

# CARSON CITY PUBLIC WORKS WATER DIVISION

WATER CONSERVATION PLAN  
September 2023



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The Carson City Public Works Utility Water Division provides potable water to customers within an overall service area that extends north to the Goni Canyon Area, south to the Douglas County border, east to the Lyon County border and west to the Sierra foothills. Production facilities include the Quill Water Treatment Plant and 32 groundwater wells. Water is obtained from both surface and groundwater sources. Currently, Carson City has completed a regional water system intertie project which resulted in the interconnection of the Minden water system, the North Douglas County water system, the Indian Hills General Improvement water system, the Carson City water system and the Lyon County (Dayton) water system. Carson City has purchased an additional 1,250 acre feet of water rights from the Town of Minden. Minden will supply up to 12,000 gallons per minute of water to the regional system. Ultimately, this adds an additional 4,500 gpm to Carson City's production capability. Carson City is also in final design on upgrades to the Quill Water Treatment Plant which is scheduled for construction beginning in 2024; once complete these upgrades will expand production to a maximum of 6 million gallons per day.

At the time this plan was prepared, the distribution system includes approximately 348 miles of water mains, 3,130 fire hydrants, 32 wells, 16 storage tanks, and 16 pressure zones. All customer connections are metered (*NRS 540.141 (1)(g)*).

There has been a 1.4 percent per year decrease in overall water use since a peak occurred in 2007. The likely reason for the decrease is the economic downturn during the recession, increased conservation efforts, improved fixture efficiencies, and pressure from increased and tiered water rates. Most of the decrease in water use has occurred during June through September, these months of highest water use are associated with summer irrigation.

One highlight of the Carson City conservation effort includes conjunctive use. Conjunctive use is the coordinated management of surface water and groundwater supplies to maximize the yield of the overall water resource. Carson City's approach is to rely on surface water in wet years and to use groundwater in dry years. Conjunctive use is becoming a key part of the City's overall water management strategy in terms of coping with its water demands.

The City continues the three-day-a-week watering schedule from June 1st to October 1st, requiring that odd-numbered addresses water on Tuesday, Thursday, and Saturday and even-numbered addresses water on Sunday, Wednesday, and Friday with no watering between the hours of 10:00 a.m. and 6:00 p.m. Outdoor irrigation is not allowed on Mondays. (*NRS 540.141 (1)(j)*)

The Public Works Utility Division routinely evaluates potential new uses for reclaimed wastewater. Currently all of the treated effluent that is produced is put to use. Uses include irrigation of the Prison Farm and three local golf courses. Potential future uses of treated effluent include re-establishing previous usage sites such as Edmonds Sports Complex, Lone Mountain Cemetery, and Mills Park, among others. These sites were removed from effluent service in 2013 due to reduced sanitary sewer inflows due to drought (I&I), water conservation, and the recession. (*NRS 540.141 (1)(d)*)

Regarding efforts to reduce the amount of unaccounted for water, the Water Utility has an ongoing leak detection program that includes the survey of approximately 25 miles of pipe annually. (*NRS 540.141 (1)(c)*)

The purpose of this plan is to document current conservation efforts and provide a strategy for future water saving measures and incentives.

This plan is mandated by Nevada Revised Statute (NRS) 540.131 and is compliant with NRS 540.121 through 540.151. This plan has also been updated to comply with the additions as a result of the 2017 Nevada Legislative Session. Per NRS 540.131.4(a) this plan is available for public inspection at the following location:

**Carson City Public Works  
3505 Butti Way  
Carson City, Nevada 89701  
Ph: 775-887-2355  
Fax: 775-887-2112**

This plan is also available on the Carson City Public Works website at:

[www.carson.org/government/departments-g-z/public-works/divisions/water](http://www.carson.org/government/departments-g-z/public-works/divisions/water)

Public comments about this plan are encouraged. Written comments may be sent to the address above.

## SECTION 1 – WATER USE PROFILE AND FORECAST

Nevada is considered the driest State in the nation. Because of this, the proper management of water rights is an important aspect of water conservation. This section provides a profile of water production, usage, and a quantitative description of the Carson City water system that will include the following:

- Water rights information
- Existing supply sources and their production
- System water use profile with customer classifications and unaccounted for water
- Water use forecast using projected population growth

The purpose of this section is to analyze water sources and demand and establish a basis for conservation measures.

### 1.1 Water Rights

Total current usable water rights (ground + surface) equal 18,648 acre-ft annually (AFA) per year in the name of Carson City. Carson City's average water demand from 2018 to 2022 is 10,870 AFA. Carson City has access to surface water from Marlette Hobart Water System (MHWS). These state owned rights are not added in to the total usable rights due to water quality issues, but the City has access to them for purchase. The only useable right from the MHWS comes from springs on the East Slope spring collection system that is diverted to Carson City and to Virginia City and that number is shown in the useable section. As mentioned in the introduction, Carson City is currently finalizing plant upgrades for the Quill Water Treatment Plant to allow expanded usage of the MHWS supply in the future.

#### 1.1.1 Ground Water Rights.

Table 1.1 is a summary of current ground water rights currently held by Carson City. The Eagle Valley is a total combined duty amount for 6,716.30 AFA, or supplementally adjusted, and does not include the drought permits (Permit 61505, 61507, 61508) which allows Carson City to pump a maximum of 11,700 AF for a one year period provided that the average groundwater pumped from Eagle Valley over a period of five consecutive drought years will not exceed 9,900 AFA, as set forth under State Engineer Order 1140. (See Permit Terms for Drought Permits) The Carson Valley groundwater totals include the Carson – Douglas Intertie Pipeline.

**TABLE 1.1**

Summary of Carson City Ground Water Rights

<b>GROUNDWATER</b>	<b>ANNUAL PERMITTED (AF)</b>	<b>USABLE (AF)</b>
Eagle Valley (Basin 104)	6,716	6,716
Dayton Valley (Basin 103)	3,206	2,330
Carson Valley (Basin 105)	4,803	4,803
<b>Totals</b>	<b>14,725</b>	<b>13,849</b>

#### 1.1.2 Surface Water Rights.

Table 1.2 is a summary of current surface water rights currently held by Carson City. The Quill Water Treatment Plant production has been significantly reduced in recent years due to water quality issues from both the Marlette Hobart and Ash Creek sources.

**TABLE 1.2**

Summary of Carson City Surface Water Rights

<b>SURFACE WATER</b>	<b>ANNUAL PERMITTED (AF)</b>	<b>USABLE (AF)</b>
Carson River (Basin 103)	2,295	2,095
Kings Canyon (Basin 104)	939	939
Ash Canyon (Basin 104)	1,666	0
Clear Creek (Basin 105))	273	0
State Owned Franktown Creek Decree and Marlette Water (Basins 89 and 90 respectively)	3,000 from Marlette State Owned (7,240 from Franktown Creek State Owned (Not included in total))	1,969
<b>Totals</b>	<b>8,173</b>	<b>5003</b>

## 1.2 Supply Sources, Production and Storage

### 1.2.1 Supply Sources

Table 1.3 shows 2017 yearly average production for the Quill water treatment plant and wells in the Carson City system.

**TABLE 1.3**

Daily Average Production Capabilities by Source (2017)

Source or Well Number	Production (gpm)
3	1,231
4	0
5	289
6	430
7	250
8	358
9	350
10B	870
11	556
16B	0
24B	985
25B	830
33	96
34	330
38	331
40	1,240
41	1,595
43	504
44	335
45	511
46	227
47	0
48	280
49	0
50	750
51	866
53	100
54	0
55	797
Town of Minden Intertie	3,500
Quill WTP	1,600
<b>Total Daily Average Production (gpm)</b>	<b>19,211</b>



### 1.2.2 Storage

Table 1.4 shows existing Carson City storage facilities and their capacities.

**TABLE 1.4**

Storage Facilities

<b>Storage Facility</b>	<b>Capacity (gal)</b>
Quill Tank	4,000,000
Quill Reservoirs	3,200,000
Chlorine Contact Tank	500,000
Ash Canyon Tanks	6,000,000
Ash Canyon Reservoir	1,000,000
Timberline Tank	600,000
Lakeview Tank	508,000
Tanstaaf Tanks	500,000
Goni Tank	3,000,000
East Carson Tank	2,600,000
Prison Hill Tank	3,000,000
Goni Canyon Tank	400,000
Voltaire Tank	2,000,000
Highway 50 East Water Tank	3,000,000
<b>Total Storage Capacity</b>	<b>30,308,000</b>

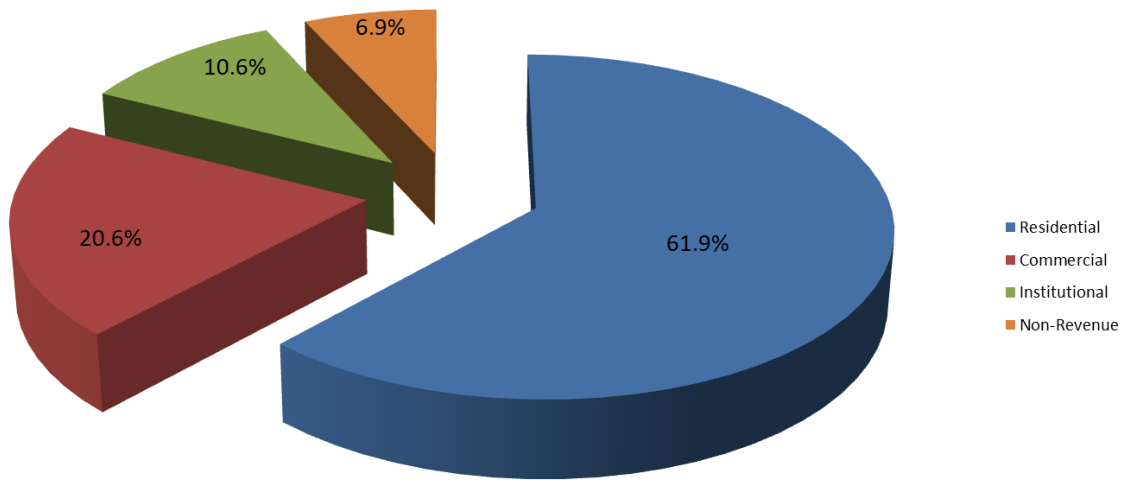
## 1.3 Water Use Profile

### 1.3.1 Use by Customer Class

Water use categories in the Carson City system include residential, commercial, and institutional users. The institutional users include Federal, State (including the Nevada State Prisons), and City connections. Percentages in Figure 1.1 are averages derived from the Water Division's Fiscal Year Water Consumption reports from 2006 to 2022. The Figure includes non-revenue water; the 10 percent average being considered standard for the water industry.

The system unaccounted-for water is the difference between the amount produced and the amount used by metered customers. Using average values for total production, including surface water sources, and total revenues per class, the Carson City system has approximately 8 percent gross unaccounted-for water which is below the industry average. This number is taken from an average of the last 4 years of production data, which best represents how the system is operating. Potential causes for unaccounted-for water include leaking mains, fire flow testing, system flushing, dead meters, under-registering meters, record keeping practices, un-metered uses, and unauthorized use. Carson City does a system flush every year and that amount is not accounted for in this number. The actual water loss would be much lower if that was accounted for.

**FIGURE 1.1**  
Customer Use by Class



**FIGURE 1.2**

Overall Monthly Use

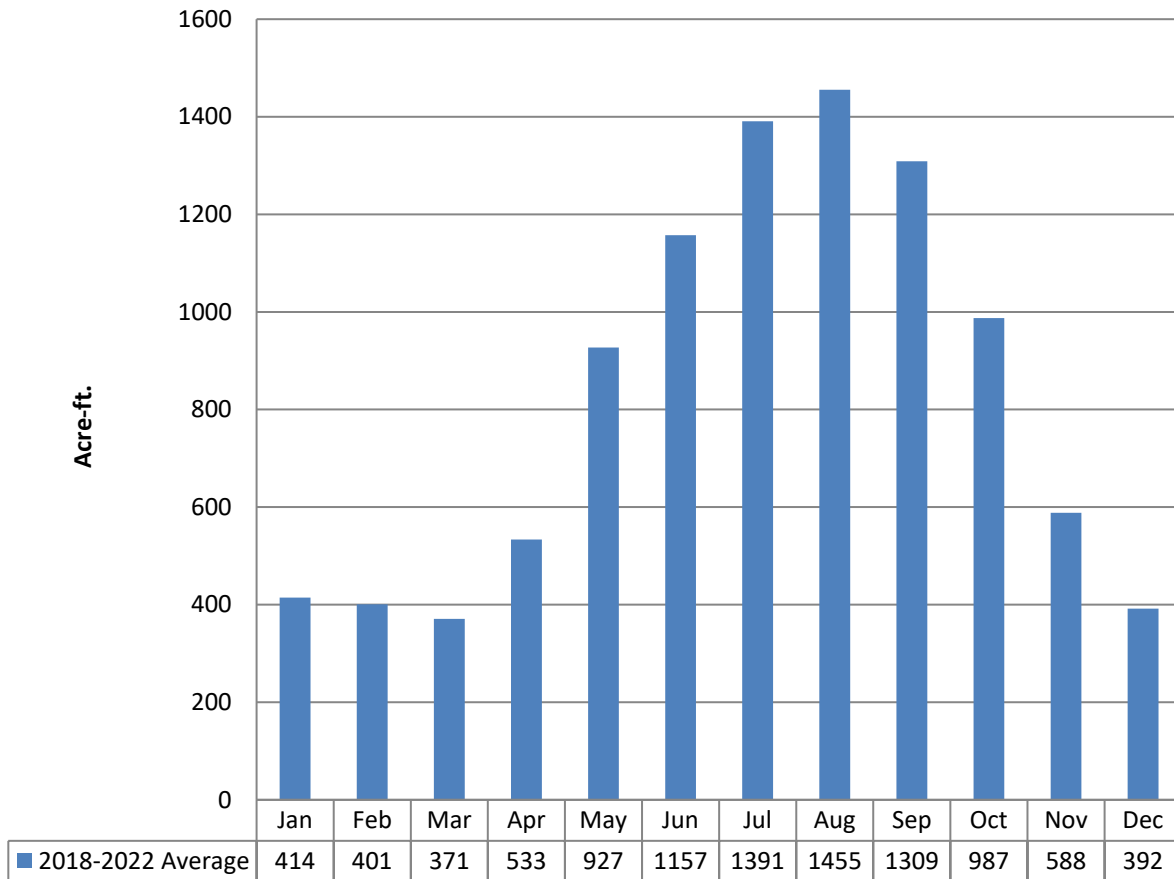


Figure 1.2 shows the monthly water use for 2018 through 2022. In the Carson City system the highest use occurs from July through September and the lowest from December through February. August (highest month) use is approximately 400 percent higher than December (lowest month) use.

Total Carson City metered use (including commercial, residential and institutional) was approximately 157 gallons per capita per day (gpcd). This number is the result of the average usage from FY2014 to FY2023. The gpcd is based on the Nevada State Demographers population estimate for Carson City of 56,953 for 2022.

The average residential-only gpcd for this same 10-year period was 110 gpcd. This amount is less than the State average residential use supplied by a public entity of 122 gpcd (United State Geological Survey for year 2015).

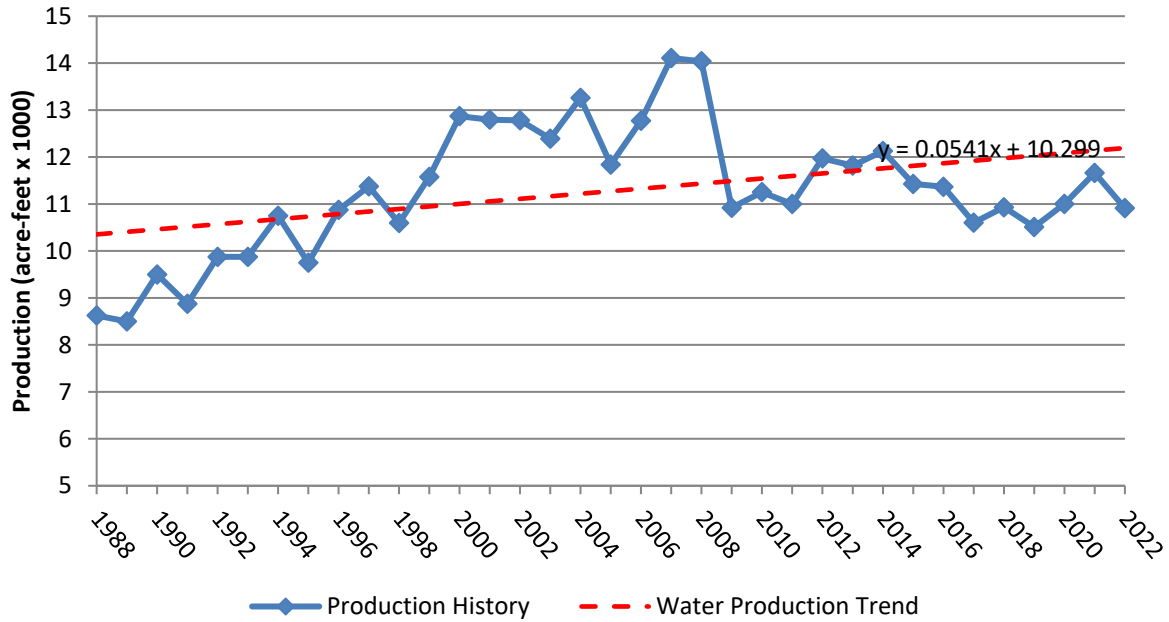
**1.4 Water Use Forecast**

From 1988 to 2009, demand has increased at an average rate of 262 acre-feet per year as shown in Figure 1.3. However, from 2007 through 2022, overall usage in the Carson City area

decreased at a rate of about 1.4 percent per year. This was also during the great recession where population decreased significantly. Another very important factor that shows up in this chart is that Carson City raised its rates in the fall of 2013 and again in 2020 which greatly affected the consumption and decreased the gpcpd, especially in the residential use. Because of this, the production forecast in this plan is based on the 34-year period rather than the short-term. Also, often times water consumption will return back to “normal” a few years after conservation takes place if the conservation is due to a change in water rates, also known as “rate shock”. This is important to track in future updates to this plan.

**FIGURE 1.3**

Water Production 1988 through 2022



Using the 34-year trend line shown in Figure 1.3, approximately 0.5% increase per year to predict future demand, projected production through 2040 is as shown in Table 1.5.

**TABLE 1.5**

Projected production for 2022 to 2040 based on Figure 1.3 trend line

Year	Production (AF)
2022	10,912
2023	10,921
2024	10,935
2025	10,953
2026	10,976
2027	11,003
2028	11,035
2029	11,072
2030	11,113
2031	11,158
2032	11,208
2033	11,263
2034	11,322
2035	11,386
2036	11,455
2037	11,528
2038	11,605
2039	11,687
2040	11,774

Table 1.6 shows Carson City population estimates from the “Nevada County Population Projections 2021-2040” report created by the Nevada Department of Taxation.

**TABLE 1.6**

Population estimate 2022 to 2040

<b>Year</b>	<b>Population</b>
2022	56953
2023	57264
2024	57609
2025	57922
2026	58215
2027	58486
2028	58731
2029	58947
2030	59153
2031	59346
2032	59528
2033	59694
2034	59845
2035	59979
2036	60100
2037	60201
2038	60284
2039	60346
2040	60391

Assuming that the demand continues to be 157 gpcd, projected metered water use for 2023 through 2040 is shown in Table 1.7.

**TABLE 1.7**

Projected metered use for 2023 through 2040 based on State Demographers population estimates

<b>Year</b>	<b>Metered Use (AF)</b>
2023	10,071
2024	10,131
2025	10,186
2026	10,238
2027	10,285
2028	10,329
2029	10,367
2030	10,403
2031	10,437
2032	10,469
2033	10,498
2034	10,524
2035	10,548
2036	10,569
2037	10,587
2038	10,602
2039	10,613
2040	10,621

The production estimate from the trend line (Table 1.5) and the production estimate derived from the October 2017 State Demographers population estimates and current estimated gpcd (Table 1.7) provide a range for estimating future water needs. However, the estimate based on the latest demographer’s report and gpcd may be more accurate due to the fact that much of the trend line data predates conservation efforts.

## **SECTION 2 – CONSERVATION INCENTIVES AND MEASURES**

Conservation incentives by definition are those things that increase awareness and encourage conservation. There are three general categories of conservation incentives: Educational, Financial, and Regulatory.

A conservation measure is a device or practice that reduces water consumption. Conservation measures are divided into two fundamental categories: (1) hardware or equipment, and (2) behavior or management practices. Examples of hardware measures include low-volume toilets and irrigation rain sensors. Examples of behavioral measures include not using the toilet as a trash can and watering lawns less frequently. Examples of management measures include the reuse of treated effluent and rebate programs. Some conservation measures are mandated by state and/or federal laws and others are voluntarily implemented by local water purveyors and/or customers.

This section discusses the incentives and measures currently in place or planned for future implementation in the Carson City service area. Incentives and measures discussed include:

- Water Rates (existing incentive)
- Ordinances (existing incentive)
- Educational materials (existing incentive)
- Plumbing standards (existing incentive)
- Landscape code (existing incentive)
- Plumbing Retrofits
- Watering schedule (existing measure)
- Leak detection, Meter Accuracy, and Pressure Management (existing measure)
- Effluent reuse (existing and proposed measure)
- Drought plan (existing measure)

### **2.1 Water Rates**

Carson City uses an inclining block rate structure that could be considered a financial conservation incentive. With inclining block rate structures the unit price for water increases as the volume consumed increases. The service charge rate schedules and block rate charges for the Carson City service area are shown in Tables 2.1 and 2.2.

**TABLE 2.1**

Monthly residential and commercial service charges (effective 7/1/2023)

<b>Meter Size</b>	<b>Residential/Commercial</b>	<b>Multifamily</b>
5/8"	\$30.83	\$10.92 per unit
1"	\$46.92	
1-1/2"	\$70.03	
2"	\$87.12	
3"	\$127.34	
4"	\$167.56	
6"	\$247.98	
10"	\$616.61	



**TABLE 2.2**

Monthly residential and commercial commodity charges (per 1000 gallons)

Residential Usage		Charge	Other Users	
First	5,000 gallons per month	\$1.98	Commercial	\$3.98 per 1000 gallons
Next	25,000 gallons per month	\$3.45	Multifamily	\$2.24 per 1000 gallons
Over	30,000 gallons per month	\$5.53	Industrial Manufacturing	\$4.17 per 1000 gallons

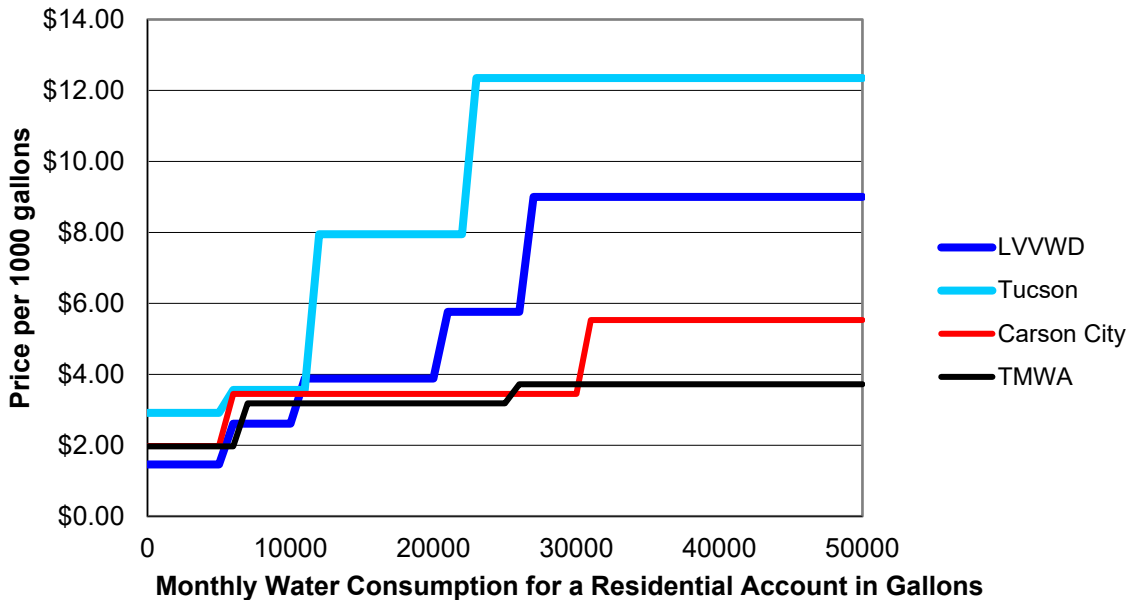
**2.1.1 Analysis of Rate Structure (NRS 540.141.2)**

Although marginal prices (see Figure 2.1) are important, the average price for water is what water customers see reflected in their bills. Because consumers respond to what they see on their monthly bill, the most effective inclining block rate structures are those that send a strong price signal to customers as consumption increases.

Average prices are most effective when they increase at higher levels of consumption. The average price curves shown in Figure 2.2 compare the curve for Carson City with those of the Las Vegas Valley Water District (LVVWD), City of Tucson Arizona, and Truckee Meadows Water Authority (TMWA). The comparison shows that in Carson City, the average price per unit of water decreases until users exceed 30,000 gallons; above 30,000 gallons the average price of water increases. In Tuscon, the average price begins to increase much earlier at 11,000 gallons, much earlier than Carson City. The point at which the average price begins to increase sends a signal to water users that water use beyond that point will be more expensive.

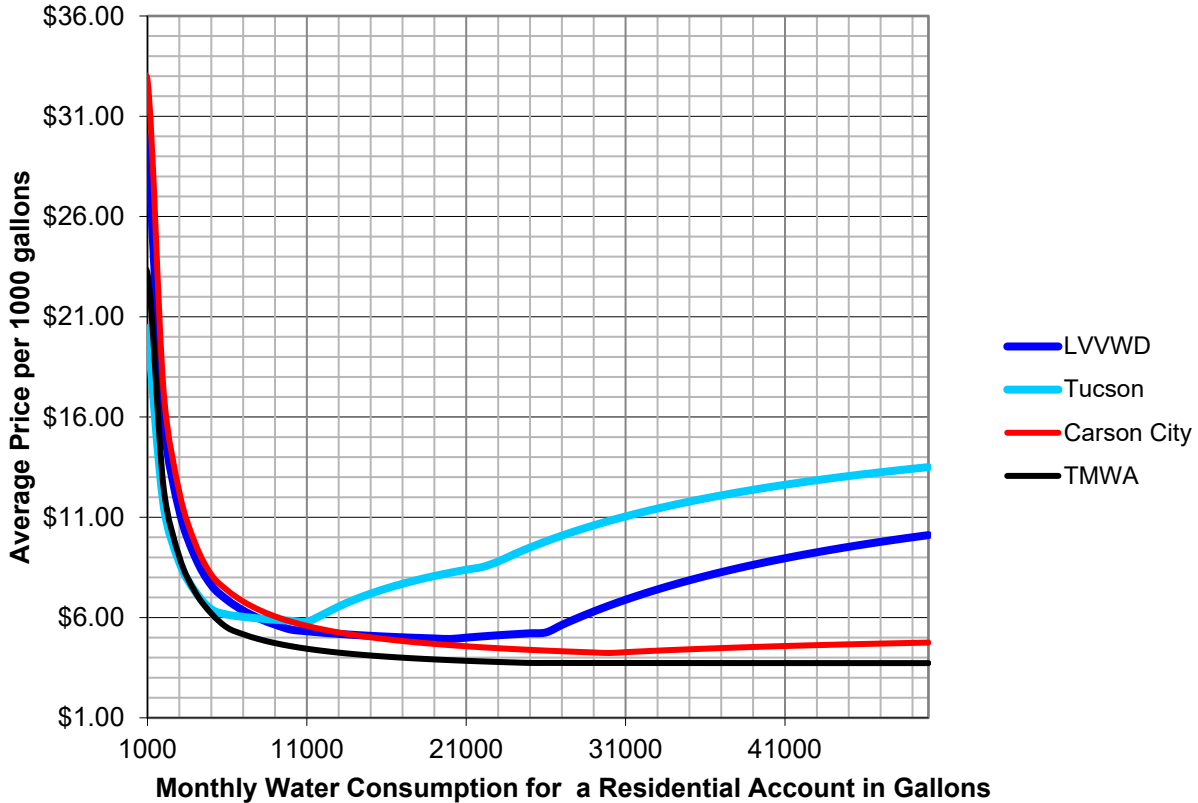
**FIGURE 2.1**

Carson City Marginal Price Curve Comparison as of August 2023



**FIGURE 2.2**

Carson City Average Price Curve Comparison as of August 2023



Not all systems can structure their rates to achieve the same sharp increase in average price for high water usage like Tucson. Each system has to implement rates that balance conservation with revenue and demographic needs. The Carson City rate schedule accounts for system needs while sending a price signal to customers who exceed average use levels.

It is difficult at this time to estimate the amount of water that will be conserved as a result of the inclining block rates, or if conservation limits have been reached. The Carson City rate structure has been in place since 2017.

**2.2 Ordinances and Enforcement**

Carson City has enacted ordinances prohibiting water waste and limiting irrigation. The ordinances are included in Appendix F.

**2.3 Educational Materials and Programs**

Carson City has developed conservation objectives that include public education. Educational materials in the form of pamphlets that encourage reduction in lawn size and provide general conservation measures are available at the public works office, on the Carson City website <http://carson.org/government/departments-g-z/public-works/water>, and through periodic mail distribution. These pamphlets are shown in Appendix A.

Landscape guides are useful to water customers who need information regarding water friendly landscapes. There are two excellent landscape guides available online that are well suited to

the Carson City area. One is the guide created by Truckee Meadows Water Authority (TMWA). It can be found at: [http://www.tmwlandscapeguide.com/landscape\\_guide/interactive/index.php](http://www.tmwlandscapeguide.com/landscape_guide/interactive/index.php). Another excellent guide created by the University of Nevada Cooperative Extension is the Home Landscaping Guide for the Tahoe Basin. The guide was designed specifically to help homeowners landscape their property in the most environmentally sensitive way. The guide can be found at: <http://www.unce.unr.edu/publications/files/nr/2006/eb0601.pdf>.

Educational materials encourage changes in water use habits. Table 2.3 shows U.S. Environmental Protection Agency (EPA) estimates for residential water use by fixtures and appliances. The average Carson City residential gpcd of 113 is less than mid-range according to the EPA estimates. With the current population of 55,188, a minor reduction in the use of each fixture and appliance could save a substantial amount of water.

Carson City Public Works has implemented an Open House Day in recent years; in May of 2023 this program was expanded to include two days of visits by 5<sup>th</sup> graders in area elementary schools. As part of this program, the Utility Division educated the students on the importance of water conservation measures.

**TABLE 2.3**

Range of Residential Water Use in Gallons per Day (EPA National Estimates)

Use	Per Person (Low)	Per Person (High)
Toilets	6.4	48.00
Showers	7.50	75.00
Baths	6.00	10.00
Washing Machine	9.00	25.00
Dish Washer	1.00	4.50
Kitchen Faucet	1.00	15.00
Bathroom Faucet	1.00	9.00
Landscape	12.2	162.6
<b>Total</b>	<b>44.1</b>	<b>349.1</b>

If water customers were to reduce use by just 10 gallons per day, millions of gallons of water per year could be saved. Table 2.4 shows a range of potential savings depending on different customer participation levels.

**TABLE 2.4**

Potential Residential Conservation Resulting from Education

% of Users Consuming 190 gallons/day	New gpcd Average (gal)	Amount Conserved Annually (AF)
25	217.5	157
50	205.0	313
75	192.5	470

\*Table assumes current population of 55,188

**2.4 Plumbing Standards (NRS 540.151.1(b))**

The most recent Federal plumbing standards in Table 2.5 apply to the Carson City service area. California’s standards are also included in the table. In the event Carson City implements a fixture retrofit program, the City could choose to use the California standards since they meet or

exceed the Federal standards. The use of California standards could potentially allow for greater water savings.

In 2006, the U.S. Environmental Protection Agency (EPA) created the [WaterSense Program](#). This voluntary national program certifies products that use 20 percent less water than the federal minimum without sacrificing performance. WaterSense certified fixtures include dual-flush toilets and 1.28 gpf toilets, which are lower than the federal maximum flow rate of 1.6 gpf. Since then, California, Georgia, Texas, and most recently Colorado have matched the EPA WaterSense flow rate criteria in creating their state efficiency standards.

**TABLE 2.5**

Federal and California Plumbing Standards

Device	FEDERAL ENERGY POLICY ACT (FEPA) AND NEVADA'S CURRENT STANDARDS		CALIFORNIA	
	Manufacture	Effective Date	Sale and Installation	Effective Date
Shower Heads	2.5 gpm*	1/1/94	2.5 gpm	1/1/2014
Lavatory Faucets	2.5 gpm	1/1/94	2.2 gpm	1/1/2014
Sink Faucets	2.5 gpm	1/1/94	2.2 gpm	1/1/2014
Metering Faucets	*	1/1/94	†	7/1/92
Tub Spout Diverters	Not included in FEPA		0.1 to 0.3‡	3/20/92
Residential Toilets	1.6 gpf§	1/1/94	1.28gpf	1/1/2014
Urinals	1.0 gpf§	1/1/94	1.0 gpf	1/1/92

<http://www.ncsl.org/research/environment-and-natural-resources/water-efficient-plumbing-fixtures635433474.aspx#standards>

\* Gallons per minute.

† Hot water maximum flow rate range from 0.25 to 0.75 gal/cycle and/or from 0.5 gpm to 2.5 gpm, depending on controls and hot water system.

‡ 0.1 (new), to 0.3 gpm (after 15,000 cycles of diverting).

§ Gallons per flush.

**2.5 Landscape Code (NRS 540.151.(c))**

The Carson City landscape code applies to the following new development:

- Multi-family residential with 3 or more units
- Institutional uses
- Commercial uses
- Industrial uses
- Public uses

The code includes provisions for irrigation, tree and plant types, mulches, turf, and maintenance. The following summarizes code requirements specifically related to conservation:

1. Well planned irrigation systems with separate irrigation zones based on water needs.
2. Automatic irrigation components that conserve water.
3. Turf standards that minimize the need for irrigation and reduce runoff. This includes slope limitations, buffer zones, and limitations on turf size. Turf size limitations are the following:

Development Area	Permitted Turf Area
Less than 5 acres	50%
5 acres to less than 10 acres	40%
10 acres to less than 15 acres	30%
15 acres or larger	25%

4. Approved lists of plants and trees that are indigenous to arid regions.
5. Mulch requirements that will keep the soil cool and prevent or limit evaporation.
6. Maintenance requirements that will ensure that the landscape will continue to function as originally planned.

A copy of the code is included in Appendix I.

## 2.6 Plumbing Retrofits (NRS 540.151.1(b))

Literature distributed by Carson City PWWD encourages the retrofit of plumbing fixtures. Even though the Federal Energy Policy Act (FEPA) has mandated the manufacture and installation of efficient plumbing fixtures since 1994, there are still inefficient fixtures and appliances in use.

Table 2.6 includes physical housing characteristics for occupied housing units from the 2012-2016 American Community Survey for Carson City. The table shows the number and percentage of the total of houses built per decade from pre-1939 to present. The table can be used to estimate the number of homes that could benefit from plumbing retrofits.

**TABLE 2.6**

Housing Data for the estimated 23,459 existing houses in Carson City

Year Structure Built	Occupied Housing Units	Number of Houses
2014 or later	0.0%	0
2010 to 2013	1.0%	244
2000 to 2009	11.3%	2,657
1990 to 1999	20.9%	4,893
1980 to 1989	19.7%	4,616
1970 to 1979	29.8%	7,000
1960 to 1969	12.4%	2,919
1950 to 1959	2.8%	660
1940 to 1949	1.0%	231
1939 or earlier	1.0%	239

Source: U.S. Census Bureau

Table 2.7 shows the capacity of older plumbing fixtures and the potential water savings that could result from the retrofit of these fixtures. The assumed average household size for the table is 2.43 persons per U.S. Census household data for Carson City.

**TABLE 2.7**

Potential Plumbing Retrofit Water Savings

Fixture*	Fixture Capacity	WATER USE (gpd)		WATER SAVINGS (gpd)	
		Per Capita	Per Household**	Per Capita	Per Household**
<b>Toilets***</b>					
Efficient	1.5 gal/flush	6.0	14.6	N/A	N/A
Low-Flow	3.5 gal/flush	14.0	34.0	8.0	19.4
Conventional	5.5 gal/flush	22.0	53.5	16.0	38.9
Conventional	7.0 gal/flush	28.0	68.0	22.0	53.5
<b>Showerheads†§</b>					
Efficient	2.5 [1.7] gal/min	8.2	19.9	N/A	N/A
Low-Flow	3.0 to 5.0 [2.6] gal/min	12.5	30.4	4.3	10.5
Conventional	5.0 to 8.0 gal/min	16.3	39.6	8.1	19.7
<b>Faucets†§</b>					
Efficient	2.5 [1.7] gal/min	6.8	16.5	N/A	N/A
Low-Flow	3.0 [2.0] gal/min	8.0	19.4	1.2	2.9
Conventional	3.0 to 7.0 gal/min	13.2	32.1	6.4	15.6
<b>Fixtures Combined</b>					
Efficient	N/A	21.0	51.0	N/A	N/A
Low-Flow	N/A	34.5	83.8	13.4	32.6
Conventional	N/A	54.5	132.4	33.5	81.4

Source: Amy Vickers, "Water Use Efficiency Standards for Plumbing Fixtures: Benefits of National Legislation", *American Water Works Association Journal*, Vol 82 (May 1990): 53

\*Efficient = post-1994, Low-Flow = post-1980, Conventional = pre-1980;

\*\*Assumes 2.43 persons per household.

\*\*\*Assumes four flushes per person per day. Does not include losses through leakage.

†For showerheads and faucets: maximum rated fixture capacity [measured fixture capacity]. Measured capacity equals about 2/3 the maximum.

§Assumes 4.8 shower-use-minutes per person per day and 4.0 faucet-use-minutes per person per day.

Table 2.8 provides an estimate of potential water savings by combining information from both tables 2.6 and 2.7. Table 2.8 also assumes the following:

- 2.43 persons per household
- All fixtures in the homes will be retrofitted
- The 2012-2016 American Community Survey is accurate

The estimate shown is likely high since many homes may have already been retrofitted and the savings from those retrofits has already occurred. However, the table demonstrates that a substantial amount of water can be saved by retrofitting older homes with more efficient fixtures.

**TABLE 2.8**

Estimates of Potential Retrofit Water Savings for Carson City

Year Structure Built	Number of Houses	WATER SAVINGS (gpd)				
		Toilets	Shower heads	Faucets	Per Household	Total for all Homes
1980 to 1989	4,616	19.4	11.0	3.1	34.5	159,252
1979 or earlier	11,049	48.45	20.7	16.4	85.6	945,794
<b>Grand Total</b>						<b>1,105,046</b>

Total estimated potential savings from Table 2.8 is 1,238 AF annually.

**2.7 Watering Schedule**

Per Carson City Municipal Code Ordinance 12.01.130, water regulations are in effect from June 1<sup>st</sup> to September 30<sup>th</sup>. During this period, no watering is allowed between 10 a.m. and 6 p.m. daily and no watering is allowed on Mondays.

The schedule is based on the odd/even address system. Odd addresses water on Tuesday, Thursday, and Saturday; even addresses on Sunday, Wednesday, and Friday.

Studies have shown that watering restrictions can reduce summertime water use by 20 to 30 percent depending upon climate and soils. The Carson City watering schedule is shown in Appendix B.

**2.8 Leak Detection, Meter Accuracy, and Pressure Management**

**2.8.1 Leak Detection**

Carson City Public Works has an ongoing leak detection program that includes the survey of approximately 25 miles of pipe per year (NRS 540.141.1(c)(1)). The amount of water savings from this measure can vary substantially from year to year due to the varying condition of the pipes surveyed. For example, a detailed water audit and leak detection program of 47 California water utilities found an average loss of 10 percent and a range of 30 percent to less than 5 percent of the total water supplied by the utilities. The July 1997 American Water Works Association Journal cites examples of more than 45 percent leakage.

Between 2018 and 2022, the average amount of unaccounted-for water in Carson City was approximately 8.4%. It is probable that some of the unaccounted-for water can be attributed to causes other than leaks. Water losses can also occur due to illegal connections, accounting procedure errors, theft, etc. Other losses can be due to beneficial uses such as main flushing and/or firefighting.

*Goal: Reduce unaccounted-for water to 7.5% for next planning period.*

**2.8.2 Water Loss Audit**

An AWWA Water Loss Audit was performed as required by NRS 540.145.1(a) for the most recent year of record, 2022. Results of the audit are summarized below.

Infrastructure Leakage Index:	2.9
Water Audit Data Validity Score:	62
Unit Apparent Losses:	2.2 gal/conn/day
Unit Real Losses:	56.8 gal/conn/day
Real Loss Cost Rate:	\$15.93/conn/year

The full results of the audit can be found in Appendix J.

*Goal: Improve Performance Indicators listed above by 5% over next planning period.*

**2.8.2 Meter Accuracy**

Carson City has an ongoing meter testing program. Typically, the utility either replaces or sends out meters to the manufacturer when inaccuracies are suspected.

**2.8.3 Pressure Management**

The Uniform plumbing code requires pressure regulating valves be installed on all water services. Carson City has installed and maintains over 45 prv's throughout the city to regulate pressure in 22 different pressure zones. The city maintains between 25 and 150 psi., the average being approx. 60-110 lbs.

**2.9 Effluent Reuse (NRS 540.141.1(d))**

Carson City has developed objectives aimed at maximizing effluent reuse. The objectives include the following:

1. Development of a land use application priority list for excess effluent, to be evaluated on an annual basis.
2. To continue to meet with existing effluent users on an annual basis to assess their current needs.
3. To continue to work jointly with the Nevada Division of Environmental Protection on Carson City's reuse system, ensuring continued compliance with reuse regulations and discharge limits.
4. To continue to meet the City's existing contractual agreements with current effluent users.

Currently, Carson City supplies treated effluent to 4 locations including:

- Eagle Valley Golf Course



- Empire Ranch Golf Course
- Silver Oak Golf Course
- Prison Farm Irrigation

The current total reuse program saves more than 1 billion gallons of potable water per year. In 2013 the Park, Cemetery, and Dust Control usage was removed from the program due to a reduction in wastewater flows, largely due to conservation measures and the drought. Currently effluent production is balanced with usage. In 2021 Carson City updated its Wastewater Effluent Reuse Plan with an eye towards eventual expansion of the program as usage increases with future growth. Table 2.9 below shows a breakdown of the recent reuse usage.

**TABLE 2.9**  
Reclaimed Wastewater Re-Use Summary 2010 – 2022

Effluent Reuse Summary 2010 - 2022														
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF
Eagle Valley Golf Course	792	778	920	828	778	801	857	727	863	826	918	1017	900	847
Empire Ranch Golf Course	536	531	680	765	938	832	837	602	800	643	809	915	806	746
Silver Oak Golf Course	428	420	486	465	425	451	504	300	506	439	525	525	510	460
Prison Farm Usage	1397	1510	968	780	1103	753	1208	1188	1450	1484	1553	1285	1417	1238
Subtotal	3153	3239	3054	2838	3244	2837	3406	2817	3619	3392	3805	3742	3633	3291
Pet Cemetery	3	3												3
Governors Field	23	21	25	21										23
Upper Centennial Field	23	19	25	17										21
Edmonds Park	70	73	85	85										78
Lone Mtn Cemetery	22	21	27	20	4									19
Butti Way Reuse Fill Stand		1			10	1								4
Butti Way Hydrant Station		3	1		4	1								2
Arrowhead Fill Stand	11	8	4											8
College Parkway Fill Stand	51	33	29	18										33
Subtotal Parks, other	203	182	196	161	18	2								127
Total AF Reuse	3356	3421	3250	2999	3262	2839	3406	2817	3619	3392	3805	3742	3633	3349
Potable Water Supplementation to Prison Farm					327	159	185				47	83	138	157

**2.10 Drought Plan**

The Carson City Drought Plan is included in Appendix D (NRS 540.141.1(e)).

**2.11 Additional Incentives and Measures**

The following incentives and measures may be considered for future implementation.

**2.11.1 School Visits.**

Local school children can be taught about conservation by local public works experts. There are a number of water models available that can be used to do this.

### 2.11.2 Education for Large Water Consumers.

Some water customers consume large amounts of water as a matter of necessity. Examples of these customers include hotels, golf courses, manufacturing companies and even large homes. Schools and parks may also use large amounts of water. Carson City Public Works can encourage these entities to use water more efficiently by offering conservation training or performing audits that help pinpoint sources of potential waste. The City can also sponsor courses offered by the Irrigation Association. These courses provide information on irrigation techniques including audits, design, installation and maintenance. Information for the Irrigation Association may be found at [www.irrigation.org](http://www.irrigation.org).

### 2.11.3 Submetering.

Submeters are meters installed in the main water lines that enter the individual units of multi-family properties (apartments, condominiums, duplexes, etc...) and/or subdivided areas of commercial, industrial, or institutional (ICI) facilities. Traditionally such properties and facilities were built with one master meter that served the entire complex or facility. Submeters can be used as a measure that property or company owners can use to conserve water and cut costs. Submetering has the following basic advantages:

- Decrease in overall water consumption of 18% to 39%<sup>1</sup>.
- Fair allocation of water costs to residents.
- Potential increase in property owners net operating income.
- Increase in water use efficiency.
- Proper allocation of water costs within ICI operations.

<sup>1</sup> *Submetering, RUBS, and Water Conservation*, prepared for the National Apartment Association and the National Multi Housing Council by Industrial Economics Incorporated, June 1999.

In residential applications, submeters can reduce consumption by making the individual users responsible for their own water bill. When water use by multi-family units is measured by a single meter, leaks in individual units often go undetected. Measuring the consumption of each unit may also discourage waste.

In ICI applications separate meters can be used for individual processes thereby encouraging use efficiency. Landscape irrigation can be monitored separately from facility use. In institutions such as universities, water costs can be directed to the departments that use the water. Manufactures can cut costs and determine which processes or equipment needs to be improved or replaced.

There are some disadvantages to submetering. Retrofits may be expensive and may prove to be economically unfeasible. Also, some of the financial incentive for landlords to install conservation devices (low-volume toilets and low-flow fixtures) is removed. These shortcomings, however, are not present in new construction. Whether new construction or retrofit, consideration should be given to both conservation and cost.

### 2.11.4 Conservation Committee.

A conservation committee made up of public works representatives, landscape specialists, and community leaders could be created. This committee is important because some conservation measures can have a broad affect on the utility as well as the community. The committee could

discuss proposed measures and incentives prior to implementation to be certain all contingencies have been considered.

2.11.5 Monitoring.

Monitoring water use helps the City focus on customers that consume the greatest amount. By establishing the sources of greatest use, specific customers could receive conservation training specifically related to their needs. High use customers could benefit from audits, leak detection, and technology upgrades. Also, commercial and industrial connections could be audited/inspected to determine if their consumption could be reduced. For all water customers there is financial incentive to cut waste. Currently, the Utility Billing Technicians monitor unusual consumption reports and contact the affected customer to advise them of potential leaks.

### SECTION 3 – CONSERVATION PLAN IMPLEMENTATION SCHEDULE

Table 3.1 shows the estimated schedule for the implementation of measures and incentives in the Carson City area (NRS 540.141.1(f)).

**TABLE 3.1**  
Plan Implementation Schedule

<b><i>Incentives and Measures</i></b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>
Water Rates	New Rates Approved	Approved 3% Rate Increase	Approved 3% Rate Increase	Approved 3% Rate Increase	Approved 3% Rate Increase	CPI Rate Increase, 3% Max	CPI Rate Increase, 3% Max
Effluent reuse	Implemented						
Educational Materials	Implemented			5 <sup>th</sup> Grade PW Day visits			
Landscape code	Implemented						
Leak Detection	Implemented						
Waste ordinance	Implemented						

Additional incentives and/or measures may be added as the success of those that are currently in place or proposed are evaluated. Also, existing programs may be expanded according to their effectiveness and need.

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## SECTION 4 – WATER SAVINGS SUMMARY

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This Section shows the estimated savings due to implementation of the conservation measures explained in Section 2.

### 4.1 Savings due to Rates

Carson City residents use approximately 113 gpcd and the average number of persons per home is 2.43. Based on these statistics, the average use per home per month is estimated to be 8,223 gallons. Based on rates effective July 1, 2023, the cost for this amount of water is \$51.08.

Carson City annual water rate increases of 3.0% were approved in 2020, with implementation starting July 1, 2021. The final increase is scheduled to occur July 1, 2024; beginning on July 1, 2025 rates will increase annually by the previous year's Consumer Price Index (CPI) increase (limited to 3% max). This represents a new approach to rate stability by Carson City and should help to maintain rate “pressure” as a conservation measure compared to rates that stabilize after an increase period.

### 4.2 Savings due to Effluent Reuse

Carson City Public Works currently saves approximately 3000 acre-feet of potable water per year by using treated effluent for landscape irrigation. The City is planning to use effluent at additional sites in the future as wastewater flows increase; the City saw a marked decrease in wastewater flows after the 2013 50% water rate increase. Currently the effluent reuse program is essentially balanced between production and reuse, addition of more sites would result in needed supplementation to meet demands negating any benefits.

### 4.3 Savings due to Educational Materials

It is difficult to estimate the effect of educational materials on water conservation. However, studies have shown that when public information is the only conservation measure offered by a utility, water savings range from 2 to 5 percent during non-crisis periods (American Water Works “*Water Conservation for Small and Medium-Sized Utilities*”). If this estimate of savings is accurate, the amount saved annually is somewhere between 285 and 713 acre-ft. Table 2.4 shows the approximate mid-range (470 AF) at 75% participation. Water savings of 2 to 5 percent would result in a gpcd reduction of 3.7 to 9.3 gallons.

#### **4.4 Savings due to Watering Schedules**

An odd/even watering schedule is currently in place in the Carson City system. Large cities, including Los Angeles, California and Austin, Texas have reported savings between 20 and 30 percent due to odd/even schedules and the associated restrictions (watering hours, etc...).

#### **4.5 Savings due to Plumbing Standards/Retrofits**

Carson City does not have a plumbing retrofit program in place but educational material distributed by the public works department encourages water customers to retrofit fixtures. Table 2.8 shows the potential conservation that could come from retrofits. It is difficult, however, to estimate additional savings since fixtures in many of the older homes in the service area may have already been retrofitted with newer more efficient fixtures. Table 2.8 provides an estimate of potential water savings based on the participation shown. The Table suggests that as much as 18.4 gpcd could be saved from a plumbing retrofit program however it is likely these savings have mostly already been realized.

#### **4.6 Savings due to the Landscape Code**

The landscape code applies only to new construction but it limits the amount of turf that can be installed on projects as specified in Section 2.7. The code states the following: *“The following standards for the use of turf in landscaping are intended to conserve water by minimizing the need for water for irrigation and minimizing irrigation water wasting.”*

Because the amount and type of new construction in Carson City cannot be predicted, it is difficult, if not impossible, to estimate the amount of water saved due to the code. However, demonstration garden experiments done by the East Bay Municipal Utility District (EBMUD) showed a 45 to 55 percent difference in water use between traditional landscapes and low-water-use landscapes. The main difference between the landscape types was a reduction in the use of turf.

#### **4.7 Savings due to Turf Rebates**

Lawn rebates have been shown to be very effective in Las Vegas. According to the Southern Nevada Water Authority (SNWA) the average savings has been 55 gallons per square foot of turf per year. The savings in Carson City would be approximately 25 gallons per square foot, an estimate based on current evapotranspiration rates from May through September. For this reason, Carson City is maintaining consideration of a turf rebate program if needed.

#### **4.8 Savings due to Leak Detection**

Carson City has a leak detection program that surveys approximately 25 miles of pipe per year. The system currently has an average of 7.5 percent unaccounted-for water. It should be noted, however, that all unaccounted-for water may not be attributed to leaks.

#### **4.9 Savings due to Waste Ordinances**

The existing waste ordinance has been in place for several years and no studies were done to compare current waste with that experienced in the past. Nevertheless, the ordinance acts as deterrence to unnecessary waste.

## **SECTION 5 – BENEFITS AND COSTS**

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The implementation of conservation measures and incentives can provide benefits to both water customers and the City. For water customers the benefits are as follows:

- Reduced energy use (lower hot water use)
- Reduced maintenance costs (due to low-water-use landscaping)
- Lower water bills

The City benefits from lower water use as well. The potential benefits include:

- Reduced water purchases
- Reduced pumping costs
- Lower chemical use
- Reduced or deferred facility capital expansion costs
- Reduced storage costs
- Reduced wastewater processing costs

There are also costs associated with conservation measures and incentives. Some potential costs include:

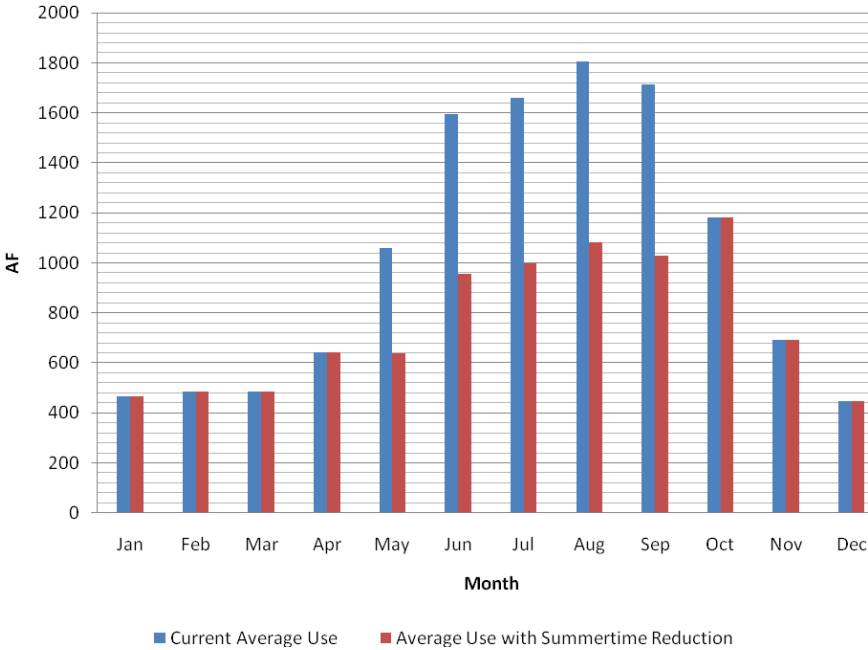
- Administration including managing programs and keeping records
- Field labor costs
- Material costs
- Marketing costs

Water savings must be realized in order to justify the cost of measures and incentives.

Figure 5.1 shows savings resulting from converting to low-water-use landscaping. A 40 percent decrease in summertime use (May through September) is assumed based on the experience of EBMUD. The figure shows the average monthly use shown in Figure 1.2 as well as the same data with a 40 percent reduction in summertime use. The reduction would result in an approximate 25 percent annual decrease in water use.

**FIGURE 5.1**

Projected water savings from Low-Water-Use Landscape Conversion





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## SECTION 6 – PLAN METRICS

NRS 540.141.2(a) requires that this plan include a provision relating to measures to evaluate the effectiveness of this plan. The plan metrics are described below.

The American Water Works Association Water Conservation Division January 2010 Subcommittee Report “*Water Conservation Measurement Metrics*” defines a metric as follows:

*“A metric is a unit of measure (or a parameter being measured) that can be used to assess the rate of water use during a given period of time and at a given level of data aggregation (e.g., system-wide, sector-wide, customer level, or end-use level). Another term for a metric is performance indicator.*

*Basically, a metric is a formula. In the context of measuring water use, there are very many possible metrics that can be formulated. Some examples of water usage metrics include: total water use per capita per day; residential indoor water use per dwelling unit per day; or average volume of water being used for flushing toilets.”*

The same report defines benchmarks:

*“A benchmark is a particular (numerical) value of a metric that denotes a specific level of performance, such as a water efficiency target. Sometimes a distinction is made between a benchmark (which indicates a current state of achievement) and a target which indicates a state of achievement expected at some time in the future.*

*Basically, benchmarks or targets are numerical values of the metric to which the calculated metric values are intended to be compared. Metrics and benchmarks can be defined in either absolute or relative terms. For example, some broadly defined benchmarks may reflect conservation goals of water utility, which are often expressed in relative terms, such as a 15 percent reduction of average annual per capita water use in 10 years.*

*Examples of specific absolute-value benchmarks include: Energy Policy Act of 1992 requirement that all residential toilets had to flush using no more than 1.6 gallons per flush; or  
Energy Star residential clothes washer standard water factor  $WF \leq 8.0$  gallons per cycle per cubic foot. Here, the values of 1.6 gallons and 8.0 gallons are benchmarks, which are expressed in absolute terms (i.e., quantity of water being used).”*

Regarding metrics, the most commonly used scaling variable is population served. The metric of aggregate use is the “per capita use” in gallons per capita per day (gpcd). This metric is obtained by dividing average daily production (in gallons) by total population served. This, along with the benchmarks shown in Tables 2.3, 2.5 and 2.7 and Appendix H, provide a means to measure the success of the measures and incentives discussed in this plan.

This plan will be reviewed and updated a minimum of every 5 years in accordance with NRS 540.131.4(c). When the plan is reviewed, the plan metrics and benchmarks can be used to determine the effectiveness or appropriateness (due to economics) of the measures and incentives included in this plan. The current residential use is 110 gpcd, which is already on the low end, which can be used as the basis for future reviews.

The Carson City PWWD recommends the following conservation objectives:

- Continue to implement through existing ordinance, an ultra-low-flow plumbing fixture program, thus gaining additional wastewater treatment capacity and water rights through their installation.
- To continue to review existing City ordinances and develop new ordinances to ensure that state-of-the-art water conservation fixtures are maintained.
- To encourage reduction in the size of lawns and the use of plants that are adapted to arid and semi-arid climates.
- To increase public awareness through public education, of the limited water supply in the State of Nevada and the need to conserve water.
- To continue to utilize a tiered rate structure that encourages and rewards conservation efforts.

Of the objectives listed, those expected to have the greatest effect on conservation are lawn size reduction and the plumbing program. PWWD has considered the possibility of implementing a lawn rebate program and found that a rate increase would be required to fund such a program, therefore making it not feasible at this time. Therefore PWWD will continue to encourage lawn size reduction through programs currently in place.

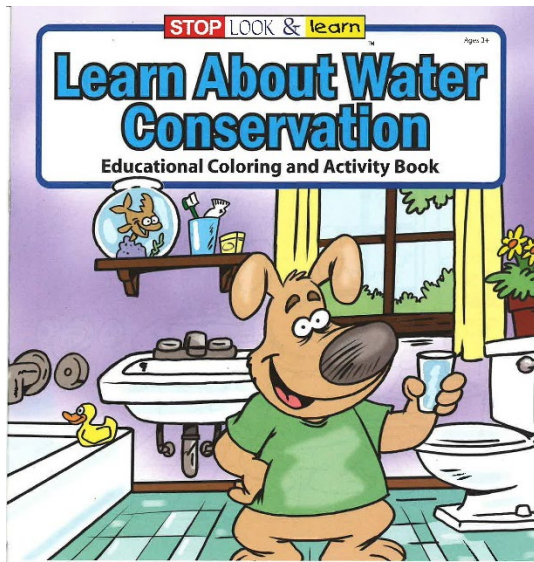
**Carson City Website**



Water Conservation Tips can be found on the Carson City Public Works Website at <https://www.carson.org/government/departments-g-z/public-works/divisions/water/conservation-tips>.

**Carson City Handouts**

Carson City maintains a stock of fliers and pamphlets at the Carson City Public Works main office, examples are shown below.



Carson City Public Works  
 3505 Butti Way  
 Carson City, NV 89701  
 (775) 887-2355



Water Loss in Gallons		
Leak This Size	Loss Per Day	Loss Per Month
•	120	3,600
•	360	10,800
•	693	20,790
•	1,200	36,000
•	1,920	57,600
•	3,056	92,880
•	4,296	128,880
•	6,640	199,200
•	6,984	200,520
•	8,424	252,720
•	9,888	296,640
•	11,324	339,720
•	12,720	381,600
•	14,952	448,560



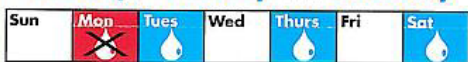
**Leaks Can Be Costly!**  
 CARSON CITY PUBLIC WORKS  
 3505 BUTTI WAY  
 CARSON CITY, NV 89701  
 (775) 887-2355

# When to Water

**Carson City Public Works asks that you be water smart.**

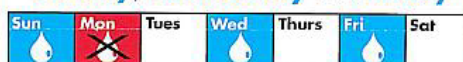
Per Carson City Municipal Code Ordinance #12.01.130 water regulations are in effect from **June 1<sup>st</sup> to September 30<sup>th</sup>**. During this time frame there is no watering between **10 a.m.** and **6 p.m.** daily and no watering on Mondays. Make sure you water on your assigned days and hours.

**Odd** addresses water on **Tuesday, Thursday and Saturday**



**Even** addresses water on

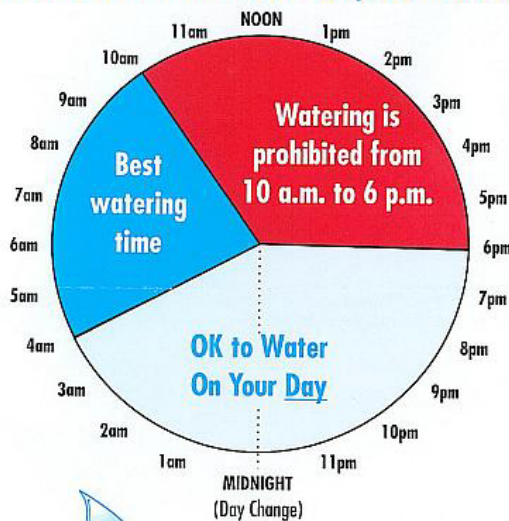
**Sunday, Wednesday and Friday**



**Last number of your address determines odd or even status.**

**NO WATERING ON MONDAYS**

Please don't water when temperatures are too high or conditions are windy.



Excessive watering can cause waste. City ordinance #12.01.120 prohibits waste of water running along the street, gutter or storm drain. Hand watering is allowed when flowers, shrubs and vegetables need a little extra. Remember there is **NO watering on Mondays**; make sure you make every drop count!



For information please call  
**775 887-2355**

CARSON CITY  
PUBLIC WORKS

**BE WATER SMART**

## APPENDIX C – CONSERVATION MEASURES

Conservation measures are divided into two types: (1) Hardware/Equipment and (2) Behavioral/Managerial. Each of these is subdivided into five categories of application: (1) Residential, (2) Landscape, (3) Industrial, Commercial, and Institutional (ICI) (4) Agricultural, and (5) Purveyor. The following conservation measures will be classified first by application and then by type.

### C.1 RESIDENTIAL CONSERVATION MEASURES

#### C.1.1 Behavioral Measures

C.1.1.1 Residential Water Audits. Water audits could target high use customers first and then be offered to all customers. The following elements should be part of an effective audit.

- Purpose for the audit.
- Estimation of use for all fixtures and appliances.
- Check for and repair leaks.
- Evaluation of Landscape (See "Landscape Conservation Measures).
- Evaluation of outdoor water use.
- Evaluate efficiency measures.
- Educate customers using available flyers.

An audit should take no more than 30 to 45 minutes.

C.1.1.2 Additional Measures. The sample pamphlets in Appendix A include additional behavioral conservation measures.

#### C.1.2 Hardware/Equipment Measures

The following is a list of devices/practices that will reduce water consumption in the home.

Measure	Description
<b><i>Bathroom/Kitchen Fixtures</i></b>	
Low-flow toilets	1.6 gallons per flush
Toilet retrofit devices	Bladders (bags), dams, early close flappers, other hardware and adjustments
Toilet leak repairs	Includes detection (dye tabs) and replacement of worn parts.
Low-volume shower heads	2.5 gallons per minute @ 80 psi
Showerhead retrofit devices	Includes temporary cutoff valves and restrictors.
Low-volume faucets	2.5 gallons per minute @ 80 psi
Faucet retrofit devices	Includes aerators, activation sensors, self closing and metered valves
Faucet maintenance	Includes washer replacement, repacking, tightening, and cleaning aerators
Water pressure reduction	Only needed if house pressure exceeds what's required
<b><i>High Efficiency Appliances</i></b>	
Clothes washers	27 gallons per load
Dish washers	4.5 gallons per load

## C.2 LANDSCAPE CONSERVATION MEASURES

### C.2.1 Behavioral Measures

C.2.1.1 Landscape Water Audits. Landscape water audits should be conducted on park and golf course irrigation systems and could be considered an option on residential irrigation systems, targeting high-volume users. The following should be included as part of a landscape audit:

- Purpose for the audit.
- Estimation of outdoor use based on meter records.
- Check for and repair leaks.
- Evaluation of Landscape (size, soil, amount of turf, types of plants)
- Evaluation of irrigation system (Timers, Use of drip, Precipitation amounts).
- Efficiency recommendations.
- Educate customers using available flyers

A residential landscape audit should take no more than an hour. Parks and golf courses could take substantially longer.

C.2.1.2 Xeriscape™. Xeriscape is a method of landscaping that employs low-water use plants, turf, ground covers, shrubs and trees. It includes careful planning, soil analysis, and irrigation system design.

C.1.1.3 Additional Measures. The sample pamphlets in Appendix A include additional behavioral conservation measures.

### C.2.2 Hardware/Equipment Measures

Landscape hardware measures consist of two basic groups: (1) Landscape materials and (2) Irrigation equipment.

Measure	Description
<b><i>Landscape Materials</i></b>	
Trees, plants, and grass	Should be well suited to climate and altitude and be drought tolerant
Organic mulch	Grass clippings, leaves, wood chips, bark, and pine needles. Organic mulches help to retain soil moisture and keep ground cool around plants.
Inorganic mulch	Boulders, gravel, pavers, decomposed granite, and stepping stones. Inorganic mulches are generally more for decorative purposes but they reduce the amount of trees, plants, and turf thereby conserving water.
Compost	Made of manure or biosolids and wood, straw, grass, and leaves. Helps plants stay healthy and retains moisture in the soil.
<b><i>Irrigation Equipment</i></b>	
Valves	Should be sized to meet requirements and checked periodically for leaks
Sprinkler Heads	Should match water volume requirements of area being irrigated.
Sprinkler Nozzles	Should have proper arc of coverage and proper trajectory.
Irrigation Controllers	Should have required number of stations, programs, and starts. Also rain delays and sensor terminals.
Drip irrigation	Insures water is directed to where it's needed.

### C.3 INDUSTRIAL, COMMERCIAL, AND INSTITUTIONAL (ICI) CONSERVATION MEASURES

#### C.3.1 Behavioral and Hardware/Equipment Measures

C.3.1.1 ICI Water Audits. Since ICI water audits can require a substantial amount of time (4 hours or more), it may be necessary to have a private engineering firm hired by the water user conduct the audit. There is incentive for ICI customers to pay for audits since the results of an audit could translate into substantial savings. An ICI water audit should include the following elements:

- Support from ICI owners, managers, and employees
- Survey/Estimation of facility use based on meter records.
- Calculation of water-related costs.
- Evaluation of efficiency measures.
- Evaluation of payback periods for measures.
- Efficiency recommendations and implementation.
- Tracking and reporting system.

C.3.1.2 Manual Washing. Manual washing is cleaning done on surfaces with hoses and cloths.

<b>MANUAL WASHING</b>	
<b>Behavioral Measures</b>	<b>Hardware/Equipment Measures</b>
<ul style="list-style-type: none"> <li>• Surfaces should be swept or brushed off before using water to clean.</li> </ul>	<ul style="list-style-type: none"> <li>• High pressure low-volume hoses with automatic shut-off nozzles</li> <li>• High-pressure pumps, steam cleaners.</li> </ul>

C.3.1.3 Vehicle Washing. Vehicle washing includes manual washing and automated car washes or a combination of both.

<b>VEHICLE WASHING</b>	
<b>Behavioral Measures</b>	<b>Hardware/Equipment Measures</b>
<ul style="list-style-type: none"> <li>• Limit number of spray nozzles and set flow rates at lowest volume and pressure required.</li> <li>• Adjust nozzles in automated systems so that they take full advantage of gravity and position. Also make sure water shuts off after vehicles have passed.</li> <li>• Increase conveyor speeds or reduce rinse cycle time.</li> <li>• Sweep wash area before using water to clean.</li> <li>• Establish a regular maintenance schedule that includes checking for leaks and making repairs.</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling systems. These would include filters and storage tanks.</li> <li>• High pressure pumping systems.</li> </ul>

C.3.1.4 Kitchens and Restaurants. Kitchen and restaurant conservation is divided into four areas of application: (1) Food and drink preparation, (2) Dishwashing, (3) Garbage disposal and scraping trough, and (4) Ice making.

## FOOD AND DRINK PREPARATION

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Presoak and wash food service articles in basins instead of running water.</li> <li>• Reduce thawing of food with hot water unless required by law. If required use lower flow.</li> <li>• Avoid running water to melt ice in sinks.</li> <li>• Use full loads in dishwashers and other automated equipment.</li> <li>• Serve water only when requested by customers.</li> </ul>	<ul style="list-style-type: none"> <li>• Low-volume faucets</li> <li>• Hands-free foot pedal valves for faucets</li> <li>• On demand hot water dispensers</li> </ul>

## DISHWASHING

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Presoak utensils, dishes, and pots and pans in basins of water instead of using running water prior to loading dishwashing machines.</li> <li>• Scrape food off of plates rather than use running water.</li> <li>• Operate scraping troughs only while dishes are actually being washed.</li> <li>• Assess the water efficiency of the current dishwashing system to determine where improvements might be made.</li> <li>• Always wash full loads in automated machines.</li> <li>• Operate conveyor type dishwashers only when dishes are actually passing through the machine.</li> <li>• Verify that the dishwashing equipment is using the minimum amount of flow recommended by the manufacturer.</li> <li>• Since many older automated dishwashing systems are neither energy nor water efficient, evaluate the cost of retrofitting or replacing existing equipment.</li> <li>• Turn dishwashers off when not in use.</li> <li>• Routinely check all dishwashing equipment to ensure there are no leaks.</li> <li>• Post signs requesting that personnel minimize their use of utensils, dishes, and pots and pans to save water.</li> </ul>	<ul style="list-style-type: none"> <li>• Manual pre-wash sprayers with “dead man” shut off controls.</li> <li>• Low-flow spray heads on all sprayers.</li> <li>• New water efficient dishwashing equipment.</li> <li>• Electronic eye sensors that shut off conveyer type systems when dishes are not passing through the machine.</li> </ul>



### GARBAGE DISPOSER AND SCRAPING TROUGH

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Eliminate disposers and troughs.</li> <li>• Use the minimum acceptable flow rate on all machines.</li> <li>• Reuse wastewater in the mixing chamber of the disposer.</li> </ul>	<ul style="list-style-type: none"> <li>• Garbage strainers (instead of disposers)</li> <li>• Sensors that detect the amount of flow in a disposer and regulate flow accordingly.</li> <li>• Solenoid valves that turn water off when the disposer is off.</li> <li>• Flow regulators for disposer supply lines.</li> </ul>

### ICE MAKERS

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Use the minimum flow rate recommended by the manufacturer on water cooled icemakers.</li> <li>• Adjust machines to produce ice only when it's needed.</li> <li>• Collect spent cooling water and reuse it for non-potable purposes.</li> </ul>	<ul style="list-style-type: none"> <li>• Air-cooled icemakers.</li> <li>• Re-circulating systems for water-cooled icemakers.</li> <li>• Ice flake machines that use less bleed off than cube machines.</li> </ul>

C.3.1.5 Laundries and Laundromats. This section includes measures that are applicable in hotels, motels, hospitals, nursing homes, diaper services, restaurants, and coin operated Laundromats.

### LAUNDRIES AND LAUNDROMATS

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Operate equipment with full loads only.</li> <li>• Reduce water levels for partial loads.</li> <li>• Back flush filters or softeners only when necessary.</li> </ul>	<ul style="list-style-type: none"> <li>• Computer controlled rinse water reclamation systems.</li> <li>• Wash and rinse water treatment and reclamation systems.</li> <li>• Continuous batch washers.</li> <li>• Ozone laundry systems.</li> <li>• Horizontal axis washers.</li> </ul>

C.3.1.6 Swimming Pools. The measures in this section can be applied to commercial and residential swimming pools.

### SWIMMING POOLS

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Limit the frequency of pool refilling.</li> <li>• Cover the pool with an insulated cover when not in use to reduce losses due to heat and evaporation.</li> <li>• Reduce the level of the pool to avoid losses due to splashing.</li> <li>• Lower the pool temperature.</li> <li>• Back wash filters only when necessary. If backwash is timed, verify that frequency is efficient.</li> <li>• Regularly check pool for leaks and cracks. Keep pool and filter clean to avoid unnecessary backwashing.</li> </ul>	<p>There are no special equipment measures that would help conserve water in pools. It is important however that available equipment is efficient and used properly.</p>

C.3.1.7 Cooling Systems. This section includes measures for three types of cooling systems: (1) Single-pass, (2) Evaporative, and (3) Equipment. Single-pass cooling uses fresh water to cool without re-circulating any of the water used in the first pass. Evaporative coolers are used for cooling in commercial and residential applications and are commonly known as swamp coolers. Equipment cooling includes both single-pass and re-circulating systems that are used to cool equipment and machinery.

**SINGLE-PASS COOLING**

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>Reuse water for landscaping, vehicle washing, or another cooling application that allows for water to be at a higher temperature.</li> <li>Eliminate single-pass systems.</li> </ul>	<ul style="list-style-type: none"> <li>Air-cooled equipment (i.e. compressors, pumps, icemakers, etc...)</li> <li>Automatic controls that insure coolers only operate when needed.</li> </ul>

**EVAPORATIVE COOLING**

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>Regularly check for leaks in hoses and pan.</li> <li>Replace pads at least annually.</li> <li>Shut cooler off when building is unoccupied.</li> <li>Annually service the equipment by oiling moving parts and cleaning off accumulated scale or corrosion.</li> </ul>	<p>There are currently no equipment measures for evaporative coolers. The design of the coolers is relatively simple.</p>

**EQUIPMENT COOLING**

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>Reuse water in single pass systems for other cooling purposes. Examples of reuse include cooling molten materials, landscape, of boiler make-up water.</li> <li>Replace al single pass cooling systems with closed-loop systems or replace water-cooled equipment with air-cooled.</li> </ul>	<p>Equipment varies depending on application.</p>

C.3.1.8 Heating Systems. This section deals with conservation measures for boilers and steam generators which are used to heat large buildings and multiple-building facilities.

## HEATING SYSTEMS

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Regularly inspect systems for leaks and make repairs.</li> <li>• Insulate all piping.</li> <li>• Limit boiler bleed-off to a level that satisfies water quality requirements.</li> <li>• Discharge blow-down into an expansion tank instead of using cold water to cool it.</li> </ul>	<ul style="list-style-type: none"> <li>• Flow meters for make-up and blow-down valves.</li> <li>• Automatic controls to discharge blow-down.</li> </ul>

C.3.1.9 Leaks and Water Losses. This section covers water conservation measures relating to leaks and losses.

## LEAKS AND WATER LOSSES

Behavioral Measures	Hardware/Equipment Measures
<ul style="list-style-type: none"> <li>• Regularly check for leaks at all water connections. Keep in mind that higher pressure applications have more incidence of leakage.</li> <li>• Regularly check all vessels that contain water for cracks or bad seals.</li> <li>• Regularly check all heating and cooling systems.</li> <li>• Repair any leaks that are discovered.</li> </ul>	<ul style="list-style-type: none"> <li>• Leak detection equipment. This could include sonic or probe type equipment.</li> <li>• Any equipment used to stop a leak. This would depend on the material of the pipe or vessel that has a leak.</li> </ul>

C.3.1.10 ICI Maintenance Practices. This section reemphasizes maintenance conservation measures for ICI facilities that have been mentioned in previous sections. These measures should become standard procedure at all ICI facilities.

- Create a maintenance schedule that includes schedules for leak detection inspections and meter reading, and repair procedures.
- Monitor water-use records keeping track of any increases or decreases in use.
- Conduct water audits every one to three years.
- Shut off supply lines to areas that are not being used.
- Install pressure reducers where feasible.
- Keep a maintenance schedule to clean cooling and heating equipment regularly.
- Recycle and reuse water when feasible.
- Insulate all hot water pipes.
- Replace old equipment with water saving equipment.
- Install timers wherever possible.
- Educate employees on water saving techniques.

## C.4 GENERAL CONSERVATION MEASURES

This list of conservation behaviors is divided into four parts: (1) Home, (2) Landscaping, (3) Community, and (4) Miscellaneous.

### HOME BEHAVIORS

1. When washing dishes by hand, don't let the water run while rinsing. Fill one sink with wash water and the other with rinse water.

2. Evaporative coolers require a seasonal maintenance checkup. For more efficient cooling, check your evaporative cooler annually.
3. Run your washing machine and dishwasher only when they are full and you could save 1000 gallons a month.
4. Use the garbage disposal sparingly. Compost instead and save gallons every time.
5. Keep a pitcher of water in the refrigerator instead of running the tap for cold drinks, so that every drop goes down you not the drain.
6. Check your water meter and bill to track your water usage.
7. Wash your produce in the sink or a pan that is partially filled with water instead of running water from the tap.
8. Use a broom instead of a hose to clean your driveway or sidewalk and save 80 gallons of water every time.
9. If your shower can fill a one-gallon bucket in less than 20 seconds, replace it with a water efficient showerhead.
10. Collect the water you use for rinsing produce and reuse it to water houseplants.
11. We're more likely to notice leaky faucets indoors, but don't forget to check outdoor faucets, pipes, and hoses for leaks.
12. When you shop for a new appliance, consider one offering cycle and load size adjustments. They are more water and energy-efficient than older appliances.
13. Time your shower to keep it under 5 minutes. You'll save up to 1000 gallons a month.
14. Install low-volume toilets.
15. When you clean your fish tank, use the water you've drained on your plants. The water is rich in nitrogen and phosphorus, providing you with a free and effective fertilizer.
16. Put food coloring in your toilet tank. If it seeps into the toilet bowl, you have a leak. It's easy to fix, and you can save more than 600 gallons a month.
17. Plug the bathtub before turning the water on, and then adjust the temperature as the tub fills up.
18. Designate one glass for your drinking water each day. This will cut down on the number of times you run your dishwasher.
19. Don't use running water to thaw food.
20. Grab a wrench and fix that leaky faucet. It's simple, inexpensive, and can save 140 gallons a week.
21. When doing laundry, match the water level to the size of the load.
22. Teach your children to turn the faucets off tightly after each use.
23. Before you lather up, install a low-flow showerhead. They're inexpensive, easy to install, and can save your family more than 500 gallons a week.
24. Soak your pots and pans instead of letting the water run while you scrape them clean.

- 25.** Make sure you know where your master water shut-off valve is located. This could save gallons of water and damage to your home if a pipe were to burst.
- 26.** Turn off the water while you brush your teeth and save 4 gallons a minute. That's 200 gallons a week for a family of four.
- 27.** Make sure your toilet flapper doesn't stick open after flushing.
- 28.** Make sure there are aerators on all of your faucets.
- 29.** Install an instant water heater on your kitchen sink so you don't have to let the water run while it heats up. This will also reduce heating costs for your household.
- 30.** Cut back on rinsing if your dishwasher is new. Newer models clean more thoroughly than older ones.
- 31.** Bathe your young children together.
- 32.** Winterize outdoor spigots when temps dip to 20 degrees F to prevent pipes from bursting or freezing.
- 33.** Insulate hot water pipes so you don't have to run as much water to get hot water to the faucet.
- 34.** Drop that tissue in the trash instead of flushing it and save gallons every time.
- 35.** If your toilet was installed prior to 1980, place a toilet dam or bottle filled with water in your toilet tank to cut down on the amount of water used for each flush. Be sure these devices do not interfere with operating parts.
- 36.** Install water softening systems only when necessary. Save water and salt by running the minimum number of regenerations necessary to maintain water softness.
- 37.** Wash clothes only when you have a full load and save up to 600 gallons each month.
- 38.** Listen for dripping faucets and toilets that flush themselves. Fixing a leak can save 500 gallons each month.
- 39.** Cook food in as little water as possible. This will also retain more of the nutrients.
- 40.** Turn the water off while you shampoo and condition your hair and you can save more than 50 gallons a week.
- 41.** Choose new water-saving appliances, like washing machines that save up to 20 gallons per load.
- 42.** Select the proper size pans for cooking. Large pans require more cooking water than may be necessary.
- 43.** Turn off the water while you shave and you can save more than 100 gallons a week.
- 44.** To save water and time, consider washing your face or brushing your teeth while in the shower.
- 45.** For hanging baskets, planters and pots, place ice cubes under the moss or dirt to give your plants a cool drink of water and help eliminate water overflow.
- 46.** Throw trimmings and peelings from fruits and vegetables into your yard compost to prevent from using the garbage disposal.
- 47.** Keep a bucket in the shower to catch water as it warms up or runs. Use this water to flush toilets or water plants.

48. When you are washing your hands, don't let the water run while you lather.
49. Pre-treat stains before washing clothes to avoid re-washing.
50. Use the shortest wash cycle for lightly soiled clothes.
51. Check washing machine hoses regularly for leaks.
52. Do not pre-rinse dishes except in cases of sticky or burnt-on food.
53. Scrape off food with a utensil or used paper napkin when pre-cleaning for dishwasher.

## **LANDSCAPE BEHAVIORS**

1. Check your sprinkler system frequently and adjust sprinklers so only your lawn is watered and not the house, sidewalk, or street.
2. Avoid planting turf in areas that are hard to water such as steep inclines and isolated strips along sidewalks and driveways.
3. Plant during the spring or fall when the watering requirements are lower.
4. Minimize evaporation by watering during the early morning hours, when temperatures are cooler and winds are lighter.
5. Use a layer of organic mulch around plants to reduce evaporation and save hundreds of gallons of water a year.
6. Divide your watering cycle into shorter periods to reduce runoff and allow for better absorption every time you water.
7. Only water your lawn when needed. You can tell this by simply walking across your lawn. If you leave footprints, it's time to water.
8. Adjust your lawn mower to a higher setting. Longer grass shades root systems and holds soil moisture better than a closely clipped lawn.
9. Use the sprinkler for larger areas of grass. Water small patches by hand to avoid waste.
10. Use porous materials for walkways and patios to keep water in your yard and prevent wasteful runoff.
11. Direct downspouts and other runoff towards shrubs and trees, or collect and use for your garden.
12. Install a rain shut-off device on your automatic sprinklers to eliminate unnecessary watering.
13. Choose a water-efficient drip irrigation system for trees, shrubs and flowers. Watering at the roots is very effective, be careful not to over water.
14. Reduce the amount of grass in your yard by planting shrubs and ground cover with rock and granite mulching.
15. Remember to check your sprinkler system valves periodically for leaks and keep the heads in good shape.
16. Don't water your lawn on windy days. After all, sidewalks and driveways don't need water.
17. Water your plants deeply but less frequently to create healthier and stronger landscapes.

18. When watering grass on steep slopes, use a soaker hose to prevent wasteful runoff.
19. Group plants with the same watering needs together to get the most out of your watering time.
20. Remember to weed your lawn and garden regularly. Weeds compete with other plants for nutrients, light, and water.
21. While fertilizers promote plant growth, they also increase water consumption. Apply the minimum amount of fertilizer needed.
22. Avoid installing ornamental water features and fountains that spray water into the air. Trickling or cascading fountains lose less water to evaporation.
23. Buy a rain gauge to track how much rain or irrigation your yard receives. Check with your local water agency to see how much rain is needed to skip an irrigation cycle.
24. Teach your family how to shut off your automatic watering systems. Turn sprinklers off if the system is malfunctioning or when a storm is approaching.
25. Set a kitchen timer when watering your lawn or garden with a hose.
26. Next time you add or replace a flower or shrub, choose a low water use plant for year-round landscape color and save up to 550 gallons each year.
27. Use a screwdriver as a soil probe to test soil moisture. If it goes in easily, don't water. Proper lawn watering can save thousands of gallons of water annually.
28. Avoid over-seeding your lawn with winter grass. Once established, ryegrass needs water every three to five days, whereas dormant Bermuda grass needs water only once a month.
29. Landscape with Xeriscape trees, plants and groundcovers. Call your local conservation office for more information about these water thrifty plants.
30. If you have an evaporative cooler, direct the water drain to a flowerbed, tree, or your lawn.
31. Leave lower branches on trees and shrubs and allow leaf litter to accumulate on top of the soil. This keeps the soil cooler and reduces evaporation.
32. Start a compost pile. Using compost when you plant adds water-holding organic matter to the soil.
33. Use sprinklers that throw big drops of water close to the ground. Smaller drops of water and mist often evaporate before they hit the ground.
34. More plants die from over-watering than from under-watering. Be sure only to water plants when necessary.
35. Water only as rapidly as the soil can absorb the water.
36. Aerate your lawn. Punch holes in your lawn about six inches apart so water will reach the roots rather than run off the surface.

## **COMMUNITY BEHAVIORS**

1. Encourage your school system and local government to help develop and promote a water conservation ethic among children and adults.
2. Make suggestions to your employer to save water (and dollars) at work.

3. Support projects that use reclaimed wastewater for irrigation and other uses.
4. Encourage your friends and neighbors to be part of a water-conscious community.
5. Pick-up the phone and report significant water losses from broken pipes, open hydrants and errant sprinklers to the property owner or your water management district.

#### **MISCELLANEOUS BEHAVIORS**

1. Install covers on pools and spas and check for leaks around your pumps.
2. Periodically check your pool for leaks if you have an automatic refilling device.
3. Use a commercial car wash that recycles water.
4. Don't buy recreational water toys that require a constant flow of water.
5. Use a grease pencil to mark the water level of your pool at the skimmer. Check the mark 24 hours later. Your pool should lose no more than  $\frac{1}{4}$  inch each day.
6. When the kids want to cool off, use the sprinkler in an area where your lawn needs it the most.
7. Make sure your swimming pools, fountains, and ponds are equipped with re-circulating pumps.
8. Bathe your pets outdoors in an area in need of water.
9. While staying in a hotel or even at home, consider reusing your towels.
10. When backwashing your pool, consider using the water on your landscaping.





**CARSON CITY PUBLIC WORKS  
PROCEDURE**

Ken Arnold, Public Works  
Operations Manager  
Revised: 02-06-07  
Lack of Water Plan

**CARSON CITY UTILITIES  
CONTINGENCY PLAN  
(For dealing with Water Demand that exceeds Supply capabilities)**

This plan may be put into action upon authorization from the City Manager and /or designee in-order to avoid a city wide water emergency. It is anticipated that most instances of implementation of the plan would be for very short time frames.

- City Manager or designee notified by Utilities Operations Manager or designee when it is determined that water demand is exceeding production capability in one or more pressure zones and/or storage levels are at the critical level (see attached Standard Operating Procedures for Storage Reservoirs). And that standard operating procedures such as adjusting pressure zones, increasing patrols to ensure compliance with restrictions, all production facilities are in operation and that all surface water that can be obtained from other users has been diverted to the treatment plant have yielded no effect.
- City Manager or designee notified by Utilities Operations Manager or designee that the following plan should be implemented.
- City Manager or designee approves and directs that Plan be implemented.

**Voluntary cut backs**

**STAGE 1**

- Contact the Carson City Parks Department and request that they voluntarily cut back outdoor irrigation of City parks, planters and City buildings as much as possible until further notice.
- Contact the Carson City School District and request that they voluntarily cut back outdoor irrigation as much as possible until further notice.
- Contact State Buildings and Grounds and request that they voluntarily cut back outdoor irrigation as much as possible until further notice.
- Contact Legislative Counsel Bureau Grounds Division and request that they voluntarily cut back outdoor irrigation as much as possible until further notice.

- Request that the Fire Department suspend all certification testing of Fire trucks and pumping equipment and suspend all drills with live water flow until further notice.
- Request that all residents in the affected areas voluntarily cut back outdoor irrigation as much as possible until further notice.

**Required reduction of potable water use**

**STAGE 2**

- Direct the Carson City Parks Department to **stop all** potable water irrigation of City parks, planters and City buildings until further notice.
- Contact the Carson City School District and direct them to **stop all** outdoor irrigation until further notice.
- Contact State Buildings and Grounds and direct them to **stop all** outdoor irrigation until further notice.
- Contact the Legislative Counsel Bureau Grounds Division and direct them to **stop all** outdoor irrigation until further notice.
- Direct the Carson City Fire Department to **stop all** certification testing of Fire trucks and pumping equipment and **stop all** drills with live water flow until further notice.
- Require all residents in the affected areas to **stop all** outdoor irrigation until further notice.
- Notify the media of additional watering restrictions in the affected areas and ask for everyone's assistance in conserving as much water as possible.

**STAGE 3**

- **Citywide ban on all outside irrigation until further notice!!!**

**WATER**

- [www.energystar.gov](http://www.energystar.gov)

**DROUGHT**

- <https://droughtmonitor.unl.edu/CurrentMap.aspx>

**LANDSCAPE**

- <https://extension.unr.edu/publications.aspx>
- <https://tmwa.com/water-efficient-landscape-guide/>

**EDUCATION**

- [www.wateruseitwisely.com](http://www.wateruseitwisely.com)
- <https://wrcc.dri.edu/washoeEt/>

**INSTITUTIONAL**

- [www.douglascountynv.gov/sites/main/index.cfm](http://www.douglascountynv.gov/sites/main/index.cfm)
- [www.lvwd.com](http://www.lvwd.com)
- [www.snwa.com](http://www.snwa.com)
- [www.co.washoe.nv.us/water\\_dept/rwpc/regionalplm](http://www.co.washoe.nv.us/water_dept/rwpc/regionalplm)
- <https://tmwa.com>
- [www.cabq.gov](http://www.cabq.gov)
- [www.ci.phoenix.az.us/WATER/wtrteach.html](http://www.ci.phoenix.az.us/WATER/wtrteach.html)
- [www.owue.water.ca.gov/leak/faq/faq.cfm](http://www.owue.water.ca.gov/leak/faq/faq.cfm)

**LEAK DETECTION**

- [www.who.int/docstore/water\\_sanitation\\_health/leakage/begin.html](http://www.who.int/docstore/water_sanitation_health/leakage/begin.html)

**12.01.110 - Findings.**

The Carson City board of supervisors finds that a severe water shortage exists within Carson City due to the fact of population growth and the fact that only a specified amount of water can be withdrawn from Eagle Valley. Therefore, pursuant to the police power vested in Carson City, the following sections are hereby enacted: 12.01.120 and 12.01.130.

*(Ord. 1982-8 § 2 (part), 1982).*

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**12.01.120 - Waste of water prohibited.**

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It is unlawful for anyone connected to the city water system to waste water. For the purpose of this section, "waste" means any excessive usage which causes water to run into or along any street, alley, storm drainage system, or into or upon another's property; provided nothing in this section shall be construed as to apply to the accidental breaking of any hose, water pipe, or other irrigation device unless same is not abated within 2 hours after personal notice of such break is given the person owning, controlling or maintaining the same or having any pecuniary interest therein. If such breaks are not repaired or the water turned off within the specified time, it shall be the duty of the utilities director or his/her designee to cause the water to be shut off, and it is unlawful for any person to again turn on such water until proper repairs have been made. If personal notice is unable to be given, the water shall be immediately shut off by the public works director or his/her designee and a notice shall be placed on the front door stating the reason(s) for said shutoff. Each and every request for the water to be turned on will require the payment of \$25.00 which the city will add to the monthly bill.

Exception: Car washing by civic or philanthropic groups may receive written approval from the public works director or his/her designee when it is determined that said usage will not be detrimental to the city's water situation.

*(Ord. 2008-8 § 7, 2008: Ord. 1999-14 § 5, 1999: Ord. 1991-12 § 8, 1991: Ord. 1987-18 § 1, 1987: Ord. 1982-8 § 2 (part), 1982).*

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**12.01.130 - Limitations on irrigation.**

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1.

From June 1st to October 1st of each year it is unlawful for any person to use water from public mains for the purpose of irrigating, regardless of method, lawns, gardens, trees, grass, shrubbery or other vegetation from ten a.m. to six p.m. or on any Monday. The board of supervisors may, by resolution, set a different length of limitation period and hours for restricted watering should circumstances so dictate. For the purposes of this section, a calendar day is defined as a 24 hour period, beginning at 12:01 a.m. and ending at midnight. Additionally, the following restrictions apply:

- A.** The irrigation of lawns, gardens, trees, grass, shrubbery or other vegetation located on premises having an odd-numbered address shall be limited to Tuesday, Thursday and Saturday effective June 1, 2005;
- B.** The irrigation of lawns, gardens, trees, grass, shrubbery or other vegetation located on premises having an even-numbered address shall be limited to Sunday, Wednesday and Friday effective June 1, 2005;
- C.** If unlawful irrigation is observed as noted under this section, and personal notification cannot be made, the utilities director or his/her designee may cause the water to be shut off and a notice shall be placed on the front door stating the reason for said shutoff.

**2.**

Exempted from this section are the following:

- A.** Carson City licensed commercial gardeners or caretakers who are on the premises at the time watering is taking place;
- B.** Vegetable gardens, flower beds, trees within 2 months of planting;
- C.** New lawns, for 21 days from planting or installation date, that have been planted or sodded prior to June 15th or after August 15th;
- D.** Complexes that file for and receive approval of an irrigation plan.
- E.** Residential customers adjusting and repairing their irrigation system during the non-watering times for a not to exceed time frame of 1 hour.

**3.**

Special exemptions from this section may be granted by the public works director or his/her designee subject to filing an appropriate application and the determination that the special request shall not be detrimental to the city's water situation.

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(Ord. 2008-8 § 8, 2008: Ord. 2004-16 § 1, 2004: Ord. 1999-14 § 6, 1999: Ord. 1993-44 § 8, 1993: Ord. 1991-12 § 9, 1991: Ord. 1990-9 § 1, 1990: Ord. 1988-8 § 1, 1988: Ord. 1987-18 § 2, 1987: Ord. 1982-8 § 2 (part), 1982).

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### Locate Your Meter

Most water meters will be located outside in front of your house next to the curb on the street under a steel or concrete lid.

### Reading Your Meter

There are two basic types of meters; a dial with a needle that measures in tenths of a cubic foot and a digital meter that measures from 100,000 down to 1 cubic foot. Most meters also have a small triangle on the face called a flow indicator. It will move when there is water passing through it. Read your meter from left to right.

### Measuring Water Use Activities

It is possible to measure the water use of certain activities. These activities include but are not limited to the following:

- Shower or bath use.
- Watering the lawn.
- Washing clothes or dishes.
- Flushing a toilet
- Washing a car

To measure the water use of an activity, do the following (in order):

1. Make sure all water off. This includes all faucets (inside and out), appliances, swamp coolers, or icemakers.
2. Write down the meter reading to two decimal places.
3. Perform the activity. Be sure to measure the amount of time in minutes that the activity required.
4. At the end of the activity read the meter again. Subtract the first meter reading from the second one. The result is the amount of water used for the activity in cubic feet. To convert to gallons multiply the result by 7.48. To determine how many gallons per minute were used divide the gallon amount by the number of minutes the activity required. You should now have the water used amount in *gallons per minute*.

### Detecting Leaks

1. Make sure all water off. This includes all faucets (inside and out), appliances, swamp coolers, or icemakers.
2. Write down the meter reading and time of day to the minute.
3. Wait at least an hour before reading the meter a second time. Make sure no water is used during the test. Read the meter at the end of the test and record the time to the minute. If the flow indicator is moving during the test you either have a leak or a meter malfunction.

4. Subtract the first meter reading from the second. Multiply the remainder by 7.48. The result is the amount of water in gallons that passed through the meter during the test period. Also record the time duration of the test.
5. Divide the amount of water by the number of minutes in the test. The result is the amount of water that went through the meter in *gallons per minute*.
6. To measure amount lost over time multiply the gallons per minute by the following:
  - 1,440 for gallons per day.
  - 43,920 for gallons per month.
  - 527,040 for gallons per year.
7. Locating a leak is a process of elimination. Shut off one toilet at a time at the wall. Go to the meter and check to see if the flow indicator (triangle) is still moving. If the triangle has stopped you have discovered the leak. If not go on to the next one and repeat the above steps.
8. Check your sprinkler system. Shut off the system at the anti siphon valve and check the meter.
9. Check your main service line. You will need to shut off the valve between your house and the meter. If the meter stops the leak is between the meter and the valve.
10. These steps can be repeated for every fixture and fitting in your home. In the event you cannot locate the leak, you should call a professional plumber to find and fix it.

**APPENDIX H – EPA Residential Benchmarks**

<b>Type of Use</b>	<b>Likely Range of Values</b>
<b>INDOOR USES</b>	
Average household size	2.0 – 3.0 persons
Frequency of toilet flushing	4.0 – 6.0 flushes per person per day
Flushing volumes	1.6 – 8.0 gallons per flush
Fraction of leaking toilets	0 – 30 percent
Showering frequency	0 – 1.0 showers per person per day
Duration of average shower	5 – 15 minutes
Shower flow rates	1.5 – 5.0 gallons per minute
Bathing frequency	0 – 0.2 baths per person per day
Volume of water	30 – 50 gallons per cycle
Washing machine use	0.2 – 0.5 loads per person per day
Volume of water	45 – 50 Gallons per cycle
Dishwasher use	0.1 – 0.3 Loads per person per day
Volume of water	10 – 15 gallons per cycle
Kitchen faucet use	0.5 – 5.0 Minutes per person per day
Faucet flow rates	2.0 – 3.0 gallons per minute
<b>OUTDOOR USES</b>	
Average lot size	5000 – 8000 square feet
Average house size	1200 – 2500 square feet
Landscape area	4000 – 5000 square feet
Fraction of lot size in turf	30 – 50 percent
Water application rates	1 – 5 feet per year
Homes with pools	10 – 25 percent
Pools evaporation losses	3 – 7 feet per year
Frequency of refilling pool	1 – 2 times per year



## **APPENDIX I – Landscape Code**

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Carson City Landscape Code is found within Carson City Municipal Code Title 18 Appendix – Carson City Development Standards – Division 3 - Landscaping

[https://library.municode.com/nv/carson\\_city/codes/code\\_of\\_ordinances?nodeId+TIT18\\_AppendixCADES\\_T\\_Div3LA](https://library.municode.com/nv/carson_city/codes/code_of_ordinances?nodeId+TIT18_AppendixCADES_T_Div3LA)

## **APPENDIX J – AWWA Water Loss Audit**

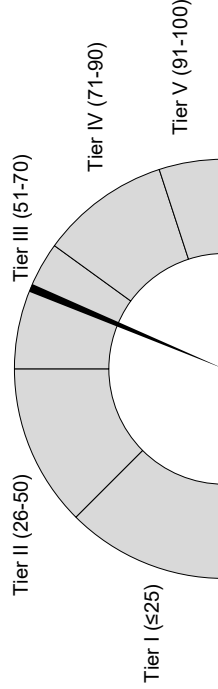
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The AWWA Water Loss Audit found on the following pages was performed utilizing the AWWA Free Water Audit Software v6.0 utilizing Carson City data for calendar year 2022.

### Data Validity

Data Validity Score: **62** Data Validity Tier: **Tier III (51-70)**

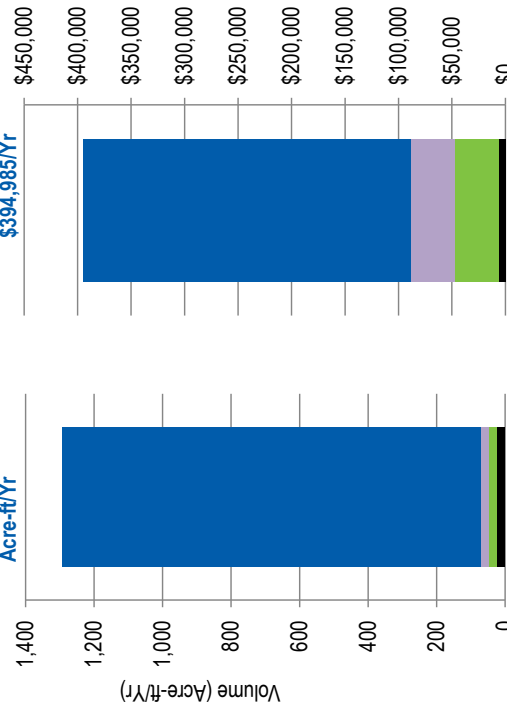
See [Loss Control Planning](#) for Tier Details



### NRW Components Summary

Total Volume of NRW = 1,294 Acre-ft/Yr

Total Cost of NRW = \$394,985/Yr

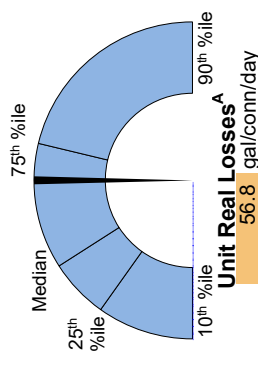
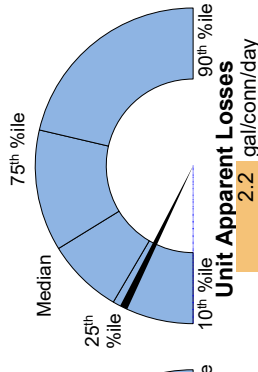
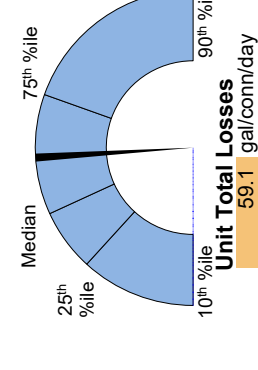
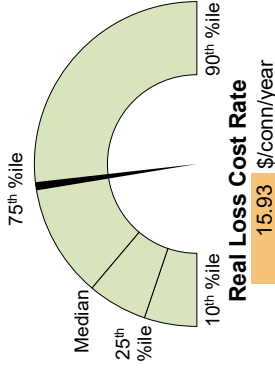
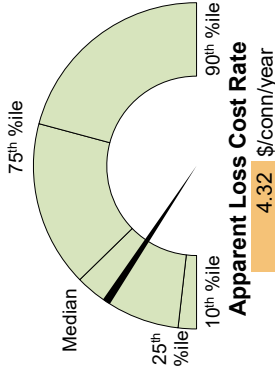
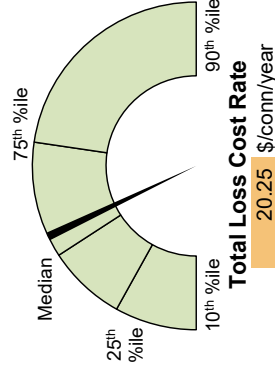


Component	Volume (Acre-ft/Yr)	Value (\$/Yr)	Basis of Valuation
Real Losses	1,222.3	\$305,962	VPC
Systematic Data Handling Errors	48.1	\$83,007	CRUC
Customer Metering Inaccuracies	24.0	\$6,015	VPC
<b>Total</b>	<b>1,294.4</b>	<b>\$394,985</b>	<b>Blended</b>

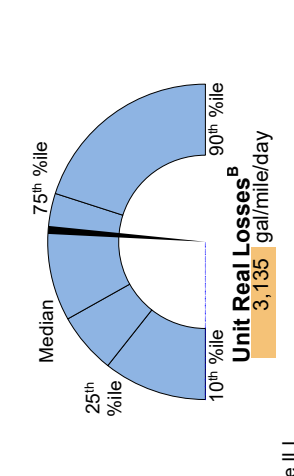
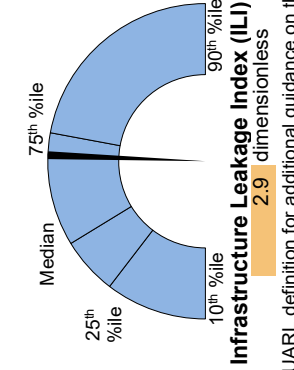
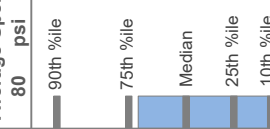
Actual KPI result

### Key Performance Indicators

gauge %iles per validated industry ranges<sup>2</sup>



Average Operating Pressure



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses

426.9 Acre-ft/Yr

19.8 gal/conn/day

### Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs<sup>1</sup>.
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)<sup>1</sup>, with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)<sup>2</sup>.
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)<sup>5</sup>.
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny. Percentiles not intended to imply targets. Targets may be input by use for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)<sup>1</sup>, with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes				Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓		✓	Utility, Regulators
	Unit Real Losses <sup>A</sup> (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓		✓	Utility, Regulators, Policy Makers
	Unit Real Losses <sup>B</sup> (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓		✓	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) <b>New KPI</b>	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) <b>New KPI</b>	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) <b>New KPI</b>		✓			✓	✓	Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓			✓	Regulators, Utilities



**AWWA Free Water Audit Software:  
Determining Water Loss Standing**

FWAS v6.0  
American Water Works Association.  
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Water Audit Report for: **Carson City Public Works**

Audit Year: **2022**      Jan 01 2022 - Dec 30 2022

Data Validity Tier: **Tier III (51-70)**

**Water Loss Control Planning Guide**

**Water Audit Data Validity Tier (Score Range)**

Functional Focus Area	Tier I (1-25)	Tier II (26-50)	Tier III (51-70)	Tier IV (71-90)	Tier V (91-100)
Audit Data Collection	Launch auditing and loss control team; address supply metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations; identify data gaps; improve supply metering	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs; Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or AMR/AMI system	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon with Pls for performance comparisons for real losses	Performance Benchmarking with Pls is meaningful in comparing real loss standing	Identify Best Practices/ Best in class; Pls are very reliable as real loss performance indicators for best in class service

*For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.*