



HEALDSBURG 2015 URBAN WATER MANAGEMENT PLAN UPDATE

**CITY OF HEALDSBURG
UTILITY DEPARTMENT**

June 2016

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Acronym List

ABAG	Association of Bay Area Governments
Act	Urban Water Management Planning Act
AF	Acre-foot or acre-feet
AFY	Acre-feet per year
BMP	Best Management Practice
BiOp	Biological Opinion
CDPH	California Department of Health
CII	Commercial, Industrial, and Institutional
Corps	United States Army Corps of Engineers
CSA	County Service Area
CUWCC	California Urban Water Conservation Council
CWC	California Water Code
DDW	State Water Resources Control Board's Division of Drinking Water
DMM	Demand Management Measure
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EOP	Emergency Operations Plan
ETo	Evapo-transpiration
GPCD	Gallons per capita per day
IPR	Indirect Potable Reuse
ITP	Independent Technical Panel
MCL	Maximum Contaminant Level
MPA	Microscopic Particulate Analysis
NAICS	North American Industry Classification System
NMFS	National Marine Fisheries Service
SB X7-7	Water Conservation Act of 2009
SCWA	Sonoma County Water Agency
SWRCB	State Water Resources Control Board
TPW	County of Sonoma's Department of Transportation and Public Works
UWMP	Urban Water Management Plan
WSCP	Water Shortage Contingency Plan
WSEP	Water Shortage Emergency Plan
WWTP	Wastewater Treatment, Reclamation and Disposal Facility

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1. Introduction and Overview

1.1 Background and Purpose

Water planning is an essential function of water suppliers but becomes critical as California grapples with ongoing drought and expected long-term climate changes.

Prior to the adoption of the Urban Water Management Planning (UWMP) Act (Act), there were no specific requirements that water agencies conduct long-term resource planning. While many water agencies conducted long-term water supply and resource planning prior to the Act, those that did not were left vulnerable to supply disruptions during dry periods or catastrophic events. The Act was proposed and adopted, requiring a minimum level of resource assessment and planning by water suppliers.

The Act was enacted in 1983 with the purpose of requiring urban water suppliers “to develop water management plans to actively pursue the efficient use of available [water] supplies” (Water Code § 10610.4.). The Act requires each urban water supplier with 3,000 or more connections, or that supplies at least 3,000 acre-feet per year (AFY) of potable water, to submit a UWMP to the California Department of Water Resources (DWR) every five years.

The Act has been modified over the years in response to the State’s water shortages, droughts, and other factors. A significant amendment was made in 2009; in response to the 2007-2009 drought, the Governor called for a statewide 20 percent reduction in urban water use by the year 2020. This was the Water Conservation Act of 2009, also known as SB X7-7, which required agencies to establish water use targets for 2015 and 2020 that would result in state-wide savings of 20 percent by 2020.

The purpose of developing a UWMP is to evaluate whether a water supplier can meet the water demands of its water customers as projected over a 20- or 25-year planning horizon. This evaluation is accomplished through analysis of current and projected water supply and demand for normal, single-dry, and multiple-dry water year conditions. This UWMP has been developed with a 25-year planning horizon (2015-2040).

This UWMP will:

- Provide current service area population figures as well as population growth projections;
- Report current water use by sector, including an estimate of water losses;
- Verify the calculation of the City’s SB X7-7 water use baseline and targets and assess the City’s progress toward achieving those targets;
- Summarize the City’s water supply sources and future water supply projects;
- Assess the reliability of the water supply sources during normal, single-dry, and multiple-dry water year scenarios;
- Identify stages of action to address up to 50 percent reduction in water supplies during dry water years;

- Identify actions to be implemented in the event of a catastrophic interruption in water supplies; and
- Provide a description of water demand management (water conservation) measures.

This document sets forth the City of Healdsburg's 2015 UWMP as required by the Act, California Water Code (CWC) §§ 10610 et seq., and to fulfil the requirements of the Water Conservation Act of 2009 (SB X7-7), California Water Code §§ 10608-10608.64.

1.2 Urban Water Management Planning and the California Water Code

This section provides summaries of California Water Code (CWC) sections applicable to Urban Water Management Plans (UWMPs).

1.2.1 Urban Water Management Planning Act of 1983

UWMPs provide a framework for long term water planning and inform the public of a supplier's plans for long-term resource planning that ensures adequate water supplies for existing and future demands.

This part of the CWC requires urban water suppliers to report, describe, and evaluate:

- Water deliveries and uses;
- Water supply sources;
- Efficient water uses;
- Demand management measures; and
- Water shortage contingency planning.

1.2.2 Applicable Changes to the Water Code since 2010

2014 Amendments to the Water Code include eight changes relevant to the preparation of UWMPs, as described in Appendix C of the 2015 *Urban Water Management Plan Guidebook for Urban Water Suppliers*, also called the "Guidebook" (DWR 2016). These changes include:

- Revisions to the demand management measure requirements, reducing the burden of the narrative descriptions required and reflecting the legislative changes which allow more flexibility in water suppliers' selection of demand management measures (AB 2067, 2014).
- Requires submittal to the DWR by July 1, 2016. Note that the due date for the 2010 UWMPs was July 1, 2010. However, previously, UWMPs had been due December 15 of years ending in 0 and 5. The July 1 due date is now codified indefinitely.
- Requires electronic submittal of UWMPs.
- Requires the plan to include any standardized forms, tables, or displays.
- Requires plans to quantify and report distribution system water losses using a specified format.

- Provides for water use projections to account for the water savings estimated to result from adopted codes, ordinances, etc. (when available).
- Voluntary Reporting of Energy Intensity, as related to the nexus of water and energy consumption.
- Requires features that are artificially supplied with water (including ponds, lakes, waterfalls and fountains) to be addressed separately from pools and spas.

1.2.3 Water Conservation Act of 2009 (SB X7-7)

The Water Conservation Act of 2009 requires retail urban water suppliers to set targets and track progress toward decreasing daily per capita urban water use in their service area, which will assist the State in meeting its 20 percent reduction by 2020 goal. To accomplish this, 2010 UWMP required calculation and reporting of Base Daily per Capita Water Use (Baseline GPCD), 2015 Interim Urban Water Use Target, 2020 Urban Water Use Target, and Compliance Daily per Capita Water Use. This 2015 UWMP is required to report on progress made toward achieving the water use targets established in the 2010 UWMP.

For more information about calculation of baseline usage, targets, and the City of Healdsburg's performance as compared to these, please see section 5: SB X7-7 Baselines and Targets.

1.3 Urban Water Management Plans in Relation to Other Planning Efforts

Urban suppliers provide information on water management specific to their service areas. However, water management does not happen in isolation; there are other planning processes that integrate with the UWMP to accomplish urban planning. Some of these plans include city and county General Plans, Water Master Plans, Recycled Water Master Plans, integrated resource plans, Integrated Regional Water Management Plans, Groundwater Management Plans, and others.

This UWMP relies on information used in the preparation of the City's General Plan, 2003 Water System Master Plan, and others.

1.4 UWMP Organization

The structure of this UWMP generally follows the suggestions outlined in the 2015 UWMP Guidebook. This outline groups the requirements by topic and presents the topics in the order recommended by DWR. This order does not follow the order of the legislation. This UWMP is organized as follows:

Section 1 - Introduction and Overview: This introductory section provides an overview of the UWMP background, purpose, and requirements.

Section 2 - Plan Preparation: This section provides information on the process for developing the UWMP, including efforts in coordination and outreach.

Section 3 - System Description: This section provides a description of the service area and climate, the Public Water Systems, current and projected population and the agency's organizational structure.

Section 4 - System Water Use: This section describes and quantifies the current and projected water uses within the City's service area.

Section 5 – SB X7-7 Baselines and Targets: This section describes the methods for calculating the City's water consumption baseline and targets. In addition, it summarizes the City's performance against the 2015 interim water use target, and their plans for achieving their 2020 water use target.

Section 6 - System Supplies: This section describes and quantifies the current and projected sources of water available to the City, including a description and quantification of recycled water uses and supply availability.

Section 7 - Water Supply Reliability Assessment: This section describes the reliability of the City's water supply and projected reliability out 25 years for normal, single-dry, and multiple-dry year conditions.

Section 8 - Water Shortage Contingency Planning: This section provides the City's staged plan for dealing with water shortages, including a catastrophic supply interruption.

Section 9 - Demand Management Measures: This section summarizes the City's efforts to promote conservation and to reduce demand of its water supply, and specifically addresses several demand management measures.

Section 10 - Plan Adoption, Submittal, and Implementation: This section describes the steps taken to adopt and submit the UWMP and to make it publicly available, including a discussion of the City's plan to implement the UWMP.

1.5 UWMPs and Grant or Loan Eligibility

In order for an urban water supplier to be eligible for any water management grant or loan administered by the Department of Water Resources (DWR), the agency must have a current UWMP on file that has been determined by DWR to address the requirements of the CWC. A current UWMP must also be maintained by the water supplier throughout the term of any grant or loan administered by DWR.

An UWMP may also be required in order to be eligible for other State funding, depending on the conditions that are specified in the funding guidelines.

2. Plan Preparation

2.1 Basis for Preparing a Plan

The Urban Water Management Plan (UWMP) Act, as codified in California Water Code (CWC) Sections 10610 through 10656, requires urban water suppliers with 3,000 or more service connections or supplying 3,000 or more acre-feet of water per year are required to prepare an UWMP. In 2015, the City had 4,433 connections within its service territory and, therefore, meets the threshold for this State requirement.¹

2.1.1 Public Water Systems

As defined by the CWC, a public water system is a system which provides water for human consumption, through pipes or other constructed conveyances: that has 15 or more service connections; or regularly serves at least 25 individuals daily at least 60 days out of the year. Table 2-1 summarizes the City of Healdsburg's public water system information for the year 2015.

Table 2-1. Public Water Systems

(DWR Table 2-1)

Public Water System Number	Public Water System Name	Number of Municipal Connections 2015	Volume of Water Supplied 2015 in Acre-Feet
CA4910005	City of Healdsburg	4,433	1,644

2.2 Regional Planning

The City regularly meets with Sonoma County Water Agency (SCWA) staff to discuss and coordinate regional efforts. In addition, the City collaborates with Sonoma County's Regional Climate Protection Authority (RCPA), the eight incorporated jurisdictions of Sonoma County, as well as the County of Sonoma itself, to create and implement a Climate Action Plan (see Section 3.3 for more information about this Plan). The City is a member of the Russian River Watershed Association and the California Municipal Utilities Association.

¹ Source: Annual report to the California Department of Public Health.

2.3 Individual or Regional Planning and Compliance

The Act allows for the preparation of UWMPs by a group of water suppliers or as an individual water supplier. As illustrated in Table 2-2 below, the City is an individual water supplier and developed this UWMP as an individual UWMP addressing all requirements of the CWC.

Table 2-2. Plan Identification

(DWR Table 2-2)

X	Individual UWMP
	Regional UWMP (RUWMP)

2.4 Reporting Cycle and Units of Measure

This UWMP reports data on a calendar year basis and water quantities in acre-feet (AF), unless otherwise noted. Section 5 discusses *baselines* and *targets* in terms of gallons per capita per day (gpcd), compliant with SB X7-7. Table 2-3 summarizes the City of Healdsburg's identifications for the purpose of preparing this UWMP.

Table 2-3. Agency Identification

(DWR Table 2-3)

Type of Agency	
	Agency is a wholesaler
X	Agency is a retailer
Fiscal or Calendar Year	
X	UWMP Tables Are in Calendar Years
	UWMP Tables Are in Fiscal Years
Units of Measure Used in UWMP	
Unit	Acre-feet (AF); Acre-feet per year (AFY)

Note: The City provides water on a wholesale basis to the County of Sonoma for the Fitch Mountain population. Because both the population and quantity of water served are below the threshold for wholesale requirements, the CWC's wholesaler requirements are not triggered.

2.5 Coordination and Outreach

The City meets regularly with the Sonoma County Water Agency (SCWA); the County of Sonoma, Department of Transportation and Public Works (TPW); and other water rights holders along the northern Russian River, including vineyard owners.

Table 2-4 identifies the various agencies and entities that the City is coordinating with during the UWMP preparation process, and/or on an ongoing basis in relation to water supply planning.

Table 2-4. Water Supplier Information Exchange

(DWR Table 2-4)

The retail supplier has informed the following wholesale supplier(s) of projected water use in accordance with CWC 10631.

Sonoma County Water Agency

Although the City of Healdsburg has its own water rights and does not rely on SCWA for its water supply, SCWA manages in-river flows and reservoir levels along with state and federal agencies. The City coordinates with and provides SCWA with water demand updates.

Urban water suppliers are required by the Act to encourage active involvement of the community within the service area during the preparation of its UWMP. The City included a public notice in the Healdsburg Tribune on June 2, 2016 notifying the public of the City's intent to prepare its UWMP and asked for public input during the preparation of the UWMP.

The City held the formal public hearing at the City Council Chambers on June 20, 2016. More information about the public hearing and the adoption of the 2015 UWMP is presented in Section 10 of this UWMP.

Though the Act requires only one public hearing for review of and to receive public input on the UWMP, the City held an informational community workshop prior to the public hearing. The community workshop provided the public with an update on the 2015 UWMP update process and provided an opportunity for the public to provide input at an earlier stage than the public hearing for UWMP review and adoption. This meeting was held at the City of Healdsburg Community Center on May 12, 2016.

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3. System Description

This section describes the physical characteristics of the City's water service area as well as current and projected population for the service area.

3.1 General Description

The City of Healdsburg is located in the County of Sonoma (County), approximately 12 miles north of the City of Santa Rosa. Healdsburg is within the nine-county San Francisco Bay Region. The location of Healdsburg in California is shown in Figure 3-1. The City of Healdsburg is located in an inland valley between Highway 101 and the Russian River, which flows southward to the east of the City and crosses through the southern portion of the City in a westerly direction. The City's water service area is roughly equivalent to the City Limit. Figure 3-2 shows the City Limit, sphere of influence, and water distribution areas, which includes CSA41/24 to which the City is a wholesale water supplier.

The Healdsburg City Council is the governing entity of the City. The Council consists of five council members that serve four-year terms and appoint a Mayor once per year. The Council sets policy and adopts a budget for the City bi-annually.

The City has developed and adopted several planning documents, including:

- Healdsburg 2030 General Plan
- City of Healdsburg 2003 Water System Master Plan
- Saggio Hills Area Plan (2010)
- Central Healdsburg Avenue Plan (2013)

These documents provide information to the public and decision-makers regarding the City's goals, policies, and implementation programs including: the City's sphere of influence and land use; development opportunities and constraints; as well as planned and recommended infrastructure improvements.

Historically, the City's economy was supported by agriculture and logging. In more recent years, the City has experienced an increase in urban development and a diversification of the local economy with tourism as a growing element of the economy.

3.2 Service Area Boundaries

The City of Healdsburg serves as the water provider within the municipality's water service area. The service area is approximately four square miles and serves primarily residential and commercial customers. The City rests at an elevation of approximately 106 feet above mean sea level.

The potable water distribution system contains three pressure zones that are each served by one or more of the six storage reservoirs. Figure 3-2 is a map of the City's service area showing the pressure zones in various colors, including the Fitch Mountain Service area (CSA41/24) to which the City is a wholesaler. The principal water mains in the distribution system range in size from 4 to 16 inches in diameter. Most of the distribution piping in the older areas of the City range in size

from 1-1/2 to 4 inches, while the newer areas are served by pipes 6 to 16 inches in diameter. The City also has a recycled water distribution system with an active recycled water transmission main extending northward from the Wastewater Treatment, Reclamation and Disposal Facility (WWTP) following the West Slough and terminating at a recycled water hydrant on Kinley Drive, southwest of Highway 101. Another segment of recycled water pipe extends southward from the WWTP to multiple Syar owned vineyard properties, approximately 4,382 feet from the WWTP.

Figure 3-3 shows the approximate layout of the distribution system piping, along with the major physical components of the water system including wells, pump stations, reservoirs, and water sampling locations.

3.3 Service Area Climate

The City lies within the Russian River watershed and has a Mediterranean climate. The typical weather pattern for this climate is a wet winter and a dry summer season, with little or no rain. Typically, less than 5 percent of the annual rainfall falls during the five months of May through September.

The mean annual temperature for this area is 60.0°F. The average annual rainfall for the Healdsburg vicinity is 41.3 inches per year. The average annual rate of evapo-transpiration of common turf grass (ET_o) is approximately 50.5 inches per year. ET_o is a measurement of evaporation combined with transpiration and is expressed in the form of a rate. ET_o can be generally equated to the amount of precipitation needed for turf to grow in a specific region, whether from rain or irrigation. As part of this UWMP update, historical climate data for this area was reviewed and updated, as necessary. Monthly ET_o, rainfall, and temperature averages, along with annual totals are summarized in Table 3-1 below.

Table 3-1. Monthly Climatic Averages

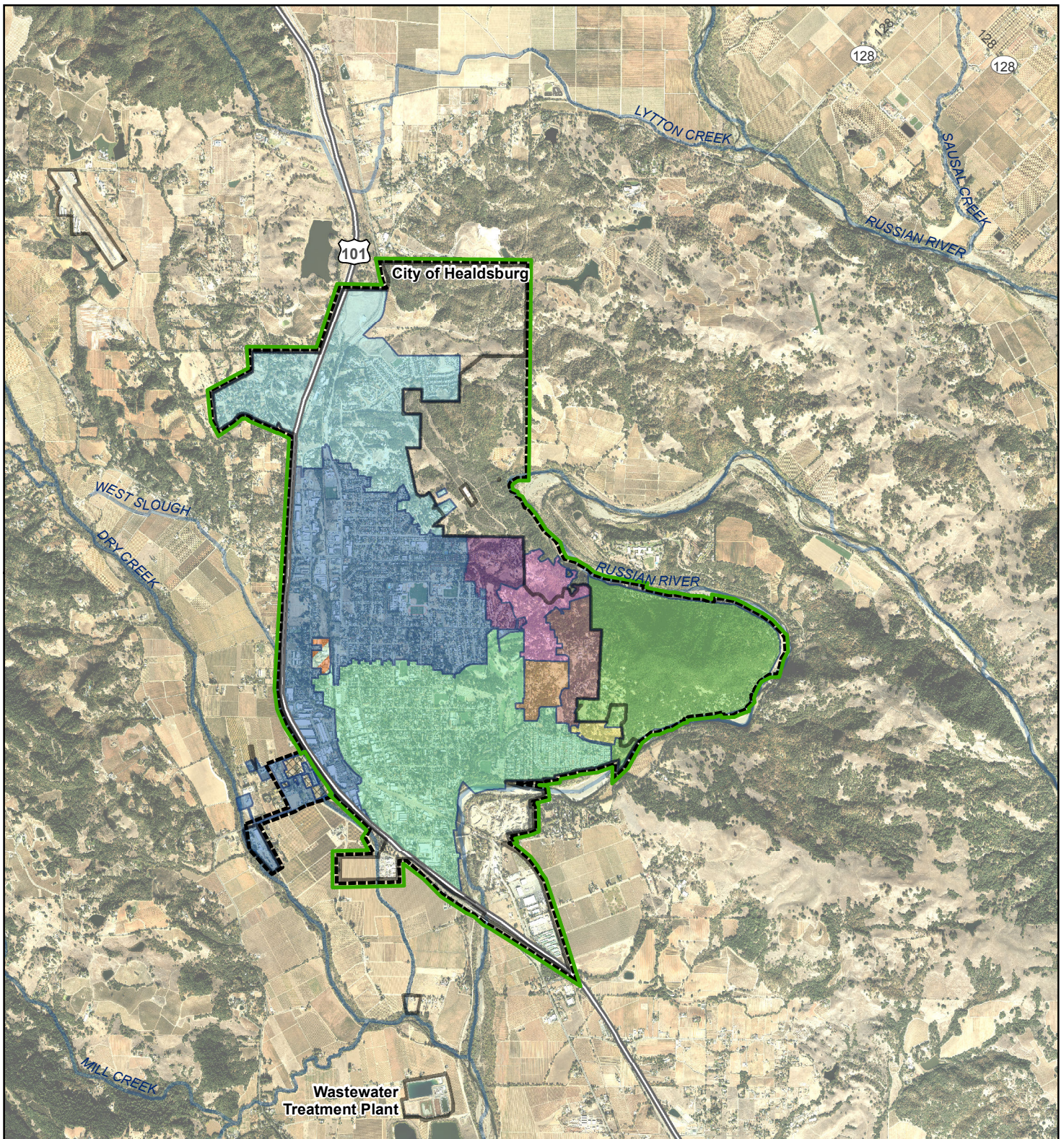
Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Total or Average
Standard Monthly Average ET _o ^a	1.3	1.9	3.3	4.7	5.9	7	7.8	6.8	5.2	3.5	2	1.2	50.5
Average Rainfall (inches) ^b	9.4	7.3	5.4	2.5	1.1	0.3	0	0.1	0.4	2.1	5.1	7.6	41.3
Average Temperature (°F) ^c	47.8	51.5	54.5	58.3	63.6	68.6	70.9	70.5	68.7	62.8	54.3	48.3	60.0

Notes:

a = ET_o data averaged from August 1986 to May 1994. The reference "crop" is typical turf grasses.

b = Average rainfall in inches. Period of record is 2/1/1893 to 8/31/2012.

c = Temperature averaged from 1931 to 2010.



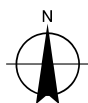
Water Distribution Areas

	Iverson North		Sunset
	Cadoul		Iverson South
	CSA41/24		Tayman
	Hidden Acres		Latimer
	Panorama		Multiple Zones
	No Service		

	Limited Access Highway
	Healdsburg City Limits
	Named Streams & Rivers

	Sphere of Influence
	Water Service Boundary

Paper Size 8.5" x 11" (ANSI A)
 0 1,000 2,000 3,000 4,000 5,000
 Feet
 Map Projection: Lambert Conformal Conic
 Horizontal Datum: North American 1983
 Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

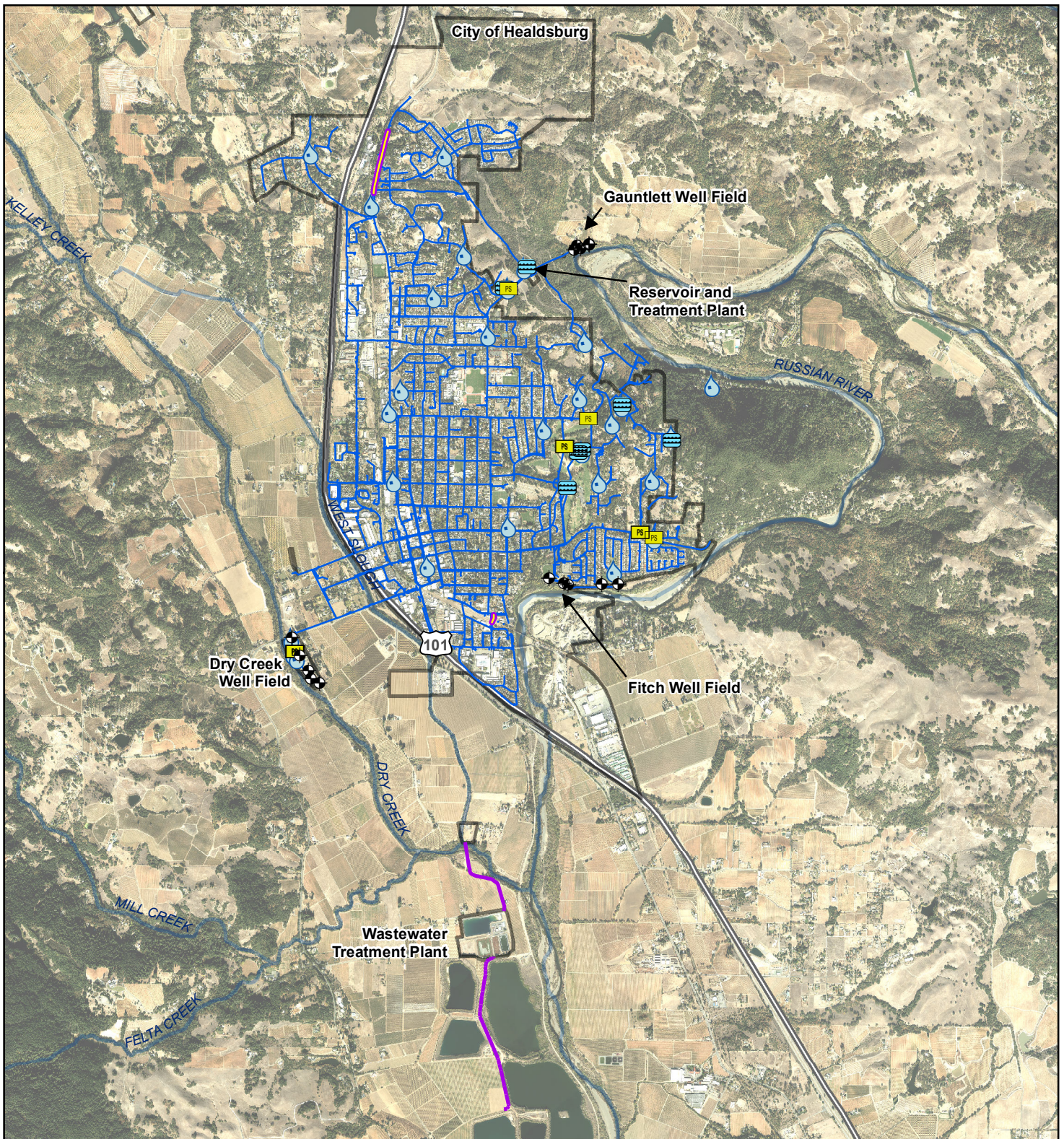


City of Healdsburg
 Urban Water Management Plan Update 2015

Job Number 11110660
 Revision A
 Date 16 May 2016

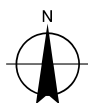
Water Service Areas and Pressure Zones

Figure 3-2



- | | | |
|---|---|--|
|  Pump Station |  Water Main |  Limited Access Highway |
|  Storage |  Inactive Reclaimed Water Main |  Healdsburg City Limits |
|  Well |  Reclaimed Water Main |  Named Streams & Rivers |
|  Water Sample Location | | |

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 Feet
 Map Projection: Lambert Conformal Conic
 Horizontal Datum: North American 1983
 Grid: NAD 1983 StatePlane California II FIPS 0402 Feet



City of Healdsburg
 Urban Water Management Plan Update 2015

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 Revision 1
 Date 03 May 2016

Water Distribution System

Figure 3-3

3.3.1 Climate Change

The City of Healdsburg recognizes climate change's effect on weather patterns and water supply, and the importance of accounting for these changes when analyzing our future water security. Whenever possible, historical data has been updated in this UWMP to ensure forecasts are based on more recent conditions which show the impact of climate change.

In addition, the City is focusing on reducing greenhouse gas emissions and mitigating climate change through the development of a Climate Action Plan. In collaboration with Sonoma County's Regional Climate Protection Authority (RCPA) the City, along with the other eight incorporated jurisdictions of Sonoma County, as well as the County of Sonoma itself, have created and are proposing to adopt *Climate Action 2020: Community Climate Action Plan (CAP)*. The objective of this Plan is to reduce greenhouse gas (GHG) emissions and respond to the impacts of climate change within the nine incorporated jurisdictions, as well as the unincorporated regions, of Sonoma County. The CAP identifies 20 goals across six sectors (Building Energy; Transportation & Land Use; Solid Waste Generation; Water Conveyance & Wastewater Treatment; Livestock & Fertilizer; and Advanced Climate Initiatives) and develops GHG reduction measures to be adopted by jurisdictions and implemented on a local level. These local measures, coupled with State and Regional GHG reduction measures, will allow us to meet the CAP target of a 25% countywide reduction in GHG emissions by 2020, as compared to 1990 levels (RCPA, 2016).

In addition, RCPA developed *Climate Ready Sonoma County: Climate Hazards and Vulnerabilities* to assess local climate risks. This assessment identifies four climate futures Sonoma County can expect to experience. We can expect to experience the following across all four of the possible climate futures: hotter, drier weather with longer summers (more extreme heat events, longer and more frequent droughts, greater frequency and intensity of wildfires, fewer winter nights that freeze); more variable rain; bigger, more variable floods; and sea level rise (higher sea level and storm surge).

3.4 Service Area Population and Demographics

California Department of Finance E-1 population estimates were used for the baseline 2015 City of Healdsburg population and projections. These estimates are based on 2010 U.S. Census Bureau data that is updated using annual housing unit change data are supplied by local jurisdictions and the U.S. Census Bureau. Based on these figures, there were an estimated 11,667 residents in the City of Healdsburg in 2015.

Based on E-4 population estimates from the California Department of Finance, the City of Healdsburg experienced an annual average population growth of 0.6% between April 1, 2010 and January 1, 2016. During the period of 2005 through 2010 the City experienced virtually zero growth in population.

With the economy again expanding, and the City Council focused on increasing the amount of affordable housing within Healdsburg, the annual population growth rate could exceed the historical one percent growth per year in the short-term. To account for this potential growth, and to ensure that projected water conditions can accommodate a large increase in population, this UWMP estimates population will grow by 3 percent between 2015 and 2025, and that it will return to 1 percent per year from 2025 to 2040. Assuming this rate of growth, the population served by the

City would reach 18,203 by the year 2040. Population estimates every five years from 2015 through 2040 are presented in Table 3-2 below.

The population projections differ from those outlined in the 2010/2013 UWMP and are based on City staff knowledge of planned developments and City policies intended to increase the amount of affordable housing (Community Housing Committee Action Goals). These forecasted numbers exceed the more moderate historical trend of 1 percent per year.

Table 3-2. Population - Current and Projected

(DWR Table 3-1)

	2015	2020	2025	2030	2035	2040
Population Served	11,667	13,525	15,679	16,479	17,320	18,203

Notes: Population projections are based on 2015, with a projected growth of 3% per year up to 2025, and 1% per year from 2025 to 2040

4. System Water Use

This section of the UWMP presents the City's water system demands; providing the actual and projected number of water accounts and annual water use in five-year increments between 2015 and 2040. Note the terms "water demand" and "water use" are used interchangeably throughout this UWMP as well as in the 2015 UWMP Guidebook.

4.1 Recycled versus Potable Water Demand

In order to clearly distinguish recycled water from potable water demand, reporting for these demands is discussed separately, as recommended in the 2015 UWMP Guidebook. Recycled water is addressed comprehensively in Section 6.5, but a summary of recycled water demand is included in Table 4-4.

4.2 Water Use by Sector

The California Water Code (CWC) requires the reporting of past and projected demand in terms of pre-determined water use sectors. Sectors applicable to the City are outlined in section 4.2.1, along with a description obtained from the 2015 UWMP Guidebook. The definitions listed in Table 4-1 are used by DWR for each of the water sectors listed in the CWC that apply to the City of Healdsburg. The order of the sectors follows the order found in the CWC.

4.2.1 Demand Sectors Listed in Water Code

Table 4-1. Demand Sector Descriptions

Sector	Description
Residential	Dwelling units. A single-family dwelling unit is a parcel with a free-standing building containing one dwelling unit that may include a detached secondary dwelling. Multi-family dwelling units are those contained within one building or several buildings within one complex. The City's billing data does not distinguish between these use sectors. This is a retail demand.
Commercial	A water user that provides or distributes a product or service. This is a retail demand.
Industrial	A water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System (NAICS), or an entity that is a water user primarily engaged in research and development. This is a retail demand.
Institutional and Governmental	A water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions. This is a retail demand.
Landscape	Water connections supplying water solely for landscape irrigation. Such landscapes may be associated with multi-family, commercial, industrial, or institutional/governmental sites, but are considered a separate water use sector if the connection is solely for landscape irrigation. This is a retail demand.
Sales to Other Agencies	Water sales made to another agency. See description in Section 4.2.2 below. This is a wholesale demand.
Distribution System Water Loss	Generally, the difference between water produced and water delivered. See description in Section 4.3 below.

4.2.2 Sales to Other Agencies

Since the mid-1990s, the City has sold water to the County of Sonoma Department of Transportation and Public Works (TPW) under the County's operation of the Fitch Mountain County Service Area (CSA) #41, which is a small water system located outside of the City's limits. The TPW currently does not own pumping facilities and, because of this, is solely dependent upon the City to supply municipal water.

4.2.3 Water Demands by Sector – 2015 Actual

This section and the following section (4.2.4) discuss water demands based on the demand sectors listed in Table 4-1. The following information could be helpful when reviewing the water demand by sector in Tables 4-2 and 4-3: institutional facilities include City facilities, schools, and churches; landscape includes separately metered usage from both residential and non-residential properties; Sales/Transfers/Exchanges to other agencies represents water sold to TPW for the Fitch Mountain service area. Also, please note that while commercial hydrants require a manual adjustment, the flow from the hydrants is accounted as part of the commercial sector.

Customer water use for the year 2015, presented in Table 4-2, was obtained from actual billing data provided by the City's Finance Department. Actual water deliveries in 2015 were 1,644 AF. Compared with the 2015 projected water delivery of 2,151 AF reported in the 2010/2013 UWMP, actual total water deliveries in 2015 were 24 percent lower. Actual water deliveries in 2015 were lower than projected because of the dramatic water conservation achieved in response to continued drought conditions. Water conservation at this level is not expected to continue as drought conditions subside.

Water use in the City's service area is predominantly residential use. In 2015, residential customers received 61.9 percent of the total water deliveries. The second largest use is commercial customers, who received 18.4 percent. The remaining end uses include: separately metered landscape irrigation (10.6%); wholesale (3.2%); industrial (2.6%); unaccounted water (2.5%); and institutional/governmental (0.8%). Tayman Park Golf Course and Badger Park are the only customers that receive raw (untreated) water, which is used for irrigation purposes only. Table 4-2 details actual water served in 2015 by sector, including sales, losses, and recycled water demand.

Table 4-2. Demands for Potable Water - 2015 Actual

(DWR Table 4-1)

Use Type	2015 Actual		
	Additional Description (as needed)	Level of Treatment When Delivered <i>Drop down list</i>	Volume (AF)
Single Family	No records on single vs. multi-family residential use	Drinking Water	1,018
Multi-Family			
Commercial		Drinking Water	302
Industrial		Drinking Water	43
Institutional/Governmental		Drinking Water	12
Landscape		Drinking Water	175
Sales/Transfers/Exchanges to other agencies		Drinking Water	53
Losses		Drinking Water	41
Recycled Water ^a	Offsetting potable use	Tertiary	25
TOTAL			1,619

Notes: This data was gathered from the 2015 Annual PWS report.

^aRecycled water is shown as a use type for the volume used to offset potable use only, and is deducted from total demand so that potable water demand is not over stated.

4.2.4 Potable Water Demands by Sector – Projected

Because of the mandatory water conservation measures in place in 2015, water use for that year was lower than it would have been, absent those restrictions. Using this data to project water use could potentially understate future water. Because of this, future demand is projected based on actual water use in 2013, with assumed population growth rates discussed in Section 3.4.

The non-residential sectors are not expected to grow as rapidly as the residential sector. The Healdsburg 2030 General Plan EIR has generalized estimates of land areas to be developed into commercial or industrial uses; however, without specific business use information, it is difficult to determine specific water use estimates. Therefore, it was assumed that water consumption for increased commercial, industrial and institutional sector growth would follow the historical growth rates. The growth rates discussed in Section 3.4 are estimated to be at 1.0% per year through 2040. These growth rate estimates were applied to all non-residential demand sectors equally, with the exception of water losses (discussed in section 4.3) and recycled water (discussed in section 6.5). Actual future population and water consumption may differ from these projections.

Table 4-3 summarizes the potable water demand projections for the water use sectors discussed above from 2020 through the year 2040, including projected distribution system water losses.

Table 4-4 summarizes the total projected potable and recycled water demands from 2020 through the year 2040. Discussion of recycled water can be found in Section 6.5.

Table 4-3. Demands for Potable Water – Projected AFY

(DWR Table 4-2)

Use Type	Additional Description	2013 Water Use	2015 Water Use	Projected Water Use				
				2020	2025	2030	2035	2040
Single Family	No records on single/ multi-family residential use	1,495	1,018	1,839	2,132	2,240	2,355	2,475
Multi-Family								
Commercial		335	302	359	377	396	417	438
Industrial		52	43	55	58	61	64	68
Institutional/ Governmental		35	12	37	39	41	43	45
Landscape		242	175	260	273	287	301	317
Sales/Transfers/ Exchanges to other agencies		65	53	70	74	77	81	85
Losses		-	41	131	148	155	163	171
Other		-	-	-	-	-	-	-
Recycled Water ^a		-	25	48	48	125	125	125
Total		2,224	1,619	2,703	3,052	3,134	3,300	3,474

^aRecycled water is shown as a use type for the volume used to offset potable use only, and is deducted from total demand so that potable water demand is not over stated.

Table 4-4. Total Water Demands - AFY

(DWR Table 4-3)

	2013	2015	2020	2025	2030	2035	2040
Potable Water (from Tables 4-2 and 4-3)	2,224	1,619	2,703	3,052	3,134	3,300	3,474
Recycled Water Demand (From Table 6-4)	0	25	48	48	125	125	125
Total Water Demand	2,224	1,644	2,751	3,100	3,259	3,425	3,599

4.3 Distribution System Water Loss

Distribution system water losses (also known as *real losses*) are the physical water losses from the water distribution system and from the water storage facilities up to the point of customer consumption. For the purpose of this UWMP, total losses are included as a demand sector and are calculated as the difference between all water supplied and all water delivered, or metered. Total losses include both actual water loss and apparent water loss. Actual water loss is due to system leaks while apparent are due to: unmetered authorized uses, such as hydrant flushing; inaccurate water use measurement due to faulty meters; and firefighting.

Table 4-5 presents the total potable water loss for calendar year 2015, as calculated by subtracting the total potable water sold to customers from the total potable water supplied by the potable water delivery system. In 2015 the water loss represented approximately 2.5% percent of the total water supplied.

Water loss values of less than 10 percent are generally considered acceptable by industry standards. As discussed in section 1.3.1, new to the 2015 UWMP is the inclusion of a water loss audit report form irrespective of water loss percentage. Based on the results of the loss audit, approximately one percent is physical water loss. This report is included as Appendix C.

The 2015 losses are also included in Table 4-2 and projected losses are included in Table 4-3, along with other water use sectors to describe the total demands.

Table 4-5. 12-Month Water Loss Audit Reporting

(DWR Table 4-4)

Reporting Period Start Date (mm/yyyy)	Volume of Water Loss
01/2015	41

Notes: This loss figure is derived from subtracting total water metered from total water produced.

4.4 Estimating Future Water Savings

Water savings from codes, standards, ordinances, or transportation and land use plans are known as “passive savings”. These various factors decrease the water use for new and future customers, compared to historical customers.

Since the development of the 2005 UWMP, the City has greatly increased its efforts to reduce water loss and increase water conservation through addressing water system leaks, performing meter calibration and replacement, as well as developing and implementing a robust water conservation program. In addition, the City of Healdsburg is in the process of, and expects to become, a signatory of the California Urban Water Conservation Council (CUWCC), by the end of 2016.

The City's future water demand projections set forth in Tables 4-3 and 4-4 (above) assume no future water savings from demand management measures. Through the robust water conservation program implemented in 2014 and 2015, and expected to be supported and expanded into the future, it is reasonable to include a reduction in demand from water conservation programs.

Because water demand projections are based on 2013 water demand, reduction in demand from water conservation programs will also be projected using 2013 water demand. 24.3 AF of water was saved through water conservation programs in 2015; this is approximately 1% of total water demand in 2013. These estimated savings are based on the on-going savings expected from increased efficiency of water-using appliances, fixtures, and landscapes. Drought-related savings from mandatory water use restrictions are not included. Assuming a conservative growth in program participation, water savings from conservation programs are projected at 1 percent growth per year. Table 4-6 summarizes the total actual and projected potable and recycled water demand, as well as demand savings from conservation, for 2015 through 2040. Details of the City's water use reduction plan are discussed in detail in Section 9.

Table 4-6. Total Water Demands (including Conservation) – AFY

	2013	2015	2020	2025	2030	2035	2040
Potable Water Demand (Tables 4-1 and 4-2)	2,247	1,643	2,703	3,052	3,134	3,300	3,474
Recycled Water Demand (Table 6-4)	0	25	48	48	125	125	125
Conservation Demand Savings	23	24	76	131	189	249	313
Total Water Demand	2,224	1,644	2,675	2,969	3,070	3,176	3,286

Notes: Recycled water demand expected to offset potable water use. This amount is included as a reduction to potable water demand in Tables 4-2 and 4-3 so that the total water demand listed in this table is not overstated

Water agencies are required to state the extent to which passive water savings are considered in these water use projections. The information meeting this requirement is included Table 4-7 below.

Table 4-7. Inclusion of Future Water Savings in Water Use Projections

(DWR Table 4-5)

Are Future Water Savings Included in Projections?	Yes
If "Yes" to above, state the section or page number where citations of the codes, ordinances, etc... utilized in demand projections are found.	Section 4.4 and 9
Are Lower Income Residential Demands Included In Projections?	Yes

4.5 Water Use for Lower Income Households

SB X7-7 includes a requirement for identifying water use projections for lower income households. Under the statute, a lower income household is defined by California Health and Safety Code as being 80 percent of the median income, adjusted for family size. In addition, the U.S. Office of Management and Budget defines low-income households as households with incomes less than twice the federal poverty line.

Based on City of Healdsburg population data from the *United States Census 2010*, the estimated 80 percent median income is approximately \$45,575 and 14.5% of the people in the City of Healdsburg earn less than 80 percent of the median income.

Table 4-8 shows the estimated 2015 and projected water demands through the year 2040 for lower income residential households. The City does not have records of water use for single vs. multi-family residential use, and does not document water demands for lower income residents.

Table 4-8. Lower-Income Estimated 2015 and Projected Water Demands - AFY

Water Distributed	2015	2020	2025	2030	2035	2040
Residential (Single and Multi-Family)	148	267	309	325	341	359

Because these lower-income water demands estimates are a subset of the total residential water use for the City, they are not added to the previous water demand estimates and projections. The estimated water demand for lower-income households in 2015 was 148 AF based on actual 2015 residential water use reported in Table 4-2. This estimate was derived by multiplying the volume of residential water use by 14.5 percent.

4.6 Climate Change

As discussed in section 3.3.1, impacts of climate change must be considered in the preparation of long-term planning documents. The City is focused on promoting water conservation programs to achieve long-term passive savings (lawn conversion, toilet replacement, appliance upgrades, etc.). Implementation of these types of measures will offset customer's need to increase water demand from climate change (e.g. hotter and drier weather may lead to an increased demand in landscape irrigation).

5. SB X7-7 Baselines and Targets

Senate Bill SB X7-7 established new requirements for Urban Water Management Plans (UWMPs), beginning with the 2010 update, to include the development of baseline water use and urban water use targets. Specifically, each urban water supplier must develop a long-term baseline daily per capita water use, establish a per capita water use target for 2020, and provide an interim water use target for 2015. By determining the baseline and water use targets, the City can help fulfil the requirement set forth by SB X7-7.

The purpose of SB X7-7 is to establish requirements for the State of California to reduce its state-wide urban per capita water use by 20 percent by the year 2020. An interim target is set for 2015 which requires a 10 percent reduction in urban per capita water use. After year 2021, failure to meet the 2020 water use target constitutes a violation of State law. The City is required to meet these water use targets and is on schedule to meet them.

Compliance with the 2015 and 2020 water use targets is also a requirement for eligibility for State water grants and loans. A discussion of the baselines and targets is provided in the following sections.

5.1 Updating Calculations from the 2010 UWMP

5.1.1 Update of Target Method

In 2010 UWMPs, water agencies calculated a 2020 Urban Water Use Target through the use of one of four selected target methods. In 2015 UWMPs, water agencies may update their 2020 Target and may make this calculation using a different target method than was used in 2010. The City Council adopted Method 1 for the development of its individual water use target on July 29, 2015. Section 5.2 summarizes the process of determining its baseline water demands and target water demands for the years 2015 and 2020.

5.1.2 Required Use of 2010 U.S. Census Data

DWR has determined that any 2010 UWMPs that did not use the 2010 Census data for baseline population projection calculations must recalculate their baseline population for the 2015 UWMP using 2010 Census data. The City of Healdsburg used the 2010 Census data in the preparation of the City's 2010/2013 UWMP. As such, the re-calculation of baselines and targets for this UWMP is not required, but was re-verified with the SB X7-7 Verification Form.

5.1.3 SB X7-7 Verification Form

All retail agencies are required to submit the standardized tables in the SB X7-7 Verification Form with their 2015 UWMPs. These standardized tables were not available in 2010 and are required to demonstrate compliance with the Water Conservation Act of 2009.

The baseline periods calculated for this UWMP update did not differ from the 2010/2013 UWMP. The SB X7-7 Verification Form and associated tables are included in Appendix D.

5.2 Baseline Periods

The purpose of developing a baseline daily per capita water use is to establish a benchmark from which the 2015 and 2020 water use targets are derived. For most urban water suppliers, the baseline daily per capita water use is developed using a 10-year average, ending no earlier than December 31, 2004, and no later than December 31, 2010.

The baseline daily per capita water use is the City's average gross daily per capita use, in gallons. The baseline includes all water entering the water distribution system, including water losses. It does not, however, include recycled water delivered within the supplier's service area, water placed into long-term storage, or water conveyed for use by another urban water supplier (per CWC § 10608.12).

The City is a wholesale water supplier to the County of Sonoma, who owns and operates the water distribution system in the Fitch Mountain service area. Since this area is not part of the City's water distribution system, it is not included in the baseline period or water use targets established in the City's UWMP.

5.2.1 Determination of the 10-15 Year Baseline Period (Baseline GPCD)

To determine the 10-15 year baseline daily per capita water use, the 2008 recycled water and total urban water supplied are used to determine the number of years that can be included in the base period range. Specifically, water suppliers whose recycled water supply in 2008 was 10 percent or greater than the total urban water supply, can develop the baseline daily per capita water using a 10-15 year range. Since the City did not deliver recycled water in 2008, the baseline period range must be no more than 10 years.

The City's baseline daily per capita water use is calculated using the 10-year period from 1995 to 2004. For each year in the baseline period, daily per capita water use was developed using the U.S. Census data and population estimates that correspond with the limits of the City's distribution system and the City's retail water service area, as per the 2015 UWMP Guidelines. Gross water use was calculated by adding all well production as reported annually to the Water Quality Control Board Division of Drinking Water (WQCB DDW) by the City, and subtracting water sold wholesale to the Fitch Mountain service area (County district).

The 10-year baseline water is an average of the annual daily per capita water use over that 10-year time period. A summary of the City's annual production and per capita water use during this 10-year period is included with the SB X7-7 Verification Form located in Appendix D.

Table 5-1 summarizes the City's annual production and per capita water use during this 10-year baseline period. The City's baseline daily per capita (person) water use is 203 gallons per capita per day (gpcd). The 10-year baseline per capita water use of 203 gpcd is only 1 gpcd higher than the per capita water use value that was used to develop future water demands in the City's 2003 Water System Master Plan².

² City of Healdsburg Water System Master Plan, October 2003 by HDR

Table 5-1. Baseline Daily Per Capita Water Use – 10-Year Range

Base Period Year		Distribution System Population	Gross Water Production (mg/yr)	Gross Annual Production (AFY)	Annual Daily Per Capita Water Use (gpcd)
Sequence Year	Calendar Year				
Year 1	1995	9,698	795	2,441	225
Year 2	1996	9,895	772	2,369	214
Year 3	1997	10,005	684	2,100	187
Year 4	1998	10,262	712	2,185	190
Year 5	1999	10,427	778	2,386	204
Year 6	2000	10,896	763	2,342	192
Year 7	2001	11,316	802	2,463	194
Year 8	2002	11,504	870	2,670	207
Year 9	2003	11,414	831	2,551	200
Year 10	2004	11,361	900	2,763	217
				Base Daily Per Capita Water Use	203

5.2.2 Determination of the 5-Year Baseline Period (Target Confirmation)

Also required by the 2010 UWMP is the determination of a 5-year base daily per capita water use using a 5-year range ending no earlier than 2007 and no later than 2010. If the 5-year base daily water use exceeds 100 gpcd, then the 2020 water use target established by the City must be less than or equal to 95 percent of this 5-year baseline.

For the development of the City's 5-year baseline daily per capita water use, a 5-year average from 2003 to 2007 was used. A summary of the City's annual production and per capita water use during this 5-year period is included with the SB X7-7 Verification Form located in Appendix D.

The 5-year baseline daily per capita water use is derived by averaging the annual daily per capita water use over the 5-year time period. Table 5-2 summarizes the City's annual production and per capita water use during this 5-year baseline period. The City's 5-year baseline daily per capita (person) water use is 201 gpcd, which is the average base daily water use for this 5-year period.

Because the 5-year baseline daily per capita water use is greater than 100 gpcd, the 2020 water use target established by the City should not be greater than 95% of 201 gpcd. Development of the City's 2020 water use target is discussed in the following sections.

Table 5-2. Baseline Daily Per Capita Water Use – 5-Year Range

Base Period Year		Distribution System Population	System Gross Water Use (MG)	Gross Annual Production (AFY)	Base Daily Per Capita Water Use (gpcd)
Sequence Year	Calendar Year				
Year 1	2003	11,414	831	2,551	200
Year 2	2004	11,361	900	2,763	217
Year 3	2005	11,305	844	2,591	205
Year 4	2006	11,222	802	2,462	196
Year 5	2007	11,161	760	2,331	186
Base Daily Per Capita Water Use				2,540	201

5.3 Service Area Population

In order to correctly calculate annual gallons per capita per day (gpcd), agencies must determine the population they served for each baseline year in both of the baseline periods as well as the 2015 compliance year. As discussed in section 1.2.2, updates to CWC require that baseline periods and 2015 target be revised using 2010 Census data. Because the City of Healdsburg used the 2010 Census data, obtained from the California Department of Finance, in the preparation of the City's 2010 UWMP and for this 2015 UWMP update, the re-calculation of baselines and targets for this UWMP is not necessary.

5.4 Gross Water Use

Gross water use is a measure of water that enters the distribution system of the supplier over a 12-month period (either fiscal or calendar year) with certain allowable exclusions. These exclusions are:

- Recycled water delivered within the service area. Recycled water use has been excluded from all calculation of gross water, as reflected in the SB X7-7 Tables in Appendix D. Water suppliers are not required to report their recycled water use, nor demonstrate any reduction in recycled water use for purposes of SB X7-7;
- Indirect recycled water (see Methodology 1 from the Methodologies document, DWR 2011);
- Water placed into long term storage (surface or groundwater);
- Water conveyed to another urban supplier;
- Water delivered for agricultural use;
- Process water.

The two exclusions from the City's gross water use calculation are:

1. Recycled water delivered in the service area (deliveries began after 2008)
2. Water conveyed to the Fitch Mountain service area.

Gross water use must be reported for each year in the baseline periods as well as 2015, the interim compliance year. The gross water use is reported for the baseline periods in Tables 5-1 and 5-2. The gross water use for the interim compliance year 2015 is discussed in Section 5.5.3. The SB X7-7 Verification Form, including the gross water calculations, is located in Appendix D.

5.5 2015 and 2020 Targets

Under SB X7-7, each individual urban water supplier must develop a water use target for year 2020 using one of four allowable methods, discussed below. Note that the 2015 Interim Target is a water use target that is halfway between the 10-year baseline daily per capita water use of 203 gpcd (Table 5-1) and the 2020 water use target. There is no penalty for an agency not achieving its 2015 interim target.

5.5.1 Select and Apply a Target Method

The California Department of Water Resources (DWR) is the agency responsible for establishing the four methodologies for determining water use targets. Three methods are provided in SB X7-7 and the fourth was subsequently established by the DWR. The City can choose one of the four methods described below to develop the 2015 and 2020 water use targets:

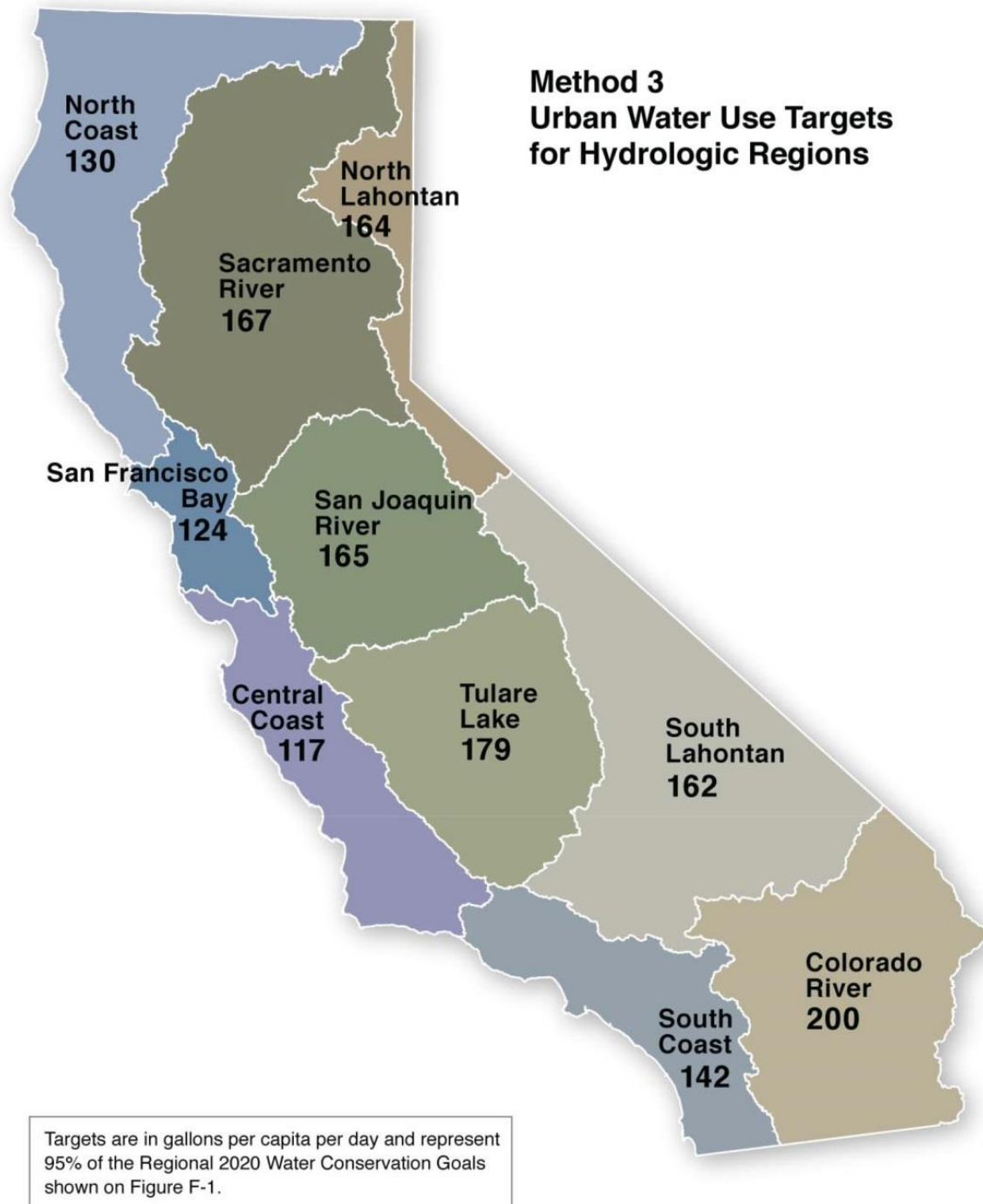
- Method 1 : 80 percent of Base Daily Per Capita Use;
- Method 2: Performance standards based on actual water use data for indoor residential water use, landscaped area, and commercial, industrial and institutional (CII) water use;

Method 3: 95 percent of the North Coast hydrologic region target (130 gpcd target) (see

- Figure 5-1); or
- Method 4: Savings by water sector (indoor residential and CII) and landscape and water loss savings.

The City Council adopted Method 1 for the development of its individual water use target on July 29, 2015.

Based on the City's 10-year baseline daily per capita use of 203 gpcd, the City's per capita water use targets in comparison to the projected per capita water use are shown in Table 5-3. The 2020 water use target of 162 gpcd is 80% of the 10-year baseline daily per capita use of 203 gpcd. This determination is based on the 10-year range of 1995-2004, as described in Section 5.2.1 above. The 2015 interim target is 182 gpcd, and is the midpoint between the 10-year baseline and the 2020 target.

Figure 5-1. Hydrologic Region Map for DWR Water Use Target Method 3

5.5.2 5-Year Baseline – 2020 Target Confirmation

Once the water use targets are determined, SB X7-7 requires confirmation that the 2020 water use targets meet the minimum water use reduction established by statute, as described in Section 5.2 above. The established 2020 water use target must be less than or equal to 95 percent of the five-year base daily per capita use. As shown in Table 5-3, the 5-year base daily per capita water use is 201 gpcd. Ninety-five percent of 201 gpcd is 191 gpcd. Because the water use target calculated by Method 1 is less than 191 gpcd, no further adjustments need to be made; therefore the City can establish the 2020 water use target as 162 gpcd.

Table 5-3. Baselines and Targets Summary

(DWR Table 5-1)

Baseline Period	Start Year	End Year	Average Baseline GPCD*	2015 Interim Target *	Confirmed 2020 Target*
10 year	1995	2004	203	182	162
5 Year	2003	2007	201		

*All values are in Gallons per Capita per Day (GPCD)

Notes:

Values obtained from the City's 2010 UWMP. Since 2010 Census data was used, no re-calculation was necessary, per DWR requirements

5.5.3 Calculate the 2015 Interim Urban Water Use Target

The 2015 gallon per capita per day (gpcd) gross water demand is determined by subtracting water sales/transfers/exchanges to other agencies from the total water demand, as reported in Table 4-2, dividing by the City of Healdsburg 2015 population, as reported in Table 3-2, and then converting from acre-feet to gallons. This gross water demand is inclusive of all water demands in the City including losses and excluding wholesale water sales to the Fitch Mountain County Service Area and recycled water. The 2015 actual gross daily per capita water use is reported in Table 5-4 and shows that the City is in compliance with the 2015 Interim Target.

Table 5-4. 2015 Compliance

(DWR Table 5-2)

2015 Actual GPCD	2015 Interim Target GPCD	Optional Adjustments to 2015 GPCD Enter "0" for adjustments not used From Methodology 8					2015 GPCD (Adjusted if applicable)	Did Supplier Achieve Targeted Reduction for 2015? Y/N
		Extraordinary Events	Economic Adjustment	Weather Normalization	TOTAL Adjustments	Adjusted 2015 GPCD		
122	182	0	0	0	0	122	122	Yes

*All values are in Gallons per Capita per Day (GPCD)

6. System Supplies

This section describes the City's water supplies: surface water, the water treatment system, recycled water supply, and future water supply projects. Water supply constraints, such as water rights and water quality, are also discussed in this section.

6.1 Purchased or Imported Water

In 1992 the City signed a contract with the Sonoma County Water Agency (SCWA) for a backup water supply. The purpose of the 1992 agreement was to supply the City with a backup water supply should the City water rights become unavailable. After two one-year extensions of the 20-year contract, the City and SCWA were able to negotiate a Water Sale Agreement for 425 AFY. Along with the for fee water, the City is obligated to maintain a conservation program as well as increase local water supplies through the promotion and expansion of recycled water reuse.

6.2 Groundwater

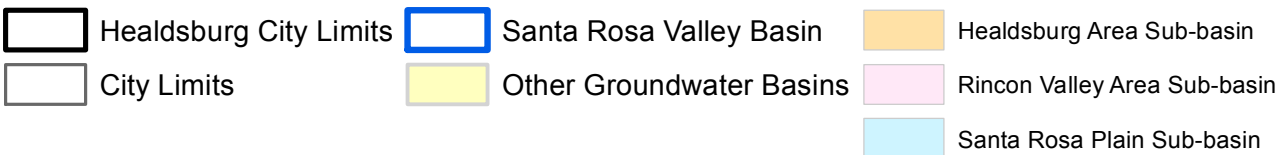
Although the City does not currently pump from groundwater basins or aquifers, a discussion is included in this report.

6.2.1 Basin Description

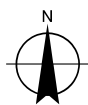
The City is partially located in the North Coast Hydrologic Region, at the north end of the Santa Rosa Valley Groundwater Basin, and partially in the long and very narrow Healdsburg Area Subbasin No. 1-55.02 (See Figure 6-1) as identified in DWR Bulletin 118. Healdsburg encompasses approximately 4 square miles, and also extends east of the Healdsburg Area Subbasin to an area west of the narrow Alexander Area Subbasin. The Healdsburg Area subbasin includes the floodplain of the Russian River, where the City diverts potable water from wells along the Russian River and Dry Creek. Many smaller communities rely on the local surface water and groundwater systems in the North Coast Region. Figure 6-1 shows the Healdsburg Area Subbasin.

Surface water and groundwater storage changes as precipitation varies from year to year. In wetter years, the volume of water stored is usually increased. In drier years, storage volumes may be reduced.

According to the description of the Healdsburg Area hydrogeology in DWR's Bulletin 118, the area is underlain by sedimentary units with inclusions of metamorphic, granitic, and volcanic rock.



Paper Size 8.5" x 11" (ANSI A)
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 Feet
 Map Projection: Lambert Conformal Conic
 Horizontal Datum: North American 1983
 Grid: NAD 1983 StatePlane California II FIPS 0402 Feet



City of Healdsburg
 Urban Water Management Plan Update 2015

Job Number 11110660
 Revision 0
 Date 06 May 2016

Groundwater
 Basins

Figure 6-1

6.3 Surface Water

The City's water supply comes only from surface water diverted either through City held water rights or the SCWA water sale agreement. As discussed previously in the document, the City diverts surface water at three locations: the Gauntlett Well Field, the Fitch Well Field, and the Dry Creek Well Field. Through the City's water rights and agreements, each of these diversion points are available to the City year round. Due to turbidity issues, the Fitch Well Field is not used to supply potable water between November 1 and May 1 each year. Instead, during this time period, a limited portion of the water available through this water right is used for irrigation of Tayman Park Golf Course and Badger Park.

6.3.1 Water Rights

The Russian River's flow has been augmented by diversions from the Eel River since 1908 for the operation of the Potter Valley hydroelectric power plant. Under the California State Water Resources Control Board (SWRCB) permits 8594, 7847, 11039, and 13059 the City diverts (pump) water from the Russian River and Dry Creek. Additionally, the City has one application pending with the SWRCB for additional water rights on Dry Creek. Table 6-1 shows the total water supply available to the City based on current and pending water rights for each of the well fields.

Table 6-1. Existing Water Rights and Diversion Limits

Permit Number	Location	Maximum Water Right (AFY)	Actual Currently Available Supply (AFY)	Diversion Rate Limit (cfs) ^a	Diversion Season
Dry Creek Water Rights					
8594 (A 014068)	Dry Creek Well Field	426.5 ^b	424	1	April 1 to November 1
Russian River Water Rights					
7847 (A 013217)	Fitch Well Field	1,385	1,385	3	Year Round
11039 (A 017121)	Gauntlett Well Field	1,865	1,865	4	Year Round ^c
13059 (A 017632)	Fitch Mountain – Diggers Bend Diversion Points	578	578	1.39	April 1 to November 1
Total		4,254.5	4,252		

Notes:

a = Cubic feet per second

b = There is a diversion limit applicable to water right 8594 of 1 cfs from April through October. This limitation lowers the annual maximum diversion to 424 AF.

c = With the issuance of the City's current Domestic Water Supply Permit in 1999, operation of the Gauntlett and Fitch Well Fields was restricted to May 1st through October 31st due to elevated levels in turbidity. This was a temporary condition that was eliminated on the Gauntlett Well Field in October 2005 with the microfiltration water treatment system. In 1988, the permit Order was amended so that the combined maximum annual use under the two permits for 7847 and 11039 was limited to 3,250 acre-feet.

On December 5, 1997, the City filed for an additional water right permit for Dry Creek water (Application Number A30663). The application seeks an appropriative right to divert an additional 880 AFY from the five existing Dry Creek wells at a maximum rate of 1.6 cfs from April 1st through October 31st, and 2.6 cfs from November 1st through March 31st. The application was publicly noticed by the SWRCB in 2001 and is still under consideration, as the City and the SWRCB work to resolve public comments received in response the application.

For planning purposes, the City conservatively assumes that the current diversion of 1.0 cfs from April 1 to –November 1 (424 AFY) will be expanded to a minimum of 1.0 cfs year-round (304 AFY) which results in a total of 724 AFY available from Dry Creek. Future water supply calculations assume an increase of 304 AFY until the application is approved. This plan assumes the application will be approved by 2020.

Table 6-2 summarizes the pending water rights and the diversion limits.

Table 6-2. Pending Water Rights and Diversion Limits

Application Number	Location	Additional Water Right (AFY)	Total Diversion Rate Limit (cfs)	Diversion Season
A30663	Dry Creek Well Field	880 ^a	1.6 (from 1.0) 2.6 (from 0)	April 1 through Oct. 31 Nov 1 through March 31
Total of Water Rights from Table 4-1 (includes Diggers Bend, and 424 AFY maximum for Dry Creek)		4,254.5	NA	
Total of Water Rights with Assumed Rate of Pending Water Rights		5,134.5		

Note:

a = currently, there is a limitation of 1 cfs diversion rate between April and October. The pending Dry Creek application, if approved in full, would be added to the current water right for a total of 420 + 880 = 1,300 AFY.

The City's water rights on the Dry Creek Well Field are currently under review with respect to the definition of this water supply as surface water versus groundwater. In 2012, the California Department of Public Health (CDPH) wrote a letter to the City indicating that data collected in 1997 identified that the Dry Creek wells may be under the direct influence of surface water and required the City to conduct testing to further clarify the issue. The City completed Microscopic Particulate Analysis (MPA) on all of the Dry Creek wells, and the laboratory analyses indicated greater similarities to groundwater than to surface water. The data was submitted to DWR and the City is awaiting a response. For planning purposes, the City assumes the Dry Creek wells are groundwater sources and are not directly influenced by surface water and do not require micro-filtration.

6.3.2 Russian River and Dry Creek Flows

Three major reservoirs provide water supply for the Russian River watershed: Lake Pillsbury on the Eel River, Lake Mendocino on the East Fork of the Russian River and Lake Sonoma on Dry Creek. The Russian River and Dry Creek water flows are controlled by releases from two dams: Warm

Springs Dam, located on Dry Creek forming Lake Sonoma, and Coyote Valley Dam which is located on the Russian River to the north of Ukiah that forms Lake Mendocino. Both Lake Sonoma and Lake Mendocino have separate pools for water supply and flood control, determined by the elevation of the water surface. Above a specific elevation, the United States Army Corps of Engineers (Corps) controls releases for flood control; below that elevation the Water Agency controls releases for water supply.

Currently, the Water Agency must maintain sufficient water flow in the river to be protective of human health, fish and wildlife and for recreation in the Russian River. In 2008, the National Marine Fisheries Service (NMFS), through the determination of a Biological Opinion (biOp), concluded that the Water Agency should modify some of the flood control and water supply operations. The BiOp requires that the summertime flows be permanently reduced to replicate natural summertime river flows, starting in 2010. The BiOp conclusions differ from the water rights decision made by the State Water Resources Control Board in 1986, known as "Decision 1610." Decision 1610 set minimum summertime flow requirements for the Russian River. Since then, the Water Agency has annually petitioned the State Board for interim changes to Decision 1610 depending on what type of water year it is: normal or dry. During a normal year, the Water Agency is required to maintain minimum flow for the Russian River between the mouth of Dry Creek and the mouth of the Russian River from 125 cfs to 70 cfs. During dry years, for that same stretch, the minimum flow requirement is reduced to a range from 85 cfs to 70 cfs.³

Each year, the Water Agency has petitioned for, and has received, temporary urgency change orders to preserve water levels in Lake Mendocino to ensure an adequate supply in the fall for both human uses and for the fall Chinook salmon run.

The City's water rights are affected by the flow of these rivers, but with a minimum flow required, the City's supply reliability is good. The City's Water Rights are senior to the SCWA's rights to operate the Warm Springs and Coyote Valley Dams. Under Decision 1610, SCWA is obligated to reserve a certain amount of water and instream flows for senior water rights holders such as the City of Healdsburg.

6.3.3 Dry Creek Well Field

The Dry Creek Well Field is located above the 100-year floodplain along the east bank of Dry Creek next to the City's corporation yard on Westside Road and southwest of the City. The geology of the Dry Creek Well Field consists of a uniform sequence of blue clay overlain by 30 to 50 feet of alluvial sand and gravel, which in turn is overlain by a surficial zone of sand, silt, or silty clay.

The Dry Creek Well Field has a total of five wells, which are permitted for use in the City's domestic water system (Permit 8594). The City's SWRCB Department of Drinking Water (DDW) permit allows the use of two of the wells only in conjunction with ortho-polyphosphate sequestration treatment for manganese. In practice, the City minimizes the use of these wells to avoid introducing manganese to the distribution system, even with the sequestration treatment. The City can legally pump up to 1.0 cfs seasonally (April 1 through October 31st) from these wells combined. This flow rate is equivalent to a maximum of delivery rate of 424 AFY.

The City applied to the DDW for an additional water right for Dry Creek in the amount of 1,033 AFY in December 1997, which would bring the total Dry Creek diversion to approximately 1,457 AFY.

³ Sonoma County Water Agency. 2010 UWMP, page 4-3.

This application is still pending, as it has not yet been fully reviewed and approved by the SWRCB. For planning purposes, the City assumes that this pending water right would be granted by 2020 at a minimum of 1.0 cfs year-round, approximately equal to 724 AFY. See Section 6.3 for additional details regarding this pending water right for the Dry Creek Well Field.

6.3.4 Gauntlett and Fitch Well Fields

Studies performed by the City in 1998 and 1999 indicated that the Russian River alluvial deposits provided sufficient river bank filtration for the Gauntlett and Fitch Well Fields to be used between May and October, without additional treatment. The DDW concurred with these findings; however, the DDW also determined that during the rainy season, when turbidity levels of the Russian River increase, the well water turbidity levels would increase, and the alluvium does not provide a sufficient filtration barrier for turbidity. Subsequently, the DDW reissued the City's Domestic Water Supply Permit in June of 1999, placing a seasonal restriction on the use of the Gauntlett and Fitch Well Fields. This permit did not allow the Gauntlett and Fitch Well Fields to be operated between November 1st and April 30th. Until late 2005, this seasonal restriction on the Gauntlett and Fitch Well Fields prevented the City from fully utilizing its Russian River water rights. In 2004 and 2005, the City constructed a water treatment facility for the Gauntlett/Fitch Well Fields. In August 2005, the City submitted an application to modify the DDW permit to eliminate the seasonal restriction on the use of the Gauntlett Well Field. The DDW responded in October 2005, lifting the seasonal restrictions for those wells now being treated. This action allows the City to use of the Gauntlett Wells year-round. Further descriptions of the Gauntlett and Fitch Well Fields are provided below.

Gauntlett Well Field

The Gauntlett Well Field is located along the west bank of the Russian River, and is situated within the 100-year flood plain at the north end of the City. The geology consists of a uniform stratigraphic sequence of gray-green massive shale from the Franciscan formation, overlain by alluvial stream channel and over-bank deposits of coarse-grained sand and gravel.

With no seasonal restrictions, the City's permit allows for a diversion of up to 4 cfs from the Gauntlett Well Field. These wells pump to the Gauntlett Reservoir where the raw water is gravity fed to the City's microfiltration plant to reduce the turbidity. From there the water goes to Panorama Reservoir, where it is distributed to customers. Most of the potable water used by the City in the winter months comes from these wells.

As mentioned in previous sections, there are four active potable use wells at the Gauntlett Well Field. The number of wells operating and the rate of production are based on demand and are controlled to maintain a minimum level in the Gauntlett Reservoir. When the Well Field is in use, the City typically operates two of the wells, and brings the other two on-line if needed to meet demand. Overlapping cones of depression limit the simultaneous operation of all four wells.

Fitch Well Field

The Fitch Well Field is located along the north bank of the Russian River, just south of Fitch Mountain Road and in the southeast part of the City. It is situated within the 100-year flood plain. The Well Field is characterized by a consistent stratigraphic blue clay overlain by 30 to 50 feet of alluvial sand and gravel, in turn overlain by brown sand, silt or silty clay with occasional gravels.

Because the Fitch Well Field is directly adjacent to the Russian River, it is affected by the river's flow. These wells are considered groundwater under the direct influence of surface water. The City is allowed to pump these wells up to 3 cfs year round with an annual maximum of 3,250 acre-feet shared between Fitch and Gauntlett Well Fields.

Currently, the City's ability to supply drinking water from the Fitch Well Field is limited by the DDW, due to water quality issues.

Only three of the five wells at the Fitch Well Field are active and permitted for use in the potable water system. The fifth well had a collapsed casing and was properly abandoned. The third well has been disconnected from the potable water system due to high manganese levels, but is used to irrigate Tayman Park Golf Course and Badger Park. Of the 3 active potable water wells, the number of those wells in use and the rate of production are varied to maintain minimum water levels in the Tayman Reservoirs.

The City was given water rights to divert flow from the Russian River at Diggers Bend by the CSA. One of the allowable diversion points for that water right is located in the Fitch Well Field. The City may pump a total of 578 AFY using this right, however, due to turbidity issues, there is a seasonal restriction on this well. This is illustrated in Table 6-1.

6.3.5 Water Quality

According to DWR's 2009 California Water Plan Update (Bulletin 160-09, Volume 3), the North Coast Hydrologic Region has several water quality challenges. In the Healdsburg Area, sediment, temperature and nutrients are the focus for the Regional Water Quality Control Board for the Russian River. Turbidity and manganese are two main water quality concerns for the City.

Turbidity

The Russian River is listed as a 303(d) impaired water body for sedimentation/siltation and temperature. The City also has turbidity issues with the water from some of their Gauntlett and Fitch Well Fields in the winter. It is for this reason that the City installed a water treatment plan for the Gauntlett wells, allowing year-round production. A treatment plant may be installed at the Fitch wells, if needed.

Manganese

The City has discovered manganese in concentrations above drinking water limits in some of the Dry Creek wells. To lower the manganese level to allowable drinking water limits, the water is treated with ortho-polyphosphate treatment.

6.4 Stormwater

The City has no large-scale stormwater recovery system in place for water supply augmentation. The City does have storm water low impact development (LID) features throughout the City. These include recent retrofit projects of pervious street bulb outs in downtown as well as detention basins. These features are largely designed for flood control, ground water recharge, and water quality treatment purposes.

6.5 Wastewater and Recycled Water

The City operates a tertiary level wastewater treatment plant (WWTP), known as the City of Healdsburg's Wastewater Treatment, Reclamation and Disposal Facility, which treats all of the City's wastewater to Title 22 recycled water standards. The City certified an Environmental Impact Report (EIR) on July 11, 2005 for the WWTP Upgrade Project, and the WWTP went into operation in May 2008. The WWTP Project provides tertiary treated wastewater that can be used in agricultural and urban irrigation areas. The service area for recycled water use was expanded in 2014 and again in 2016 by addendum to the EIR for seasonal irrigation of vineyards by pipeline and trucked water deliveries. The City's recycled water program is regulated by State of California Water Resources Control Board General Waste Discharge Requirements for Recycled Water Use – Order WQ 2014-0090-DWQ and California Recycling Criteria – CCR Title 22, Chapter 3, Article 7 Section 06323 administered by the North Coast Regional Water Quality Control Board.

6.5.1 Recycled Water Coordination

The City does not coordinate with any other wastewater facilities or agencies within the City's service area regarding the quality and availability of recycled water for beneficial reuse. There are no other agencies collecting, treating, or discharging municipal wastewater both generated and treated within the City's service area.

6.5.2 Wastewater Collection, Treatment, and Disposal

The City's wastewater collection, treatment and disposal system is described in detail in the Title 22 Engineering Report. The collection system consists of a network of underground pipelines that collect and convey raw wastewater from individual user connections to the City's advanced WWTP. The WWTP is shown on Figure 6-2. The WWTP includes the following treatment processes:

- Influent equalization ponds.
- Screening and grit removal.
- Primary biological and aeration treatment using aerobic, anoxic, and pre-anoxic basins to provide biological removal of BOD and nitrogen.
- Waste Activated Sludge (WAS) pumping.
- Secondary membrane bioreactors (MBR)
- Effluent disinfection using ultraviolet (UV) lamps.
- Treated effluent storage (25 million gallon storage capacity) and pumping.
- Solids stabilization (sludge management).
- Dewatering facilities (sludge dewatering).
- Discharge of treated effluent (recycled water) to the Basalt Pond or reuse through the City's recycled water system.

Table 3-3 summarizes some of the relevant details about the City's WWTP. Table 6-4 summarizes details of the City's wastewater discharge permit as well as the volume of wastewater treated and discharged in 2015. Currently, the City discharges the treated effluent year-round to a former gravel extraction pit (Basalt Pond) for percolation into the underlying groundwater basin, which is

hydrologically connected to the Russian River. The Basalt Pond is owned by Syar Industries and was created by terrace mining operations that ended in 1985.

Table 6-3. Wastewater Collection within Service Area in 2015

(DWR Table 6-2)

Wastewater Collection		Recipient of Collected Wastewater				
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated?	Volume of Wastewater Collected in 2015	Name of Wastewater Treatment Agency Receiving Collected Wastewater	Treatment Plant Name (as it appears on the discharge permit)	Is WWTP Located Within UWMP Area?	Is WWTP Operation Contracted to a Third Party?
City of Healdsburg	Metered	954	City of Healdsburg	City of Healdsburg Wastewater Treatment, Reclamation and Disposal Facility	Yes	No
Total Wastewater Collected from Service Area in 2015:		954				

Table 6-4. Wastewater Treatment and Discharge within Service Area in 2015

(DWR Table 6-3)

Wastewater Treatment Plant Name	Discharge Location	Discharge Location Description	Wastewater Discharge ID Number	Method of Disposal	Does This Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level	2015 volumes (AF)			
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area
City of Healdsburg Wastewater Treatment, Reclamation and Disposal Facility	Basalt Pond	Former gravel excavation pit	1B82046OSON	River or creek outfall	No	Tertiary	954	924	30	5
Total							954	924	30	5

6.5.3 Recycled Water System

The City completed design of a recycled water pumping, storage and distribution system in 2011, and has been implementing elements of the project as funding allows. The recycled water system design includes transmission pipelines to convey recycled water to potential agricultural (vineyard) irrigation users west of U.S. 101. The recycled water system also includes a pump station at the WWTP and a terminal storage reservoir at Tayman Park. To date the City has completed installation of transmission / distribution mains extending from the 25 million gallon storage reservoir at the WWTP south to irrigate Syar owned vineyards and to Kinley Drive, including a pipe bridge across Dry Creek (Figure 6-2). Section 6.8.1 discusses the future implementation options of recycled water for urban irrigation, should it become cost effective.

6.5.4 Recycled Water Beneficial Uses

Currently, a percentage of the City's treated wastewater is delivered to irrigate vineyards just north and south of the WWTP. This use of recycled water does not offset the City's potable water use; it is mainly offsetting the use of groundwater derived from private wells. There is a hydrant connected to the recycled water system at Kinley Drive and another at the WWTP. These hydrants can be accessed by water tank trucks. The WWTP hydrant is used to supply a small amount of recycled water for dust control, construction site operators and a few vineyards. This hydrant is metered per state requirements. A direct connection to the recycled water pipeline provides recycled water to the Syar Industries gravel plant for dust control.

The second recycled water hydrant that was installed off the northern portion of the recycled water pipeline on Kinley Drive is also accessible to water hauling trucks. Recycled water from this hydrant is also being used for dust control at construction sites and for several nearby vineyards. The dust control usage offsets potable water use for the City. These hydrants are metered. At present, however, the City's metering practices do not differentiate between recycled water that does or does not offset potable use.

The areas that may receive hauled recycled water are located in the Dry Creek, Alexander, and Russian River Valleys. The extent of the potential recycled water hauling area is shown in Figure 6-2.

Table 6-5 lists the current and projected beneficial uses of the City's recycled water, and compares the actual 2015 recycled water use to the 2015 projections from the 2010 UWMP.

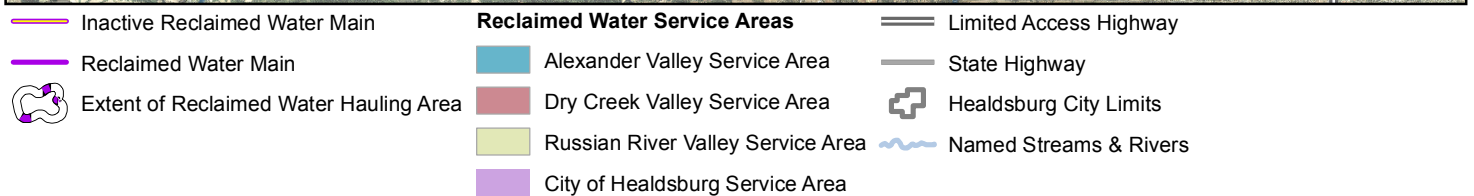
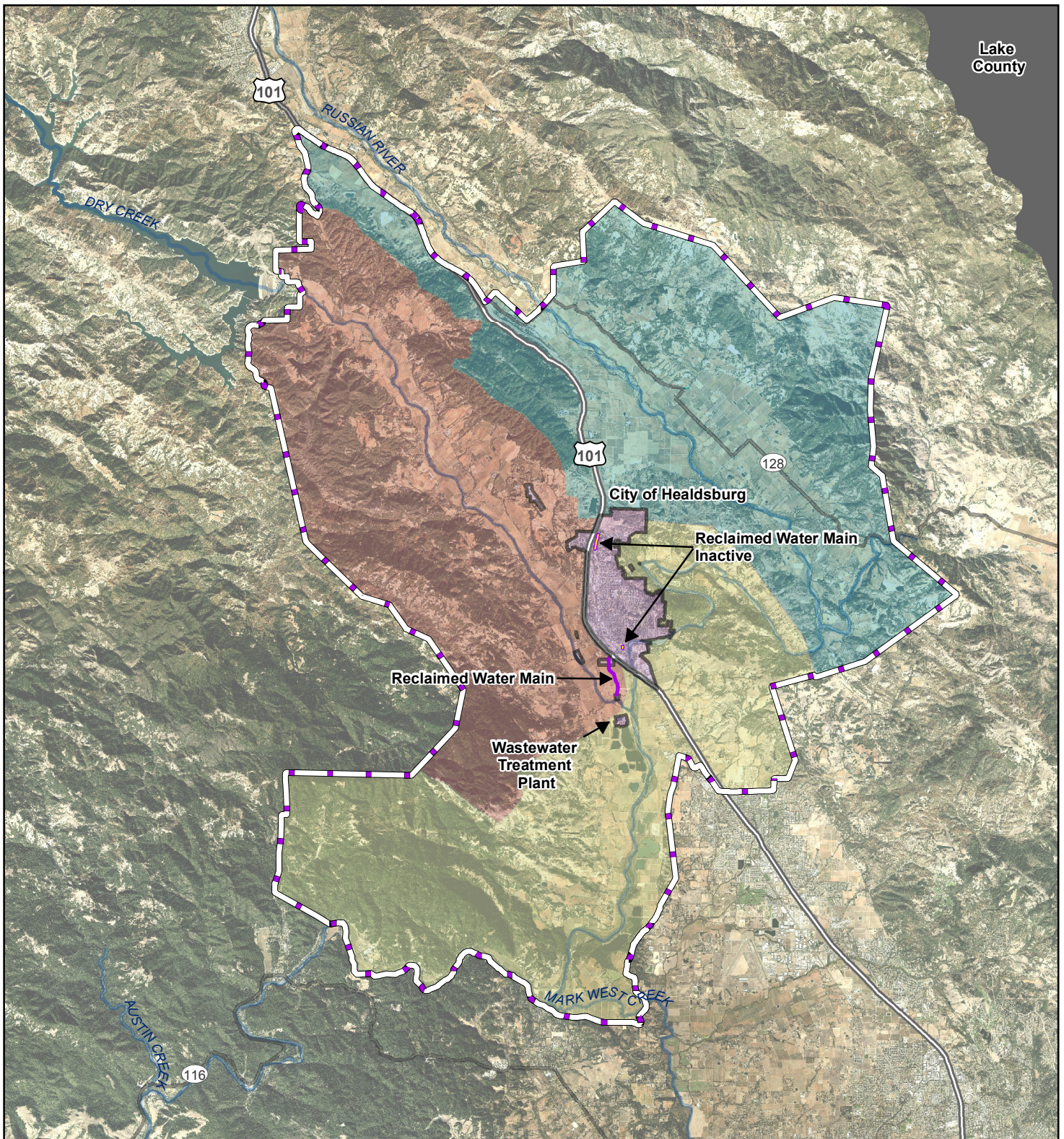


Table 6-5. Current and Projected Recycled Water Direct Beneficial Uses within Service Area*(DWR Table 6-4)*

Name of Agency Producing (Treating) the Recycled Water:		City of Healdsburg						
Name of Agency Operating the Recycled Water Distribution System:		City of Healdsburg						
Supplemental Water Added in 2015		None						
Source of 2015 Supplemental Water		N/A						
Beneficial Use Type	General Description of 2015 Uses	Level of Treatment	2015 (AF)	2020 (AF)	2025 (AF)	2030 (AF)	2035 (AF)	2040 (AF)
Agricultural irrigation	Vineyard irrigation (groundwater offset)	Tertiary	5	200	400	420	420	420
Landscape irrigation (excludes golf courses)	Potable water offset	-	0	3	3	80	80	80
Golf course irrigation	-	-	0	0	0	90	90	90
Commercial use	Dust control for construction (potable water offset)	Tertiary	25	30	30	30	30	30
Industrial use	Potable water offset	-	0	15	15	15	15	15
Geothermal and other energy production	-	-	0	0	0	0	0	0
Seawater intrusion barrier	-	-	0	0	0	0	0	0
Recreational impoundment	-	-	0	0	0	0	0	0
Wetlands or wildlife habitat	-	-	0	0	0	0	0	0
Groundwater recharge (IPR)	-	-	0	0	0	0	0	0
Surface water augmentation (IPR)	-	-	0	0	0	0	0	0
Direct potable reuse	-	-	0	0	0	0	0	0
Other	-	-	0	0	0	0	0	0
Total:			30	248	448	635	635	635

Notes: IPR - Indirect Potable Reuse

Table 6-6. 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual

(DWR Table 6-5)

Use Type	2010 Projection for 2015 (AF)	2015 Actual Use (AF)
Agricultural irrigation	10	5
Landscape irrigation (excludes golf courses)	0	0
Golf course irrigation	0	0
Commercial use	45	25
Industrial use	0	0
Geothermal and other energy production	0	0
Seawater intrusion barrier	0	0
Recreational impoundment	0	0
Wetlands or wildlife habitat	0	0
Groundwater recharge (IPR)	0	0
Surface water augmentation (IPR)	0	0
Direct potable reuse	0	0
Other	0	0
Total	55	30

6.5.5 Actions to Encourage and Optimize Future Recycled Water Use

The original impetus for the City of Healdsburg to develop a recycled water system was to curtail effluent discharge into the Russian River from May 15 to September 30. The City estimates that if all of the vineyards currently connected to the recycled water pipeline irrigated using recycled water rather than well water, and if nearby vineyards were to continue using trucked recycled water, approximately 50 AFY would be diverted from the Syar discharge pond to these uses. The City actively pursues users of the recycled water system by meeting with vineyard operators, and currently provides recycled water at no cost to encourage its use. While this use is not a direct offset of City potable water, it does contribute to the requirement of the seasonal discharge prohibition.

Included in the 2005 EIR and master plan for the recycled water system was the irrigating of public properties with recycled water (Table 6-7). These properties have the potential to consume approximately 26 AFY of recycled water for urban irrigation. Unfortunately, to reach these properties requires a lengthy and costly extension of the pipeline, making these sites less attractive than the vineyards adjacent the WWTP. In future years, changes to regulatory requirements may make use of recycled water within the City limits more feasible.

Issues constraining expanded use of recycled water include public perception, regulatory reporting requirements, and the cost of expanding the recycled water system to reach all potential users identified in the City's service area and surrounding areas.

Table 6-7. Methods to Expand Future Recycled Water Use*(DWR Table 6-6)*

Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use (AF)
Expansion of recycled water system	Increase recycled water beneficial use for urban irrigation customers at seven sites	2035	26
Total			26

6.6 Desalinated Water Opportunities

There are currently no plans for desalination, and no desalination for future water supply is anticipated.

6.7 Exchanges or Transfers

The City has no current agreements of future plans for water exchanges or transfers with other water users or agencies.

6.8 Future Water Projects

The City is currently working to expand the recycled water system in the most economical way. Under the City's current assumptions, this will delay expanding the recycled water system into the City until State regulations regarding the reuse of recycled water for indirect and direct potable water is better defined. Future recycled water projects are discussed in more detail below.

Table 6-8. Expected Future Water Supply Projects or Programs*(DWR Table 6-7)*

Name of Future Projects or Programs	Joint Project with other agencies?		Description (if needed)	Planned Implementation Year	Planned for Use in Year Type <i>Drop Down List</i> User may select more than one.	Expected Increase in Water Supply to Agency, AF
	<i>Drop Down List (y/n)</i>	<i>If Yes, Agency Name</i>				
Expansion of recycled water system	No	N/A	Increase recycled water beneficial use for irrigation customers at seven sites	2035	Average Year	26

6.8.1 Recycled Water

As previously discussed in Section 6.5.3, the City has completed the design of a recycled water system which, if implemented, would extend recycled water mains to agricultural irrigation areas first and, if cost effective, to urban reuse areas within the City. If urban reuse is pursued, the available urban reuse area totals approximately 85 irrigable acres. These urban reuse areas include:

- Tayman Park Golf Course
- Badger Park
- Recreation Park
- The Healdsburg cemetery
- Healdsburg Elementary School
- Healdsburg Junior High School
- Healdsburg High School

Full implementation of the recycled water plan would require constructing a pipeline under U.S. 101 and constructing a new recycled water storage reservoir. The City is currently evaluating options and funding alternatives to continue expansion of the system into urban areas.

Most of the economical recycled water use is for agricultural irrigation (vineyards), and is therefore not an offset to the City's potable water use. The use of recycled water by vineyards does offset groundwater extraction in the basin.

As described above, Syar Industries uses recycled water for dust control at their facility. They are also planning to switch to recycled water use for gravel washing in the near future.

6.9 Summary of Existing and Planned Sources of Water

Table 6-9 shows the actual volume of water available in 2015 from each supply source. Projected water supply for the next 25 years was calculated using 2015 actual water supply, as well as the recycled water for potable water offset projections shown in Table 6-7. Future water projections are shown in Table 6-10.

Table 6-9. Water Supplies – Actual

(DWR Table 6-8)

Water Supply	Additional Detail on Water Supply	2015	
		Actual Volume (AF)	Water Quality
Surface Water	Dry Creek Well Field	424	Drinking Water
Surface Water	Gauntlett Well Field	1,865	Drinking Water
Surface Water	Fitch Well Fields	1,385	Drinking Water
Surface water	Fitch Well Field - Diggers Bend Diversion	578	Drinking Water
Recycled Water	WWTP Title 22 Recycled Water	55	Recycled Water
Purchased or Imported Water	Purchase from SCWA	425	Drinking Water
Total		4,732	

Table 6-10. Water Supplies – Projected

(DWR Table 6-9)

Water Supply	Additional Detail on Water Supply	Projected Water Supply (AFY)					
		2020	2025	2030	2035	2040	
		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	
Surface water	Dry Creek Well Field	424	424	424	424	424	
Surface water	Dry Creek Well Field - Approval of year round Diversion ^(a)	304	304	304	304	304	
Surface water	Gauntlett Well Field	1,865	1,865	1,865	1,865	1,865	
Surface water	Fitch Well Fields	1,385	1,385	1,385	1,385	1,385	
Surface water	Fitch Well Field - Diggers Bend Diversion	578	578	578	578	578	
Recycled Water	Potable Water Offset	48	48	125	125	125	
Purchased or Imported Water	Purchased from SCWA	425	425	425	425	425	
Total		5,029	5,029	5,106	5,106	5,106	

Notes:

2020-2035 data from The City's 2010 UWMP, DWR Table 16

(a) The City's request is for an additional 880 AFY from the Dry Creek Well. This table is assuming a conservative response to the water rights permit application.

6.10 Climate Change Impacts to Supply

As discussed in section 3.3, the City of Healdsburg recognizes climate change's effect on weather patterns and water supply, and the importance of accounting for these changes when analyzing our future water security. Whenever possible, historical data has been updated in this UWMP to ensure forecasts are based on more recent conditions which show the impact of climate change.

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7. Water Supply Reliability Assessment

The Act requires that each UWMP include an assessment of its water supply reliability in normal, dry, and multiple dry water years. Factors influencing the City's water supply reliability are discussed in this section.

7.1 Constraints on Water Sources

The City of Healdsburg has a water supply with a high level of reliability. Several constraints affect the reliability of the City's supply, as described in the following sections.

7.1.1 Source Constraints

The reliability of the City's supply is generally protected by the Sonoma County Water Agency (SCWA) diversion requirement to maintain the flow of the Russian River at minimum levels at specific points in the Russian River. As described in Section 6.3.2, the SCWA has the responsibility for maintaining these minimum flows with releases from Warm Springs Dam, which insures adequate flows at the Dry Creek Well Field, located below the dam.

As described in Section 6.3.2, the flow of the Russian River has been augmented by diversions from the Eel River since 1908 for operation of the Potter Valley hydroelectric power project. This water diversion has been controversial for many years due to concerns over impairment of Eel River salmonid populations over the life of the project. In January 2004, the Federal Energy Regulatory Commission issued a decision that amended the plant's operational license, currently held by Pacific Gas & Electric (PG&E). The amended plan generally reduced the allowable annual diversion from the Eel River by 15%. This license expires in the year 2022.⁴ Because it is believed that the endangered salmonid species in the Russian River are reliant on these diversions, it is anticipated by the SCWA that these diversions will continue during the planning horizon of the 2015 UWMP.⁵

As described in Section 6.3.2, the SCWA must maintain sufficient water flow in the river to be protective of human health, fish and wildlife and for recreation in the Russian River. In 2008, the National Marine Fisheries Service (NMFS), through the determination of a Biological Opinion (BiOp), concluded that the SCWA should modify some of the flood control and water supply operations. The BiOp requires that the summertime flows be permanently reduced to replicate natural summertime river flows, starting in 2010. [Since then, the SCWA has annually petitioned the State Board for interim changes to Decision 1610 depending on what type of water year it is: normal, dry or critically dry. During a normal year, the SCWA is required to maintain 185 cfs for the upper Russian River (between the confluence of the East and West Forks of the Russian River and the confluence of the Russian River and Dry Creek) and 125 cfs for the lower Russian River (between its confluence with Dry Creek and the Pacific Ocean).]

⁴ Sonoma County Water Agency, 2010 Urban Water Management Plan, June 2011. Note that the SCWA 2005 UWMP reported that the permit would expire in 2033.

⁵ Sonoma County Water Agency, 2010 Urban Water Management Plan, June 2011.

The City has a water sale agreement with the SCWA executed in 2015. The agreement allows the City to divert SCWA water up to 425 AF per year. Under the agreement if SCWA has a shortage of water, the water sold to the City could also be curtailed.

7.1.2 Legal & Environmental Constraints

There are factors other than drought or emergency that cause, or have the potential to cause, inconsistent supply to meet demands and are due to legal, environmental, or climatic issues.

The City presently holds four existing water rights permits for diversion from Dry Creek and the Russian River. In addition, the City has one application pending with the SWRCB for additional water rights on Dry Creek. Summaries of each existing and pending water rights permit are provided in Table 6-1 and Table 6-2, respectively with discussion in Section 6.3.

In September 2008, a final Biological Opinion (BiOp) was released by the National Marine Fisheries Service (NMFS) and issued to the SCWA, the U.S. Army Corps of Engineers (Corps), the California Department of Fish and Game, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District. The BiOp is a federal mandate on Russian River operations of the receiving agencies listed above that affect salmonids on state and federal endangered species lists (steelhead, Coho, and Chinook) which affects the SCWA's water supply operations and subsequent delivery to its water customers, including the City.

The BiOp calls for the elimination or reduction of impacts to salmonids due to water supply and flood control activities in the Russian River watershed through measures deemed to be "reasonable and prudent alternatives," including:

- Extensive monitoring of both habitat and fish in Dry Creek, the estuary and the Russian River;
- Eliminating impediments to fish migration and improving habitat on several streams;
- Restoring up to six miles of habitat in Dry Creek and studying a bypass project;
- Requesting the SWRCB to reduce summertime flows in the Russian River; and
- Creating a freshwater lagoon in the estuary at the mouth of the Russian River during the summer months.

NMFS concluded that lower flows in Dry Creek and Russian River create a better environment for juvenile salmon and steelhead and the BiOp identified habitat restoration projects in Dry Creek to reduce water velocities in the stream/river. Current minimum summer flows are based on weather conditions, and range from 125 cfs (during a normal year, as measured at the Healdsburg Gage upstream of the Dry Creek confluence) to 85 cfs (as measured during a dry year). Under the terms of the BiOp, minimum flows would be dropped to 70 cfs with an additional 15 cfs to maintain system flexibility for a total flow of 85 cfs. The BiOp acknowledged a need for balance and flexibility and noted that SCWA may find alternative minimum flow requirements that meet the goals of restoring functional salmonid-rearing habitat while promoting water conservation and limited adverse effects on other in-stream resources.

7.1.3 Water Quality Constraints

The quality of the City's water deliveries is regulated by the California State Water Quality Control Board (SWRCB) Division of Drinking Water (DDW), which requires regular collection and testing of water samples to ensure that the quality meets regulatory standards and does not exceed Maximum Contaminant Levels (MCLs). The City performs water quality testing, which has consistently yielded results within the acceptable regulatory limits (2015 Healdsburg Consumer Confidence Report).

The quality of existing surface water, groundwater, and recycled water supply sources over the next 25 years is expected to be adequate. Groundwater and groundwater under the influence of surface water will continue to be treated to drinking water standards, and no surface water, groundwater, or recycled water quality deficiencies are foreseen to occur in the next 25 years.

Various City-owned wells have or have had water quality issues and use restrictions due to manganese and/or elevated turbidity. These concerns are managed with water treatment facilities and use management, as discussed in Section 6.3.5. Currently, the seasonal use restrictions affecting the City due to water quality concerns are the seasonal restrictions on the Gauntlett and Fitch Well Fields. The City treats water obtained from the Gauntlett Well Field in order to utilize this water source year-round. The City is exploring options for the Fitch Well Field to extend the availability of this water source year-round. The City anticipates completing improvements or adding diversion points to allow the year-round use of the Fitch Water Right by 2020. The City is not constrained in its access to its total water right due to water quality constraints; but rather limited in when it can use water pumped from these sources *without treatment* seasonally.

7.2 Reliability by Type of Year

This section describes the historic reliability of the City's water supply and any vulnerability due to seasonal or climatic shortage. Discussion generally pertains to curtailments of *supply* due to hydrologic shortages. It does not preclude possible requirements imposed by the state to reduce *demand*.

The following section, 7.2.1, discusses the types of rainfall years for which the UWMP requires forecast planning: average, single-dry, and multiple-dry years. Previous UWMPs prepared by the City of Healdsburg have used representative years identified in watershed modelling developed by the Sonoma County Water Agency. Because of changing weather patterns, the recent drought, and comments received from the Public during development of the 2010/2013 UWMP, the City decided to re-evaluate the representative years. Unfortunately, there isn't consistent rainfall data for the City of Healdsburg. Because of this, the analysis was completed for the 25-year period from 1990 to 2015, using Santa Rosa rainfall data, which has the most complete data set. In general, historically, Healdsburg receives 6 more inches of rain per year than Santa Rosa.

The findings of this analysis and adjustments to the representative years, as well as supply reduction assumptions, are discussed in the subsequent section and summarized in Table 7-1.

7.2.1 Types of Years

Average Year

For the purposes of UWMP, *Average Year* is defined as a year, or an averaged range of years, that most closely represents the average water supply available to the City. This is also referred to as “normal” conditions in the UWMP Act.

The City’s previous UWMP used 1962 as the representative average year, with 46 inches of rain in Healdsburg. Analysis of the 25-year period from 1990-2015 showed an average rainfall (in Santa Rosa) of 31 inches and 2002 received 31 inches of rainfall, 2002 will be considered the average, or normal, rainfall year. Since Healdsburg generally receives 6 inches more per year than Santa Rosa, we now expect to receive 37 inches of rain in an average year. Even though this shows an average loss of 9 inches of rain per year, 37 inches of rainfall will provide adequate water supply.

For forecasting purposes, 2002 will be used as the average year and calculations will assume no restriction to supply. The City notes that this is a significant change and will continue to monitor weather conditions.

Tables 7-2 and 7-3 project water supply in average year conditions over the next 25 years.

Single-dry year

The single-dry year is the year that represents the lowest water supply available to the City.

Previous UWMPs for the City of Healdsburg used 1977, with 15.31 inches of rainfall, as the representative single-dry year. In the 25-year period of 1990-2015, 2013 received 8.77 inches of rain, almost 7 inches less than 1977. Because of the minimal amount of rain received in 2013, the City’s Gauntlett water right was fully curtailed in 2014.

For forecasting purposes, 2013 will be used as the single-dry year and calculations will assume the same restriction plus a reduction in water purchased from the SCWA of 25%.

Tables 7-4, 7-5, and 7-6 show projected water supply in single-dry year conditions over the next 25 years.

Multiple-dry year period

The multiple-dry year period is a period that represents the lowest average water supply available to the City for a consecutive multiple year period (three years or more). This is generally considered to be the period that has the lowest average runoff for consecutive years (three or more) for a watershed since 1903.

1988-1991 was used in previous UWMPs as the City’s multiple-dry year period. This period received 73 inches of rainfall total, an average of about 18 inches per year. Analysis of the 25-year period from 1990-2015 finds the lowest average rainfall was 2013-2015: 53 inches of rainfall, or an average of about 17 inches per year. Because of the extensive drought conditions caused by the minimal rain received over this period, Governor Jerry Brown issued an Executive Order requiring 25% water conservation state-wide. To codify this requirement, the SWRQB adopted an Emergency Regulation in May 2015 to be implemented June 2015 through February 2016.

For forecasting purposes, 2013-2015 will be used as the multiple-dry year period and calculations will assume a 25% reduction for all water supply sources.

Tables 7-7 and 7-8 project water supply in multiple-dry year conditions over the next 25 years.

Table 7-1 provides the base years for average, single-dry and multiple-dry water years. These base years may change in future UWMPs, if it is determined that the current or a future drought is a worse scenario than the years listed here. This table also summarizes the reliability of the City's water supply when compared to historical drought conditions, as related to potential supply curtailments.

Table 7-1 illustrates single-year and multi-year drought scenarios based on actual historical droughts and the assumed water right and supply curtailments noted above.

Table 7-1. Basis of Water Year Data

(DWR Table 7-1)

Year Type	Base Year	Available Supplies if Year Type Repeats	
		Volume Available (AF)	% of Average Supply
Average Year	2002	4,732	100%
Single-Dry Year	2013	2,761	58%
Multiple-Dry Years 1st Year	2013	3,563	75%
Multiple-Dry Years 2nd Year	2014	3,563	75%
Multiple-Dry Years 3rd Year	2015	3,563	75%

7.3 Supply Reliability and Demand Assessment

This section summarizes the City's expected water supply reliability and demands for average, single-dry, and multiple-dry years for 2020, 2025, 2030, 2035 and 2040. Each supply reliability scenario is compared against demand projects both including and excluding conservation. This additional analysis indicates what role conservation can play in ensuring demand is met. For clarity and comparison's sake, these demand scenarios are shown in separate tables.

7.3.1 Average Dry Year Supply and Demand Assessment

Table 7-2 and 7-3 show comparisons for the average year; projected total supply is referenced from Table 6-12, total demand (excluding conservation) is referenced from Table 4-4, and total demand (including conservation) is referenced from Table 4-6.

Both Tables show that, in a normal year, the City of Healdsburg is expected to maintain a projected surplus sufficient to meet projected demands.

**Table 7-2. Normal Year Supply and Demand (excluding Conservation)
Comparison - AFY**

(DWR Table 7-2)

	2020	2025	2030	2035	2040
Supply totals (from Table 6-12)	5,029	5,029	5,106	5,106	5,106
Demand totals (from Table 4-4)	2,751	3,100	3,259	3,425	3,599
Difference	2,278	1,929	1,847	1,682	1,507

**Table 7-3. Average Year Supply and Demand (including Conservation)
Comparison - AFY**

	2020	2025	2030	2035	2040
Supply totals (from Table 6-12)	5,029	5,029	5,106	5,106	5,106
Demand totals (from Table 4-6)	2,675	2,969	3,070	3,176	3,286
Difference	2,354	2,060	2,036	1,930	1,820

7.3.2 Single-Dry Year Supply and Demand Assessment

Table 7-4 and 7-5 show comparisons for the single-dry year; projected total supply is referenced from Table 6-12, reduced to assuming full curtailment of the City's Gauntlett water right and a 25% reduction of purchases from the SWCA; total demand (excluding conservation) is referenced from Table 4-4; and total demand (including conservation) is referenced from Table 4-6.

Both Tables show that, in a single-dry year, the City of Healdsburg there will be a water supply shortage in later years. Table 7-6 shows a mandatory conservation requirement of 10% implemented in the single-dry year. This minimal mandatory requirement is sufficient to completely mitigate the supply shortage.

**Table 7-4. Single Dry Year Supply and Demand (excluding Conservation)
Comparison - AFY**

(DWR Table 7-3)

	2020	2025	2030	2035	2040
Supply totals (from Table 6-12)	3,058	3,164	3,241	3,241	3,241
Demand totals (from Table 4-4)	2,751	3,100	3,259	3,425	3,599
Difference	307	64	(18)	(184)	(358)

**Table 7-5. Single Dry Year Supply and Demand (including Conservation)
Comparison - AFY**

	2020	2025	2030	2035	2040
Supply totals (from Table 6-12)	3,058	3,164	3,241	3,241	3,241
Demand totals (from Table 4-6)	2,675	2,969	3,070	3,176	3,286
Difference	383	195	171	65	(45)

**Table 7-6. Single Dry Year Supply, Demand (including Conservation), and
Mandatory Conservation Comparison - AFY**

	2020	2025	2030	2035	2040
Supply totals (from Table 6-12)	3,058	3,164	3,241	3,241	3,241
Demand totals (from Table 4-4)	2,675	2,969	3,070	3,176	3,286
Mandatory Conservation (10%)	268	297	307	318	329
Difference	651	492	478	383	284

7.3.3 Multiple-Dry Year Supply and Demand Assessment

Table 7-7 and 7-8 show comparisons for the multiple-dry year scenario; projected total supply is referenced from Table 6-12, reduced to assuming a 25% reduction in all water supply sources, except for recycled water; total demand (excluding conservation) is referenced from Table 4-4; and total demand (including conservation) is referenced from Table 4-6.

Both tables show that, in a multiple-dry year period, the City of Healdsburg is expected to maintain a projected surplus sufficient to meet projected demands.

**Table 7-7. Multiple Dry Years Supply and Demand (excluding Conservation)
Comparison - AF**

(DWR Table 7-4)

		2020	2025	2030	2035	2040
First year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-4)	2,751	3,100	3,259	3,425	3,599
	Difference	1,033	684	602	436	262
Second year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-4)	2,751	3,100	3,259	3,425	3,599
	Difference	1,033	684	602	436	262
Third year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-4)	2,751	3,100	3,259	3,425	3,599
	Difference	1,033	684	602	436	262

**Table 7-8. Multiple Dry Years Supply and Demand (including Conservation)
Comparison - AFY**

		2020	2025	2030	2035	2040
First year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-6)	2,675	2,969	3,070	3,176	3,286
	Difference	1,109	815	791	685	575
Second year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-6)	2,675	2,969	3,070	3,176	3,286
	Difference	1,109	815	791	685	575
Third year	Supply totals (from Table 6-12)	3,784	3,784	3,861	3,861	3,861
	Demand totals (from Table 4-6)	2,675	2,969	3,070	3,176	3,286
	Difference	1,109	815	791	685	575

7.3.4 Summary of Supply and Demand Analysis

The City's combined projected water supplies are sufficient to meet projected demands during normal and multiple-dry year conditions under the water supply conditions described in section 7.2.1. Although water supplies are projected to be insufficient to meet demand in 2035 and 2040 under single-dry year conditions, a minimal mandatory conservation rate of 10% is enough to cover the deficit.

These conditions occur when comparing demand to water supply, when including a conservative estimate of: increases in accessible supply from approved water permit applications; demand reduction from conservation; and mandatory water conservation target implementation.

7.4 Regional Supply Reliability

The City of Healdsburg has numerous water management tools and options, planned for or already implemented, that maximize the use of the local water resources and minimize the need to import water from other regions or purchase water from the SCWA. For example, the City is implementing a robust water conservation program and, in accordance with State Law, has specific restrictions and prohibitions of potable water end use. Section 8 has in-depth discussion of the City's water conservation programs and ordinances. In addition, the City completed design of a recycled water transmission and distribution system which, when fully implemented, has the potential to offset potable water use by approximately 125 AFY, through use in landscape, commercial, and industrial uses. See section 6.5 for discussion of the City's recycled water beneficial use projections.

8. Water Shortage Contingency Planning

Water shortage contingency planning is a strategic planning process to prepare for and respond to water shortages. Good planning and preparation can help agencies maintain reliable supplies and reduce the impacts of supply interruptions.

Section 10632 of the California Water Code (CWC) requires that UWMPs provide a contingency analysis to serve as a resource in the case of water supply interruption due to drought or other factors causing water shortage. Specifically, the CWC requires UWMPs to:

- Describe Stages of Action the City will take in response to a water supply shortage
- Describe non-essential water use during a water shortage, and report prohibitions, penalties and consumption reduction methods
- Estimate the minimum water supply for the next three years
- Analyze Revenue Impacts due to reduced sales during shortages

This section summarizes the City's water shortage contingency plan (WSCP).

8.1 Stages of Action

In 2009, the City of Healdsburg modified the Municipal Code adding the Water Shortage Emergency Plan (WSEP) which contains description of the actions to be undertaken in response to water supply shortages of up to 40 percent. The WSEP was updated in 2014 to comply with the state's mandatory drought requirements, which require specific water use prohibitions and specific reductions in water usage. In addition, the WSEP was adjusted to allow Council to adopt via resolution additional, short-term water conservation measures without modifying the WSEP. This allows the City to more nimbly implement State restrictions and requirements. The WSEP outlines three water emergency stages, water use restrictions for these stages, as well as the reduction in water use associated with each stage. The Stages increase to reflect increasing severity of drought conditions and include water waste prohibitions.

Stage 1 measures are voluntary and in place under normal water supply conditions. When the City Council declares a water alert (or a Stage 2 water shortage), the voluntary measures of Stage 1 become mandatory and compliance enforceable. A water emergency (or Stage 3 water shortage) includes all prohibitions of Stage 2 plus additional restrictions. A summary of the water shortage stages and corresponding reduction are outlined in Table 8-1. A detailed description of the stages and process that will be used to implement the stages of action is provided in the City's water shortage emergency ordinance, which is included as Appendix B.

Table 8-1. Stages of Water Shortage Contingency Plan

(DWR Table 8-1)

Stage	Percent Supply Reduction	Water Supply Condition
1	10%	Normal Conditions
2	20%	Water Alert
3	40%	Water Emergency

The City expects to revise the WSEP to incorporate the permanent water use restrictions outlined in Governor Jerry Brown's May 9, 2016 Executive Order: *Making Water Conservation a California Way of Life*, to ensure compliance with CWC requirements, and agreement with this UWMP.

8.2 Prohibitions on End Uses

The measures resulting from the stages summarized in Table 8-1 are outlined in Table 8-2. They are meant to be temporary, and in response to drought conditions. A water waste prohibition ordinance will be adopted as an element of the City's developing water conservation program.

Table 8-2. Restrictions and Prohibitions on End Uses

(DWR Table 8-2)

Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
2	Landscape - Limit landscape irrigation to specific times	No watering between 7:00 am and 8:00 pm	Warning; fine; disconnect service
2	Landscape - Limit landscape irrigation to specific days	Every other day	Warning; fine; disconnect service
2	Landscape - Other landscape restriction or prohibition	Eliminate over-spray	Warning; fine; disconnect service
2	Landscape - Restrict or prohibit runoff from landscape irrigation	Prevent pooling or run-off to gutters	Warning; fine; disconnect service
2	Other - Prohibit use of potable water for washing hard surfaces	Except for public health purposes	Warning; fine; disconnect service
2	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	Repair breaks or leaks within 72 hrs	Warning; fine; disconnect service
2	Other	Wash privately owned vehicles only with bucket and hose equipped with an automatic shut-off	Warning; fine; disconnect service

Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
2	Other	Use of water from a fire hydrant for uses other than firefighting and line flushing	Warning; fine; disconnect service
2	Other water feature or swimming pool restriction	Use of potable water from the City's system to fill a new swimming pool	Warning; fine; disconnect service
2	Other water feature or swimming pool restriction	Refilling of a swimming pool except to top off to prevent damage to pump and filter	Warning; fine; disconnect service
2	Other - Prohibit use of potable water for construction and dust control	Use recycled water only	Warning; fine; disconnect service
2	Other	Vehicle washing facilities will limit water use to 80 percent of water used by the customer during the corresponding billing period in the previous year unless wash water is treated and recycled.	Warning; fine; disconnect service
2	CII - Other CII restriction or prohibition	Commercial use of water for nonresidential use shall be limited to 80 percent of the water used by the customer during the corresponding billing period in the previous year	Warning; fine; disconnect service
3	Landscape - Prohibit certain types of landscape irrigation	Irrigation of any lawn with potable water at any time of day or night	Warning; fine; disconnect service
3	Landscape - Other landscape restriction or prohibition	Planting any new landscaping except for designated drought resistant landscaping	Warning; fine; disconnect service
3	Landscape - Other landscape restriction or prohibition	Irrigation sprinkling is allowable only by hand-held nozzle. (Drip irrigation systems for established perennials and trees are allowable.)	Warning; fine; disconnect service
3	Landscape - Other landscape restriction or prohibition	Planting of new annual plants, vegetables, flowers or vines	Warning; fine; disconnect service

8.3 Penalties, Charges, Other Enforcement of Prohibitions

Violations of the provisions of the water shortage ordinance are enforced according to the City's code enforcement ordinance (Municipal Chapter 1.12). Enforcement response is progressive; beginning with warning notices and escalating to penalties. If warning letters and penalties are not sufficient to cause the violations to cease, the City Engineer has the authority to direct the installation of a flow-restricting device on the service line, with cost recovery of expenses incurred by the City. Section 1.12.010 through 1.12.080 of the Municipal Code outlines the City's enforcement process.

8.4 Consumption Reduction Methods

Consumption reduction methods are actions that are taken by the City to reduce water demand within the service area, whereas the prohibitions, discussed in Section 8.2 and 8.3, limit specific uses of water.

Table 8-3. Stages of Water Shortage Contingency Plan – Consumption Reduction Methods

(DWR Table 8-3)

Stage	Consumption Reduction Methods by Water Supplier	Additional Explanation or Reference (optional)
1	Provide Rebates or Giveaways	
2	Improve Customer Billing	
2	Increase Frequency of Meter Reading	
2	Offer Water Use Surveys	
2	Expand Public Information Campaign	
2	Increase Water Waste Patrols	
3	Decrease Line Flushing	
3	Reduce System Water Loss	
3	Implement or Modify Drought Rate Structure Surcharge	

8.5 Determining Water Shortage Reductions

The City meters well water production, customer water consumption, and sales to the County for the Fitch Mountain Service Territory. Because water use is metered, determining actual water savings associated with water shortage stage implementation is straight forward. In addition to monitoring water demand reductions, meter reading and use analysis allows the City to identify abnormally high water use. The City contacts individual customers to resolve issues related to abnormally high water use.

8.6 Revenue and Expenditure Impacts

The current water and wastewater rate structures include a fixed monthly service charge per account and a usage charge based on the amount consumed. Reductions in water consumption will reduce revenue received by the City from usage charges.

Some expenses, such as cost associated with pumping and treating the water, will decrease as water consumption decreases. Most of the City's costs associated with supplying clean drinking water are fixed and will not change with a decrease in water consumption. These expenses include staffing, billing, facilities maintenance, etc.

Should revenue drops become a concern to the City, capital projects could be deferred or available reserves could be used to cover operational expenses. Additionally, drought rates or drought contingency fees could be implemented.

8.7 Resolution or Ordinance

The City adopted a Water Shortage Emergency Plan which was codified by Ordinance No. 1134, amending Section 13.12 of the Municipal Code. This Ordinance is included in Appendix B.

8.8 Catastrophic Supply Interruption

Catastrophic supply interruptions differ from the staged drought responses addressed earlier in this section in that catastrophic interruptions occur suddenly and can immediately jeopardize a large portion, or all, of an agency's water supply. In accordance with the Emergency Services Act, the City has developed an Emergency Operation Plan (EOP) which identifies the City's emergency planning, organization, and response policies. This EOP guides response to unpredicted catastrophic events that might impact water delivery including regional power outages, earthquakes, or other disasters.

The EOP includes a concept of recovery operations, a hazard analysis, responsibilities, and departmentalized standard operating procedures for emergency response. Because several of the hazards identified in the EOP could result in a catastrophic interruption of water supplies, the EOP provides the actions that the City would implement to minimize the impacts of supply interruption. A general summary of the hazards and response protocols identified in the City's EOP related to the water system is provided below.

8.8.1 Hazard Analysis

The City's water system is vulnerable to a wide range of threats. There are three broad categories of hazards: natural, technological, and domestic security threats.

- Natural Hazards
 - Earthquakes
 - Floods
 - Wildland fires
 - Landslides
 - Extreme weather/storms
- Technological/Man-Made Hazards
 - Dam failure
 - Hazardous materials spills or contamination
 - Major vehicle accident
 - Airplane crash
- Domestic Security Threats
 - Civil unrest
 - Terrorism

8.8.3 Concept of Operations

The City's response to disasters is based on four phases:

1. Increased readiness;
2. Initial response operations;
3. Extended response operations; and
4. Recovery operations.

During each phase, specific actions are taken to reduce and/or eliminate the threat of disaster situations. Recovery operations occur in two phases: short-term and long-term. The major objectives of short-term recovery operations include an orderly and coordinated restoration of essential utility services, including water and electricity.

Utility restoration will involve all of the agencies participating in the City's disaster response; however, the main responsibility will be assumed by the Utility Department. This will include checking critical City facilities and equipment, testing systems, mobilizing personnel, resources, and equipment, performing damage assessments, and repairing/restoring damaged utility systems. The Utility Department is currently developing standard operating procedures that will contain the detailed actions that are necessary to fulfil these responsibilities in a timely and prudent way should such disasters be realized.

8.9 Minimum Supply Next Three Years

As discussed in Section 7.3, the City has water rights seniority, and historical drought conditions are not sufficient to result in supply curtailments large enough to create a deficit. As shown in Table 8-4, the minimum supply over the next three years is anticipated to exceed the available supply in 2015.

Table 8-4. Minimum Supply Next Three Years

(DWR Table 8-4)

	2016	2017	2018
Available Water Supply (from 6-9)	4,732	4,732	4,732

9. Demand Management Measures

Demand management measures (DMMs) are water conservation measures. The DMMs listed in the UWMP Act correlate to the California Urban Water Conservation Council's (CUWCC's) original Best Management Practices (BMPs) for water conservation. The 2015 Urban Water Management Plan (UWMP) Guidebook uses the terms DMMs and BMPs interchangeably.

The purpose of this section is to provide a comprehensive description of the City's water current and future conservation and how they correspond to the water use reduction plan meant to achieve the SB X7-7 2015 and 2020 water use targets.

Previously, UWMPs could only include information about 14 specific DDM measures. Any programs outside of these 14 were not to be included. New to this UWMP is a streamlined reporting requirement that allows the City to report all water conservation measures (programs) under the following six DDM categories:

- Water waste prevention ordinances
- Metering
- Conservation pricing
- Public education and outreach
- Programs to assess and manage distribution system real loss
- Water conservation program coordination and staffing support
- Other demand management measures that have a significant impact on water use as measured in gallons per capita per day (GPCD), including innovative measures, if implemented.

9.1 Demand Management Measures for Retail Agencies

Implementation is discussed by category for the six DMM topics in Sections 9.1.1 through 9.1.7 below.

9.1.1 Water Waste Prevention Ordinances

As discussed in Section 8, in 2014 the City updated the Water Supply Emergency Plan (WSEP) ordinance to include water waste prohibitions as part of Stage 2 and 3 water shortage scenarios.

These measures were meant to be temporary, and in response to drought conditions. The City will update the WSEP based on new State regulation which outlines permanent prohibited water uses.

9.1.2 Metering

The City's water system is fully metered, including: production, consumption, and sales to the County for the Fitch Mountain Service Territory. Metering is essential for water conservation as it allows for water customers to be billed for the volume of water consumed rather than a flat rate, which incentivizes water efficiency. Metering also allows for tracking of water use by sector and individual accounts, which provides for better evaluation of water conservation programs.

All of the City's water accounts are metered and all water is billed by volume (versus a flat fee). As In 2005, the City began implementing a \$2 million meter and pipe replacement program. This effort for meter replacement was initiated because the meter inventory was old and no longer measuring water use accurately. Because failing meters tend to err on the side of under-measuring water consumed, inaccurate meters contribute to the volume of water perceived as water loss and cause a loss of revenue to the City. The City reviews individual accounts for water use to search for accounts that have unusually low water use characteristic for the type of account. The meters on those accounts are prioritized for meter inspection, and replacement if appropriate.

In 2014, the City began installing Advance metering Infrastructure (AMI) which allows water meters to be read multiple times a day instead of once a month. This provides a more granular level of water use data, which is helpful in identifying water use behaviour and patterns, conservation potentials, and leaks much more quickly.

9.1.3 Conservation Pricing

Conservation pricing is a rate structure for water and sewer rates designed to recover the cost of providing service based on volume of use rather than a flat rate charged irrespective of volume used. A conservation pricing structure is always in place and is not dependent upon a water shortage for implementation.

The City's rate structure includes both a flat fee per account, charged each billing cycle regardless of volume of water used, and a volumetric charge per unit of water used for that billing cycle. The City's rate structure meets the requirements of conservation pricing because of the volumetric charge; the customer will pay less on a monthly basis if they use less water.

9.1.4 Public education and outreach

In 2015, the City of Healdsburg's Utility Department created the Smart Living Healdsburg program which is dedicated to providing customers with information, opportunities, and incentives to help them use their utilities efficiently and effectively. The water conservation section of the Smart Living Healdsburg web page provides information about water supply and water use, mandatory water conservation measures, suggestions for reducing indoor and outdoor water use rebate programs and applications; and presentations and workshops. The City uses the Smart Living Healdsburg Facebook page to connect with customers and provide information about conservation.

Several times a year, the City develops and disseminates marketing material about water conservation programs to customers. This includes ads in the newspaper, direct mailers, utility billing inserts, and ads/posters posted around town. In addition, a water conservation update is included in the weekly publication of the Healdsburg Tribune. The update covers water use, conservation compared to 2013, and water use reduction tips.

The City provides educational workshops and presentations covering water use, efficiency, and conservation to the public. In addition, City Staff is available to provide presentations to local schools and can tailor presentation topics based on need.

9.1.5 Programs to Assess and Manage Distribution System Real Loss

To implement this DMM, water suppliers should annually calculate the percentage of water lost from the water distribution system and, if that loss is greater than 10%, conduct a water system leak audit and repair the leaks found, as feasible. Additionally, the water supplier should evaluate *real water loss* (system leaks), versus *apparent water loss*, (water consumed by customers that is not accurately metered or accounted for in the supplier's water billing system). A water system leak audit indicating a low level of leaks signals inaccurate metering or accounting.

As discussed in section 9.1.2, starting in 2005, the City implemented a \$2 million meter and pipe replacement program. The primary goal for this program was to significantly reduce the percentage of water loss in the distribution system (23% in 2005). This loss reduction program has been highly successful; since implementation of this program, the percent of water loss decreased significantly: 8% in 2010; 0% in 2013; and 3% in 2015. The real water loss for these periods may differ slightly due to differences in the billing and production data time periods.

As mentioned above, industry standard considers a water loss of less than 10% is acceptable. The City will continue its efforts in leak detection, leak repair, and meter replacement to maintain a water loss level less than 10%.

9.1.6 Water conservation program coordination and staffing support

In 2014, the City Council approved the addition of a Utility Conservation staff position, whose duties include acting as the Water Conservation Coordinator. Meg Patterson was hired in the Fall of 2014 as the City's Utility Conservation Analyst. Mrs. Patterson spends approximately 50 percent of her time supporting the water conservation program.

In addition, other City Staff provide program support through water waste monitoring, rebate processing, lawn conversion inspections, customer coordination and education, and other tasks. This additional support is equal to 25 percent a full-time equivalent (FTE) employee.

Meg Patterson can be contacted at mpatterson@ci.healdsburg.ca.us or 707.431.3122.

9.1.7 Other demand management measures

This section is dedicated to other DMMs that have a significant impact on water use as measured in gallons per capita per day (GPCD), including innovative measures, if implemented.

- In 2015, the City designed and implemented a robust collection of water conservation rebate programs; building on and adding to, those developed in 2014. These include:
 - Free indoor water saving items
 - Direct Install Toilet Program
 - Low-Flow Toilet Rebate Program
 - Clothes Washer Rebate
 - Lawn Conversion Rebate
 - Irrigation System Audit
 - Irrigation System Update Rebate
 - Greywater System Rebate
 - Indoor Water Audits

Customer participation in these programs in 2015 provided an annual water use reduction of 8 million gallons. The City will continue to support these and develop new programs.

- The City Council adopted the Water Efficient Landscape Ordinance (No. 1091) in December 2009. The ordinance promotes the efficient design and installation of water-efficient landscapes in Healdsburg associated with new construction and substantial alterations of existing development where landscapes are proposed. The ordinance applies standards and guidelines for irrigation system efficiency as well as encouraging climate appropriate plantings. The implementation of this ordinance will reduce water use on new and substantially renovated landscapes on a per square foot basis for the following categories of development:
 - All new residential, commercial, office, industrial, public or quasi-public projects with landscaping.
 - All additions/remodels to existing residential, commercial, office, industrial, public or quasi-public projects with new or replaced contractor-installed landscapes of 2,500 square feet or more.
 - All additions/remodels to existing residential, commercial, office, industrial, public or quasi-public projects with new or replaced property owner-installed landscapes of 5,000 square feet or more.
- The City offers dedicated irrigation meters to customers.
- The City has initiated a lawn conversion rebate program, which provides \$1.00 per square foot of lawn replaced with climate appropriate landscape.

9.2 Implementation over the Past Five Years

AB 2067 requires urban water suppliers to provide narratives describing the water supplier's demand management measures. The bill requires *"the narrative to address the nature and extent of each water demand management measure implemented over the past 5 years and describe the water demand management measures that the supplier plans to implement to achieve its water use targets."*

As discussed previously, the City of Healdsburg focused its 2005-2010 water conservation efforts on City operations to reduce the level of unaccounted-for water. Specifically, the City put its efforts into seeking and repairing leaks in the water distribution system and recalibrating and replacing meters which have not been accurately measuring water consumption. The City has been successful in reducing water losses, unaccounted for water, and its per capita water use.

In 2014, the City Council approved the addition of one staff position which was developed to include water conservation coordinator tasks. In 2015, the City implemented a robust water conservation program. This program was developed in response to continued drought conditions, State drought regulation, and long-term water use efficiency targets.

Table 9-1. 2015 Water Conservation Program Performance

Program	Number	Rebate	Annual Savings (gallons)
Lawn Conversion*	153	\$195,000	5,200,000
Toilet Rebate	233	\$25,000	1,000,000
Direct Install Toilet	137	\$48,000	1,400,000
Clothes washers	20	\$1,000	200,000
Irrigation Audits	5	\$375	17,000
Irrigation Upgrades	5	\$500	45,000
Home Audits	15	\$1,500	50,000
Totals	568	\$271,375	7,912,000

Note: Lawn Conversion savings based on 215,000 sf of turf converted

9.3 Planned Implementation to Achieve Water Use Targets

The City of Healdsburg has exceeded its 2015 interim water use target, as detailed in Chapter 5. Although a portion of that water savings is due to the temporary emergency drought restrictions, the water use reduction is also due to increases in water efficiency achieved through implementation of water conservation programs.

The City will continue to implement the demand management measures outlined in Section 9 as well as complete regular analysis to identify other measures that can be implemented to reduce water consumption. This focus will help the City meet its 2020 GPCD target.

9.4 Members of the California Urban Water Conservation Council

Although the City of Healdsburg is not a signatory of the California Urban Water Conservation Council (CUWCC), the City is actively pursuing membership. Whether a member of CUWCC or not, the City will continue improving and increasing its water conservation efforts.

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10. Plan Adoption, Submittal, and Implementation

This chapter details the process of soliciting input from public and private entities regarding this Plan, and includes information regarding public hearings, plan adoption, and submittal to the DWR and other agencies for approval and implementation.

10.1 Inclusion of All 2015 Data

For reporting of water use and supply information, data for the entire calendar year of 2015 was included in this Plan.

10.2 Public Hearing

The City invited public involvement and input in the Plan update via a public workshop, a public hearing and review/comment of the draft document. Public hearing notifications were published in the Healdsburg Tribune on June 2 and 9, 2016. Copies of the published notices are included in Appendix A.

In addition, Sonoma County was contacted directly, by email to inform the appropriate contacts of the hearing location and time.

Table 10-1. Notification to Cities and Counties

(DWR Table 10-1)

County Name	60 Day Notice	Notice of Public Hearing
Sonoma County	☒	☒

10.3 Public Hearing and Adoption

The public hearing was held on June 20, 2016. The hearing was an opportunity for the public to learn and ask questions regarding the quantity, reliability, and quality of their water supply. The public hearing included a discussion of the City's progress toward meeting its 2020 water use targets. A hard copy of the draft Plan was available for review at City Hall and an electronic version was available for review on the City website 14 days prior to the hearing.

The Plan was adopted on June 20, 2016 by the City Council. A copy of the resolution for adoption is included as Appendix B. The City submitted the Final Plan to the Department of Water Resources and California State Library on July 1, 2016, within 30 days after adoption.

10.4 Plan Submittal

After Plan was adopted, it was submitted to the Department of Water Resources on July 1, 2016. Additional copies of the Plan were also sent to the California State Library as well as the County of Sonoma.

10.5 Public Availability

The Final 2015 Plan is available for review on the City Website at the following link: <http://cityofhealdsburg.org/622/Urban-Water-Management-Plan>. The 2015 Plan is also be available in hard copy form at City Hall for public review upon request.

10.6 Amending an Adopted UWMP

If the City amends the Plan after it has been adopted, the amendments will be made available for public review prior to adoption. Amendments to the Plan will be publicly noticed and presented at a public hearing

11. References

- City of Healdsburg. 2003. *Water System Master Plan*. October, 2003.
- City of Healdsburg. 2005. *Final Environmental Impact Report, City of Healdsburg Water Treatment Plan Upgrade Project for the Healdsburg-Geysers Connection Project*. July 11, 2005.
- City of Healdsburg. 2009. *Healdsburg 2030 General Plan: Background Report*. July 6, 2009.
- City of Healdsburg. 2009. *Healdsburg 2030 General Plan: Land Use Map*.
- City of Healdsburg. 2010. *Wastewater Treatment Plant Title 22 Engineering Report*. August 2010.
- City of Healdsburg. 2013. *Central Healdsburg Avenue Plan*. November, 2013.
- City of Healdsburg. 2013. *City of Healdsburg 2013 Consumer Confidence Report*.
- City of Healdsburg. 2013. *City of Healdsburg Emergency Operations Plan*. Adopted February 4, 2013.
- City of Healdsburg. 2014. *City of Healdsburg Zoning Map*. August 27, 2014.
- Department of Water Resources (DWR). 2016. *2015 Urban Water Management Plans: Guidebook for Urban Water Suppliers – Final Draft*. January 2016.
- Department of Water Resources (DWR). 2003. *Bulletin 118: California's Groundwater, Update 2003*. October 2003.
- Department of Water Resources (DWR). 2009. *Bulletin 160-09: California Water Plan Update 2009*.
- National Marine Fisheries Service (NMFS). 2008. *Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River watershed*. September 24, 2008.
- California Department of Finance. 2016. *State of California, Department of Finance, E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2015 and 2016*. Sacramento, California, May 2016.
- Sonoma County Water Agency. 2010. *2010 Urban Water Management Plan*. June 2010.
- Sonoma County Regional Climate Protection Authority (RCPA). 2016. *Climate Action 2020 and Beyond: Public Review Draft*. March 2016.
- California Department of Finance. 2016. *State of California, Department of Finance, E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2015 and 2016*. Sacramento, California, May 2016.
- California Department of Finance. 2016. *E-4 Population Estimates for Cities, Counties, and the State, 2011-2016, with 2010 Census Benchmark*. Sacramento, California, May 2016.

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Appendices

Appendix A – Public Involvement Documents

A.1 Public Hearing Notice

A.2 Resolution of Adoption

A.3 Transmittal Letters for Final UWMP

PROOF OF PUBLICATION

(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Sonoma

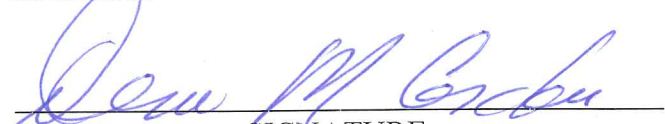
I am a citizen of the United States and a resident of the county aforesaid: I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of The Press Democrat, a newspaper of general circulation, printed and published DAILY IN THE City of Santa Rosa, County of Sonoma; and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Sonoma, State of California, under the date of November 29, 1951, Case number 34831, that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates to wit:

The Press Democrat - Legal Notices
6/2 1x, s6/9 1x - 06/09/2016

I certify (or declare) under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct.

Dated at Santa Rosa, California, on

06/09/2016


SIGNATURE

This space for County Clerk's Filing Stamp

Proof of Publication of

**CITY OF HEALDSBURG
OFFICE OF THE CITY CLERK
NOTICE OF PUBLIC HEARING**

NOTICE IS HEREBY GIVEN that the City Council of the City of Healdsburg, at a regularly scheduled meeting on Monday, June 20, 2016, at or after 6:00 P.M. to be held in the City Hall Council Chamber, 401 Grove Street, Healdsburg, California, will hear public comment prior to the consideration of adoption of the Draft Urban Water Management Plan (UWMP).

A draft of the Urban Water Management Plan is available for review in the City Clerk's Office, 401 Grove Street, Healdsburg, California. Monday through Friday between the hours of 8:00 A.M. and 5:00 P.M., holidays excepted. Details on this matter and any comments received to date are available for review by contacting Terry Crowley, Healdsburg Utility Director, 401 Grove Street, Healdsburg, California 95448, (707) 431-3346 or email to tcrowley@ci.healdsburg.ca.us

All interested persons are invited to send written comments to the City Clerk's Office, 401 Grove Street, Healdsburg, CA 95448 no later than the hearing date and/or be present to comment orally on this issue.

Dated: May 10, 2016

Maria Curiel, City Clerk
2742852 - Pub. Jun 2, 9, 2016 2ti

CITY OF HEALDSBURG

RESOLUTION NO. 66-2016

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF
HEALDSBURG ADOPTING THE CITY OF HEALDSBURG'S
2015 URBAN WATER MANAGEMENT PLAN

WHEREAS, California's Urban Water Management Planning Act requires urban water suppliers with more than 3,000 customers to prepare and submit an Urban Water Management Plan ("UWMP") every five years; and

WHEREAS, the general purpose of the UWMP is to demonstrate that the urban water supplier has adequate water supplies to meet future water demands; and

WHEREAS, a public workshop was held on May 12, 2016 to gain public input on forecasted water demands, water supply availability, and water conservation; and

WHEREAS, the City's 2010/2013 UWMP met the requirements of Water Conservation Act of 2009 (SBx7-7) to set water conservation targets to meet an overall water conservation of 20% by the year 2020; and

WHEREAS, the 2015 UWMP demonstrates that the City is on track to meet the 2020 conservation target of SBx7-7; and

WHEREAS, the 2015 UWMP includes added focus and discussion regarding water conservation and demand management measures; and

WHEREAS, under section 15378(b)(2) of the California Environmental Quality Act, continued administrative actions do not qualify as a "Project". Therefore, no further CEQA or environmental review is required.

NOW, THEREFORE BE IT RESOLVED, that the City Council of the City of Healdsburg hereby adopts the City of Healdsburg's 2015 Urban Water Management Plan.

PASSED, APPROVED, AND ADOPTED by the City Council of the City of Healdsburg this 20th day of June 2016, by the following vote:

AYES: Councilmembers: (4) Mansell, Plass, Ziedrich and Mayor Chambers

NOES: Councilmembers: (0) None

ABSENT: Councilmembers: (1) McCaffery

ABSTAINING: Councilmembers: (0) None

SO ORDERED:

ATTEST:

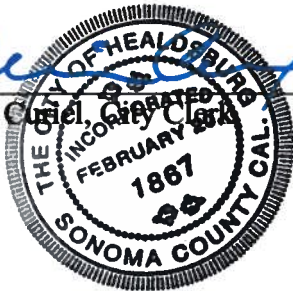

Thomas L. Chambers, Mayor

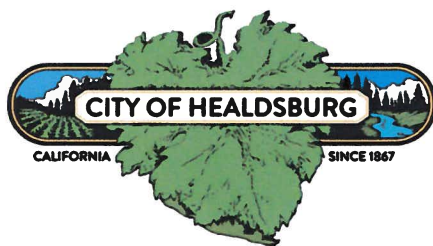

Maria Curiel, City Clerk

I, MARIA CUIEL, City Clerk of the City of Healdsburg, do hereby certify that the foregoing is a full, true, and correct copy of Resolution No. 66-2016 adopted by the City Council of the City of Healdsburg on the 20th day of June, 2016.



Maria Cuiel, City Clerk





July 1, 2016

Department of Water Resources
Statewide Integrated Water Management
Water Use and Efficiency Branch
P.O. Box 942836
Sacramento, CA 94236-0001
Attn: Coordinator, Urban Water Management Plans

**Re: 2015 Urban Water Management Plan
 City of Healdsburg**

Please find one copy of the City of Healdsburg 2015 Urban Water Management Plan, attached. The 2015 Urban Water Management Plan is available for public review at the Healdsburg Community Development Center as well as on the City's website: <http://cityofhealdsburg.org/622/Urban-Water-Management-Plan>.

The 2015 Urban Water Management Plan is being submitted to the California State Library and the link to the on-line version is being provided to the Sonoma County Water Agency and the Sonoma County Public Works Department.

Should you have any questions regarding this document please contact:

Mrs. Meg Patterson
Utilities Conservation Analyst
(707) 431-3122
mpatterson@ci.healdsburg.ca.us

Sincerely,


Meg Patterson

Encl. 2015 Urban Water Management Plan
cc: Terry Crowley, Utility Director | City of Healdsburg
California State Library

UTILITIES DEPARTMENT

401 GROVE STREET, HEALDSBURG, CA 95448 | 707.431.3346

SMARTLIVINGHEALDSBURG.ORG | CITYOFHEALDSBURG.ORG



July 1, 2016

California State Library
Government Publications Section
P.O. Box 942837
Sacramento, CA 94237-0001
Attn: Coordinator, Urban Water Management Plans

**Re: 2015 Urban Water Management Plan
City of Healdsburg**

Enclosed, please find one hard copy of the City of Healdsburg 2015 Urban Water Management Plan. The 2015 Urban Water Management Plan is available for public review at the Healdsburg Community Development Center as well as on the City's website: <http://cityofhealdsburg.org/622/Urban-Water-Management-Plan>.

Should you have any questions regarding this document please contact:

Mrs. Meg Patterson
Utility Conservation Analyst
(707) 431-3122
mpatterson@ci.healdsburg.ca.us

Sincerely,



Meg Patterson

Encl. 2015 Urban Water Management Plan
cc: Terry Crowley, Utility Director | City of Healdsburg
Department of Water Resources

UTILITIES DEPARTMENT

401 GROVE STREET, HEALDSBURG, CA 95448 | 707.431.3346

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Appendix B – Water Shortage Emergency Ordinance, Ord. No. 1134

CITY OF HEALDSBURG

ORDINANCE NO. 1134

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF
HEALDSBURG AMENDING CHAPTER 13.12, WATER
SYSTEM, OF THE HEALDSBURG MUNICIPAL CODE

WHEREAS, due to the continuing drought the City Council of the City of Healdsburg enacted Stage 2 Water Conservation measures on January 21, 2014; and

WHEREAS, Chapter 13.12 of the Healdsburg's Municipal Code defines uses of water waste for each Stage of water conservation; and

WHEREAS, the existing Stages of conservation and definitions of water waste require additional clarity and broader scope; and

WHEREAS, various other administrative changes were required of Chapter 13.12;

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF HEALDSBURG DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. Chapter 13.12, Water System, of the Healdsburg Municipal Code is hereby deleted in its entirety and replaced as follows:

Chapter 13.12

WATER SYSTEM

Sections:

Article I. General Provisions

- 13.12.010 Definitions.
- 13.12.020 Adoption of rules and regulations authorized.
- 13.12.030 Application for water service – Generally.
- 13.12.040 Application for water service – By past delinquent.
- 13.12.050 Certain premises to be separately metered.
- 13.12.060 Exceptions from separate meter requirements.
- 13.12.070 Meters required for water service outside City.
- 13.12.080 Location of meters – Additional meters.
- 13.12.090 Meter failure.
- 13.12.100 Meter readers.
- 13.12.110 Shutdowns.
- 13.12.120 Maintenance of water service connections generally.
- 13.12.130 Water service outside City generally.
- 13.12.140 Tank truck water.
- 13.12.150 Funds for maintenance of fluoridating process.
- 13.12.160 Purchase of equipment and supplies for maintenance of fluoridation.
- 13.12.170 Failure to obey provisions of chapter.

Article II. Rates

13.12.180 Schedule of rates for water service.

Article III. Bills

13.12.190 To be rendered monthly – Computation.

13.12.200 Payment – Delinquent notice.

13.12.210 Disconnection of service for nonpayment.

Article IV. Water Shortage Emergency Plan

13.12.220 Water shortage emergency plan.

Article I. General Provisions

13.12.010 Definitions.

For the purposes of this Chapter, the following words and phrases shall have the following definitions:

“Apartment house” means a single building under one roof containing three or more dwelling units complete with kitchen facilities.

“Boardinghouse” means a dwelling other than a hotel where lodging or lodging and meals for three or more persons is provided for compensation.

“Business occupancy” means any building or portion thereof or a room or rooms used or occupied by a person to carry on a business, profession, trade or occupation for gain or profit.

“Charge” or “Rate” means the amount of money to be paid by consumers to the City for water services or materials; “minimum charge” shall mean the charge to be paid by a consumer for each and every connection to the City water system irrespective of whether or not water is delivered through such connection to a consumer during the period for which such charge is made.

“City” means the City of Healdsburg acting by and through the City of Healdsburg public works department as operator of the City of Healdsburg Water System.

“City Engineer” is the City employee qualified through experience and professional licensure assigned the title of City Engineer or a designee of the incumbent City Engineer.

“City Manager” or “Manager” is the City Manager of the City of Healdsburg or a designee of the incumbent City Manager.

“Customer” means any person, firm, partnership, association, corporation, company, organization, or governmental entity, whether within or without the geographic boundaries of the City of Healdsburg, who uses water supplied by the City.

“Cross-connection” means any physical connection between the piping system from the City water service and that of any other water supply that is not, or cannot be, approved as safe and potable for human consumption, whereby water from the unapproved source may be forced or drawn into the City distribution mains.

“Dwelling group” means a group of two or more detached or semidetached dwelling units occupying a parcel of land in one ownership, and having any yard or court in common but not including motels or auto courts.

“Dwelling unit” means one or more rooms under one roof used for living purposes by one family and containing one kitchen.

“Duplex” means a single building under one roof containing only two dwelling units complete with kitchen facilities.

“Fluoridation” means the process and result of adding fluoride or similar ingredients or compounds to water for the prevention or reduction of tooth decay.

“Fluoride” means a chemical compound (sodium fluoride or sodium silicofluoride) commonly approved and added to water in such amounts as will produce benefits in reducing dental decay.

“Guest house” means detached living quarters of a permanent type of construction and without kitchen or cooking facilities and not to be leased or rented separately from the main dwelling.

“GPD” means gallons per day.

“Hotel” means any building or portion thereof containing six or more guest rooms used or intended to be used, let or hired out, whether the compensation for hire be paid directly or indirectly.

“Mobile home” means a portable structure having no foundation other than wheels, jacks or skirting and so designed or constructed as to permit occupancy as a dwelling.

“Mobile home Park” means a site or portion of a site, which is used or intended to be used by persons living in mobile homes.

“Motel” means a group of two or more detached or semidetached buildings each containing a guest room with automobile storage space provided in connection therewith, which group is used primarily for the accommodation of transient automobile travelers and in which there are no kitchen facilities.

“Outside rates,” “outside users,” “outside consumers” and “surplus water” as used herein relate to City water delivered or distributed outside the corporate limits of the City.

“Recycled Water” shall have the same definition as provided by the State Water Code, Section 13050, as amended.

“Service” or “water service” means one or more connections through which water is supplied or is available to a consumer from and out of the water system owned and operated by the City.

“Travel trailer park” means a site or portion of a site, which is used or intended to be used by persons with travel trailers or vans on a transient basis.

“Water” means potable water supplied by the City Water Department.

“Water Department” means the City Council, performing functions related to the City water services, together with the City Engineer, Water Superintendent or other duly authorized representatives.

13.12.020 Adoption of rules and regulations authorized.

The City Council may from time to time by resolution adopt and amend rules and regulations for the purpose of administering and enforcing the provisions of this chapter and for the purpose of regulating and operating the municipal water system; provided, however, that no change or amendment of rates for the sale of water to consumers within the corporate limits shall be made or established except by ordinance regularly adopted.

13.12.030 Application for water service – Generally.

Any person making application for water shall do so by signing an application for service provided by the City.

13.12.040 Application for water service – By past delinquent.

When an application for water service is made by a former consumer who was responsible for and failed to pay all bills for service previously rendered, regardless of location or time when incurred, the City shall refuse to furnish service to such applicant until the outstanding bills are paid. He may also require, as a guarantee for the payment of future bills, a regular deposit as prescribed in HMC 13.04.030.

13.12.050 Certain premises to be separately metered.

Each dwelling unit and each unit of a duplex, whether inside or outside of the City, shall be separately metered. Where business premises are located in separate buildings on the same lot or parcel, each such separate premises shall be separately metered. No consumer of a City utility service shall convey any part of such service from his property to a separate lot or parcel of property, whether or not the other lot or parcel of property is owned by the same consumer. Notwithstanding the foregoing, a multi-unit condominium or planned development project may be served by a single meter where service is applied and paid for by a homeowner or condominium association organized and operating as approved in the final subdivision public report issued for the project by the State Department of Real Estate.

13.12.060 Exceptions from separate meter requirements.

Separate meters are not required for guesthouses, dwelling groups, boardinghouses, apartment houses, hotels, motels, auto courts, trailer courts or multiple business occupancies in a single commercial building.

13.12.070 Meters required for water service outside City.

All water services outside the City shall be metered.

13.12.080 Location of meters – Additional meters.

All water meters shall be located in the sidewalk area or at a point on the premises nearest the road or street on which the property faces. Charges for a single lateral and meter service shall be as set forth in HMC 13.12.180. Additional meters manifolded from a single lateral shall be installed by the owner at no expense to the City and such installation shall be inspected and approved by the City Engineer.

13.12.090 Meter failure.

If a meter fails to register due to any cause except the nonuse of water, the charge for water will be made on the basis of the average charge per month covering the period of the preceding months, first ascertaining whether the meter has properly functioned during such period and whether normal conditions prevailed in regard to the use of the water at the premises supplied. In the preparation of such averaged bills due consideration will be given to fluctuations caused by seasonal changes or any interruption to the service known to have occurred.

13.12.100 Meter readers.

The meter reader shall have the authority to enter any premises for the purpose of reading water meters and for inspecting, testing, replacing or removing water meters and meter boxes. The

meter reader shall seal off all meters so ordered by proper application of the consumer and shall restore such services upon the proper application of a new consumer. All connections and disconnections shall be properly recorded in the meter books and records of the meter reader. The meter reader shall make, when required, any other disconnections provided by this chapter.

13.12.110 Shutdowns.

The water of any consumer may be shut off from the main at any time for repairs, alterations or other purposes and the office of the City shall inform such consumers, in advance, of the time such shutdown will occur and although notice is not received by the consumer due to his absence, the City will not be responsible nor liable for any consequent damage resulting from such shutdown.

In the event of an emergency necessitating immediate action, the service of any consumer may be shut off without prior notice and the City will not be liable for any consequent damages resulting from such shutdown.

13.12.120 Maintenance of water service connections generally.

All water service pipes and connections to water mains within the City shall be installed and maintained by the City to a point inside the curb line or sidewalk where an approved shutoff valve shall be installed as near the water meter location as possible. Existing galvanized service connections shall, if damaged or leaking, be replaced by the City upon application and payment by the owner or consumer for a new service. Any service pipe, fittings, or water meter damaged as a result of negligence, malicious acts or intent shall be repaired by the City and the actual cost of the repair shall be charged to the owner or consumer.

13.12.130 Water service outside City generally.

The City may furnish and provide surplus water to persons outside the corporate limits of the City upon application to the City on forms so provided. Meters shall be of a type approved by the City Engineer. The meters shall be installed at the expense of the owner or consumer at a point on the premises nearest the road or street on which the property faces; the location and installation to be approved by the City Engineer.

Any water pipe or main to be used to carry water to a consumer outside the City shall be of a type and quality approved by the City Engineer and a map showing its location shall be furnished to the City superintendent upon completion of installation of the pipe. The City shall not be liable for any expense incurred in the installation or maintenance of water pipes, mains, or services outside the corporate limits of the City and the time and material cost of the connection made by the City to the City water main shall be charged to the applicant.

13.12.140 Tank truck water.

No person shall draw or consume water from any standpipe or fire hydrant for the purpose of filling a tank truck or for any other purpose without first making an application for such service with the City. The rate for water consumed under this section shall be set by a resolution of the City Council.

No person shall draw or consume water from any standpipe or fire hydrant for purposes set forth in this section without first presenting a copy of his application to the City Engineer. Upon consideration of the time, in days or weeks, in which withdrawals will be made, the City Engineer shall designate the standpipe or hydrant to be used and connect a water-metering device to the hydrant. The City Engineer shall also provide the applicant with a hydrant wrench, such wrench to be returned to the City superintendent before settlement of all charges. The applicant shall be charged full replacement cost for loss of, damage to or failure to return hydrant wrench to the City Engineer.

13.12.150 Funds for maintenance of fluoridating process.

The mayor and City Council, out of surplus revenues received from the sale of municipal water, shall appropriate and make available sufficient money for the purpose of maintaining a fluoridating process in the City water system

13.12.160 Purchase of equipment and supplies for maintenance of fluoridation.

The mayor and City Council shall purchase appropriate apparatus including machinery, appliances, equipment, fluoride, ingredients, compounds, and materials required for the maintenance of fluoride in the City water supply.

13.12.170 Failure to obey provisions of chapter.

In addition to the enforcement remedies provided in Chapter 1.12 HMC, if an owner or consumer fails to comply with any of the provisions of this chapter, the City shall have the right to refuse or discontinue service.

Article II. Rates

13.12.180 Schedule of rates for water service.

The City Council shall fix the rates to be charged for water service by the City, by resolution, and in so doing shall distinguish the different classes of service made available and fix rates appropriate to each class of service. Rates shall be fixed and revised from time to time with the objective that the City water distribution system shall be operated on a sound economic basis as a revenue-producing enterprise.

Article III. Bills

13.12.190 To be rendered monthly – Computation.

The City shall render bills monthly, to be received by the consumer on the first day of each month, which bills shall include a charge for the water consumed for a 30-day period ending approximately on the fifteenth day of the month prior to the bill date and to include any charges for water unpaid at that time. Opening bills covering new consumers for less than two weeks' service may, at the discretion of the City, be included in the next regular billing. Closing bills covering service of less than two weeks may be determined by the meter reading or by proration of the minimum charge, whichever is greater.

13.12.200 Payment – Delinquent notice.

Bills for water service shall be due and payable on the first day of each month at the office of the City and if not paid on or before the twentieth day of each month a notice may be sent to the consumer setting forth the amount due and the date on which service will be disconnected.

13.12.210 Disconnection of service for nonpayment.

A consumer's water service may be disconnected for the nonpayment of a bill for water service rendered if the bill is not paid by the twentieth day of the month in which the bill is due as provided in HMC 13.12.200. A consumer's water service may be discontinued at his present location for nonpayment of a bill that was rendered him by the City at a previous location, provided such bill is not paid within 20 days after presentation or mailing at his new location.

Article IV. Water Shortage Emergency Plan

13.12.220 Water Shortage Emergency Plan.

- A. Title. This section shall be known as the "Water Shortage Emergency Plan" of the City of Healdsburg and may be so cited.
- B. Purpose and Intent. The purpose of this water shortage emergency plan (plan) is to establish different levels of water conservation during a water shortage emergency resulting from a reduced supply of water such as may result from drought, water supply shortages, or limitations of water delivery conditions.

Nothing in this section will preclude the City Council from passing an emergency resolution for the immediate curtailment of water use by its customers due to water supply shortages and delivery limitations caused by catastrophic events and conditions, either natural or unnatural.

- C. Authorization. The City Manager or his or her designee is authorized and directed to implement the applicable provisions of this section upon adoption of a City Council resolution determining that such implementation is necessary to protect the public health, safety, and welfare.
- D. Application. The provisions of this plan shall apply to all customers and property served by the City's potable water and recycled water systems.
- E. Water Conservation Stages. No customer shall make, cause, use, or permit the use of water for residential, commercial, industrial, agricultural, governmental, or any other purpose in a manner contrary to any provision of this plan, or in an amount in excess of that use permitted by either conservation stage 2 or 3 when in effect as declared by resolution of the City Council. While in effect, the requirements of Stage 2 or 3 will supersede any conflicting sections of the Healdsburg Municipal Code.
 - 1. Stage 1 – Voluntary Conservation. In order to achieve an overall system-wide reduction goal of 10 percent, all customers of the City shall be requested to:
 - a. Utilize City and other sources of information regarding water efficiency, reading water meters, repairing ordinary leaks, and water efficient landscape.
 - b. Apply outdoor irrigation water only during the evening and early morning hours to reduce evaporation losses (8:00 p.m. to 7:00 a.m.).
 - c. For property with an even-numbered street address, irrigate outdoors only on even days of the Month.
 - d. For property with an odd-numbered street address, irrigate outdoors only on odd days of the Month.
 - e. Routinely inspect, and repair as required, all irrigation systems for leaks, and adjust spray heads to provide optimum coverage and eliminate avoidable over-spray and run-off.
 - f. For irrigation valves controlling water applied to lawns, vary the minutes of run-time consistent with fluctuations in weather. Reduce minutes of run-time for each irrigation cycle if water begins to pool or run off to gutters and/or ditches before the irrigation cycle is completed.
 - g. Utilize water conservation incentives, as available, to replace inefficient plumbing fixtures and appliances with water efficient models.

- h. Stop the washing of sidewalks, walkways, driveways, parking lots and other hard-surfaced areas by direct hosing, except as may be necessary to prevent or eliminate materials that present a danger to public health and safety.
 - i. Correct and repair the escape of water through breaks or leaks within the customer's plumbing or private distribution system. It shall be presumed that a period of seventy-two (72) hours after the customer discovers such a break or leak, or receives notice from the City, is a reasonable time within which to correct such break or leak or, at a minimum, to stop the flow of water from such break or leak.
 - j. Stop the noncommercial washing of privately owned motor vehicles, trailers or boats excepting when utilizing a bucket and hose equipped with an automatic shut-off;
 - k. Not use water from a fire hydrant, except for fighting fires and line flushing as required by regulatory agencies.
- 2. Stage 2 – Mandatory Compliance – Water Alert. The City Council may by resolution declare a conservation stage 2 based on water supply and delivery projections by the City Manager or City engineer that an overall system-wide reduction of twenty (20) percent is necessary. Following a declaration of conservation Stage 2 status, and in order to achieve an overall system-wide reduction of 20 percent, in addition to Stage 1 activities being mandatory, the following restrictions shall be implemented:
 - a. Nonessential uses of water, including the following, are prohibited:
 - i. The City will not accept or approve building permits for new swimming pools unless the owner agrees to obtain pool water from a source other than the City's potable water system.
 - ii. Refilling of a swimming pool except when topping off to prevent damage to pump and filter equipment is not allowed. Owners of pools should use a cover to minimize evaporation.
 - iii. Use of potable water for dust control, compaction, and other construction purposes. Only Recycled Water may be used for dust control, compaction, and other construction purposes as allowed by the Regional Water Quality Control Board or other governing bodies.
 - b. Water use by a vehicle washing facility shall be limited to 80 percent of the water used by the facility from corresponding billing period in the prior year, unless such washing facility treats and recycles wash water, in which case this provision shall not apply.

- c. Water use for any nonresidential use shall be limited to 80 percent of the water used by the customer during the corresponding billing period in the prior year.
 - d. The City Council may, by resolution, prohibit other activities and water uses upon the recommendation of the City Manager or City Engineer that such additional measures are necessary to achieve an overall system-wide reduction of twenty (20) percent in water usage.
- 3. Stage 3 – Mandatory Compliance – Water Emergency. The City Council may, by resolution, declare a conservation stage 3, based on water supply and delivery projections by the City Manager or City Engineer that an overall system-wide reduction of forty (40) percent is necessary. Following a declaration of conservation stage 3 status, and in order to achieve an overall system-wide reduction of 40 percent, the following activities shall be prohibited:
 - a. Any activities prohibited during conservation stages 1 and 2.
 - b. Irrigation of any lawn (residential, commercial, or industrial) with water, at any time of day or night.
 - c. Planting any new landscaping, except for designated drought resistant landscaping prescribed by the City Manager or designated representative.
 - d. All day and night-time irrigation sprinkling unless only a hand-held nozzle is used. This prohibition shall not apply to drip irrigation systems for established perennial plants and trees using manual or automatic time-controlled water application.
 - e. Planting of new annual plants, vegetables, flowers, or vines.
- E. Exceptions and Application Procedures for Exceptions. Any customer may make written application for an exception to the regulations and prohibitions described in this section. Said application shall describe in detail why applicant believes an exception is justified.
 - 1. The City engineer may grant exceptions for use of water otherwise prohibited by this section upon finding and determining that failure to do so would cause an emergency condition affecting the health, sanitation, fire protection or safety of the applicant or public; or cause an unnecessary and undue hardship on applicant or the public, including, but not limited to, adverse economic impacts, such as loss of production or jobs.
 - 2. Decisions of the City engineer may be appealed to the City Manager or his or her designee by submitting a written appeal to the City Clerk within seven calendar days of the date of the decision by the City engineer. Upon granting any appeal the City Manager, or his or her designee, may impose any conditions determined to be just and proper. Exceptions granted shall be prepared in writing and filed with the City Clerk.

F. Violation/Enforcement.

1. Any violation of any provision of this plan is hereby declared to be a public nuisance and shall be enforced in accordance with the provisions of the code enforcement ordinance (Chapter [1.12](#) HMC), including without limitation the imposition of administrative penalties, notice and hearing requirements and appeals procedures.
2. Any violation of the provisions of this section shall be deemed an infraction.
3. In addition to the enforcement remedies provided in Chapter [1.12](#) HMC, upon a violation of any provision of this section, the City engineer may authorize the installation of a flow-restricting device on the services line to the property(ies) in violation, and the cost of installation of such a device shall be charged to the person(s) or entity(ies) responsible for payment of water service charges or a lien against the affected property(ies).
4. In addition to the enforcement remedies provided in Chapter [1.12](#) HMC, upon a continued violation of any provision of this section, the City engineer may authorize the termination of water service to the property(ies) in violation. The cost of terminating and restoring service shall be charged to the person(s) or entity(ies) responsible for payment of water service charges or a lien against the affected property(ies).

- G. Additional Enforcement Remedy. Before either installing a water restrictor or terminating water service, the City shall give written notice to the person responsible for the service connection to be either restricted or terminated of its intention to do so. The person or persons to whom notice is given shall have five business days from the date of service of the notice to request a hearing before the City Manager or his or her designee in order to present any and all evidence they may have as to why a restrictor should not be installed or service terminated.

If a hearing is requested, the City Manager, or his or her designee, shall schedule a date and time for said hearing as soon as possible after the request is filed, but not later than five business days after the filing of such request for hearing. At the hearing, the person whose service connections are to be restricted or terminated and the utilities personnel may offer evidence. The City Manager, or his or her designee, shall make a final determination as to whether service should be restricted or terminated and under what conditions.

Section 2. Compliance with California Environmental Quality Act

The City Council finds that this ordinance is not a project for the purposes of the California Environmental Quality Act because it does not have a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment.

Section 3. Severability: If any section, subsection, sentence, clause or phrase or word of this Ordinance is for any reason held to be unconstitutional, unlawful or otherwise invalid by a court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this ordinance. The City Council of the City of Healdsburg hereby declares that it would have passed and adopted this Ordinance and each and all provisions thereof irrespective of the fact that any one or more of said provisions may be declared invalid or unconstitutional without regard to any such decision or preemptive legislation.

Section 4. Effective Date: This Ordinance of the City of Healdsburg shall be effective thirty (30) days after the date of its passage, this ordinance or a summary thereof, as provided in Government Code Section 36933, shall be published at least once in a newspaper of general circulation published and circulated in the City of Healdsburg, along with the names of the City Council voting for and against its passage.

INTRODUCED by the City Council of the City of Healdsburg on the 7th day of April 2014, and PASSED and APPROVED on the 21st day of April 2014 by the following roll call vote:

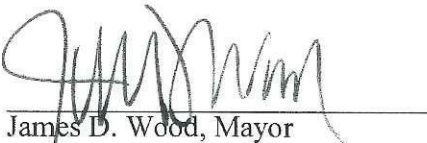
AYES: Councilmembers: (5) Chambers, Jones, McCaffery, Plass and Mayor Wood

NOES: Councilmembers: (0) None

ABSENT: Councilmembers: (0) None

ABSTAINING: Councilmembers: (0) None

SO ORDERED:


James D. Wood, Mayor

ATTEST:


Maria Curiel, City Clerk

Dated: April 22, 2014

Appendix C – 2015 Water Loss Audit Form

Table Name	Description	Links from	Comment	Data Needs/Questions
Table 0	Units of Measure Used in UWMP	--		
Table 1	Baseline Period Ranges	--		
Table 2	Method for Population Estimates	--		
Table 3	Service Area Population	--		
Table 4	Annual Gross Water Use	3, 4-A, 4-B, 4-D		
Table 4-A	Volume Entering the Distribution System	3		
Table 4-B	Indirect Recycled Water Use Deduction	--		
Table 4-C	Process Water Deduction Eligibility	--		
Table 4-C.1	Process Water Deduction Eligibility: Criteria 1	3, 4		
Table 4-C.2	Process Water Deduction Eligibility: Criteria 2	0, 3		
Table 4-C.3	Process Water Deduction Eligibility: Criteria 3	0, 3, 4		
Table 4-C.4	Process Water Deduction Eligibility: Criteria 4	--		
Table 4-D	Process Water Deduction - Volume	0		
Table 5	Gallons Per Capita Per Day (GPCD)	0, 3, 4		
Table 6	Gallons per Capita per Day	5		
Table 7	2020 Target Method	--		
Table 7-A	Target Method 1	5		
Table 7-B	Target Method 2			
Table 7-C	Target Method 2			
Table 7-D	Target Method 2			
Table 7-E	Target Method 3			
Table 7-F	Confirm Minimum Reduction for 2020 Target	5		
Table 8	2015 Interim Target GPCD	5, 7		
Table 9	2015 Compliance	5, 8		

SB X7-7 Table 0: Units of Measure Used in UWMP**(select one from the drop down list)*

Acre Feet

**The unit of measure must be consistent with Table 2-3*

SB X7-7 Table-1: Baseline Period Ranges

Baseline	Parameter	Value	Units
10- to 15-year baseline period	2008 total water deliveries	2,297	Acre Feet
	2008 total volume of delivered recycled water	0	Acre Feet
	2008 recycled water as a percent of total deliveries	0.00%	Percent
	Number of years in baseline period ^{1,2}	10	Years
	Year beginning baseline period range	1995	
	Year ending baseline period range ^{3,4}	2004	
5-year baseline period	Number of years in baseline period	5	Years
	Year beginning baseline period range	2003	
	Year ending baseline period range ^{3,4}	2007	
¹ If the 2008 recycled water percent is less than 10 percent, then the first baseline period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first baseline period is a continuous 10- to 15-year period.			
² The Water Code requires that the baseline period is between 10 and 15 years. However, DWR recognizes that some water suppliers may not have the minimum 10 years of baseline data.			
³⁻³ The ending year must be between December 31, 2004 and December 31, 2010.			
³⁻⁴ The ending year must be between December 31, 2007 and December 31, 2010.			
NOTES: From 2010 UWMP			

SB X7-7 Table 2: Method for Population Estimates

Method Used to Determine Population (may check more than one)	
☒	1. Department of Finance (DOF) DOF Table E-8 (1990 - 2000) and (2000-2010) and DOF Table E-5 (2011 - 2015) when available
☐	2. Persons-per-Connection Method
☐	3. DWR Population Tool
☐	4. Other DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: Service Area Population

Year		Population
10 to 15 Year Baseline Population		
Year 1	1995	9,698
Year 2	1996	9,895
Year 3	1997	10,005
Year 4	1998	10,262
Year 5	1999	10,427
Year 6	2000	10,896
Year 7	2001	11,316
Year 8	2002	11,504
Year 9	2003	11,414
Year 10	2004	11,361
Year 11		
Year 12		
Year 13		
Year 14		
Year 15		
5 Year Baseline Population		
Year 1	2003	11,414
Year 2	2004	11,361
Year 3	2005	11,305
Year 4	2006	11,222
Year 5	2007	11,161
2015 Compliance Year Population		
2015		11,667

NOTES: From DOF Tables E-5 and E-8

SB X7-7 Table 4: Annual Gross Water Use *

Baseline Year <i>Fm SB X7-7 Table 3</i>		Volume Into Distribution System <i>This column will remain blank until SB X7-7 Table 4-A is completed.</i>	Deductions					Annual Gross Water Use
			Exported Water	Change in Dist. System Storage (+/-)	Indirect Recycled Water <i>This column will remain blank until SB X7-7 Table 4-B is completed.</i>	Water Delivered for Agricultural Use	Process Water <i>This column will remain blank until SB X7-7 Table 4-D is completed.</i>	
10 to 15 Year Baseline - Gross Water Use								
Year 1	1995	2,441	0	0	0	0	0	2,441
Year 2	1996	2,369	0	0	0	0	0	2,369
Year 3	1997	2,100	0	0	0	0	0	2,100
Year 4	1998	2,185	0	0	0	0	0	2,185
Year 5	1999	2,386	0	0	0	0	0	2,386
Year 6	2000	2,342	0	0	0	0	0	2,342
Year 7	2001	2,463	0	0	0	0	0	2,463
Year 8	2002	2,670	0	0	0	0	0	2,670
Year 9	2003	2,551	0	0	0	0	0	2,551
Year 10	2004	2,763	0	0	0	0	0	2,763
Year 11	0				0			0
Year 12	0				0			0
Year 13	0				0			0
Year 14	0				0			0
Year 15	0				0			0
10 - 15 year baseline average gross water use								2,427
5 Year Baseline - Gross Water Use								
Year 1	2003	2,551	0	0	0	0	0	2,551
Year 2	2004	2,763	0	0	0	0	0	2,763
Year 3	2005	2,591	0	0	0	0	0	2,591
Year 4	2006	2,462	0	0	0	0	0	2,462
Year 5	2007	2,331	0	0	0	0	0	2,331
5 year baseline average gross water use								2,540
2015 Compliance Year - Gross Water Use								
2015		1,587	0	0	0	0	0	1,587
* NOTE that the units of measure must remain consistent throughout the UWMP, as reported in Table 2-3								
NOTES:								

SB X7-7 Table 4-A: Volume Entering the Distribution System(s)

Complete one table for each source.

Name of Source		Surface Water Rights		
This water source is:				
☒	The supplier's own water source			
☐	A purchased or imported source			
Baseline Year <i>Fm SB X7-7 Table 3</i>		Volume Entering Distribution System	Meter Error Adjustment* <i>Optional</i> (+/-)	Corrected Volume Entering Distribution System
10 to 15 Year Baseline - Water into Distribution System				
Year 1	1995	2,440.70	0	2,441
Year 2	1996	2,368.80	0	2,369
Year 3	1997	2,099.90	0	2,100
Year 4	1998	2,184.80	0	2,185
Year 5	1999	2,386.20	0	2,386
Year 6	2000	2,341.90	0	2,342
Year 7	2001	2,462.60	0	2,463
Year 8	2002	2,670.40	0	2,670
Year 9	2003	2,550.80	0	2,551
Year 10	2004	2,762.60	0	2,763
Year 11	0			0
Year 12	0			0
Year 13	0			0
Year 14	0			0
Year 15	0			0
5 Year Baseline - Water into Distribution System				
Year 1	2003	2550.8	0	2,551
Year 2	2004	2762.6	0	2,763
Year 3	2005	2591.2	0	2,591
Year 4	2006	2462.4	0	2,462
Year 5	2007	2330.9	0	2,331
2015 Compliance Year - Water into Distribution System				
2015		1,587		1,587
* Meter Error Adjustment - See guidance in Methodology 1, Step 3 of Methodologies Document				
NOTES:				

SB X7-7 Table 5: Gallons Per Capita Per Day (GPCD)

Baseline Year <i>Fm SB X7-7 Table 3</i>		Service Area Population <i>Fm SB X7-7 Table 3</i>	Annual Gross Water Use <i>Fm SB X7-7 Table 4</i>	Daily Per Capita Water Use (GPCD)
10 to 15 Year Baseline GPCD				
Year 1	1995	9,698	2,441	225
Year 2	1996	9,895	2,369	214
Year 3	1997	10,005	2,100	187
Year 4	1998	10,262	2,185	190
Year 5	1999	10,427	2,386	204
Year 6	2000	10,896	2,342	192
Year 7	2001	11,316	2,463	194
Year 8	2002	11,504	2,670	207
Year 9	2003	11,414	2,551	200
Year 10	2004	11,361	2,763	217
Year 11				
Year 12				
Year 13				
Year 14				
Year 15				
10-15 Year Average Baseline GPCD				203
5 Year Baseline GPCD				
Baseline Year <i>Fm SB X7-7 Table 3</i>		Service Area Population <i>Fm SB X7-7 Table 3</i>	Gross Water Use <i>Fm SB X7-7 Table 4</i>	Daily Per Capita Water Use
Year 1	2003	11,414	2,551	200
Year 2	2004	11,361	2,763	217
Year 3	2005	11,305	2,591	205
Year 4	2006	11,222	2,462	196
Year 5	2007	11,161	2,331	186
5 Year Average Baseline GPCD				201
2015 Compliance Year GPCD				
2015		11,667	1,587	121
NOTES:				

SB X7-7 Table 6: Gallons per Capita per Day*Summary From Table SB X7-7 Table 5*

10-15 Year Baseline GPCD	203
5 Year Baseline GPCD	201
2015 Compliance Year GPCD	121
NOTES:	

SB X7-7 Table 7: 2020 Target Method*Select Only One*

Target Method		Supporting Documentation
☒	Method 1	SB X7-7 Table 7A
☐	Method 2	SB X7-7 Tables 7B, 7C, and 7D
☐	Method 3	SB X7-7 Table 7-E
☐	Method 4	Method 4 Calculator

NOTES:

SB X7-7 Table 7-A: Target Method 1
20% Reduction

10-15 Year Baseline GPCD	2020 Target GPCD
203	162
NOTES:	

SB X7-7 Table 7-F: Confirm Minimum Reduction for 2020 Target

5 Year Baseline GPCD <i>From SB X7-7 Table 5</i>	Maximum 2020 Target ¹	Calculated 2020 Target (from SBx7-7 Table 7-A)	Confirmed 2020 Target ²
201	191	162	162

¹ Maximum 2020 Target is 95% of the 5 Year Baseline GPCD

² 2020 Target is calculated based on the selected Target Method, see SB X7-7 Table 7 and corresponding tables for agency's calculated target.

NOTES:

SB X7-7 Table 8: 2015 Interim Target GPCD

Confirmed 2020 Target <i>Fm SB X7-7 Table 7-F</i>	10-15 year Baseline GPCD <i>Fm SB X7-7 Table 5</i>	2015 Interim Target GPCD
162	203	183

NOTES:

SB X7-7 Table 9: 2015 Compliance

Actual 2015 GPCD	2015 Interim Target GPCD	Optional Adjustments <i>(in GPCD)</i>					Adjusted 2015 GPCD (Adjusted if applicable)	Did Supplier Achieve Targeted Reduction for 2015?
		Enter "0" if No Adjustment			TOTAL Adjustments	Adjusted 2015 GPCD		
		Extraordinary Events	Weather Normalization	Economic Adjustment				
121	183	0	0	0	0	121	121	YES

NOTES:

SB X7-7 Table 4-C.1: Process Water Deduction Eligibility

Criteria 1

Industrial water use is equal to or greater than 12% of gross water use

Baseline Year <i>Fm SB X7-7 Table 3</i>	Gross Water Use Without Process Water Deduction	Industrial Water Use	Percent Industrial Water	Eligible for Exclusion Y/N
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10 to 15 Year Baseline - Process Water Deduction Eligibility

Year 1	1995	2,441		0.00%	NO
Year 2	1996	2,369		0.00%	NO
Year 3	1997	2,100		0.00%	NO
Year 4	1998	2,185		0.00%	NO
Year 5	1999	2,386		0.00%	NO
Year 6	2000	2,342		0.00%	NO
Year 7	2001	2,463		0.00%	NO
Year 8	2002	2,670		0.00%	NO
Year 9	2003	2,551		0.00%	NO
Year 10	2004	2,763		0.00%	NO
Year 11	0	0			NO
Year 12	0	0			NO
Year 13	0	0			NO
Year 14	0	0			NO
Year 15	0	0			NO

5 Year Baseline - Process Water Deduction Eligibility

Year 1	2003	2,551		0.00%	NO
Year 2	2004	2,763		0.00%	NO
Year 3	2005	2,591		0.00%	NO
Year 4	2006	2,462		0.00%	NO
Year 5	2007	2,331		0.00%	NO

2015 Compliance Year - Process Water Deduction Eligibility

2015	1,587		0.00%	NO
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NOTES:

SB X7-7 Table 4-C.3: Process Water Deduction Eligibility
Criteria 3

Non-industrial use is equal to or less than 120 GPCD

Baseline Year <i>Fm SB X7-7 Table 3</i>	Gross Water Use Without Process Water Deduction <i>Fm SB X7-7 Table 4</i>	Industrial Water Use	Non-industrial Water Use	Population <i>Fm SB X7-7 Table 3</i>	Non-Industrial GPCD	Eligible for Exclusion Y/N
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10 to 15 Year Baseline - Process Water Deduction Eligibility

Year 1	1995	2,441		2,441	9,788	223	NO
Year 2	1996	2,369		2,369	9,800	216	NO
Year 3	1997	2,100		2,100	9,875	190	NO
Year 4	1998	2,185		2,185	10,100	193	NO
Year 5	1999	2,386		2,386	10,250	208	NO
Year 6	2000	2,342		2,342	10,722	195	NO
Year 7	2001	2,463		2,463	11,381	193	NO
Year 8	2002	2,670		2,670	11,650	205	NO
Year 9	2003	2,551		2,551	11,628	196	NO
Year 10	2004	2,763		2,763	11,639	212	NO
Year 11							NO
Year 12							NO
Year 13							NO
Year 14							NO
Year 15							NO

5 Year Baseline - Process Water Deduction Eligibility

Year 1	2003	2,551		2,551	11,628	196	NO
Year 2	2004	2,763		2,763	11,639	212	NO
Year 3	2005	2,591		2,591	11,661	198	NO
Year 4	2006	2,462		2,462	11,651	189	NO
Year 5	2007	2,331		2,331	11,641	179	NO

2015 Compliance Year - Process Water Deduction Eligibility

2015	1,587		1,587	11,680	121	NO
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NOTES:

Appendix D – SB X7-7 Verification Form

AWWA Free Water Audit Software v5.0

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This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Meg Patterson		
Email Address:	mpatterson@ci.healdsburg.ca.us		
Telephone Ext.:	707-431-3122		
Name of City / Utility:	City of Healdsburg		
City/Town/Municipality:	Healdsburg		
State / Province:	California (CA)		
Country:	USA		
Year:	2015	Calendar Year	
Audit Preparation Date:	4/26/2016		
Volume Reporting Units:	Million gallons (US)		
PWSID / Other ID:	4910005		

The following guidance will help you complete the Audit

All audit data are entered on the [Reporting Worksheet](#)

	Value can be entered by user
	Value calculated based on input data
	These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions

The current sheet.
Enter contact information and basic audit details (year, units etc)

Reporting Worksheet

Enter the required data on this worksheet to calculate the water balance and data grading

Comments

Enter comments to explain how values were calculated or to document data sources

Performance Indicators

Review the performance indicators to evaluate the results of the audit

Water Balance

The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard

A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix

Presents the possible grading options for each input component of the audit

Service Connection Diagram

Diagrams depicting possible customer service connection line configurations

Definitions

Use this sheet to understand the terms used in the audit process

Loss Control Planning

Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits

Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements

Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org



AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

American Water Works Association

? Click to access definition
+ Click to add a comment

Water Audit Report for: **City of Healdsburg (4910005)**
Reporting Year: **2015** **1/2015 - 12/2015**

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the

All volumes to be entered as: **MILLION GALLONS (US) PER YEAR**

To select the correct data grading for each input, determine the highest grade where

WATER SUPPLIED

<----- Enter grading in column 'E' and 'J' -----> Pcnt: Value:

Volume from own sources:	+	?	8	534.370	MG/Yr	+	?	9	1.00%	☒	☐	MG/Yr
Water imported:	+	?	n/a	0.000	MG/Yr	+	?			☒	☐	MG/Yr
Water exported:	+	?	8	17.294	MG/Yr	+	?	9	1.00%	☒	☐	MG/Yr

WATER SUPPLIED: **511.956** MG/Yr

Master Meter and Supply Error Adjustments

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Billed metered:	+	?	9	505.230	MG/Yr
Billed unmetered:	+	?	n/a	0.000	MG/Yr
Unbilled metered:	+	?	n/a	0.000	MG/Yr
Unbilled unmetered:	+	?		6.399	MG/Yr

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: **511.629** MG/Yr

Click here: ?
for help using option

Pcnt: Value: **1.25%** ☒ ☐ MG/Yr

Use buttons to select
percentage of water
supplied
OR
value

Pcnt: Value: **0.25%** ☒ ☐ MG/Yr

-0.25% ☒ ☐ MG/Yr
0.25% ☒ ☐ MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption)

0.327 MG/Yr

Apparent Losses

Unauthorized consumption: **1.280** MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	+	?	6	-1.260	MG/Yr
Systematic data handling errors:	+	?	6	0.000	MG/Yr

Systematic data handling errors are likely, please enter a positive, non-zero value; otherwise grade = 1 (not displayed)

Apparent Losses: **0.020** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **0.307** MG/Yr

WATER LOSSES: **0.327** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **6.726** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+	?	8	49.0	miles
Number of active AND inactive service connections:	+	?	8	4,430	
Service connection density:	?			90	conn./mile main

Are customer meters typically located at the curbside or property line? **Yes**

Average length of customer service line: **65.0** psi (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: **65.0** psi

COST DATA

Total annual cost of operating water system:	+	?	8	\$4,300,000	\$/Year
Customer retail unit cost (applied to Apparent Losses):	+	?	8	\$4.49	\$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	+	?	8		\$/million gallons ☒ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 74 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Systematic data handling errors

3: Customer metering inaccuracies



AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0

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Water Audit Report for:

Reporting Year:

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 74 out of 100 ***

System Attributes:

Apparent Losses:	0.020	MG/Yr
+ Real Losses:	0.307	MG/Yr
= Water Losses:	0.327	MG/Yr

Unavoidable Annual Real Losses (UARL): MG/Yr

Annual cost of Apparent Losses:

Annual cost of Real Losses: Valued at Customer Retail Unit Cost
Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:

Non-revenue water as percent by volume of Water Supplied:

Non-revenue water as percent by cost of operating system: Real Losses valued at Customer Retail Unit Cost

Operational Efficiency:

Apparent Losses per service connection per day: gallons/connection/day

Real Losses per service connection per day: gallons/connection/day

Real Losses per length of main per day*:

Real Losses per service connection per day per psi pressure: gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): million gallons/year

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

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



AWWA Free Water Audit Software:
User Comments

A
m

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	
Audit Item	Comment
Volume from own sources:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	



AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for: **City of Healdsburg (4910005)**Reporting Year: **2015****1/2015 - 12/2015**Data Validity Score: **74**

Own Sources (Adjusted for known errors) 529.079	System Input 529.079	Water Exported 17.123	Billed Water Exported				Revenue Water 17.123
		Water Supplied 511.956	Authorized Consumption 511.629	Billed Authorized Consumption 505.230	Billed Metered Consumption (water exported is removed) 505.230	Revenue Water 505.230	
					Billed Unmetered Consumption 0.000		
				Unbilled Authorized Consumption 6.399	Unbilled Metered Consumption 0.000		Non-Revenue Water (NRW) 6.726
					Unbilled Unmetered Consumption 6.399		
			Water Losses 0.327	Apparent Losses 0.020	Unauthorized Consumption 1.280		
					Customer Metering Inaccuracies -1.260		
					Systematic Data Handling Errors 0.000		
				Real Losses 0.307	Leakage on Transmission and/or Distribution Mains Not broken down		
		Leakage and Overflows at Utility's Storage Tanks Not broken down					
Leakage on Service Connections Not broken down							
Water Imported 0.000							



AWWA Free Water Audit Software: Dashboard

WAS v5.0
American Water Works Association.
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The graphic below is a visual representation of the Water Balance with bar heights proportional to the volume of the audit components

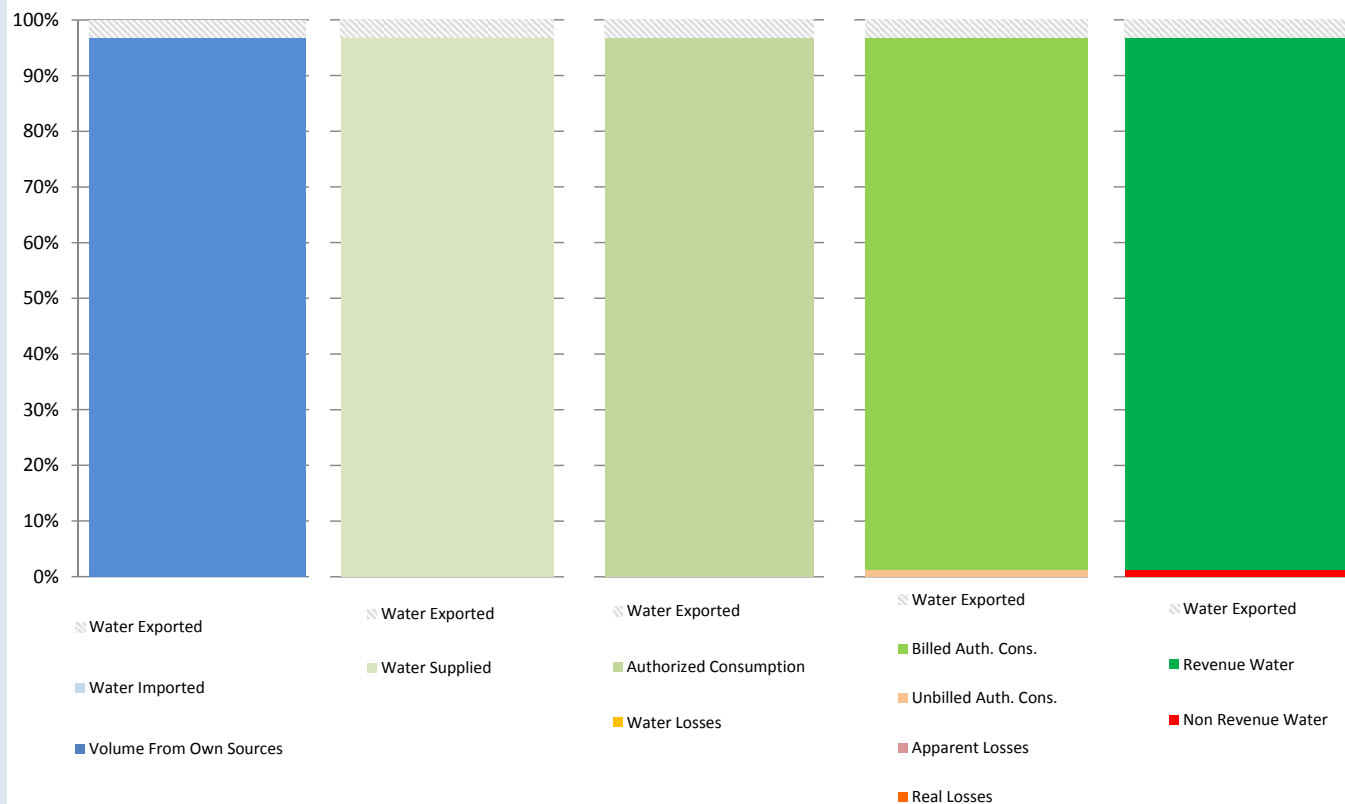
Water Audit Report for: **City of Healdsburg (4910005)**

Reporting Year: **2015** **1/2015 - 12/2015**

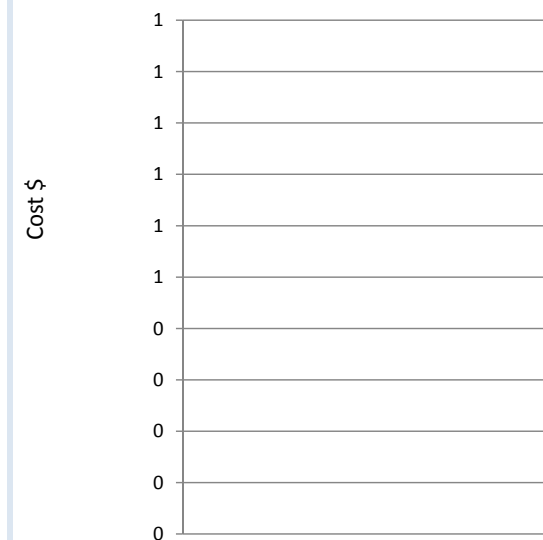
Data Validity Score: **74**

☐ Show me the VOLUME of Non-Revenue Water

☒ Show me the COST of Non-Revenue Water



Total Cost of NRW =\$



- Unbilled metered (valued at Cust.Ret.Unit Cost)
- Unbilled unmetered (valued at Cust.Ret.Unit Cost)
- Unauth. consumption
- Cust. metering inaccuracies
- Syst. data handling errors
- Real Losses (valued at Cust.Ret.Unit Cost)



AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

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The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, gr at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:		<u>to qualify for 2:</u> Organize and launch efforts to collect data for determining volume from own sources	<u>to qualify for 4:</u> Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		<u>to qualify for 8:</u> Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology, pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system; tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	<u>to qualify for 4:</u> Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		<u>to qualify for 8:</u> Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		<u>to qualify for 10:</u> Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Imported Volume" component: (Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)		<u>to qualify for 2:</u> Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	<u>To qualify for 4:</u> Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water imported master meter and supply error adjustment:	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	<u>to qualify for 4:</u> Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management, revise the terms as necessary.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		<u>to qualify for 8:</u> Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		<u>to qualify for 10:</u> Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility, at least every five years.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: (Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.)		<u>to qualify for 2:</u> Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	<u>To qualify for 4:</u> Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined. Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling (exporting) the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10			
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	<u>to qualify for 4:</u> Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		<u>to qualify for 8:</u> Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		<u>to qualify for 10:</u> Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities, at least every five years.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.			
AUTHORIZED CONSUMPTION														
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remaining accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.		Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.		Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducted by utility personnel.		Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; <u>or</u> at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; <u>or</u> minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	<u>to qualify for 2:</u> Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	<u>to qualify for 4:</u> Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		<u>to qualify for 6:</u> Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		<u>to qualify for 8:</u> Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		<u>to qualify for 10:</u> Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		<u>to maintain 10:</u> Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.			
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter, i.e. no intentionally unmetered accounts exist	Water utility policy does <u>not</u> require customer metering; flat or fixed fee billing is employed. Some metered customer accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Water utility policy does <u>not</u> require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.		Conditions between 2 and 4	Water utility policy <u>does</u> require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.		Conditions between 4 and 6	Water utility policy <u>does</u> require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.		Conditions between 6 and 8	Water utility policy <u>does</u> require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy <u>does</u> require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:		to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:		to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing exempt. Draft an outline of a new written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, unmetered consumption is usually a relatively small quantity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:		to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographic Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:		to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.
Number of active AND inactive service connections:		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	Note: The number of Service Connections does not include fire hydrant leads/lines connecting the hydrant to the water main	to qualify for 2: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	to qualify for 4: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		to qualify for 6: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		to qualify for 8: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		to qualify for 10: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		to maintain 10: Continue with standardization and random field validation to improve knowledge of system.
	Note: if customer water	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									Either of two conditions can be met for a grading of 10:

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility, and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet. b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		<u>to qualify for 2:</u> Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4:</u> Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6:</u> Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8:</u> Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10:</u> Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10:</u> Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breach pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breach pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.
Improvements to attain higher data grading for "Average Operating Pressure" component:		<u>to qualify for 2:</u> Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	<u>to qualify for 4:</u> Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		<u>to qualify for 6:</u> Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		<u>to qualify for 8:</u> Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		<u>to qualify for 10:</u> Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		<u>to maintain 10:</u> Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for realtime pressure data calibration, and averaging.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		<u>to qualify for 2:</u> Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	<u>to qualify for 4:</u> Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6:</u> Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		<u>to qualify for 8:</u> Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		<u>to qualify for 10:</u> Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10:</u> Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		<u>to qualify for 2:</u> Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	<u>to qualify for 4:</u> Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		<u>to qualify for 6:</u> Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	<u>Launch effort to fully meter the customer population and charge rates based upon water volumes</u>	<u>to qualify for 8:</u> Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to qualify for 10:</u> Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to maintain 10:</u> Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should <u>not</u> be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		<u>to qualify for 2:</u> Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	<u>to qualify for 4:</u> Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6:</u> Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		<u>to qualify for 8:</u> Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgeable third-party at least once every three years.		<u>to qualify for 10:</u> Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10:</u> Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively



AWWA Free Water Audit Software: Customer Service Line Diagrams

WAS v5.0

American Water Works Association.
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Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, L_p , for the three most common piping configurations.

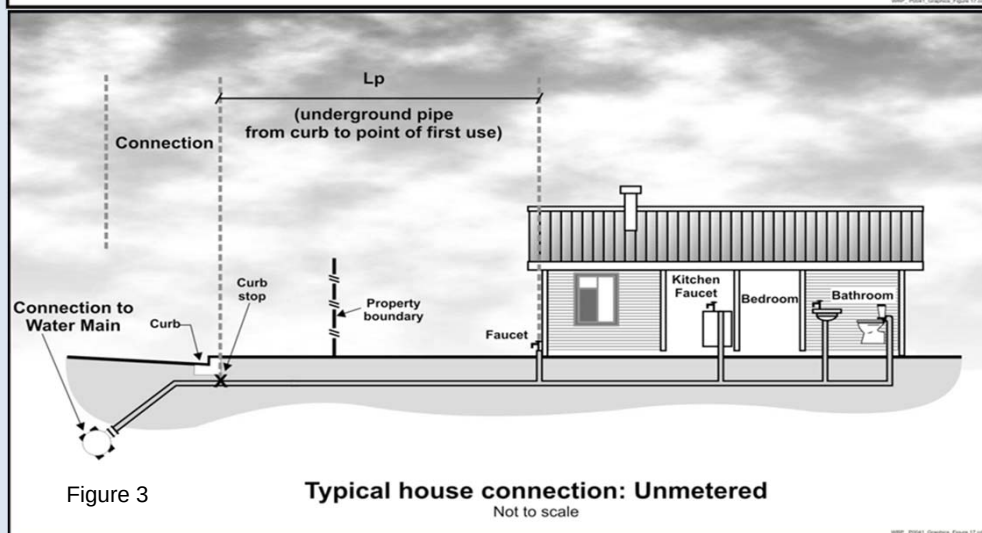
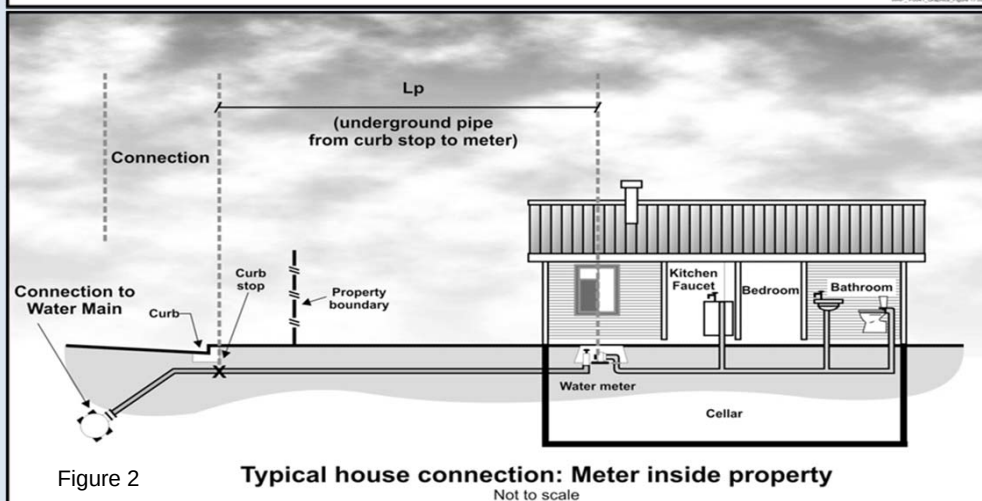
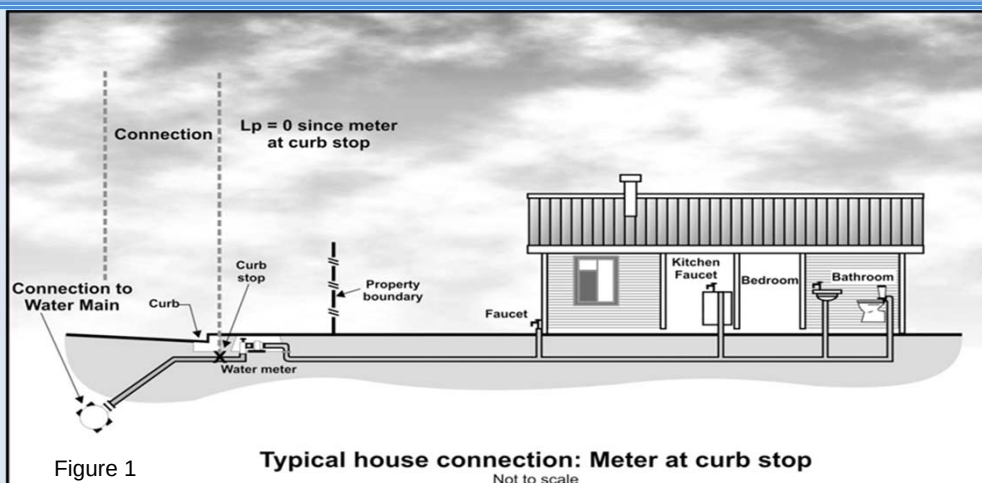
Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration $L_p = 0$ since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where L_p is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building, where L_p is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the L_p will vary notably in a community of different structures, therefore the average L_p value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

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AWWA Free Water Audit Software: Definitions

WAS v5.0

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Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component. Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
View Service Connection Diagram Average length of customer service line Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component. The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined <u>by utility policy</u> to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for <u>all</u> customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, <u>but only if</u> these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either \$/1,000 gallons, \$/hundred cubic feet, or \$/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, \$.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hydrants should be included in the "Length of mains" parameter.
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component. Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. <u>Data Transfer Errors</u> result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from <u>Data Analysis Errors</u> in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor <u>has</u> investigated the billing system and its controls, and <u>has</u> well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. <u>Note</u>: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, <u>in gallons:</u> (Lm x 32) + Nc < 3000 or P < 35psi <u>in litres:</u> (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.

Item Name	Description
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is <u>deemed by utility policy</u> to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. It does <u>not</u> include water supplied to neighboring utilities (water exported) which may be metered but not billed.
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case. This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility <u>has</u> carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: Convert From... Converts to.... 1 Million Gallons (US) = 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right Pcnt: Value: 1.25% ☒ ☐ NOTE: For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., \$/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of <u>treated</u> drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.

Item Name	Description
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.



AWWA Free Water Audit Software: Determining Water Loss Standing

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.Water Audit Report for: **City of Healdsburg (4910005)**Reporting Year: **2015** **1/2015 - 12/2015**Data Validity Score: **74**

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	Level I (0-25)	Level II (26-50)	Level III (51-70)	Level IV (71-90)	Level V (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	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 Automatic Meter Reading (AMR) 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 the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator 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.					

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities in gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 - 5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		



AWWA Free Water Audit Software: Examples of Completed and Validated Audits

WAS v5.0

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Example 1a: Million Gallons:

Example 1b: Million Gallons:

Example 2a: Megalitres:
Reporting WorksheetExample 2b: Megalitres:
Reporting Worksheet

Example Audit 1a:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

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Click to access definition
Click to add a comment

Water Audit Report for: **City of Asheville (01-11-010)**
Reporting Year: **2013** 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: **MILLION GALLONS (US) PER YEAR**

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it

WATER SUPPLIED

Volume from own sources: **7** 7,352.880 MG/Yr
Water imported: **n/a** 0.000 MG/Yr
Water exported: **n/a** 0.000 MG/Yr

Master Meter Error Adjustments

Pcnt: **3** Value: **285.450** MG/Yr
Pcnt: **0** Value: **0** MG/Yr
Pcnt: **0** Value: **0** MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: **7,067.430** MG/Yr

AUTHORIZED CONSUMPTION

Billed metered: **8** 4,782.250 MG/Yr
Billed unmetered: **n/a** 0.000 MG/Yr
Unbilled metered: **7** 27.757 MG/Yr
Unbilled unmetered: **8** **157.790** MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

AUTHORIZED CONSUMPTION: **4,967.797** MG/Yr

Click here: **?**
for help using option
buttons below

Pcnt: **0** Value: **157.790** MG/Yr

Use buttons to select
percentage of water
supplied
OR
value

Pcnt: **0.25%** Value: **0** MG/Yr

2.26% **0.25%** Value: **0** MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption)

2,099.633 MG/Yr

Apparent Losses

Unauthorized consumption: **?** **17.669** MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies: **7** **111.220** MG/Yr
Systematic data handling errors: **5** **11.956** MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: **140.844** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **?** **1,958.789** MG/Yr

WATER LOSSES: **2,099.633** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **?** **2,285.180** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains: **4** 1,236.5 miles
Number of active AND inactive service connections: **7** 55,256
Service connection density: **?** **45** conn./mile main

Are customer meters typically located at the curbstop or property line? **Yes**

Average length of customer service line: **?** (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: **4** 145.3 psi

COST DATA

Total annual cost of operating water system: **10** \$33,630.676 \$/Year
Customer retail unit cost (applied to Apparent Losses): **10** \$3.22 \$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses): **6** \$335.94 \$/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Variable production cost (applied to Real Losses)

3: Unauthorized consumption



Example Audit 1b:

AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0

American Water Works Association
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Water Audit Report for: **City of Asheville (01-11-010)**

Reporting Year: **2013** **7/2012 - 6/2013**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

Apparent Losses:	140.844	MG/Yr	
+	Real Losses:	1,958.789	MG/Yr
=	Water Losses:	2,099.633	MG/Yr

? Unavoidable Annual Real Losses (UARL): 794.34 MG/Yr

Annual cost of Apparent Losses: \$606,265

Annual cost of Real Losses: \$658,036

Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial: { Non-revenue water as percent by volume of Water Supplied: 32.3%
Non-revenue water as percent by cost of operating system: 3.9% Real Losses valued at Variable Production Cost

Operational Efficiency: { Apparent Losses per service connection per day: 6.98 gallons/connection/day
Real Losses per service connection per day: 97.12 gallons/connection/day
Real Losses per length of main per day*: N/A
Real Losses per service connection per day per psi pressure: 0.67 gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): 1,958.79 million gallons/year

? Infrastructure Leakage Index (ILI) [CARL/UARL]: 2.47

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



Example Audit 2a:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0
American Water Works Association
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[Click to access definition](#)
[Click to add a comment](#)

Water Audit Report for: **The City of Calgary**
Reporting Year: **2013** 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

Volume from own sources: 7 174,324.000 ML/Yr
Water imported: n/a 0.000 ML/Yr
Water exported: 7 8,190.131 ML/Yr

Master Meter Error Adjustments

Pcnt: 7 1.00% ☐ ☐ ML/Yr
 7 ☐ ☐ ML/Yr
 7 1.00% ☐ ☐ ML/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 164,488.979 ML/Yr

AUTHORIZED CONSUMPTION

Billed metered: 6 125,111.268 ML/Yr
Billed unmetered: 8 3,503.386 ML/Yr
Unbilled metered: 7 166.157 ML/Yr
Unbilled unmetered: 6 1,444.000 ML/Yr

AUTHORIZED CONSUMPTION: 130,224.811 ML/Yr

Click here: [?](#)
for help using option
buttons below

Pcnt: ☐ ☒ ☐ Value: 1,444.000 ML/Yr

Use buttons to select
percentage of water
supplied
OR
value

Pcnt: ☐ 0.25% ☒ ☐ Value: ML/Yr

☐ 1.00% ☒ ☐ ML/Yr
☐ 0.25% ☒ ☐ ML/Yr

WATER LOSSES (Water Supplied - Authorized Consumption)

34,264.168 ML/Yr

Apparent Losses

Unauthorized consumption: 411.222 ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies: 6 1,265.429 ML/Yr
Systematic data handling errors: 312.778 ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 1,989.429 ML/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **32,274.739 ML/Yr**

WATER LOSSES: 34,264.168 ML/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 35,874.325 ML/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains: 8 4,945.0 kilometers
Number of active AND inactive service connections: 8 312,075
Service connection density: 63 conn./km main

Are customer meters typically located at the curbside or property line? No (length of service line, beyond the property boundary, that is the responsibility of the utility)
Average length of customer service line: 8 12.0 metres

Average operating pressure: 8 50.8 metres (head)

COST DATA

Total annual cost of operating water system: 9 \$169,973,759 \$/Year
Customer retail unit cost (applied to Apparent Losses): 9 \$2.35 \$/1000 litres
Variable production cost (applied to Real Losses): 9 \$73.54 \$/Megalitre ☒ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources

2: Billed metered

3: Customer metering inaccuracies



Example Audit 2b:

AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0
American Water Works Association
Copyright ©2014, All Rights Reserved

Water Audit Report for: **The City of Calgary**

Reporting Year: **2013** **1/2013 - 12/2013**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

Apparent Losses:	1,989.429	ML/Yr	
+	Real Losses:	32,274.739	ML/Yr
=	Water Losses:	34,264.168	ML/Yr

? Unavoidable Annual Real Losses (UARL): 8,015.57 ML/Yr

Annual cost of Apparent Losses: \$4,675,159

Annual cost of Real Losses: \$75,845,637

Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:

Non-revenue water as percent by volume of Water Supplied: 21.8%

Non-revenue water as percent by cost of operating system: 49.6%

Real Losses valued at Customer Retail Unit Cost

Operational Efficiency:

Apparent Losses per service connection per day: 17.47 litres/connection/day

Real Losses per service connection per day: 283.34 litres/connection/day

Real Losses per length of main per day*: N/A

Real Losses per service connection per day per meter (head) pressure: 5.58 litres/connection/day/m

From Above, Real Losses = Current Annual Real Losses (CARL): 32,274.74 ML/year

? Infrastructure Leakage Index (ILI) [CARL/UARL]: 4.03

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline



AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65
- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009
- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the required data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknowledgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.