CHAPTER 2
Water Demand
CHAPTER 2

2.1 Introduction and Purpose

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) is completing its decadal update of the Water Resources Management Strategy (WRMS) for 2017. Because future water demand is a key component of any water resources plan, these efforts include an update to prior estimates of future water demand. Water demand projections developed as part of this effort will be used in subsequent WRMS development.

As part of previous efforts, the Water Authority used projected population growth along with water use efficiency goals to estimate future water demand through 2060. More recently, the Water Authority recognized the importance of considering uncertainty in population projection and future water demand; and, subsequently, the need to plan for a range of possible futures. As such, the Water Authority is developing multiple water demand projections. Each of these projections is represented as a variation in future population and resulting water demand.

However, while these projections were developed around variations in population, they should be considered to represent a range of future water demands; which could result from uncertainty in forecasting population, the addition of new industrial or commercial customers, changes in population density, or other potential changes in customer class or use pattern.

For example, a High water demand in 2040 could result from greater than expected population growth or Medium growth and the addition of a new industrial water user. For reference, the current areas served by the Water Authority are shown on Figure 1.

This document summarizes both historical and recent projected water demands and other considerations related to future water demand for projection through 2120.

2.2 Historical Projections

Historically, the 1997 WRMS was developed with the growing realization that the previous strategy of pumping an unlimited supply of groundwater was unsustainable and based on a faulty understanding of the aquifer and its connection to the Rio Grande. The 1997 WRMS was a landmark document that marked a fundamental philosophical shift to sustainability and resiliency. This shift lives on today with the 2007 strategy and informs this strategy update process.

As part of the 1997 and subsequent 2007 WRMS, population and water demand projections were developed. Population projections were based on historical Water Authority customer growth with changes in water demand between the 1997 WRMS and 2007 WRMS reflecting different water usage rate goals.

Water usage rate is defined as the total water produced from all sources divided by the population (Water Usage Rate=Total water produced/Population) and is expressed in gallons per capita day (gpcd). A conservation goal of a 30 percent reduction to achieve 175 gpcd by 2006 was established in 1995. This goal coupled with population projection resulted in a projected 2060 water demand of about 204,000 acre-feet (ac-ft). Once this conservation goal was achieved, a new
conservation goal was adopted in 2004\textsuperscript{1} reflecting a 40 percent reduction in water usage rate to 150 gpcd by 2014\textsuperscript{2}. This goal coupled with the original population projections resulted in a new projected 2060 water demand of about 175,000 ac-ft.

Table 1 presents the historical Water Authority customer population, water usage rate, and resulting water demand associated with historical WRMS development. Figures 2A and 2B show the projected water demand over time with the historical strategies.

From Figures 2A and 2B it can be seen that the change in conservation goal alone resulted in a reduction in the projected amount of new supply needed (~20,000 ac-ft) and a delay in the need for new supply.

Additional discussion of the 2007 WRMS can be found at the Water Authority Website: http://www.abcwua.org/Water_Resources_Management_Strategy.aspx

The remainder of this document summarizes development of updated population projections, conservation goals, and water demand projections for the 2017 WRMS.

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Table 1. Historical Water Authority Customer Population, Water Usage Rate, and Water Demand Projections for the year 2060 from Previous WRMS

<table>
<thead>
<tr>
<th></th>
<th>1997 WRMS</th>
<th>2007 WRMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2060 Population</td>
<td>1,041,566</td>
<td>1,041,566</td>
</tr>
<tr>
<td>Water Usage Rate (gpcd)</td>
<td>175</td>
<td>150</td>
</tr>
<tr>
<td>Water demand (ac-ft)</td>
<td>204,000</td>
<td>175,000</td>
</tr>
</tbody>
</table>

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\textsuperscript{1} Adopted R-04-12. Section 3  
\textsuperscript{2} This goal was achieved in 2011 and a new goal of 135 gpcd by 2024 was adopted and initially reached in 2014.
Figure 1. Water Authority Area Served
Figure 2A. Historical WRMS Water Demand, 1997

Figure 2B. Historical WRMS Water Demand, 2007
2.3 2017 WRMS, Water Demand Projections

For this update, three water demand projections were developed: “Low,” “Medium,” and “High.” The Medium projected water demand reflects recent population projections that take into account recent and historical economic conditions, natural growth, and net migration. This projection can be considered the most “expected” based on current and historical information, although not necessarily more likely than other projections. Deviations from expected growth or water usage rates result in alternative Low or High projections. The Low and High projections are developed to capture a broad range of potential future water demands.

Projected water demand is calculated from projected population multiplied by the currently planned water usage rate (per capita water demand). To provide an ability to examine the impact of future supplies and conservation, water demand is broken out into the following water use sectors: residential, commercial, institutional, industrial, multi-family, non-revenue, and miscellaneous; as well as indoor and outdoor water demand for each sector.

2.3.1 Population Growth

2.3.1.1 Background and Assumptions

For the purpose of planning, it is assumed that water system growth will correlate to population growth through 2120. As such, projected water system growth was evaluated by examining population growth projections. The following assumptions were made for the evaluation of the water system growth:

- Projection methods are generally consistent with the Water Authority’s most recent 40-Year Water Development Plan (CH2M HILL, 2012).
- Population projections include the Northwest Service Area (Corrales Trunk), consistent with adopted city and county land use plans.
- Low, Medium, and High projections should be developed to mitigate uncertainty in the estimates.
- Water system growth will correlate to population growth.

2.3.1.2 Population Growth Results

Historical Water Authority population projections were made as part of the 1997 WRMS and 2007 WRMS. These projections suggested a population of just over 1 million persons in 2060. This estimate was based on linear interpolation of historical water system growth through 1995, projected through 2060. This projection was utilized because historical system growth trends had been remarkably consistent; and because system population growth tended to exceed Bernalillo County (County) or Albuquerque (City) growth rates. Likewise, this estimate roughly corresponded to the University of New Mexico’s Bureau of Business and Economic Research (BBER) medium growth projections for Bernalillo County, adjusted to reflect the portion of Bernalillo County served by the Water Authority.

If similar methods are employed for this update, utilizing historical Water Authority system population growth from 1980 through 2014, a population of roughly 1 million persons in 2060 is expected (see Figure 3). Note, however, that this estimate includes the 2009 acquisition of New Mexico Utilities.

As such, while the 2060 population projection is similar between current and historical projections, the overall growth rate is reduced from previous estimates due to slowed growth.
growth over the last decade. Because historical water system growth is a good indicator of future growth, this linear trend is considered the most expected or Medium growth projection.

Projected population growth is presented in Table 2 and Figure 3. The Medium growth projection results in an increase in population from approximately 658,238 in 2015; to 1,038,000 in 2060; and 1,537,000 in 2120. As part of the State’s water planning process, this population growth projection was compared to recent estimates for Bernalillo County, including BBER (2012), Middle Rio Grande Council of Governments (MRCOG, 2012), and New Mexico Interstate Stream Commission (NMISC, 2014); as well as previous Water Authority estimates (CH2M HILL, 2007) and estimates made by the BBER in 2008 (Alcantara, 2008).

In general, recent BBER and MRCOG projections roughly correspond with the Medium growth populations when they are adjusted to reflect the portion of Bernalillo County served by the Water Authority. These estimates range from annual growth rates of 0.8 percent to 1.2 percent from 2030 to 2040, while the Medium projection reflects 1 percent annual growth over the same period. The BBER (2008) projection suggests population growth much greater than other sources and does not appear to reflect recent trends. Recent NMISC work (2014) developed high and low population projections for Bernalillo County through 2060 with growth rates through 2040 ranging from 0.7 to 0.9 percent.

A High population growth projection is proposed that reflects historical growth rates from the 1997 WRMS. As noted above, this projection reflected average growth rates over time through about 1995. As such, it reflects actual high growth rates previously experienced by the Water Authority and can be considered an upper bound of what is likely. For comparison, this projection results in a 1.2 percent annual growth rate from 2030-2040.

A Low population growth projection was developed that is 85 percent of Medium projection growth through 2120. This projection was developed to define the lower bound of expected growth and reflects an annual growth rate of 0.8 percent from 2030 to 2040. This rate is similar to the minimum annual growth experienced by the Water Authority in recent years. This rate is slightly greater than the recent NMISC (2012) Low projection. However, the NMISC projection assumes a relatively severe loss of employment base. Growth rates of the various projections are shown in Figure 4.

As shown on Figure 3, the Low, Medium, and High projections generally reflect the range of available population projections.

The estimates presented in Table 2 reflect:

- Low – Based on 85 percent of the Medium projection (0.8 percent growth).
- Medium - Linear fit of Water Authority population from 1980 through 2014 (1 percent growth).
- High – Historical projection from 1997 WRMS projected with linear interpolation through 2120 (1.2 percent growth)

Population projections are an estimate based on historical growth patterns as well as current and projected economic activity. As such, these projections are uncertain. Actual population will vary in magnitude and timing from projections based on future economic conditions. Likewise, overall water demand will vary based on actual population as well as other factors, such as mix of future industry, population density, and overall water usage rates.
Table 2. Historical and Projected Albuquerque Bernalillo County Water Utility Authority (ABCWUA) Population through 2120

<table>
<thead>
<tr>
<th>Year</th>
<th>Historical Population</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>423,371</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>476,285</td>
<td>1.2%</td>
</tr>
<tr>
<td>2005</td>
<td>522,937</td>
<td>2.0%</td>
</tr>
<tr>
<td>2010</td>
<td>606,780</td>
<td>3.2%</td>
</tr>
<tr>
<td>2015</td>
<td>658,238</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>Low Population</td>
<td>Medium Population</td>
</tr>
<tr>
<td>2020</td>
<td>695,478</td>
<td>706,180</td>
</tr>
<tr>
<td>2030</td>
<td>757,477</td>
<td>789,305</td>
</tr>
<tr>
<td>2040</td>
<td>819,477</td>
<td>872,430</td>
</tr>
<tr>
<td>2050</td>
<td>881,476</td>
<td>955,555</td>
</tr>
<tr>
<td>2060</td>
<td>943,475</td>
<td>1,038,680</td>
</tr>
<tr>
<td>2070</td>
<td>1,005,475</td>
<td>1,121,805</td>
</tr>
<tr>
<td>2080</td>
<td>1,067,474</td>
<td>1,204,929</td>
</tr>
<tr>
<td>2090</td>
<td>1,129,473</td>
<td>1,288,054</td>
</tr>
<tr>
<td>2100</td>
<td>1,191,473</td>
<td>1,371,179</td>
</tr>
<tr>
<td>2110</td>
<td>1,253,472</td>
<td>1,454,304</td>
</tr>
<tr>
<td>2120</td>
<td>1,315,472</td>
<td>1,537,429</td>
</tr>
</tbody>
</table>

Notes:
* 2010 population includes acquisition of New Mexico Utilities, artificially increasing the apparent annual growth rate.
* Projected Values for 2020 to 2120.
* Historical population based on number of customers times census data of persons per household.
Figure 3. Historical and Recent Population Projections
Figure 4. Population Projection Growth Rates
2.3.2 Water Usage Rate

Projected per capita water demand is based on the Water Authority’s 2011 conservation goal of reaching 135 gallons per capita day (gpcd) by 2024 (Water Authority, 2013). This goal was reached in 2014 (Yuhas, 2015). However, water usage rate is likely to fluctuate over time and a new goal has not been adopted. As such, for projection, this conservation goal remains constant at 135 gpcd through 2060 and beyond (Figure 5).

New development will accommodate a significant portion of population growth, and this new growth will likely be more water efficient than more mature areas (see Appendix A for water usage requirements for new development).

To be conservative with respect to future water demand and to allow for evaluation of new conservation goals, the current goal of 135 gpcd is kept constant. Likewise, while residential usage rates are likely to decline, new industry or a change in the mix of customer classes could result in an increase in overall water usage rate. In addition, outdoor irrigation water demand per acre is likely to increase with increasing temperatures expected under climate change, potentially affecting water usage rates (see Section 4.5).

Figure 5. Baseline Population and Conservation Goal Projections
2.3.3 Projected Water Demands

The total annual water demand is estimated by multiplying the projected population by the conservation goal.

For the purpose of tracking and examining the impacts of new supplies and conservation on water demand, water demand is disaggregated into seven sectors (residential, commercial, institutional, industrial, multi-family, non-revenue, and miscellaneous) and further into indoor and outdoor use by sector. Historical sector water demand is known through total produced water and metered customer billing data. Indoor or non-consumptive use by customer class can be estimated based on average winter (December through March) wastewater production. Outdoor or consumptive use can then be calculated as the total water demand minus the indoor portion.

2.3.3.1 Projected Annual Water Demand

For the Low, Medium, and High growth projections, water demand increases from a recent estimate of approximately 100,000 acre-feet per year\(^3\) (afy) to 200,000, 232,000 and 270,000 afy, respectively, between 2015 and 2120, as shown in Figure 6. These projections represent a relatively broad range of potential future water demands for planning purposes.

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\(^3\) This number reflects approximate water demand in 2014 including system and non-system groundwater wells, surface water, and non-potable water demand. Non-system groundwater wells are not connected to collection or distribution and supply at individual locations.
2.3.3.2 Water Demand by Sector

Water demand was evaluated relative to the seven water use sectors:

- residential
- commercial
- industrial
- institutional
- multi-family
- nonrevenue
- miscellaneous uses

It was assumed that each sector will grow in equivalent proportion to the total population growth. Data on water usage by sector was available from 2010 to 2014 and is presented in Table 3 and Figure 7. Trends in water demand by sector were projected using these data.

A further breakdown of non-revenue water is also shown in Figure 7, and the 2014 Water Audit is presented in Appendix B. Average gpcd by sector is presented in Figure 8. There is no substantial increasing or decreasing trend in these data that is expected to hold up over the long term, so average water use percentages by sector from 2010 to 2014, weighted for more recent data, are expected to be appropriate for planning purposes through 2120.

**Table 3. Actual Water Demand Percentage by Sector, 2010 to 2014**

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial¹</th>
<th>Industrial²</th>
<th>Institutional³</th>
<th>Multi-Family</th>
<th>Non-revenue</th>
<th>Miscellaneous²</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>14%</td>
<td>1%</td>
<td>4%</td>
<td>13%</td>
<td>10%</td>
<td>11%</td>
<td>46%</td>
</tr>
<tr>
<td>2011</td>
<td>14%</td>
<td>1%</td>
<td>4%</td>
<td>13%</td>
<td>11%</td>
<td>10%</td>
<td>47%</td>
</tr>
<tr>
<td>2012</td>
<td>14%</td>
<td>1%</td>
<td>5%</td>
<td>13%</td>
<td>8%</td>
<td>12%</td>
<td>47%</td>
</tr>
<tr>
<td>2013</td>
<td>15%</td>
<td>1%</td>
<td>5%</td>
<td>13%</td>
<td>8%</td>
<td>12%</td>
<td>46%</td>
</tr>
<tr>
<td>2014</td>
<td>15%</td>
<td>1%</td>
<td>5%</td>
<td>13%</td>
<td>7%</td>
<td>14%</td>
<td>45%</td>
</tr>
<tr>
<td>Average</td>
<td>14%</td>
<td>1%</td>
<td>5%</td>
<td>13%</td>
<td>9%</td>
<td>12%</td>
<td>46%</td>
</tr>
</tbody>
</table>

**Notes:**

1. Note that commercial use includes office space, restaurants, and other business.
2. Industrial includes manufacturing, mining, etc.
3. Institutional includes parks, schools, athletic fields, city, county, and federal offices
4. Miscellaneous includes irrigation-only accounts, reuse, and non-potable; as well as a small amount of billed unmetered consumption. The bulk of the water use in this category comes from approximately 1,350 potable and non-potable irrigation-only accounts that meter the large turf areas around the city, such as parks, golf courses and athletic fields.
Figure 7. Average Water Demand Percentage by Sector

Note:
Non-Revenue water is divided into three components: Real Loss, Apparent Loss, and Unbilled Authorized. Real Loss is physical water lost from distribution up to the point of customer meters. Apparent loss includes metering inaccuracies, data handling errors, and theft. Unbilled Authorized includes uses such as firefighting and well wash operations.

Figure 8. Water Use in Gallons per Capita per Day (2014) by Sector
2.3.3.3 CONSUMPTIVE AND NON-CONSUMPTIVE WATER DEMAND

Water demand can be broken into non-consumptive (indoor/return flow) and consumptive (outdoor) water use by evaluating wastewater return flow relative to the total water demand. The percentage of non-consumptive use has increased from 49 percent in the early 1990s to just under 60 percent since the mid-2000s. It can be expected that this percentage will continue to increase slightly, since population growth is expected to occur through new construction which, based on current building codes, will use less outdoor water relative to older residences. Likewise, infill or higher density growth would likely result in a decrease in consumptive use and an increase in return flow percentage. However, to be conservative, a consumptive water use ratio that is an average of 2012-2014 (59 percent non-consumptive, 41 percent consumptive) is utilized. Table 4 presents historical return flow percentage from 1993 to 2014. Figure 9 shows the resulting indoor and outdoor (non-consumptive and consumptive) use by sector.

Table 4. Wastewater Effluent, 1993 to 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Return flow to river (acre-feet)</th>
<th>Return flow percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>58,934</td>
<td>49.7%</td>
</tr>
<tr>
<td>1994</td>
<td>60,763</td>
<td>50.7%</td>
</tr>
<tr>
<td>1995</td>
<td>60,260</td>
<td>50.6%</td>
</tr>
<tr>
<td>1996</td>
<td>58,107</td>
<td>50.3%</td>
</tr>
<tr>
<td>1997</td>
<td>58,590</td>
<td>55.2%</td>
</tr>
<tr>
<td>1998</td>
<td>60,690</td>
<td>55.6%</td>
</tr>
<tr>
<td>1999</td>
<td>59,759</td>
<td>56.1%</td>
</tr>
<tr>
<td>2000</td>
<td>58,127</td>
<td>52.3%</td>
</tr>
<tr>
<td>2001</td>
<td>57,311</td>
<td>52.8%</td>
</tr>
<tr>
<td>2002</td>
<td>56,066</td>
<td>53.7%</td>
</tr>
<tr>
<td>2003</td>
<td>55,538</td>
<td>53.1%</td>
</tr>
<tr>
<td>2004</td>
<td>55,821</td>
<td>54.3%</td>
</tr>
<tr>
<td>2005</td>
<td>57,670</td>
<td>55.5%</td>
</tr>
<tr>
<td>2006</td>
<td>57,864</td>
<td>57.2%</td>
</tr>
<tr>
<td>2007</td>
<td>56,702</td>
<td>57.4%</td>
</tr>
<tr>
<td>2008</td>
<td>57,046</td>
<td>57.5%</td>
</tr>
<tr>
<td>2009</td>
<td>58,079</td>
<td>57.6%</td>
</tr>
<tr>
<td>2010</td>
<td>58,025</td>
<td>56.3%</td>
</tr>
<tr>
<td>2011</td>
<td>57,695</td>
<td>56.4%</td>
</tr>
<tr>
<td>2012</td>
<td>59,834</td>
<td>59.1%</td>
</tr>
<tr>
<td>2013</td>
<td>55,862</td>
<td>59.2%</td>
</tr>
<tr>
<td>2014</td>
<td>52,896</td>
<td>56.6%</td>
</tr>
</tbody>
</table>

Notes:
1. Return flow to river reflects the quantity of water discharged to the Rio Grande for which the Water Authority receives credit.
2. Return flow percentage was calculated as return flow to the river divided by the total water produced from all sources.

2.3.3.4 MONTHLY WATER DEMAND

Evaluation of the Water Authority’s water demand on a monthly basis from 2000 to 2014 resulted in a bell-shaped water demand curve with the highest water demand (approximately 12 percent of annual water demand) occurring in June and July, and the lowest water demands (about 5 percent of annual water demand) occurring from December to February, as shown on Figure 10.

Estimates developed as part of the 1997 WRMS indicated summer-month peaks that averaged about 14 percent of annual water demand. Water Authority conservation efforts have clearly cut these peak summer water demands by about 2 percentage points in recent years. This reduction is also demonstrated by the reduction in peak day water production, from about 200 million gallons (MG) in 1995 to 150 MG in 2014.
Figure 9. Consumptive and Non-consumptive Portion of Use by Sector (Average 2012-2014)

Figure 10. Percentage Water Demand by Month, 2000 to 2014
2.4 Alternative Water Demand Projection Conditions

Presented below are conditions that would affect the water demands described above, creating either an increase or decrease in water demand.

2.4.1 Conservation Goals
As noted, the assumed conservation goal of 135 gpcd has been achieved. For planning, this rate remains in place through 2120. However, it is expected that using 135 gpcd through 2120 may over-predict water demand, since it is expected that population growth will be supported through new construction, which will have a lower per capita water use rate than existing residential properties. Likewise, existing users are also expected to have a downward conservation trend as older indoor fixtures get replaced by newer, more efficient fixtures, and as outdoor use declines from conversion to lower water use landscaping.

2.4.2 Acute Change in Demand
The Low, Medium, and High projections also do not explicitly account for large jumps in water demand by sector that may occur; if, for example, a high water use industrial or commercial development were to locate in Albuquerque. It is unknown what changes in commercial, industrial, and institutional water demands may take place in the future, but changes would have an impact on the overall water use.

2.4.3 Change in Indoor/Outdoor Use Ratio
As described in Section 2.3.3.3, the current indoor to outdoor water usage ratio is about 60 percent to 40 percent, respectively; however it is expected that this ratio will change over time, with a decrease of outdoor water use relative to indoor usage. It is expected that population growth will be supported by new residential development, which will use less outdoor water relative to indoor water use through increased xeriscape and low water use irrigation methods. It is also expected that existing properties will continue to transition to lower water use landscaping over time as well, though at a much slower overall rate relative to new construction. Likewise, infill or higher density growth would likely result in a decrease in consumptive use and an increase in return flow percentage.

Using Medium population growth estimates, approximately 44 percent of residential properties by 2060 will be new construction, relative to 2010. It is expected that new construction will use between 25 and 50 percent less water, relative to existing residential properties. For example, homes in the relatively recent Mesa del Sol development use about 30 percent less than the current residential average. Based on this estimate, the indoor usage percentage may increase to between 65 and 70 percent by 2060.

2.4.4 Change in Peaking Factors
Peaking factors are the ratio between the maximum water and average water demand. Based on historical change, it is anticipated that peaking factors may change. Peak day water demands are driven primarily by outdoor water use.
As the proportion of outdoor water use declines, it is anticipated that peak day usage will also decline. As noted in Section 2.3.3.4, these changes also potentially impact the monthly distribution of water demand. Use of alternative peaking factors should be evaluated over time. Also note that the Water Authority’s North I-25 Non-potable and Southside Reuse systems also reduce the potable system peak day water demands. These systems provide a portion of outdoor water demand (possibly as much as 6%). Additional non-potable reuse projects are currently planned, which could result in additional reductions to the potable system peaking factors.

2.4.5 Climate Variability Effects

Current predictive models of climate variability indicate that temperature will likely increase and rainfall will be more variable, which is expected to have an effect on future water demand. Climate variability is expected to increase outdoor water demand. This increase in evaporative and irrigation water demand may be mitigated to some extent by reductions in turf area and overall outdoor water demand, due to conservation trends noted in previous sections.

Data available from the West-Wide Climate Risk Assessments (Reclamation, 2011) reflect predicted evapotranspiration at regional climate stations. These data were used to predict the increase in outdoor irrigation water demand based on various future climate projections. See Appendix C for a discussion of how climate change estimates were used to adjust predicted outdoor use.

2.4.6 Additional Considerations

It is likely that new conservation goals will be developed over time to help fill gaps in supply. The nature and extent of these goals may also impact or be impacted by a number of the factors noted in this section.

For example, new pricing models could be employed as a component of conservation that result, as intended, in a reduction in water usage rate. But this method may drive consumers to modify behavior and preferences in ways that are unforeseen in the current analysis – such as specifically targeting landscape changes, resulting in changes to peaking factors.

These changes on a large scale could result in overall cultural and/or quality of life changes that ultimately affect water usage and the economic base. Likewise, changes in the economic base could result in either more or less disposable income, which could result in changed behaviors.

Ultimately, a number of the potential actions and/or external forces are interrelated, resulting in feedback to the system and potential compounding of effects. For simplicity, this analysis examines potential changes from a stable base range of future demands. It is intended that this range will capture many of these possibilities, though not necessarily represent them explicitly. Future efforts may consider developing scenarios in an explicit economic framework.
2.5 References


Appendix A

Water Conservation Regulations for New Development
Albuquerque Bernalillo County Water Utility Authority

BILL NO. R-05-13

RESOLUTION

ENHANCING THE WATER CONSERVATION PROGRAM.

WHEREAS, the Authority’s high desert environment receives an average of eight inches of rainfall per year, it is appropriate to increase conservation measures; and

WHEREAS, the Albuquerque Bernalillo County Comprehensive Plan requires that “water resources of the metropolitan area shall be managed to ensure a permanent adequate water supply”; and

WHEREAS, conservation has been found to extend the Authority’s water supply at a fraction of the cost of other alternatives and that further measures will help to ensure adequate supply of water; and

WHEREAS, dishwashers account for approximately 2% of home water use and are therefore not likely to produce significant water savings; and

WHEREAS, funds currently allocated to the dishwasher rebate program could be better spent on a program with a higher potential for water savings; and

WHEREAS, the voluntary Toilet Rebate Program has been in effect for more than ten years and it is appropriate to require the conversion of low-flow toilets prior to re-sale of a residential and commercial property; and

WHEREAS, the Water Utility Authority has achieved the conservation goal of 30% water usage reduction from 250 gallons per capita per day to 175 gallons per capita per day; and

WHEREAS, the Water Utility Authority has achieved a 38% water usage reduction from 489 gallons per household per day to 303 gallons per household per day; and

WHEREAS, the Water Utility Authority adopted bill R-04-12 which increased the water conservation goal from a 30% to a 40% savings, or a goal of approximately 150 gallons per person per day; and

WHEREAS, there is a need to enhance the water conservation rebate program in order to reach the 40% savings; and

WHEREAS, the Water Resources Advisory Committee established by the Water Utility Authority has recommended water conservation programs to implement in order to reach the 40% savings.

BE IT RESOLVED BY THE AUTHORITY:

Section 1. The toilet rebate program, washing machine rebate program, dishwasher rebate program, hot water recirculation rebate program, rain barrel rebate program, sprinkler timer rebate program and xeriscape rebate program are all authorized by the Authority.

Section 2. The dishwasher rebate program will be rescinded at the end of 2005. A public education program shall be initiated to inform customers that this program will be rescinded.

Section 3. Beginning November 1, 2005, the Xeriscape Rebate Program shall be expanded to include an increased rebate for landscapes that are supported without supplemental irrigation. These landscapes will be supported through a rainwater collection system and/or by natural rainfall. The increased amount of the rebate shall be $0.80 per square foot. Only plants on the Water Conservation Program’s extremely low water use plant list will be eligible to be planted in these areas. In addition, in order to receive the rebate, these areas must be approved by the Water Utility’s Xeriscape Inspector. In order to
allow root establishment, supplemental irrigation shall be allowed for a two-year period for shrubs and
grasses and a three-year period for trees.

Section 4. The Water Utility shall work with the City of Albuquerque and Bernalillo County to draft an
ordinance requiring that all toilets on both commercial and residential properties be converted to low-
flow prior to re-sale. Once this Ordinance has been established by the City of Albuquerque, the toilet
rebate program will be phased out.

Section 5. The Water Utility shall develop water conservation best management practices for new
residential development and shall work with the City of Albuquerque and Bernalillo County to change
the building code or other regulations in order to achieve 180 gallons per household as a goal for new
residential homes. The Water Utility Authority shall incorporate the 180 gallons per household goal into
development agreements for new services of water.

Section 6. The recommendations of the Water Resources Advisory Committee on water conservation
programs to reach the Authority’s 10% savings goal will be incorporated in the Authority’s strategic
planning, budgeting and improvement process. They include the following:

A. Initiate and maintain an aggressive policy to reduce unaccounted for water from 11% to 7% over the
next four years. In four years, review the program and set a new goal.

B. Continue to change the rate structure to encourage water conservation and penalize water waste.

C. Develop audit programs to target nursing homes, hospitals, fitness centers, apartments, high schools,
hotels, motels and restaurants. These areas should be targeted because they are non-residential high
water users and the audit program has been shown to be very effective at reducing water use.

D. Implement an Irrigation Efficiency Rebate. This program will include rain barrels, cisterns, rain sensors
for irrigation systems, upgrades to sprinkler heads, movement of sprinklers away from sidewalks and
curbs, conversion to low-flow and drip irrigation systems and soil amendments. Incentives for these
options should be based upon the potential water savings.

E. Work with local governments to develop an ordinance requiring that irrigation systems be installed by
a licensed contractor trained in efficient irrigation. Provide training for irrigation system installers to
become licensed in the region.

F. Establish a rebate for non-residential customers that is strictly results based. If you reduce your use by
X amount, you will receive a rebate of Y dollars.

G. Develop an ordinance requiring that multiple cycles of water be used in cooling towers.

H. Develop an ordinance requiring sub-metering of multi-family residential accounts (apartments,
mobile home parks and some home-owner associations).

I. Expand partnerships with educators, neighborhood representatives, master gardeners and others
interested in developing water conservation awareness.

J. Develop a Rain Water Harvesting Ordinance that requires use of water harvesting for all commercial
projects over a certain size and all residential developments with more than a certain number of units.
City of Albuquerque

Albuquerque Code of Ordinances

ARTICLE 1: WATER

PART 1: WATER CONSERVATION LANDSCAPING AND WATER WASTE

§ 6-1-1-1 SHORT TITLE.

This article shall be known as the “Water Conservation Landscaping and Water Waste Ordinance.”

(Ord. 18-1995)

§ 6-1-1-2 INTENT.


(B) To assist in reducing overall per capita water use in the city by 30%.

(C) To reduce yard irrigation and irrigation-related water waste, which comprise over 40% of the city's total annual water usage. To reduce peak summer usage, which is two to three times winter usage and determines the need for capital facilities to adequately meet system water demand. To reduce irrigation water usage without sacrificing landscape quality by using lower water use plants, improved design and planting practices, different watering practices, and better irrigation system design and maintenance.

(D) To reduce water waste; i.e., overwatering, inefficient watering, or release of excess water which generates fugitive water in the public right-of-way. To reduce damage to publicly owned streets and the public expenditures necessary to repair the damage caused by this wasted water. To increase street safety by reducing the potential of frozen water on public right-of-way.

(E) To initially encourage voluntary water conservation for existing single-family residences while requiring conservation on all other properties. To apply more stringent requirements to city-owned facilities to set an example.

(Ord. 18-1995)

§ 6-1-1-3 DEFINITIONS.

For the purpose of this article, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

ATHLETIC FIELD. A turf area used primarily for organized sports.

AUTOMATIC CONTROLLER. A solid state timer capable of operating valve stations to set the days and length of time water is applied.

BUBBLERS. Irrigation heads which deliver water to the soil adjacent to the heads.

CITY OWNED. Property owned by the City of Albuquerque.

COVENANTS. Agreements entered into by property owners, leaseholders, and renters which set conditions for the use, maintenance, and/or sale of property.

DEVELOPMENT. The construction, erection, or emplacement of one or more buildings, structures, or surface improvements on land which is a premises in order to establish or expand a principal residential or nonresidential use.

DISTURBED SLOPES. Slopes that have been altered from their natural configuration or vegetative cover by human activity.
DRIP IRRIGATION. Low pressure, low volume irrigation applied slowly, near or at ground level to minimize runoff and loss to evaporation.

EVAPOTRANSPIRATION. The quantity of water evaporated from adjacent soil surfaces and transpired by plants during a specific time.

EVEN-NUMBERED PROPERTIES. Properties whose official address ends in an even number, excluding city parks and golf courses. Landscaped areas associated with a building will use the number of that building as their address. Only one address shall be used for a large landscaped area associated with one building or activity, even if the landscaped area is broken into many separate subareas.

FLOW RESTRICTION DEVICE. Device applied by the water utility to the customer's meter that restricts the volume of flow to the customer.

FUGITIVE WATER. The pumping, flow, release, escape, or leakage of any water from any pipe, valve, faucet, connection, diversion, well, or any facility for the purposes of water supply, transport, storage, disposal, or delivery onto adjacent property or the public right-of-way.

HAND WATERING. The application of water for irrigation purposes through a hand-held hose, including hoses moved into position by hand and left to flow freely or through a shut-off nozzle.

HARVESTED WATER. Precipitation or irrigation runoff collected, stored and available for reuse for irrigation purposes.

HIGH WATER USE TURF. A surface layer of earth containing regularly mowed grass, with its roots, which requires large volumes and/or frequent application of water throughout its life. High water use grasses include but are not limited to varieties of Bluegrass, varieties of Ryegrass, varieties of Fescue, and Bentgrass.

INfiltration RATE. The amount of water absorbed by the soil per unit of time, usually expressed in inches per hour.

INSPECTION. An entry into and examination of premises for the purpose of ascertaining the existence or nonexistence of violations of this article.

LANDSCAPE AREA. The entire parcel less the building footprint, driveways, non-irrigated portions of parking lots and required off-street parking. Includes the public right-of-way.

LOW WATER USE PLANTS. Plants which are able to survive without supplemental water once established as specified in the “Albuquerque Plant List”, published by the city.

MAYOR. The Mayor of Albuquerque or his/her designated representative.

MEDIUM AND LOW WATER USE TURF. A surface layer of earth containing regularly mowed grass, with its roots, which requires moderate or low volumes and/or frequency of application of water once established as specified in the "Albuquerque Plant List" published by the city. Low and medium water use grasses include but are not limited to Bermuda and Bermuda hybrids, Zoysia, blue grama, and Buffalo grass.

MEDIUM WATER USE PLANTS. Plants which require some supplemental watering throughout the life of the plant as specified in the “Albuquerque Plant List” published by the city.

MISTER. A device that produces a cooling effect by emitting fine particles of water into the air in the form of a mist.

MULCH. Any material such as leaves, bark, straw, or other materials applied to the soil surface to reduce evaporation.
NEW DEVELOPMENT. Any development approved by the Albuquerque Planning Department on or after October 1, 1995. For development for which landscaping is required, which is all development except single family residential, only that portion approved by the Albuquerque Planning Department on or after October 1, 1995 shall be considered new development. Development approved by the Albuquerque Planning Department prior to October 1, 1995, but not completed by October 1, 1998 shall also be considered new development.

NON-CITY OWNED. All property which is not owned by the City of Albuquerque.

ODD-NUMBERED PROPERTIES. Properties whose official address ends in an odd number, excluding city parks and golf courses. Large landscaped areas associated with a building will use the number of that building as their address. Only one address shall be used for a large landscaped area associated with one building or activity, even if the landscaped area is broken into many separate subareas.

PRECIPITATION RATE. The amount of water applied per unit of time, usually expressed in inches per hour.

PROPERTY HOLDER. An owner or leaseholder, whose landscaping is governed in whole or in part by rules applied to all property holders within a property holders' association.

PROPERTY HOLDERS ASSOCIATION. An association of property owners, leaseholders, or renters whose landscaping is governed in whole or in part by rules applied to all property holders within the development.

PUBLIC RIGHT-OF-WAY. The area of land acquired or obtained by the city, county, or state primarily for the use of the public for the movement of people, goods, vehicles, or storm water. For the purposes of this article the public right-of-way shall include curbs, streets, and storm water drainage inlets.

RESPONSIBLE PARTY. The owner, manager, supervisor, or person who receives the water bill, or person in charge of the property, facility, or operation during the period of time the violation(s) is observed.

RESTRICTED PLANTS. Plants which, as specified in the "Albuquerque Plant List" published by the city, are classified as restricted due to their high water use requirements and their potential for extensive use in landscaping. Restricted plants include high water use turf, clover, and Dichondra.

RUNOFF. Water which is not absorbed by the soil or landscape to which it is applied. Runoff occurs when water is applied too quickly (application rate exceeds infiltration rate), particularly if there is a severe slope. This article does not apply to stormwater runoff which is created by natural precipitation rather than human-caused or applied water use.

SHUT-OFF NOZZLE. Device attached to end of hose that completely shuts off the flow, even if left unattended.

SINGLE-FAMILY RESIDENTIAL. A lot or premises upon which is established one dwelling only. Of the allowable principal uses, such use shall be the only use on that lot or premises.

SPRAY IRRIGATION. The application of water to landscaping by means of a device that projects water through the air in the form of small particles or droplets.

SPRINKLER HEAD. A device that projects water through the air in the form of small particles or droplets.

STATIC WATER PRESSURE. The pipeline or municipal water supply pressure when water is not flowing.

TEMPORARY IRRIGATION SYSTEMS. Irrigation systems which are installed and permanently disabled within a period of 36 contiguous months.

VALVE. A device used to control the flow of water in the irrigation system.
WATER WASTE. The nonbeneficial use of water. Nonbeneficial uses include but are not restricted to:

(1) Landscape water applied in such a manner, rate and/or quantity that it overflows the landscaped area being watered and runs onto adjacent property or public right-of-way;

(2) Landscape water which leaves a sprinkler, sprinkler system, or other application device in such a manner or direction as to spray onto adjacent property or public right-of-way;

(3) Washing of vehicles, equipment, or hard surfaces such as parking lots, aprons, pads, driveways, or other surfaced areas when water is applied in sufficient quantity to flow from that surface onto adjacent property or the public right-of-way;

(4) Water applied in sufficient quantity to cause ponding on impervious surfaces on non-city owned property.


§ 6-1-1-4 APPLICABILITY.

(A) Section 6-1-1-8, Water Budgets and Planting Restrictions, applies to all new development and to existing golf courses, city owned parks, and city owned athletic fields.

(B) Section 6-1-1-9, Design Regulations, applies to all new development and to major renovations of existing golf courses, city owned parks, and city owned athletic fields originally constructed after 1971.

(C) Section 6-1-1-10, Irrigation System Standards, applies to all new development and to expansions or major renovations of existing golf courses, city owned parks, and city owned athletic fields originally constructed after 1971. Single family residential shall be exempt from this section.

(D) Section 6-1-1-11, Inspection Requirements, applies to all new development.

(E) This article does not apply to water provided through the Middle Rio Grande Conservancy District for irrigation purposes. Water obtained through non-city water system sources, however, will be included in the calculation of inches per year for the water budgets for golf courses and parks, as described in Section 6-1-1-8.

(F) Certificates of occupancy for all new development except single family residential shall depend upon compliance with all requirements of this article.

(Ord. 18-1995; Am. Ord. 24-1998)

§ 6-1-1-5 WATERING RESTRICTIONS.

These restrictions apply to all properties within the city limits and/or served by the municipal water utility.

(A) All spray irrigation during the period beginning on April 1 and ending on October 1 of each year must occur between 6:00 p.m. and 10:00 a.m. beginning April 1, 2000. This restriction serves as a guideline for landscape watering on non-city owned property during 1999. This restriction shall not apply to drip irrigation and low precipitation bubblers, hand watering, or watering of containerized plants and plant stock.

(B) All spray irrigation on city owned property during the months of December through March must occur between 10:00 a.m. and 2:00 p.m. This restriction serves as a guideline for landscape watering on non-city owned property. This restriction shall not apply to drip irrigation and low precipitation bubblers, hand watering, or watering containerized plants and plant stock. This restriction shall not apply to golf courses or parks that are in regular use or in use for a special event during these hours.
(C) Shutoff nozzles are required on any hoses used for hand watering, car washing or other outdoor uses, excepting hoses on single-family residential.

(D) All city owned properties other than parks and golf courses shall water no more than every other day. All even-numbered properties shall water only on even-numbered dates. All odd-numbered properties shall water only on odd-numbered dates. This restriction serves as a guideline for landscape watering on non-city owned property.

(E) Restrictions in divisions (A), (B) and (D) above do not apply to the following:

1. Outdoor irrigation necessary for the establishment of newly sodded lawns and landscaping within the first 30 days of planting or watering of newly seeded turf within the first year of planting;

2. Irrigation necessary for one day only where treatment with an application of chemicals requires immediate watering to preserve an existing landscape or to establish a new landscape;

3. Water used to control dust or compact soil;

4. Visually supervised operation of watering systems for short periods of time to check system condition and effectiveness.

(F) The city shall undertake an aggressive public information campaign to address the requirements of the spray irrigation restrictions for the remainder of 1999 and each year thereafter.

(G) 6-1-1-1 through 6-1-1-99 Water Conservation Landscaping and Water Waste shall be reviewed in its entirety in FY/04 as to its effectiveness and for necessary revisions. This evaluation will be incorporated into the FY/04 budget process.

(Ord. 18-1995; Am. Ord. 24-1998; Am. Ord. 54-1999) Penalty, see § 6-1-1-99

§ 6-1-1-6 WATER WASTE.

These restrictions apply to all properties within the city limits and/or served by the municipal water utility.

(A) No person, firm, corporation, or municipal or other government facility or operation shall waste, cause or permit to be wasted any water.

(B) No person, firm, corporation, or municipal or other government facility or operation shall cause or permit the flow of fugitive water onto adjacent property or public right-of-way.

(C) The restrictions in divisions (A) and (B) of this section do not apply to the following:

1. Storm runoff allowed under provisions of the city’s Drainage Ordinance as currently adopted or subsequently amended;

2. Flow resulting from temporary water supply system failures or malfunctions. These failures or malfunctions shall be repaired as quickly as possible;

3. Flow resulting from firefighting or routine inspection of fire hydrants or from fire training activities;

4. Water applied as a dust control measure as may be required under Chapter 9, Article 5 of this code;

5. Water applied to abate spills of flammable or otherwise hazardous materials, where water is the appropriate methodology;

6. Water applied to prevent or abate health, safety, or accident hazards when alternate methods are not available;
(7) Flow resulting from routine inspection, operation, or maintenance of the municipal water supply system;

(8) Flow resulting from routine inspection or maintenance of irrigation systems;

(9) Water used by the Traffic Engineering Division, City of Albuquerque, in the course of installation or maintenance of traffic flow control devices;

(10) Water used for construction or maintenance activities where the application of water is the appropriate methodology and where no other practical alternative exists.

(Ord. 18-1995; Am. Ord. 24-1998) Penalty, see § 6-1-1-99

§ 6-1-1-7 SPECIAL PERMITS

These requirements apply to all properties within the city limits and/or served by the municipal water utility.

(A) Use of Misters

(1) The use of misters shall require a special permit, issued by the city. The Mayor shall develop regulations and administrative procedures for the issuance and conditions of such permits. The Mayor shall have the authority to limit the number of permits or revoke permits as deemed necessary to protect the public interest.

(2) Effective April 1, 1999, the use of misters without a permit, or in violation of permit conditions, shall constitute a violation of this article and shall be subject to the fee assessment processes described in §§ 6-1-1-13 and 6-1-1-99.

(3) Any person, firm, corporation, or municipal or other government facility selling, leasing, renting, installing or otherwise making misters available to any other person, firm, corporation, or municipal or other government facility shall provide notification to their customers of the special permit requirement for mister use. Notice may be delivered by prominently posting a sign at the point of purchase or by providing a document to each individual customer. The city shall provide approved language for such notification.

(Ord. 24-1998)

§ 6-1-1-8 WATER BUDGETS AND PLANTING RESTRICTIONS

Subsection (A) of this section applies to all city and non-city owned golf courses, and to all city owned parks and athletic fields. Subsection (B) of this section applies to all new development.

(A) Water Budgets for Parks and Golf Courses.

(1) Parks and golf courses shall use medium and low water use plants as much as possible. High water use turf or other restricted plants shall be allowed only in those areas with heavy usage or foot traffic, such as athletic fields, playgrounds, and golf course tees, greens, and fairways.

(2) All golf courses existing prior to October 1, 1995 will be allowed up to 40 inches of water per acre of landscape area per year. Golf courses using wells must report well usage to the city on a monthly basis. Any usage over the allowable amount will be subject to the excess use surcharge(s) described in division (A)(6) of this section. Usage will be calculated on a per individual golf course basis and shall include municipal and non-municipal water supplies.

(3) All new golf courses or existing golf course expansions permitted by the city after October 1, 1995 will be allowed up to 37 inches per acre of landscape area per year. Any usage over the allowable amount will be subject to the excess use surcharge(s) described in division (A)(6) of this section. Usage
will be calculated on a per individual golf course basis and shall include municipal and non-municipal water supplies. The landscaped area for new golf courses shall not exceed 90 acres per 18 holes or 45 acres per 9 holes.

(4) All parks will be allowed up to 35 inches of water per acre of landscape area per year. Any usage over the allowable amount will be subject to the excess use surcharge(s) described in division (A)(6) of this section. Usage will be calculated on a per individual park basis and shall include municipal and non-municipal water supplies.

(5) Athletic fields will be allowed up to 45 inches per acre of landscape area per year. Any usage over the allowable amount will be subject to the excess use surcharge(s) described in division (A)(6) of this section. Usage will be calculated on a per individual athletic field basis and shall include municipal and non-municipal water supplies.

(6) Any usage over the approved water budget will be subject to the excess use surcharge(s) defined in the Water and Sewer Rate Ordinance as currently adopted or subsequently amended (see Ch. 6, Art. 4), and established by the Mayor's rules and regulations. This surcharge(s) will be calculated on an annual basis and applied to the February water bill for the property. If two different surcharges are defined in the Water and Sewer Rate Ordinance or the Mayor's rules and regulations, the surcharge for excess usage up to 10% of the water budget shall be the lower of the surcharges. The surcharge for excess usage over 10% of the water budget shall be the higher of the surcharges.

(7) For all parks, golf courses and other facilities with greater than ten acres of restricted plants, and developed after the effective date of this section, the owner or developer shall, when available and economically feasible, use reclaimed wastewater, shallow groundwater or other alternative water supplies, as specified by the policies of the Albuquerque Water Resources Management Strategy.

(B) Planting Restrictions.

(1) All city owned new development other than parks, golf courses, and housing shall use medium and low water use plants on 100% of the landscape area.

(2) All city owned housing and all non-city owned properties other than golf courses shall not use high water use turf or other restricted plants on more than 20% of the landscape area, except that for single family residential properties;

(a) In the event that 20% of the landscape area is greater than 3,000 square feet, high water use turf and other restricted plants shall not be used on more than 3,000 square feet of the landscape area;

(b) In the event that 20% of the landscape area is less than 300 square feet, high water use turf and other restricted plants may be used on up to 300 square feet of the landscape area.

(C) Certain Restrictive Covenants Prohibited.

(1) A property holders' association shall not enforce a provision in a covenant that prohibits or restricts a property holder from: (a) Removing turf grass and installing xeriscape landscaping in compliance with the restrictions for new development in subsection (B) of this section; (b) Installing efficient irrigation systems, including underground drip systems; or

(c) Using rain barrels or other water harvesting devices, provided such devices adequately protect the public's health, safety, and welfare.

(2) A property holders' association may establish criteria for relandscaping to improve water use efficiency but cannot require a higher percentage of high water use turf than allowed in subsection (B) of this section except that it may require that the maximum percentage of high water use turf allowed in subsection (B) of this section be maintained.

§ 6-1-1-9 DESIGN REGULATIONS

The following regulations apply to all new development, and to expansions or major renovations as existing city owned parks, city and non-city owned golf courses, and city-owned athletic fields originally constructed after 1971.

(A) With the exception of temporary irrigation systems needed to establish low water use plants, spray irrigation shall not be used on slopes greater than four feet of horizontal distance per one foot vertical change (4:1).

(B) All existing disturbed slopes and all man-made slopes shall receive erosion control from plantings and/or terracing. Concrete, asphalt, or any other water and air impervious paving/cover will be allowed only where it is the most appropriate methodology and where no other practical alternative exists.

(C) Plants that require spray irrigation or a mowing frequency of more than three times per year shall not be used in street medians, except that spray irrigation may be used in street medians for up to 36 months where the primary objective is to reclaim disturbed areas with low water use plants.

(D) Spray irrigation shall not be used to apply water to any area within eight feet of a street curb or storm sewer inlet. These areas may be irrigated by drip, bubbler, soaker, or sub-surface irrigation systems.

(E) Sprinkler heads shall be installed at least eight inches away from impermeable surfaces.

(F) No spray irrigation shall be used in areas less than ten feet in any dimension excepting within back or side yards of residential properties, or where such an area is contiguous with adjacent property so that the dimension totals ten feet minimum. Within parking lots no spray irrigation shall be used on any area less than 15 feet in any dimension. These areas may be irrigated by drip, bubbler, soaker, or sub-surface irrigation systems.

(G) Any existing features should be evaluated for incorporation in design to include natural drainage, rock outcroppings, stands of native vegetation which can be protected, or detention areas where vegetation has grown and is being supported by nuisance flows or harvested water.

(H) The potential for using harvested water should be evaluated and, when practical, incorporated into landscape design. Such design shall be consistent with the requirements of the city's Flood Hazard Control Ordinance and the Drainage Ordinance as currently adopted or subsequently amended.

(I) Ponds, fountains, wetlands, marshes, water features for wildlife habitat, functional holding ponds or other reservoirs that are supplied in whole or in part by the municipal water supply shall not exceed 500 square feet or surface area unless approved by the Mayor. Multiple water features on the same property will be considered together to determine surface area. Flowing water used in fountains, waterfalls and similar features shall be recirculated.

(Ord. 18-1995; Am. Ord. 24-1998) Penalty, see § 6-1-1-99

§ 6-1-1-10 IRRIGATION SYSTEM STANDARDS

The following standards apply to all expansions or major renovations at existing parks, golf courses and athletic fields originally constructed after 1971, and to all new development except single family residential. The standards serve as voluntary guidelines for single-family residential development. In general, irrigation systems shall be designed to be site-specific, reflecting plant type, soil type, infiltration rates, slopes, and prevailing wind direction.
(A) Irrigation systems shall be designed to be in conformance with all provisions of this article. Temporary irrigation systems shall not be required to meet these standards.

(B) Application equipment for which the manufacturer specifies flow rates in gallons per minute (gpm) shall not share a control valve with equipment for which the manufacturer specifies flow rates in gallons per hour (gph). Irrigation systems shall be controlled by an automatic controller equipped with the following features:

1. Two or more independent programming schedules;
2. Capable of programming run times in one-minute increments and displaying the programmed run time as a numeric display;
3. Total program memory retention;
4. Ability to be fitted with an external rain switch interrupter and soil moisture sensor.

(C) No intentional overspray is allowed where it may obstruct pedestrian traffic on a city-required pedestrian walkway, as defined by the city’s Sidewalk, Drive Pad, Curb and Gutter Ordinance as currently adopted or subsequently amended.

(D) Irrigation systems shall be designed such that water pressure at the sprinkler or emitter is not more than 20% in excess of the manufacturer’s maximum recommended pressure range for that device. Pressure may be regulated by design or by the installation of a pressure regulating device or devices.

(E) Irrigation systems shall be designed to minimize low head line drainage.

(F) All new development with new spray irrigated landscaped areas totaling one-half acre or more shall have a Landscape Irrigation Audit performed by a Certified Landscape Irrigation Auditor, certified by the Irrigation Association. The auditor shall be independent of the property owner and of all contractors associated with the property. The audits will be conducted in accordance with the current edition of the Landscape Irrigation Auditor’s Handbook. The minimum efficiency requirements to meet in the audit are a 60% distribution uniformity for all fixed spray systems and a 70% distribution uniformity for all rotary systems. The results of the audit shall be provided to the city in a letter or other form acceptable to the city and shall be signed by the Auditor. Compliance with this provision is required before the city will issue a Certificate of Occupancy or, in the case of park development, a Letter of Final Acceptance.

(G) All new development with spray irrigated landscapes greater than ten acres shall have the sprinkler heads tested for uniformity of performance using the Center for Irrigation Technology’s (CIT) Sprinkler Profile and Coverage Evaluation (SPACE) program, or a comparable assessment acceptable to the city. The sprinkler heads shall have a scheduling coefficient of 1.3 or less for full circle heads and 1.5 or less for partial circle heads, with a rating of 1.0 being perfect. The sprinkler heads shall be installed in the spacing and pressure range tested. The results of this test shall be provided to the city in a form acceptable to the city. Compliance with this provision is required before the city will issue a Certificate of Occupancy or, in the case of park development, a Letter of Final Acceptance.

(Ord. 18-1995; Am. Ord. 24-1998) Penalty, see § 6-1-1-99

§ 6-1-1-11 INSPECTION PROCEDURES

The following procedures apply to all new development:

(A) Inspection by Consent.

1. Within the scope of his authority, the Mayor may conduct an inspection, with the voluntary consent of an occupant or custodian of the premises to be inspected who reasonably appears to be in control of the places to be inspected or otherwise authorized to give such consent.
(2) Before requesting consent for an inspection, the Mayor shall inform the person to whom the request is directed of the authority under and purposes for which the inspection is to be made and shall exhibit an identification card or document evidencing his authority to make such inspections.

(3) Inspections undertaken pursuant to this section shall be carried out with due regard for the convenience and privacy of the occupants, and during the daytime, unless, because of the nature of the premises, the convenience of the occupants, the nature of the possible violation or other circumstances, there is a reasonable basis for conducting the inspection at night.

(4) Notice of the purpose and approximate time of an inspection of an area not open to the general public shall be sent to the occupants or custodians of premises to be inspected not less than seven days before the inspection is undertaken.

(B) Inspection without Consent.

(1) Upon sufficient showing that consent to an inspection has been refused or is otherwise unobtainable with a reasonable period of time, the Mayor may make application for an inspection order/search warrant. Such application shall be made to a court having jurisdiction over the premises to be inspected. Such application shall set forth:

(a) The particular premises, or portion thereof sought to be inspected;

(b) That the owner or occupant of the premises has refused entry;

(c) That inspection of the premises is necessary to determine whether they comply with the requirements of this article;

(d) Any other reason necessitating the inspection, including knowledge or belief that a particular condition exists on the premises which constitutes a violation of this article; and

(e) That the Mayor is authorized by the city to make the inspection.

(2) The application shall be granted and the inspection order/search warrant issued upon a sufficient showing that inspection in the area in which the premises in question are located, or inspection of the particular premises, is in accordance with reasonable legislative or administrative standards, and that the circumstances of the particular inspection for which application is made are otherwise reasonable. The court shall make and keep a record of the proceedings on the application, and enter thereon its finding in accordance with the requirements of this section.

(3) While executing the inspection order/search warrant the Mayor shall, if the premises in question are unoccupied at the time of execution, be authorized to use such force as is reasonably necessary to effect entry and make the inspection.

(4) While conducting the inspection the Mayor shall, if authorized by the court on proper showing, be accompanied by one or more law enforcement officers authorized to serve search warrants who shall assist the Mayor in executing the order at his direction.

(5) After execution of the order or after unsuccessful efforts to execute the order, as the case may be, the Mayor shall return the order to the court with a sworn report of the circumstances of execution or failure thereof.

(Ord. 18-1995; Am. Ord. 24-1998) Penalty, see § 6-1-1-99

§ 6-1-1-12 VARIANCES AND APPEALS

The Mayor shall be responsible for the enforcement of this article. The Mayor may prescribe policies, rules, or regulations to carry out the intent and purposes of this article.
(A) Variances to § 6-1-1-5 (Watering Restrictions) and § 6-1-1-6 (Water Waste), and § 6-1-1-7 (Special Permits).

(1) Administrative variances to the restrictions in §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 may be issued by the Mayor or his/her designee, only for the purposes of installing or retrofitting landscaping, provided that the general intent of this article has been met, compliance with this article is proven to cause practical difficulties and unnecessary hardship, and all options for abatement through modified water management have been exhausted. The criteria to determine hardship shall include level of capital outlay and time required to be in compliance with this article.

(2) Variances may be issued for a period not to exceed one year and shall stipulate both short-term corrective measures and a schedule for completion of long-term corrective measures. Variances issued to accommodate the installation or retrofitting of landscaping are only applicable to the site where the construction that will increase the possibility of wasted water is to occur. The variance shall apply only for the period of construction. As of the date of this legislation any existing variances shall be subject to these provisions. Variances must be renewed on an annual basis if long-term corrective measures cannot be completed within one year.

(B) Appeal of § 6-1-1-5 (Watering Restrictions), § 6-1-1-6 (Water Waste), and § 6-1-1-7 (Special Permits). Any responsible party may appeal fees for violations of §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 to the City Hearing Officer by filing an appeal within seven calendar days of receiving a notice of violation. Such request shall be made in writing and filed in the Office of the City Clerk. The appeal shall identify the property and state the grounds of appeal together with all material facts in support thereof. A filing fee of $20 shall be added to the water bill in the event the violation is upheld by the Hearing Officer. When a hearing is requested, the Hearing Officer shall send written notice by certified mail, return receipt requested, to the appellant of the time and place of the hearing. At the hearing the appellant shall have the right to present evidence as to the alleged fact upon which the Mayor based the determination of the need for assessment of fee or restriction of service and any other facts which may aid the Hearing Officer in determining whether this article has been violated. The Hearing Officer shall, within seven working days following the hearing, issue a written decision specifying the fee, if appropriate, and the action that must be taken to avoid additional penalty. Fees will be void and service will not be restricted if the written decision is not issued within seven working days.

(C) Judicial Review. The exclusive remedy for parties dissatisfied with the action of the City Hearing Officer on §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 shall be the filing of a petition for a writ of certiorari with the State District Court. The petition for review shall be limited to the record made at the administrative hearing held pursuant to this article.

(D) Variances to §§ 6-1-1-8 through 6-1-1-10 requirements. A variance to the regulations in §§ 6-1-1-8 through 6-1-1-10 may be issued by the Mayor, through the Zoning Hearing Examiner, provided that the general intent of this article has been met and compliance with this article is proven to cause practical difficulties and unnecessary hardship. The variance procedure for this article will comply with the variance procedure in the Zoning Code as currently adopted or subsequently amended. (This procedure is described in § 14-16-4-2.) Appeals of decisions of the Zoning Hearing Examiner are to the Environmental Planning Commission. Appeals of decisions of the Environmental Planning Commission are to the City Council. Appeal is made by filing written notice with the Planning Department within 15 days after the request for variance has been denied. Appeal procedures will comply with those in the Zoning Code, § 14-16-4-4.


§ 6-1-1-13 FEES; ASSESSMENT
(A) Fees and Restriction of Service. Any responsible party who violates any of the provisions of §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 shall be subject to progressively higher fees and flow restriction until the violation ceases or a variance is granted. The assessment of fees and application of flow restriction shall be consecutive for violations separated by less than three calendar years. Fees and flow restriction shall be suspended pending the outcome of an appeal or variance request.

(B) Assessment of Fees. Assessment of fees for violations of the regulations in §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 will be through the city utility bills for the responsible party’s billing account. Fees shall be assessed to the account within 15 days following expiration of the appeal period or issuance of appeal findings and shall be listed as separate line item on the utility bill. Responsible parties shall be notified of the fee through certified mail within 15 days of the violation. Fees must be paid within the normal payment period allowed by the city utility billing system.

(C) In lieu of fees for violations of §§ 6-1-1-5 and 6-1-1-6, the responsible party may have a landscape water audit performed by an authorized landscape irrigation auditor, certified by the Irrigation Association. The audit will be conducted in accordance with the current edition of the Landscape Auditor’s Handbook. The audit must be performed within 30 days of notification of violation and the audit recommendation must be implemented within 60 days of the audit. If these deadlines are not met, the fees for violation will apply.

(Ord. 18-1995; Am. Ord. 24-1998) Penalty, see § 6-1-1-99

§ 6-1-1-99 PENALTY.

(A) The schedule for assessment of fees and application of flow restriction for a violation of §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7 shall be as follows:

1. First observed violation – $20;
2. Second observed violation – $50;
3. Third observed violation - $100;
4. Fourth observed violation - $300;
5. Fifth observed violation - $400;
6. Sixth observed violation - $600;
7. Seventh observed violation - $800;
8. Eighth observed violation - $1,000;
9. Ninth or more observed violation: Either a $1,000 fee per violation plus application of a flow restriction device at meter or a $2,000 fee per each violation. The flow restriction device cannot be removed by the responsible party and will not be removed by the utility until the responsible party adequately demonstrates to the city that the violation has ceased or until a variance is granted.

(B) For the purpose of assessing fees or flow restriction for violations of §§ 6-1-1-5, 6-1-1-6, and 6-1-1-7, any previous violation shall not be considered if:

1. A period of five years has elapsed since the violation was incurred; or
2. The property is acquired by a new owner; or
3. The violation occurred prior to July 1, 1998.

(C) Any responsible party who violates any provision of §§ 6-1-1-8 through 6-1-1-10 shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be punished by a fine not to exceed $500
and/or imprisonment for a period not to exceed 90 days. Application of fines for violations of the regulations in §§ 6-1-1-8 through 6-1-1-10 will comply with the Zoning Code as currently adopted or subsequently amended. (See §§ 14-16-4-1 through 14-16-4-12, and 14-16-4-99).

(D) Any person who violates the provisions of this article for which no other penalty is set forth, shall be subject to the general penalty provision of this code set forth in § 1-1-99.


PART 2: FLUORIDATION OF WATER

§ 6-1-2-1 DECLARATION OF PURPOSE OF INTENT.

The City Council, based on information supplied to it by various sources, finds and declares that:

(A) The addition of fluorides to public water supplies is a process which has been adopted and used in many parts of the United States as a measure for improving the permanent condition of the teeth, in particular the teeth of children, and is a means of benefitting the population generally at a minimal cost and difficulty.

(B) The New Mexico Department of Public Health and the United States Public Health Service recommend and encourage the addition of fluorides to public water supplies so as to maintain an optimum fluoride level in such water supplies of 0.9 parts of fluoride per million parts of water to 1.2 parts of fluoride per million parts of water as public health measures.

(C) It has been found and determined on the basis of study and investigation that the minimum optimum level of 0.9 parts of fluoride per million parts of water does not exist in the present water supply of the city.

(D) Long term studies and the use of water fortified by addition of fluorides to a point where the optimum level of 0.9 parts of fluoride per million parts of water to 1.2 parts of fluoride per million parts of water has been maintained in public water supplies have demonstrated that such process does reduce the incidence of dental caries and tooth decay in the permanent teeth of children and does not produce deleterious effects to any persons; and also is of benefit to adults.

('74 Code, § 8-3-1) (Ord. 151-1970)

§ 6-1-2-2 AUTHORITY TO PROCEED WITH FLUORIDATION OF WATER SUPPLY.

(A) The Mayor is directed to acquire the necessary facilities and supplies for the fluoridation of the city public water supply as soon as practicable to the end that the fluoride content of the water supply can be raised to and maintained at the optimum fluoride level of 0.9 parts of fluoride per million parts of water to 1.2 parts of fluoride per million parts of water no later than January 1, 1972.

(B) The Mayor is hereby authorized to cause the addition of fluorides to the city public water supply in controlled amounts to reach and maintain the optimum fluoride level as soon as the facilities and supplies have been acquired and made operational.

('74 Code, § 8-3-2) (Ord. 151-1970)

PART 3: PUBLIC USE OF FIRE HYDRANTS

§ 6-1-3-1 PERMIT REQUIRED.

(A) No person, individual, firm, partnership or corporation (hereinafter called "User") shall obtain water from any fire hydrant located within the city for any purpose other than public emergency use without obtaining a permit from the city as provided herein.
(B) A User may obtain such a permit upon application to the city as provided in § 6-1-3-2. The permit shall designate the fire hydrants from which the User may obtain water.

(C) A permit may be revoked at any time for cause, such as, but not limited to:

(1) User’s failure to pay for water at the specified time;
(2) User’s interference with emergency use of designated fire hydrant;
(3) User obtaining water from other than designated fire hydrant;
(4) Conviction of the User for any violation of §§ 6-1-3-1 et seq.;
(5) Compelling need of the city.

(D) The granting of a permit under this section does not grant any right of privilege to the User to interfere with the city’s duty to the public. Emergency use for fire protection supersedes and takes precedence over all other uses.

(‘74 Code, § 8-2-1) (Ord. 234-1972) Penalty, see § 1-1-99

§ 6-1-3-2 METER REQUIRED.

The user shall use a meter owned by the city in order to keep a record of the water used. The User is required to deposit $300 for each meter. This deposit shall be reimbursed to the User upon the return of the water meter in good condition and certification by the Water Division that the fire hydrant concerned is in good condition. The user is responsible for any damage incurred to fire hydrant or water meter. The deposit shall be applied toward the payment for any such damage and may be applied to any unpaid charges for water obtained pursuant to the provisions of § 6-1-3-1 et seq.

(‘74 Code, § 8-2-2) (Ord. 234-1972) Penalty, see § 1-1-99

§ 6-1-3-3 CROSS-CONNECTIONS.

Unprotected cross-connections (as defined within the Cross-Connection Prevention and Control Ordinance set forth in § 6-2-1 et seq.) are prohibited.


PART 4: WATER CONSERVATION LARGE USERS

§ 6-1-4-1 SHORT TITLE.

This article shall be known as the “Water Conservation Large Users Ordinance.”

(Ord. 18-1998)

§ 6-1-4-2 INTENT.

(A) To implement the recommendations related to large water users called for in Resolution Bill No. R-173, Enactment No. 40-1995, adopted by the Council in March of 1995.

(B) To assist in reducing overall per capita water use in the city by 30% from 250 to 175 gallons per person per day.

(C) To require development, adoption, and implementation of water conservation plans for customers using large amounts of water through a cooperative process with the city.

(D) To assist large users in identifying ways to reduce water use.
(E) To formalize monitoring and feedback for large users on meeting approved goals for water use reductions.

(Ord. 18-1998)

§ 6-1-4-3 DEFINITIONS.

For the purpose of this article, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

ATHLETIC FIELD. Physically defined high water use turf area used regularly for athletic practices and/or games.

EXISTING CUSTOMER. Any city water system customer for which a water meter was installed prior to the effective date of this article.

LANDSCAPED AREA. The entire parcel less the building footprint, driveways, and non-irrigated portions of parking lots.

LARGE USER. Any city water system customer which used or uses in excess of 50,000 gallons per day in 1997 or any calendar year thereafter in which annual use is averaged over the year (50,000 gallons per day equals 18.25 million gallons or 24,398 units annually). Usage for multiple meters serving the same geographic facility will be added together and considered one customer.

LOW FLOW FIXTURES. Plumbing fixtures as follows: 1.6 gallons or less per flush toilets, 1.0 gallon or less per flush urinals, 2.5 gallons or less per minute shower heads, 2.5 gallons or less per minute faucets and/or aerators.

NEW CUSTOMER. Any city water system customer for which a water meter was not installed prior to the effective date of this article.

VERY LARGE USER. Any city water system customer which used or uses in excess of 300,000 gallons per day in 1997 or any calendar year thereafter in which annual use is averaged over the year (109.5 million gallons or 146,390 units annually). Usage for multiple meters serving the same geographic facility will be added together and considered one customer.

(Ord. 18-1998)

§ 6-1-4-4 APPLICABILITY.

All sections of this article apply to all large and very large users within the city limits and/or served by the municipal water utility, excepting customers which receive over 80% of their water from sources other than the city and public and private golf courses and parks, which are regulated by the Water Conservation Landscaping and Water Waste Ordinance. Compliance with this article is a condition of service from the utility. Private well usage will be included in the calculation of total usage and surcharges.

(Ord. 18-1998)

§ 6-1-4-5 WATER USE REQUIREMENTS.

(A) All new and existing large users shall use proven, economically feasible, most effective technology to minimize the amount of water used, including but not limited to water used for cooling, heating, processing, and operations.

(B) New large users shall:

(1) Comply with the landscaping requirements for new development in the Water Conservation Landscaping and Water Waste Ordinance;
(2) Use low flow fixtures in all kitchen facilities and bathrooms.

(C) Existing large users shall:

(1) Reduce water use for landscaped area to 35 inches per acre by 2004, excluding athletic fields at schools;

(2) Reduce water use for school athletic fields to 45 inches or less per acre per year;

(3) Use or convert to low flow fixtures in all kitchen facilities and bathrooms by 2004;

(4) For multi-family residential large users, be exempted from fully complying with divisions (C)(1) and (3) if usage equals or averages, on an annual basis, less than 180 gallons per day unit;

(5) For mobile home parks, be exempted from fully complying with divisions (C)(1) and (3) if usage equals or averages, on an annual basis, 260 gallons per day per unit.

(Ord. 18-1998)

§ 6-1-4-6 USAGE PROJECTIONS.

(A) All large users shall assess their projected usage, in cooperation with the city, by developing the following:

(1) Description of all uses of water within the facility;

(2) A plan for improvements to be implemented prior to 2004;

(3) Projections of average annual, monthly, and daily water use through 2004;

(4) Projections of annual water costs, based on current rates;

(5) Projections of annual sewer costs, based on current rates;

(6) Projections of annual energy savings through 2004 related to reduced water use, if applicable, based on current rates;

(7) Projections of changes in annual pretreatment costs through 2004 related to reduced water use, if applicable.

(B) Existing large users shall also include the following, based on information provided by the city:

(1) Average annual, monthly, and daily water use over the last three years;

(2) Last three years’ annual water and sewer costs.

(Ord. 18-1998)

§ 6-1-4-7 WATER CONSERVATION PLAN REQUIREMENTS.

(A) All large users shall develop a water conservation plan, in cooperation with the city, which includes:

(1) A policy statement reflecting the commitment of the large user to conservation;

(2) Findings from § 6-1-4-6;

(3) Improvements to be implemented by 2004, listed by year and specific type of improvement;

(4) Annual goals and water budget for water usage from the year plan is proposed through 2004 and any significant changes after 2004;

(5) A plan for promoting water conservation to employees and/or residents;

(6) A contact person with the city for implementation of this article.
(B) Existing large users’ water conservation plans shall also include:

1. Conservation-related improvements already made;

2. A schedule for converting to low water use plumbing and landscaping.

(C) Large users shall also:

1. Work with the city to evaluate and, if feasible, implement utilization of appropriately treated industrial sewage return flow to the city’s system in alternate ways, such as for deep injection well recharge and for irrigation purposes; sharing of costs to implement these solutions will be negotiated;

2. Communicate with similar water users, keep informed of new developments to reduce water use, and implement new processes as feasible;

3. Work in partnership with the city, agencies, companies, and/or universities involved in research to facilitate development and sharing of more efficient ways to use water.

(Ord. 18-1998)

§ 6-1-4-8 PLAN APPROVAL.

(A) Large users and very large users shall develop and seek approval of a water conservation plan within five months of notification by the city of the applicability of this article to the customer.

(B) The city will issue a plan approval, based on the customer’s water conservation plan, as negotiated by the city and the customer. For new customers, approval must occur prior to issuance of a city water meter. For existing customers, plan approval must occur within eight months of notification by the city of the applicability of this article to the customer, unless the plan is being mediated or appealed. Plan approval will be based on compliance with § 6-1-4-6(A)(1)-(3), § 6-1-4-6(B)(1), § 6-1-4-7(A)(1)-(6), and § 7(B)(1)-(2) of this article and any additional commitments by the customer to make improvements to use water more efficiently.

(Ord. 18-1998)

§ 6-1-4-9 PLAN REVISIONS.

Either the customer or the city may initiate a plan revision at any time except during the months of November through February to alter inaccurate projections, reflect growth or decline at the facility, or accommodate other significant changes. Plan revisions will not be made to accommodate minor, short-term fluctuations caused by line breaks, leaks, fire flow delivery, and weather. No more than two revisions may be initiated by the customer during any 12 month period. The city will notify customers prior to making plan revisions. Revisions will be made only if the projections/goals will be changed by at least 5%.

(Ord. 18-1998)

§ 6-1-4-10 VERY LARGE USERS.

(A) Very large users are subject to the same requirements as large users.

(B) In addition, prior to plan submittal, existing very large water users must provide an audit of their uses of water by a qualified expert accepted by both the city and the customer. Implementation of the auditor’s recommendations will be subject to negotiation with the city. The city may terminate water service to any very large user refusing to implement improvements the city considers reasonable, subject to the provisions described in § 6-1-4-14.

(Ord. 18-1998)
§ 6-1-4-11 NOTIFICATION.

(A) The city will notify all existing large users of the requirements in this article and its applicability within 18 months of the final adoption of the article, starting with the largest users and moving downward. Large users are not required to submit plans prior to their notification in order to allow time for adequate staff review and approval.

(B) All large water users with approved plans will be informed of their annual usage relative to their projected usage every year prior to March 31. Notification to customers who have achieved their final goal for two consecutive years will not continue unless usage exceeds the reduction goal in a subsequent year. Notification to customers who exceed their goal will continue indefinitely.

(Ord. 18-1998)

§ 6-1-4-12 VARIANCES.

(A) The Mayor shall be responsible for the enforcement of this article. The Mayor may prescribe policies, rules, or regulations to carry out the intent and purposes of this article.

(B) Administrative variances to the restrictions in § 6-1-4-5 through § 6-1-4-7 may be issued by the Mayor or his/her designee, provided that the general intent of this article has been met, compliance with this article is proven to cause practical difficulties and unnecessary hardship, and all reasonable options for abatement have been exhausted. The criteria to determine hardship shall include level of capital outlay and time required to be in compliance with this article.

(Ord. 18-1998)

§ 6-1-4-13 MEDIATION AND APPEALS.

(A) In the event that the customer and the city cannot agree on the customer’s plan and annual goals, a mediation will be scheduled through the city’s Dispute Resolution Office. The goal of the mediation is to create a mutually acceptable plan with the help of a third party mediator. The mediation will be scheduled by the Dispute Resolution Office within three weeks of the request. Follow-up mediations, if necessary, will be scheduled as quickly as possible. Costs for the mediation will be split equally between the city and the customer. Based on the mediation(s) and any subsequent discussions between the city and the customer, a plan will be proposed for approval within ten working days of the final mediation. In the event agreement is not reached through the mediation process, the city will propose a plan for approval within 12 working days of the final mediation.

(B) Any large user dissatisfied with the plan proposed by the city following the mediation may appeal the plan to the City Hearing Officer by filing an appeal within seven calendar days of receipt of the proposed plan. Such request shall be made in writing and filed in the Office of the City Clerk. The appeal shall include the proposed plan and state the customer’s disagreement with the proposed plan, together with all material facts in support thereof. When a hearing is requested, the City Hearing Officer shall send written notice by certified mail, return receipt requested, to the appellant of the time and place of the hearing. At the hearing, the appellant and the city shall have the right to present evidence to aid the City Hearing Officer in determining whether the proposed plan should be approved. The City Hearing Officer shall, within seven working days following the hearing, issue a written decision specifying any modifications to the plan that must be made prior to plan approval. If no modifications are required by the City Hearing Officer, an appeal filing fee of $20 shall be added to the customer’s water bill.

(C) The exclusive remedy for parties dissatisfied with the decision of the City Hearing Officer shall be the filing of a petition for a writ of certiorari with the State District Court. The petition for review shall be limited to the record made at the hearing held by the City Hearing Officer pursuant to this article.

(Ord. 18-1998)
§ 6-1-4-14 COMPLIANCE; NONCOMPLIANCE.

(A) Failure to comply with the provisions of this article to develop and seek approval of a water conservation plan within five months of notification by the city of the applicability of this article to the customer will result in city assignment of annual water usage goals, based on the customer’s past usage, estimated potential for reductions, and the 30% reduction goal adopted in Resolution 40-1995.

(B) Compliance with this article is a condition of service from the utility.

(C) Water conservation staff or consultants authorized for this purpose by the Mayor may conduct an inspection of a customer’s property for the purpose of assessing proposed plan validity and/or compliance with this article or approved plan. Inspections shall be conducted with the voluntary consent of the customer or the customer’s representative. Inspection is deemed a condition of service. Customer refusal of an inspection for these purposes will result in city assignment of goals as described in division (A) above.

(Ord. 18-1998)

§ 6-1-4-15 EFFECTIVE DATE.

This article shall become effective five days after publication in full.

(Ord. 18-1998)

PART 5: WATER CONSERVATION WATER BY REQUEST

§ 6-1-5-1 INTENT.

The public purpose of this ordinance is to:

(A) Assist in reducing overall per capita water use in the city, thereby helping to ensure a sustainable supply of water;

(B) Eliminate unnecessary use of water in restaurants by serving water to customers only when requested, thereby reducing water served and water used to wash glasses;

(C) Educate water system customers and hospitality industry clientele about and eliminate the unnecessary use of water by reducing the frequency of washing of sheets, towels, and other linens; and

(D) Encourage government facilities and businesses to eliminate waste and use water efficiently.

(Ord. 2-2001)

§ 6-1-5-2 SHORT TITLE.

This ordinance shall be known as the "Water Conservation Water by Request Ordinance."

(Ord. 2-2001)

§ 6-1-5-3 DEFINITIONS.

For the purpose of this article, the following definitions shall apply unless the context clearly indicates or requires a different meaning:

BUSINESS. Retail facility, office, shopping center or other facility in the commercial water billing class, other than multi-family or mobile home residential facilities.

GOVERNMENT FACILITY. Facility operated by the City of Albuquerque, Bernalillo County, State of New Mexico, United States, or other governmental entity.

LODGING ESTABLISHMENT. A motel, hotel, or bed and breakfast establishment which provides private rooms for overnight stay and provides towels and/or sheets and/or other linens.
RESTAURANT. A food service facility which serves meals to customers, including those food service facilities in lodging establishments and schools and drive-in food facilities, and excluding health and frail elderly care facilities.

(Ord. 2-2001)

§ 6-1-5-4 APPLICABILITY.

All sections of this article apply to all restaurants, lodging establishments, government facilities, and businesses within the city limits and/or served by the municipal utility. Compliance with the ordinance is a condition of service from the utility.

(Ord. 2-2001)

§ 6-1-5-5 DRINKING WATER SERVICE.

All restaurants shall provide drinking water only as specifically requested by the customer.

(Ord. 2-2001)

§ 6-1-5-6 LINEN WASHING SERVICE.

All lodging establishments shall offer customers the option of not changing sheets and towels in private rooms for stays of less than five days. Lodging establishments shall encourage this practice, at a minimum, through posting of signs in every room instructing customers how to avoid linen service for stays less than five days. Lodging establishments with less than ten rooms may encourage this practice through brochures or other general promotional materials rather than signs in each room.

(Ord. 2-2001)

§ 6-1-5-7 EDUCATING EMPLOYEES, CLIENTS, AND CUSTOMERS.

The city shall work cooperatively with government facilities and businesses to post signage informing and educating employees, clients, and customers about the need to and how to save water.

(Ord. 2-2001)

§ 6-1-5-8 ASSESSMENT OF FEES.

Any responsible party who violates the provisions of this ordinance shall be subject to progressively higher fees until the violation ceases. The schedule for assessment of fees is as follows.

First violation $20 Second violation $50 Third and additional violation $100

Assessment of fees for violations of this ordinance will be through city utility bills and placed on the responsible party's billing account. The responsible party may appeal fees for violation of this ordinance and the appeal process shall follow the process set forth in § 6-1-1-12(B) of the Water Conservation Landscaping and Water Waste Ordinance. Fees shall be assessed to the responsible party's billing account within 15 days following expiration of the appeal period or issuance of appeal findings and shall be listed as a separate line item on the utility bill. Responsible parties shall be notified of the fee through certified mail within 15 days of the violation. Fees must be paid within the normal payment period allowed by the city utility billing system. Fees shall be suspended pending the outcome of an appeal. Each day in which a violation occurs shall constitute a separate offense. The responsible party will be given seven days to comply with this ordinance before another fee may be assessed.

(Ord. 2-2001)

PART 6: [RESERVED]

PART 7: PLUMBING FIXTURE RETROFIT FOR CITY OWNED PROPERTY
§ 6-1-7-1 SHORT TITLE.
Sections 6-1-7-1 et seq. shall be cited as the "The Plumbing Fixture Retrofit Ordinance for City Owned Property."
(Ord. 2-2009)

§ 6-1-7-2 DEFINITIONS.
For the purpose of §§ 6-1-7-1 et seq., the following definitions shall apply unless the context clearly indicates or requires a different meaning:

EXISTING PLUMBING FIXTURE.
(1) Any toilet manufactured to use more than 1.6 gallons of water per flush.
(2) Any urinal manufactured to use more than 1.0 gallon of water per flush.
(3) Any showerhead manufactured to have flow capacity of more than 2.5 gallons of water per minute.
(4) Any faucet that emits more than 2.5 gallons of water per minute.

FAUCET. A fixture commonly known as a faucet but only when located at a kitchen or bathroom sink.

LOW WATER USE PLUMBING FIXTURE. Plumbing fixtures as follows: 1.6 gallons or less per flush toilets, 1.0 gallon or less per flush urinals, 2.5 gallons or less per minute shower heads, 2.5 gallons or less per minute faucets and/or aerators.

PLUMBING FIXTURE. A faucet, showerhead, urinal or toilet.

RETROFIT. Means to replace any existing plumbing fixture with a low water use plumbing fixture.
(Ord. 2-2009)

§ 6-1-7-3 DUTY OF CITY TO RETROFIT.
All plumbing fixtures in all city owned property over which the city has control shall be low water use plumbing fixtures no later than December 31, 2014. The City Council may, by Resolution, extend this deadline to complete the installation of low water use fixtures.
(Ord. 2-2009)

§ 6-1-7-4 RETROFIT EXEMPTIONS.
The following conditions and circumstances shall exempt property from the provisions of this part:

(A) Where a low water use plumbing fixture would be installed in an existing building that has been identified by a local, state, or federal government entity as an historical site, and an historically accurate water-conserving plumbing fixture is not available.

(B) Where installation of a low water use plumbing fixture would require modifications to plumbing system components located beneath a finished wall, floor or other surface.

(C) Where the unique configurations of a building drainage system or portions of a public sewer, or both, require a greater quantity of water to flush the system in a manner consistent with public health.

(D) Where the existing building will be demolished or rehabilitated within 90 days of the purchase of such existing building.
(Ord. 2-2009)
Bernalillo County

Sec. 30-249. - Design and construction regulations for new development.

This section applies to all new development.

(1) **Single-family and small multifamily development requirements.** All new single-family and small multifamily development shall use one of the three alternatives listed to select water conservation measures that will be incorporated into the design and construction of the new dwelling.

   a. **Alternative number 1.** Bernalillo County Water Conservation Measures Worksheet.

      1. Building permit applications for all single-family and small multifamily development using alternative number 1 shall include a fully and properly completed water conservation measures worksheet certifying that:

         (i) Measures selected on the worksheet will reduce indoor water use by at least 20 percent using plumbing fixtures which are more water efficient than those required in the 2006 Uniform Plumbing Code; and

         (ii) All of the selected measures shall be incorporated into the design and construction of the new dwelling; and

      2. All new single-family and small multifamily development using alternative number 1 shall comply with the planting restrictions in subsection (4); and

      3. Before obtaining a certificate of occupancy, all single-family and small multifamily development using alternative number 1 may be subject to inspection and approval by a water conservation compliance officer or other designated staff.

   b. **Alternative Number 2.** Build Green New Mexico Bronze Certification.

      1. Building permit applications for all single-family and small multifamily development using alternative number 2 shall submit a copy of a fully and properly completed Build Green New Mexico property registration form and applicant’s affidavit; and

      2. All new single-family development using alternative number 2 shall comply with the planting restrictions in subsection (4) or any subsequent modifications to the outdoor requirements of the Build Green New Mexico program whichever are more stringent; and

      3. Before obtaining a certificate of occupancy all single-family and small multifamily development using alternative number 2 must submit certification from Build Green New Mexico which shows that the dwelling meets a minimum of the Build Green New Mexico bronze certification and provide independent verifier's name and address.

   c.
Alternative number 3. EPA watersense fixtures.

1. Building permit applications for all single-family and small multifamily development using alternative number 3 shall include a fully and properly completed water conservation measures form certifying that:

   (i) All toilets installed shall meet EPA watersense specifications; and

   (ii) All bathroom faucets installed shall meet EPA watersense specifications; and

   (iii) If a dishwasher is installed by the home builder, it shall be energy star qualified; and

   (iv) If a clothes washer is installed by the home builder, it shall be energy star qualified; and

   (v) Hot water distribution systems should be designed and built to minimize the volume of water between the plumbing fixture and hot water source. This may be accomplished by minimizing pipe runs and reducing diameter of hot water pipes, using water demand initiated hot water systems, or other efficient system designs.

2. All new single-family and small multifamily development using alternative number 3 shall comply with the planting restrictions in subsection (4); and

3. Before obtaining a certificate of occupancy all single-family and small multifamily development using alternative number 3 will be subject to inspection and approval by a water conservation compliance officer or other designated staff.

(2) Requirements for commercial and large multifamily development.

a. Building permit applications for all new commercial, large multifamily and institutional development shall include a fully and properly completed commercial indoor water conservation measures worksheet certifying that:

   1. Indoor water use will be reduced by at least 20 percent using plumbing fixtures which are more water efficient than those required in the 2006 Uniform Plumbing Code; and

   2. All of the measures selected on the commercial indoor water conservation measures worksheet shall be incorporated into the design and construction of the new building.

b. Building permit applications for all new commercial and large multifamily development on more than one acre shall include a fully and properly completed commercial outdoor water conservation plan and site plan that includes three of the following seven outdoor water conservation measures related to landscaping. One of the three options completed must include option (i), (ii), or (iii). After January 1, 2016, all new development shall comply
with four of the following seven water conservation measures. One of the four options completed must include option (i), (ii) or (iii). All new development shall comply with the planting restrictions in subsection (4) of this section. The commercial outdoor water conservation plan shall be reviewed for approval by the county geohydrologist or other designated county official. Approval of commercial outdoor water conservation plan and site plan by the county will be based on the water conservation plan criteria below unless the applicant proposes alternative methods that provide equivalent or greater water conservation.

1. **Water conservation plan criteria.** The plan shall include three of the following seven outdoor water conservation measures related to landscaping. One of the three options completed must include option (i), (ii), or (iii). After January 1, 2016, all new development shall comply with four of the following seven water conservation measures. One of the four options completed must include option (i), (ii) or (iii). All new development shall comply with the planting restrictions in subsection (4) of this section.

   (i) At least 25 percent of the landscape area shall be precipitation supported plant material. Irrigation may be used for establishment of the precipitation supported plant material, but the area shall be zoned separately from any other landscaped area. If this option is chosen, then option (vii) must also be completed and the irrigation to the area should be shut off within two years and identified in the EMP. After January 1, 2013, 35 percent of the landscape area shall be provided by precipitation supported plant material. After January 1, 2016, 45 percent of the landscape area shall be provided by precipitation supported plant material.

   (ii) Passive water harvesting shall occur on at least 25 percent of the landscape area. The irrigation system shall be designed so that the water harvesting areas are zoned separately from nonwater harvesting areas. After January 1, 2013, passive water harvesting shall occur on 35 percent of the landscape area. After January 1, 2016, passive water harvesting shall occur on 45 percent of the landscape area.

   (iii) One hundred percent of the irrigation water supply shall be from a non-potable municipal, private or well source. Non-potable water supplies will need to be officially documented and confirmed.

   (iv) A smart irrigation controller (smart controller) shall be designed and installed to control all of the irrigation system for the landscape area. The smart controller must be from a list approved by Bernalillo County.

   (v) An approved soil amendment program is used during installation of the landscape to improve the nutrient and water holding capacity of the soil.
(vi) Non-potable water shall be collected and stored for use as the primary water source for landscape irrigation. Storage capacity shall be a minimum of 50 percent of the peak month landscape water demand for the property.

(vii) An exterior management plan (EMP) shall be developed and submitted to the county with other project documents. The EMP is a two-year commitment to employ best management practices that significantly reduce water use, chemical use, and water runoff as compared with standard practices.

c. All new commercial development less than one acre may follow the guidelines for outdoor water use in [subsection] (2)b. above, or use a smart controller for all landscape areas, use only low and medium use plants, and have no spray irrigation.

d. All new large multifamily residential development including mobile home parks with more than eight units shall have separate meters or submetering for water service to all dwelling units.

(3) Remodels and additions.

a. All remodels and additions for single-family and small multifamily development shall use EPA Watersense-labeled fixtures for any new plumbing fixture installed. Existing plumbing fixtures not included in the remodel shall be evaluated for replacement using incentive programs from Bernalillo County or the ABCWUA.

b. All remodels on commercial and large multifamily development shall use EPA Watersense-labeled fixtures for any new plumbing fixture installed. All remodels on commercial and large multifamily development which affect more than 50 percent of the existing plumbing fixtures shall use EPA Watersense-labeled plumbing fixtures for any new fixture installed and upgrade any existing fixtures using EPA Watersense-labeled fixtures. All additions on commercial large multifamily development which increase the floor area of the existing building by more than 50 percent of the existing square footage shall use EPA Watersense-labeled plumbing fixtures for any new fixture installed and upgrade any existing fixtures using EPA Watersense-labeled fixtures.

c. All landscaping plantings that are added or replaced as part of a remodel or addition on commercial large multifamily development shall be from the low-water-use approved plant list. Any existing landscaping may remain.

(4) Restrictions on landscape planting, ponds, and irrigation systems.

a. All properties other than county-owned parks, golf courses and athletic fields shall not be designed and constructed to use high-water-use turf or plants on more than ten percent the landscape area, except:

1. For single-family and small multifamily development, the use of high-water-use plants shall not exceed 1,500 square feet of the landscape area;
2. In the event that ten percent of the landscape area is less than 300 square feet, high-water-use turf and other high-water-use plants may be used on up to 300 square feet of the landscape area;

3. Large multifamily development may use high-water-use turf on up to 30 percent of the landscape area as long as no dimension of the turf area is less than ten feet. Swimming pools will be considered the same as high-water-use turf for the purposes of this limitation;

4. Properties zoned A-1 Agricultural with access to water provided through the Middle Rio Grande Conservancy District or community acequia systems for irrigation purposes may use high-water-use turf or other high-water-use plants in the landscape area supplied by irrigation water;

5. Private parks may have up to ten percent of the landscape area in high-water-use turf or other high-water-use plants. If grading and drainage plan details demonstrate that water harvesting will support up to 30 percent high-water-use turf or plants then up 30 percent of the landscape area may be high-water-use turf or plants;

6. Private parks which are supplied by 100 percent utility-provided, non-potable water may have up to 30 percent of the landscape area in high-water-use turf or plants.

b. Street medians, streetscapes, ornamental landscapes and common areas of subdivisions shall not be designed and constructed with high-water use turf and other high-water use plants. Street medians, streetscapes, ornamental landscapes and common areas of subdivisions that are included in a grading and drainage plan shall be evaluated for water harvesting opportunities during the grading and drainage plan review.

c. Ornamental ponds shall not be designed and constructed to exceed 500 square feet of surface area. Ornamental fountains shall not be designed and constructed to exceed 250 square feet of surface area. Multiple water features on the same property will be considered together to determine surface area. Flowing water used in fountains, waterfalls and similar features shall be recirculated. Ponds and fountains shall be designed to be consistent with the requirements of all applicable local and state regulations.

d. The list of low, medium, and high-water-use plants maintained by the ABCWUA will be the approved plant list for landscape planting. Exceptions and additions to this list may be approved if documented proof of water use can be demonstrated for the area of intended use.

e. The list of precipitation only plants maintained by the ABCWUA will be the approved plant list for precipitation Supported landscape planting. Exceptions and additions to precipitation only plant list may be approved if documented proof of water use can be demonstrated for the area of intended use.
(5) Irrigation systems.

a. All irrigation systems shall be designed and installed to meet all minimum standards established by the current editions of uniform plumbing code and uniform mechanical code. All irrigation systems should use currently accepted water conservation design principals to maximize efficiency of the irrigation system.

b. Spray irrigation systems shall not be designed and constructed for use on slopes greater than four feet of horizontal distance per one-foot vertical change (4:1).

c. Spray irrigation systems shall not be designed and constructed to apply water to any area within eight feet of a street curb or storm sewer inlet. These areas may be irrigated by drip, bubbler, soaker or subsurface irrigation systems.

d. Spray irrigation systems shall not be designed and constructed using sprinkler heads that are closer than eight inches to impermeable surfaces.

e. Spray irrigation systems shall not be designed and constructed to be used in areas less than ten feet in any dimension excepting within back or side yards of residential properties, or where such an area is contiguous with adjacent property so that the dimension totals ten feet minimum. Spray irrigation systems shall not be designed and constructed to be used on any area less than 15 feet in any dimension within parking lots. These areas may be irrigated by drip, bubbler, soaker or subsurface irrigation systems.

(Ord. No. 2010-13, § 9, 5-25-10, eff. 10-1-10)
Appendix B

Water Authority Water Audit Report for 2014
Figure B1. Screen Capture from Water Authority Water Audit

<table>
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Figure B2. Non-Revenue Water as Percent by Volume by Water Provider.
### Figure B3. Screen Capture from Water Authority Water Audit

#### AWWA Free Water Audit Software: System Attributes and Performance Indicators

**Water Audit Report for Reporting Year:** 2014 1/2014 - 12/2014

**Albuquerque Bernalillo County Water Utility Authority**

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**System Attributes:**

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<th>Item</th>
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<td>Real Losses:</td>
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<td>Annual cost of Real Losses:</td>
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**Performance Indicators:**

#### Financial:

- Non-revenue water as percent by volume of Water Supplied: 7.1%
- Non-revenue water as percent by cost of operating system: 4.8%
- Real Losses valued at Variable Production Cost

#### Operational Efficiency:

- Apparent Losses per service connection per day: 3.92 gallons/connection/day
- Real Losses per service connection per day: 18.82 gallons/connection/day
- Real Losses per length of main per day*: 0.81
- Real Losses per service connection per day per psi pressure: 0.25 gallons/connection/day/psi

**From Above, Real Losses - Current Annual Real Losses (CARL):** 1,263.4 million gallons/year

**Infrastructure Leakage Index (ILI) [CARL/UARL]:** 1.17

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* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline.
Appendix C

Climate Change Effects on Outdoor Water Demand
Appendix C

Climate Change

Projections of evapotranspiration at Albuquerque with the effects of climate change for the Western United States were developed by Reclamation as part of the West Wide Climate Assessment (Reclamation 2011). These projections were derived from work completed by the World Climate Research Program’s (WCRP) Coupled Model Intercomparison Project Phase 3 (CMIP3) (Maurer et al., 2007). The CMIP3 data were produced using general circulation models (GCM) that project global changes in atmospheric temperature and precipitation based on changes in greenhouse gas emissions. These global projections were used to develop the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report (IPCC, 2007). For regional planning purposes, the global projections were downscaled by Reclamation using the Bias Correction and Spatial Disaggregation (BCSD) approach.

The approach was used with three different carbon emissions scenarios (B1 [low], A1B [middle], A2 [high]) to produce 112 different equally likely climate traces. The general approach to develop the Downscaled GCM Projected sequences is shown graphically in figure A1. The downscaled climate information results in temperature and precipitation data that can be used to estimate evapotranspiration.

Figure C1. General Method for Development of Climate Change Hydrologies

Source: Modified from the URGIA
West-wide Climate Team Modifications for Local Use

For the purpose of water planning in the Middle Rio Grande, Reclamation organized the 112 climate traces into 5 “ensembles” by percentile of temperature and precipitation using a hybrid delta ensemble method (HDe). The “central tendency” group include all traces which fall within the 25th and 75th percentile for both precipitation and temperature change. The remaining four groups are based on the 50th percentiles of precipitation and temperature change and are referred to as hot-dry, hot-wet, warm-dry, and warm-wet (Figure A2). The HDe method uses the average of temperature and precipitation change across all traces within each ensemble for three projection points in time, 2020s, 2050s, and 2080s.

Figure C2. Grouping of the 112 Climate Traces into Five Ensembles

Source: Santa Fe Basin Study HDe Data Memo

So, for example, for the 2080s period the temperature and precipitation data from the above process were taken from the 2070 to 2099 period and compared to the simulated historical period (1950-1990). The difference in precipitation and temperature for the two periods was taken to create the 5 ensembles. The average difference for each ensemble was then used as a “delta” to modify the historical precipitation and temperature for each ensemble for the 2080 period.
Modifications Made as Part of this Study

Each sequence developed using the HDe method reflects meteorological data (temperature and precipitation) as if the climate were stable for each time-period. Thus, for a 2080s Hot-Dry ensemble, the resulting sequence reflects a time series of meteorological data for only the 2080s change over the entire sequence. Therefore, time series data in 2000 or 2020 or 2090 all reflect a 2080s climate. As such, when planning using these data, any time prior to the 2080s will over represent the impact of climate. Likewise, for a 2020s sequence, any time after the 2020s will under-represent the impact of climate. To alleviate this ambiguity, the sequences were modified to interpolate the data over time. For example, the “hot-dry” sequence was interpolated over time between the 2020s, 2050s, and 2080s to result in a single sequence that gradually changes over time. Figure A4 shows the factors used to interpolate the sequences.

This interpolation was applied to the monthly average evapotranspiration data at Albuquerque resulting in monthly average values for each of the five ensembles as well as the base “historical” sequence. The average monthly percent change was then calculated from historical to each ensemble (e.g. “Hot Dry”, “Central”, etc.) These percent changes were applied to the outdoor portion of demand when examining climate change to reflect an increase over the base expected demand due to climate change.

Figure A4 shows the monthly evapotranspiration data for the base (historical simulated), Hot Dry, and Central ensembles. Figure A5 shows the resulting percent changes. These values were interpolated over time using the method depicted in Figure A3 and applied to outdoor demand for the Hot Dry and Central ensembles.
Figure C4. Monthly Average Reference Evapotranspiration for Albuquerque (in)
Figure CS. Monthly Percentage Change in Reference Evapotranspiration from Historical