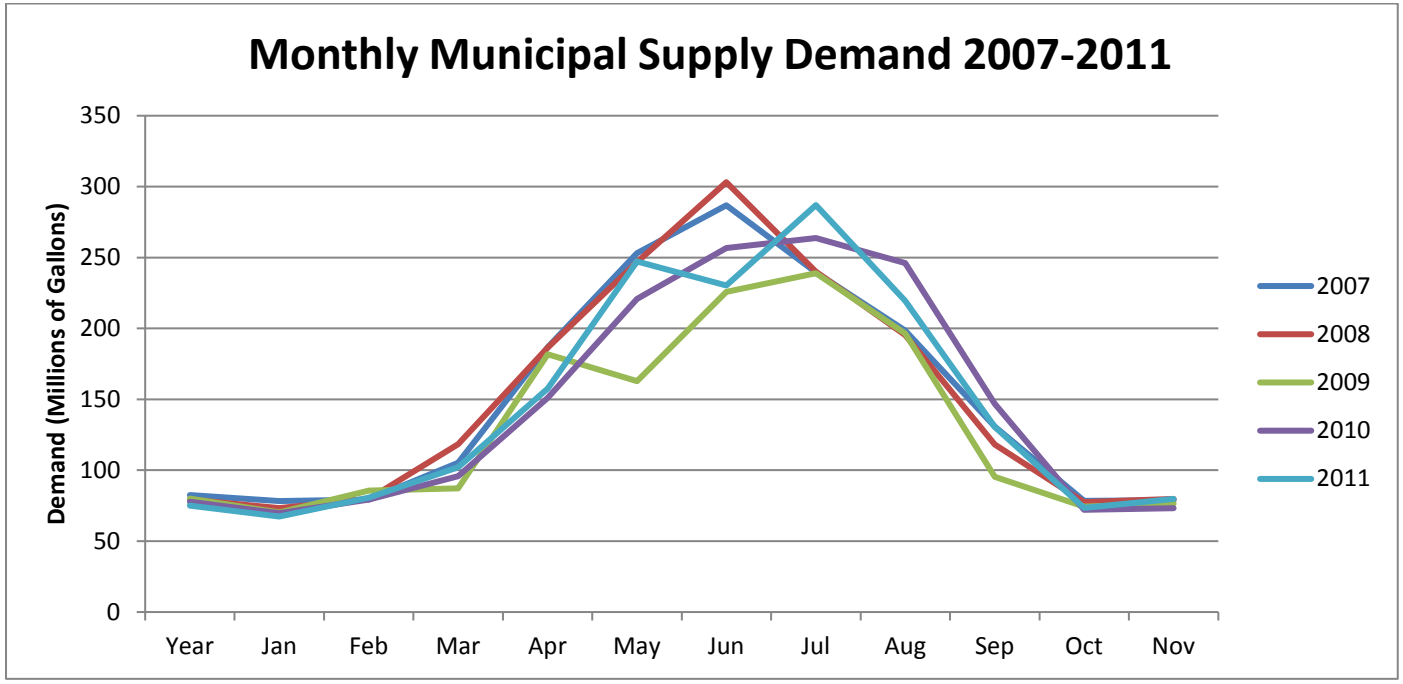

Figure 6: Municipal Supply Demand 2007-2011

Appendix F

Parks and Recreation Drought Management Plan

Parks and Recreation Drought Management Plan

March 2013

Goal

The City of Brighton Park and Recreation Department will meet water reduction requirements during times of declared drought conditions. The water conservation measures will attempt to maintain the overall health and viability of turf, trees, and shrubs within the City parks, open space areas, and right-of-ways. The use of water will provide for safe and playable facilities.

Stage 0

Parks will be irrigated on the current "Every Three Day" cycle. All facilities will be open.

Stage 1

- Reduce water consumption by 20% from the 5-year monthly average in all Parks and right-of-ways.
- Reduce open space areas by 50%
- No in-ground annual flower planting.
- Downtown baskets will be hand watered to reduce runoff.
- Increase mulch around trees and shrubs.
- Tree planting projects will be smaller size trees.
- Community gardeners will be educated to reduce water usage in gardens.
- Athletic programs will continue.
- New park construction projects will not be started.
- Irrigation of cemeteries will be reduced by 20% from the 5-year monthly average.
- The sodding of new graves will be eliminated.
- All public pools open.

Stage 2

- Reduce overall water consumption by 50% from the 5-year monthly average.
- Open space areas will be reduced 80% to keep trees viable.
- Neighborhood and community parks will be reduced irrigation up to 60%.
- Sports fields will be reduced by 20%
- No in-ground annual flowers.
- Downtown baskets will be irrigated to reduce runoff.
- Tree plantings projects with smaller size trees.
- Increase mulching of trees and shrubs.
- Community gardens will be open with education for water conservation.
- Park construction will be stopped.
- Public pools to remain open.
- Athletic programs will have reduced practice times.
- Turf maintenance will be reduced
    - Only sports fields
        - Aeration
        - Fertilization
        - Weed control
    - Mowing frequency in all parks will be reduced to every two weeks
    - Increase weed control in open space areas.
    - Increase mulch around trees and shrubs.
- Native area mowing as needed
- Cemetery irrigation will be reduced by 50% from the 5-year monthly average.
- The sodding of new graves will be eliminated.

Stage 3 – Emergency

A Stage 3 Drought is an emergency situation that will be managed based on the severity of the water shortage emergency. It is likely that all outdoor and non-essential usage would be eliminated in favor of ensuring public health and safety activities; however, management of the drought will be based on the seriousness of the emergency.

Appendix G

Drought Management Advisory Committee Meeting Agendas

Appendix H

Official Copies of Adopted Resolution

Appendix E – AWWA Manual M-36 Water Loss Assessment Methodology

Appendix E
AWWA M-36 Annual Water Audit Programs to Characterize Non-Revenue Water and Water Loss

	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15		
Water to Distribution														
Production	74,010	64,480	76,310	97,770	103,470	233,990	230,970	282,680	254,410	155,410	78,090	75,680		
System Demand	74,580	64,610	76,810	96,370	106,880	203,610	225,460	276,940	247,010	156,767	78,950	76,780		
												1,684,767		
Deliveries from Westminster	54,685	49,390	54,610	52,919	52,918	52,920	45,993	54,638	52,948	54,684	52,992	54,684		
												633,382		
Customer Use														
Potable Use														
Residential	33,022	37,719	36,677	47,735	51,986	54,801	125,881	124,829	130,187	137,502	60,053	41,603		
Commercial	29,283	28,934	22,493	29,940	28,199	33,303	44,968	44,738	74,613	54,914	33,611	39,103		
Irrigation	391	(381)	13	363	3,775	10,001	29,685	29,353	34,528	34,788	9,266	145		
Municipal (No Charge)	2,955	1,880	2,367	4,114	3,920	8,263	28,146	25,839	22,540	24,212	5,085	6,343		
Other	70	15	16	29	54	65	77	75	107	110	38	23		
Total Treated Water Deliveries	65,720	68,167	61,565	82,180	87,934	106,433	228,758	224,834	261,975	251,527	108,054	87,217		
Adjustments														
schools	779	979	898	1002	2485	2274	6358	6929	8536	9035	2960	1036		
muni charged	-	-	-	-	-	-	-	-	-	-	-	-		
henderson schools	295	331	364	312	316	79	300	263	427	473	264	292		
henderson residential	200	145	155	200	205	237	411	325	389	397	140	245		
henderson com	20	21	30	14	9	8	11	9	57	104	64	26		
With Adjustments														
Residential (B+H)	33,222	37,864	36,832	47,935	52,191	55,038	126,292	125,154	130,576	137,899	60,193	41,848		
Commercal (less Schools and HRes)	28,009	27,479	21,076	28,426	25,193	30,713	37,899	37,221	65,261	45,009	30,247	37,530		
Irrigation	391	(381)	13	363	3,775	10,001	29,685	29,353	34,528	34,788	9,266	145		
Schools	1,074	1,310	1,262	1,314	2,801	2,353	6,658	7,192	8,963	9,508	3,224	1,328		
Muni (Charged)	-	-	-	-	-	-	-	-	-	-	-	-		
Muni (NC)	2,955	1,880	2,367	4,114	3,920	8,263	28,146	25,839	22,540	24,212	5,085	6,343		
Other	70	15	16	29	54	65	77	75	107	110	38	23		
Total Treated Water Deliveries	65,720	68,167	61,565	82,180	87,934	106,433	228,758	224,834	261,975	251,527	108,054	87,217		
Total Potable Water Sold Water[a]	62,765	66,286	59,198	78,067	84,014	98,170	200,611	198,995	239,436	227,314	102,969	80,874		
												1,498,699		
Non-Potable Use														
Non-Potable Municipal	-	1,382	1,386	2,235	2,672	5,511	17,910	16,545	18,065	20,814	3,387	-		
Other Non-Potable	-	-	-	-	-	-	192	322	358	244	106	-		
Total Non-Potable Water Deliveries	-	1,382	1,386	2,235	2,672	5,511	18,102	16,867	18,423	21,058	3,493	-		
												91,129		
Non-Revenue Water	10,138	8,294	5,412	(1,257)	12,356	8,710	2,999	26,465	37,504	19,696	53,798	(1,924)		
												182,192		
												10.8%	10.8%	
Non-Revenue Less Muni NC	7,184	6,413	3,045	(5,370)	8,436	447	(25,148)	626	14,965	(4,517)	48,713	(8,267)		
												46,527		
[a] Total Water Deliveries less Muni NC												2.8%	2.8%	
Length of Pipe		191	mi	(from Utilities)										
Num Connections		9,887		(from Finance)										
System Pressure		75	psi	(from Utilities)										
Length of Service Lines		46.81	mi	(@ 25 feet per connection)										
Unavoidable Real Loss (UARL)			215,060	gpd	=(5.41*Length of Pipe)+(0.15*Num of Connections)+(7.5*Length of Service Lines)*(System Pressure)									
			78,497	1000 gpy										
Unavoidable Background Leakage			53,924	1000 gpy	=365*((0.2*Length of Pipe)+(0.008*Num of Connections)+(0.34*Length of Service Lines))*(System Pressure/70)^1.5									

Appendix F – Record of Public Notice and Public Comment

PROOF OF PUBLICATION
BRIGHTON STANDARD BLADE
COUNTY OF ADAMS SS.
STATE OF COLORADO

I, Tim Zeman, do solemnly swear that I am the Publisher of the **Brighton Standard Blade** is a weekly newspaper printed and published in the County of Adams State of Colorado, and has a general circulation therein; that said newspaper has been published continuously and uninterruptedly in said county of Adams for a period of more than fifty-two consecutive weeks prior to the first publication of the annexed legal notice or advertisement; that said newspaper has been admitted to the United States mails as second-class matter under the provisions of the act of March 3, 1879, or any amendments thereof, and that said newspaper is a weekly newspaper duly qualified for publishing legal notices and advertisements within the meaning of the laws of the State of Colorado. That the annexed legal notice or advertisement was published in the regular and entire issue of every number of said weekly newspaper for the **period of TWO consecutive insertion(s)** and that the first publication of said notice was in the issue of newspaper, dated **5th day of October, 2016** last on the **12th day of October, 2016**

Publisher, Subscribed and sworn before me, this **12th day of October 2016**

Bobi Lopez

Notary Public.
Notary ID No. 20024002511

BOBI LOPEZ NOTARY PUBLIC STATE OF COLORADO

My Commission Expires February 02, 2018

Public Notice

Water Conservation Plan Update

The City of Brighton having completed our Water Conservation Plan Update as outlined in HB04-1365, updating the Water Conservation Act of 1991, invites the public to review and comment on the proposed plan.

The Water Conservation plan is available at the City of Brighton City Hall and the City of Brighton web site http://www.brightonco.gov/308/Drought-Management-Water-Conservation. The plan will be available until November 28, 2016.

Please address any comments and/or questions to Ms. Dawn Hessheimer, City of Brighton at 303-655-2127 or dhessheimer@brightonco.gov.

Published in the Brighton Standard Blade:
Published Date:
October 5, 2016
October 12, 2016

Public Comments and Response

Public comment was received in writing from the following person. The City responses to the comments receive are provided below.

Mr. James May[1]
3000 E. 112th Ave.
Northglenn, CO

Mr. May provided written comments to the City on November 27, 2016. Many of the written comments did not pertain to the Final Draft Water Conservation Plan Update. Those comments are not included herein. Only those comments that pertain to the Final Draft Water Conservation Plan Update are included below. In that Mr. May's comments contained inaccurate and/or inappropriate language, the relevant comments have been paraphrased for purposes of brevity and clarity.

i) The financial impacts of non-revenue water should be calculated using current commercial water rates of $6.30/thousand gallons, identifying costs for both unbilled municipal water and combined real and apparent losses.
   a. The Plan was revised to comply with this comment.

ii) The City should utilize the AWWA M-36 Standardized water loss analysis in the future.
   a. The Plan indicates that the AWWA M-36 water loss analysis will be used by the utility in the future. Note that the State currently has a bill being considered that would mandate the use of the AWWA M-36 water loss assessment annually for all covered entities.

iii) The City is urged to improve water loss management through improved metering, improved data collection and management, and improved billings.
   a. These improvements have been included in the Plan and the City has begun to implement components of these improvements.

iv) Budget numbers provided in table 7 should be actual numbers.
   a. Budget numbers were used to indicate past and current expectations of available funds to support implementation of the Plan. No changes were made based on this comment.

v) Residential per capita water use of 64.7 gpcd and system wide per capita water use of 109.5 gpcd are reasonable when compared to other front range municipalities.
   a. Noted.

[1] Mr. May does not live in Brighton; however, he owns real estate within the City's service area.

CITY OF BRIGHTON
CITY COUNCIL RESOLUTION

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BRIGHTON, COLORADO, ACTING BY AND THROUGH ITS WATER ACTIVITY ENTERPRISE, ADOPTING THE CITY OF BRIGHTON 2016 WATER CONSERVATION PLAN

RESOLUTION NUMBER: 2016-127

WHEREAS, the City of Brighton City Council wishes to support sustainable practices and specifically supports the continued implementation of water conservation plans; and

WHEREAS, the Colorado State Legislature has passed HB-01-1154 and HB 04-1365 that outline requirements, expectations, and guidelines for the creation of water conservation plans for water providers; and

WHEREAS, the City has created an updated Water Conservation Plan within the guidelines of these associated Colorado State Statutes and based on the needs and requirements of the City of Brighton water system; and

WHEREAS, the City of Brighton published notice of public hearing in the Brighton Standard Blade and has complied with the required sixty-day public review period.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF BRIGHTON, COLORADO, ACTING BY AND THROUGH ITS WATER ACTIVITY ENTERPRISE, AS FOLLOWS:

1. The City of Brighton 2016 Water Conservation Plan is hereby adopted.

RESOLVED THIS 6th DAY OF December, 2016

CITY OF BRIGHTON, COLORADO

Richard N. McLean, Mayor

Attest:

Natalie Hoel, City Clerk

Approved as to form:

Margaret R. Brubaker, Esq., City Attorney