CITY OF LIVINGSTON

2020 URBAN WATER MANAGEMENT PLAN

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Prepared by:

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ABBREVIATIONS

AF	Acre-Feet
AFY	Acre-Feet per Year
AWWA	American Water Works Association
ACS	American Community Survey
AB	Assembly Bill
AMR	Automatic Radio Read Meter
BMP	Best Management Practice
CIMIS	California Irrigation Management Information System
CWC	California Water Code
City	City of Livingston
Census	United States Census Bureau
DMM	Demand Management Measure
DOF	Department of Finance
DWR	Department of Water Resources
DDW	Division of Drinking Water
DRA	Drought Risk Assessment
EAR	Electronic Annual Reports
eARDWP	Electronic Annual Reports to the Drinking Water Program
ERP	Emergency Response Plan
ET_o	Evapotranspiration
GPCD	Gallons per Capita Day
gpm	Gallons per Minute
GAC	Granular Activated Carbon
GHG	Greenhouse Gas
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCD	California Department of Housing and Community Development
CCF	Hundred Cubic Feet
in	Inch

ITP	Independent Technical Panel
IRWMP	Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
kWh/MG	Kilowatt-Hours per Million Gallons
LAFCO	Local Agency Formation Commission
MCL	Maximum Contaminant Level
MHI	Median Household Income
MCAG	Merced County Association of Governments
MSGSA	Merced Subbasin Groundwater Sustainability Agency
MIUGSA	Merced Irrigation-Urban Groundwater Sustainability Agency
MercedWRM	Merced Water Resources Model
MAF	Million Acre-Feet
MG	Million Gallons
MGD	Million Gallons per Day
µg/L	Microgram per Liter
MFR	Multi-Family Residential
PWS	Public Water System
RHNA	Regional Housing Needs Allocation
SB	Senate Bill
SFR	Single Family Residential
EC	Specific Conductivity
SOI	Sphere of Influence
SWRCB	State Water Resources Control Board
SWTP	Surface Water Treatment Plant
SGMA	Sustainable Groundwater Management Act
TCP	1,2,3-Trichloropropane
TIWD GSA-1	Turner Island Water District Groundwater Sustainability Agency #1
UWMP	Urban Water Management Plan
UWMPA	Urban Water Management Plan Act
WSCP	Water Shortage Contingency Plan
WWTP	Wastewater Treatment Plant

WDR	Waste Discharge Requirements
WRCC	Western Regional Climate Center

LAY DESCRIPTION

The City of Livingston (City) has prepared this 2020 Urban Water Management Plan (UWMP) as required by the California Department of Water Resources (DWR) for all urban water suppliers that provide water for municipal purposes to more than 3,000 customers within the State of California. This 2020 UWMP follows the State's requirements as defined in the California Water Code (CWC) and in the Urban Water Management Guidebook 2020 (DWR, 2021). The City's 2020 UWMP was adopted by the City of Livingston's City Council on_____, 2022, and submitted to DWR within 30 days after adoption. The 2020 UWMP is summarized in the flowing sections in a lay description, or executive summary, which provides the key components of each chapter of the UWMP. Table LD-1 provides a summary of each chapter within the City's 2020 UWMP.

Table LD-1 Overview of the 2020 UWMP

Chapter	Information Within Chapter
Chapter 1 – Introduction and Overview	• General legal requirements for the 2020 UWMP. • Plan organization.
Chapter 2 – Plan Preparation	• Plan preparation. • Coordination and outreach.
Chapter 3 – System Description	• Description of the City of Livingston's service area and water system. • Climate and hydrologic characteristics. • Current and projected population, socioeconomics, and demographics.
Chapter 4 – Water Use Characterization	• Description of the City's water use. • Current and projected water use and demand. • System water losses. • Climate change impacts on water use.
Chapter 5 – SB X7-7 Baselines, Targets, and 2020 Compliance	• Baseline daily gross per capita water use. • 2020 target compliance.
Chapter 6 – Water Supply Characterization	• Description of the City's water supplies, including groundwater, surface water, recycled water, and wastewater. • Expected future water projects. • Current and projected water supplies. • Climate change and regulatory condition impacts to supplies.
Chapter 7 – Water Service Reliability and Drought Risk Assessment	• Description of constraints on the City's groundwater supplies. • Projections for water supplies and demands under normal, single dry year, and five-consecutive dry years conditions. • Regional supply reliability. • Climate change impacts on supply reliability.
Chapter 8 – Water Shortage Contingency Plan	• Annual Water Supply and Demand Assessment procedures. • Description of the City's water shortage levels and actions. • Compliance and enforcement for water shortage actions. • Catastrophic and seismic risk assessment for the City's water system. • Overview of communication protocols.
Chapter 9 – Demand Management Measures	• Description of the City's Demand Measurement Measures implemented over the past five years. • Current and future Demand Measurement Measures.

Table LD-1 Overview of the 2020 UWMP	
Chapter	**Information Within Chapter**
Chapter 10 – Plan Adoption, Submittal, and Implementation	• Procedures followed for 2020 UWMP noticing and adoption process. • Plan and amendment submittal process.

This 2020 UWMP reports on a calendar year basis, with 2020 spanning from January 1, 2020, through December 31, 2020. UWMP regulations require the City to report actual supply and demand for 2020 in addition projected supply and demand in five-year increments through 2045. Projecting supply and demand through 2045 allows the City to assess the reliability and potential shortages that may come from population growth, climate change, and projected regional supply changes.

CHAPTER 1 – INTRODUCTION AND OVERVIEW

Water planning is an essential function of water suppliers and is critical as California continues to deal with ongoing drought conditions and expected long-term climate changes. Prior to the adoption of the Urban Water Management Planning Act (UWMPA) in 1983, there were no specific requirements for water agencies to conduct long-term resource planning. The UWMPA provided the foundation for the development of the UWMP, which provides the framework for long-term water planning. Additionally, the UWMP informs the public about water agencies long-term resource planning efforts that will ensure adequate water supplies for existing and future demands. This 2020 UWMP documents the availability of an appropriate level of reliability of water service sufficient to meet the needs of the City during normal, single dry and 5-consecutive dry years. A long-term reliable supply of water is essential to protect the productivity of the City and California's business and economic climate.

This 2020 UWMP is intended to serve as a general, flexible, and open-ended document that can be periodically updated to reflect changes in regional water supply trends and water use efficiency policies. This UWMP, along with other City of Livingston planning documents, will be used by City staff to guide water use and management efforts through the year 2025, when the UWMP is required to be updated.

CHAPTER 2 – PLAN PREPARATION

The City has prepared this 2020 UWMP in accordance with the UWMPA, sections 10610 through 10656 of the CWC. This UWMP summaries the City's projected retail water demands and characterizes the source water available to meet those demands for the years of 2025 through 2045. This UWMP also describes the reliability of the City's groundwater supplies and discusses the City's water shortage contingency plan during drought conditions and catastrophic events.

The City encouraged participation in this Plan by surrounding water management agencies, water retailers, public agencies, and members of the community. The draft UWMP was available for review at the Livingston City Hall located at 1416 C Street, Livingston, CA 95334, and as a PDF on the City's website (www.cityoflivingston.org) prior to the public hearing. The final 2020 UWMP will also be available at the Livingston City Hall or as a PDF on the City's website.

CHAPTER 3 – SYSTEM DESCRIPTION

The City of Livingston provides potable water service to a population of approximatley 15,448 residents, as well as commercial, industrial, and public facilities within its service area boundary. Located in north central Merced County within the Central Valley of California, the City is approximately 115 miles

southeast of San Francisco and 290 northwest of Los Angeles. The City is centrally located between Stockton and Fresno along the State Highway 99 corridor. The Union Pacific Railroad passes through the City along the general alignment of State Highway 99.

The City of Livingston is the governing agency and the sole purveyor of water within the City limits. The City owns and operates a public water system that provides water services to 2,779 metered connections. Historically, the City has provided water to residential, commercial, industrial, and institutional customers and for fire protection by use of groundwater wells. The City currently uses eight active wells, Well Nos. 8, 9, 11, 12, 13, 14, 16, and 17, to extract groundwater from the Merced Subbasin. The City's ninth groundwater well, Well No. 15, services as a standby source. The City's groundwater wells have individual capacities ranging from 800 gallons per minute (gpm) to 2,000 gpm.

The climate within the City's service area is characterized as an inland Mediterranean type of climate; summers are typically warm and dry, while winters are cool and moist.

According to the Western Regional Climate Center (WRCC), average January temperatures are a maximum of 53.7°F and a minimum of 38.1°F, and average July temperatures are a maximum of 94.6°F and a minimum of 62.6°F. According to WRCC records from the years of 1993 to 2016, the annual precipitation in the City's service area averages approximatley 10.9 inches. Snow is a rare occurrence for the City.

The City of Livingston has historically experienced steady population growth and future projections anticipate further growth. According to the Department of Finance (DOF), population within the City as of January 1, 2021, was 15,448, which was up from 13,058 at the 2010 Census and up from 10,437 at the 2000 Census. According to these population figures, the City has experienced an average annual growth rate of approximatley 1.98 percent over the last 20 years. Current and projected populations through 2045 are shown in Table LD-2

Table LD-2 Population - Current and Projected (Submittal Table 3-1)

Population Served	2020	2025	2030	2035	2040	2045
	15,448	17,039	18,794	20,730	22,865	25,220

NOTES:
(1) An annual growth rate of 1.98% is used to project population growth within the City of Livingston service area through 2045.

CHAPTER 4 – WATER USE CHARACTERIZATION

This chapter describes and quantifies the City's current water use and future water use projections through the year 2045. Water use records, combined with projections of population, provide the basis for estimating future water requirements. Water use projections provided in this chapter will allow the City to accurately analyze the use of the water resources and conduct good resource planning. Additionally, the future demand estimates presented in this chapter will allow the City to adequately manage the water supply and appropriately plan their infrastructure investments.

This chapter also details total water demand and potable demand. Water demands refer not only to the water used by customers but also water used as part of the system maintenance and operation, as well as unavoidable losses inherent in the operation of a water distribution system. Total water demand within the City was approximatley 2,267 million gallons (MG) per year on average between 2015 and 2019, and 2,779 MG in 2020. Table LD-3 summarizes the 2020 actual water uses and the projected demand through

2045 in five-year increments. Chapter 4 of this UWMP describes the methodologies and assumptions uses in projected future demands.

Table LD-3 Retail Demands for Potable and Raw Water - Projected						
Use Type	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
Single Family Residential	580	626	675	729	787	850
Multi Family Residential	58	62	67	73	79	85
Commercial[(1)]	89	96	104	112	121	130
Industrial	1,854	2,001	2,160	2,332	2,517	2,717
Landscape Irrigation	61	66	71	77	83	89
Other Potable	1	1	1	1	1	1
Losses	138	138	138	138	138	138
TOTAL	**2,779**	**2,989**	**3,216**	**3,461**	**3,725**	**4,010**
NOTES: [(1)]The City tracks commercial and institutional customer water uses as one.						

Accounting for historical water use, expected population increase and other growth, climatic variability, water conservation, and other assumptions, the potable water demand within City's service area is projected to increase to 4,010 MG by 2045.

CHAPTER 5 – SB X7-7 BASELINES, TARGETS, AND 2020 COMPLIANCE

The Water Conservation Act of 2009, also known as the SB X7-7, required urban retail water suppliers to set water conservation targets for 2020 to support the overall State goal of reducing urban per capita water use by 20 percent by 2020. As required by the Act, individual supplier conservation targets had to be determined using one of four methods that are based upon a baseline of use that was calculated using the specific guidelines described in DWR's *Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use* (DWR, 2011).

In 2015, the City of Livingston calculated their baselines and targets based on the requirements and methodologies presented in the 2015 UWMP Guidebook. In the 2015 UWMP, the City demonstrated compliance with their interim water use target for the year 2015 and that the City was on track to achieve its 2020 target. In Chapter 5 of this 2020 UWMP, the City demonstrates that it has achieved its 2020 target.

CHAPTER 6 – WATER SUPPLY CHARACTERIZATION

The City acquires all of its water supply from the underlying groundwater basin via a series of wells. The City's existing system facilities include eight active groundwater wells and one standby well. The nine wells have a combined capacity of 10,900 gpm. Water is distributed by a network of lines ranging in size from two to 16-inches in diameter. The water system also includes a 1.0 MG welded steel storage tank that is used for water storage.

The City is located within the geomorphic province known as the Central Valley, which is divided into the Sacramento Valley and the San Joaquin Valley. The groundwater underlying the City is part of the larger San Joaquin Valley Groundwater Basin within the San Joaquin River Hydrologic Region. The San Joaquin Valley Groundwater Basin is further divided into nine subbasins. The City's groundwater supply is extracted from the Merced subbasin, which is classified the DWR as a critical overdraft subbasin.

Following the passage of the Sustainable Groundwater Management Act (SGMA) by California Governor Edmund G. Brown Jr. in September 2014, County of Merced and water districts and cities within the Merced Subbasin formed three GSAs in accordance with SGMA: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1). The City of Livingston is a member of the MIUGSA, which was formed by an MOU between the Merced Irrigation District, City of Merced, City of Atwater, City of Livingston, Le Grand Community Services District, Planada Community Services District, and Winton Water and Sanitary District. The City and the MIUGSA is working collaboratively to achieve sustainable groundwater conditions by 2040 in accordance with SGMA.

In addition to the water system, the City also provides wastewater collection and treatment for a combination of residential, commercial, and industrial users. The existing sewer collection system is comprised of a network of approximately 29 miles of sewer pipelines ranging from six to 27 inches in diameter and includes nine lift stations and associated force mains. Wastewater is conveyed by the sewer collection system to the City's Domestic WWTP, located northwest of the City. The City's Domestic WWTP has a design capacity of 2.0 million gallons per day (MGD) and discharges undisinfected secondary effluent to evaporation/percolation ponds located on 40 acres of City owned land adjacent to the WWTP. The City does not currently treat any wastewater to disinfected tertiary water standards to allow it to be used as a component of its water supply.

The City also owns an industrial wastewater treatment plant. The industrial WWTP was used in the past to treat wastewater generated solely from the Foster Farms poultry processing plant. However, this facility has been abandoned and Foster Farms has now constructed an on-site wastewater treatment plant. The onsite WWTP consists of fine screening, flow equalization, and extended aeration. Treated effluent is used by Foster Farm to irrigate crops within their own land.

CHAPTER 7 – WATER SERVICE RELIABILITY AND DROUGHT RISK ASSESSMENT

Water supply reliability describes the long-term reliability of the City to meet the water needs of its customers under varying conditions. Chapter 7 describes the City's reliability to meet customer's demands through the year 2045 by analyzing plausible hydrological variability, regulatory variability, climate conditions, and other factors that affect the water supply and the customer's water use. Per the new requirements of the CWC, this chapter presents an assessment of the City's water supply by comparing projected future demands with expected water suppliers under three different hydrologic condition: normal year; a single dry year; and multiple dry years.

Reliability is expressed in terms of the City's water system ability to deliver water during normal water years and in years of water supply shortages. Reliability may be quantified by the amount and frequency of water delivery reductions required to balance customer demands with available water supplies. Based on the resiliency of the groundwater basin and if potable groundwater can be extracted by the City wells, which are individual sources in certain respects, it is not anticipated that a single or multiple dry year period will reduce the availability of water supply to the City. Groundwater has and will continue to provide drought protection for the City. However, the City has engaged in extensive emergency planning in preparation for potential service interruptions and has prepared a Water Shortage Contingency Plan

(WSCP) that will be implemented during drought conditions. Chapter 7 concludes that no water supply shortages are anticipated in the City's service are during the planning period.

CHAPTER 8 – WATER SHORTAGE CONTINGENCY PLAN

Water shortage contingency planning is a strategic planning process to prepare for and respond to water shortages. The purpose of a WSCP is to include stages of response to a water shortage, such as a drought, that occur over a period of time, as well as catastrophic supply interruptions which occur suddenly. The primary objective of a WSCP is to ensure that a supplier has in place the necessary resources and management responses needed to protect health and human safety, minimize economic disruption, and preserve environmental and community assets during water supply shortages and interruptions.

Since the City sole source of water supply is obtained from the critical overdraft Merced subbasin, the City is committed to promoting water conservation measures to maintain the reliability of the groundwater basin. On May 5, 2015, the Livingston City Council adopted Resolution No. 2015-23 declaring a local drought emergency and adopting mandatory water conservation measures so that the water supply could be conserved for the greater public benefit. Per the requirements of the UWMPA, the City's 2015 UWMP included a WSCP, which described the mandatory use restrictions that would be required to prepare for and respond to various levels of water shortages. On October 26, 2016, the City Council's adopted Resolution No. 2016-55, which rescinded Resolution 2015-23 and replaced it with the WSCP contained in the 2015 UWMP.

The 2020 WSCP presented in this Chapter updates the City's WSCP presented in their 2015 UWMP, which included only five stages of voluntary and mandatory water conservation measures. For the 2020 WSCP, each of the six water shortage stages represent an increasing gap between the City's estimated water supplies and the unconstrained water demand or the gap between supply and demand at any time due to an unforeseen event that interrupts water supplies. The six shortage stages correspond to 10, 20, 30, 40, 50 percent, and greater than 50 percent shortage compared to the normal reliability conditions, as required by new legislation.

CHAPTER 9 – DEMAND MANAGEMENT MEASURES

The City recognizes water use efficiency as an integral component of current and future water strategy in its service area. Demand management measures (DMMs) refer to policies, programs, rules, regulation and ordinances, and the use of devices, equipment, and facilities that, over the long term, have been generally justified and accepted by the industry as providing the means to achieve a "reliable" reduction in water demand. This means providing education, tools, and incentives to help residents and businesses reduce the amount of water used on their property. The City has aggressively pursued conservation to reduce demand and stretch existing water supplies.

The UWMPA originally required implementation of fourteen DMMs; also known as best management practices (BMP). In 2014, the section of the CWC addressing DMMs was significantly modified based on recommendations from the Independent Technical Panel (ITP) to the legislature. The ITP recommended that the UWMP Act should be amended to simplify, clarify, and update the DMM reporting requirements, reorganizing the 14 specific measures to six more general requirements plus a "other" category. Urban water suppliers can choose to follow the six general requirements or report by type of DMM.

The City realizes the importance of DMMs to ensure a reliable future water supply. In this 2020 UWMP, the City has reported on the seven DMM described in the 2020 UWMP Guidebook. The DMMs that have been or are planning to be implemented within the City's water service area are detailed in Chapter 9.

CHAPTER 10 – PLAN ADOPTION, SUBMITTAL, AND IMPLEMENTATION

During preparation of the 2020 UWMP, the City notified the City of Atwater, City of Merced, County of Merced, Merced County Association of Governments, and Merced Irrigation District that it was updating their 2015 UWMP in compliance with the 2020 UWMP Guidebook and invited each agency to participate in the process. On _____, 2022, a notice of public hearing was mailed, notifying each agency the date and time of the public hearing, contact information, and where the draft UWMP would be available for review. This occurred within the required 60-day notification period prior to the public hearing.

In accordance with Government Code 6066, the notice of the public hearing was also published in the City's local press to notify the general public. The notice included the date and time of the public hearing, as well as the location where the Plan is available for public inspection.

The 2020 UWMP was adopted by Resolution No._____ on _____, 2022, following the public hearing. The public hearing gave the general public the opportunity to comment on the Plan and further allowed the Livingston City Council to consider any further modifications of the UWMP in response to public input before adoption.

The UWMP was submitted to the DWR electronically on _____, 2022. A copy of the UWMP was submitted to the California State Library, Kings River Conservation District, Fresno Irrigation District, Consolidated Irrigation District, City of Fresno, City of Clovis, City of Reedley, and County of Fresno within 30 days of approval of the Plan. Finally, copies of the adopted UWMP were also made available to the public within 30 days following adoption. The public can access an electronic copy of the Plan on the City's website and also obtain a copy at City Hall office during normal business hours.

CHAPTER 1 - INTRODUCTION AND OVERVIEW

1.1. Background and Purpose

The California Water Code requires all urban water suppliers within the state to prepare and adopt Urban Water Management Plans (UWMP) for submission to the California Department of Water Resources (DWR). The UWMPs must be updated every five years and satisfy the requirements of the Urban Water Management Planning Act (UWMPA) of 1983 including amendments that have been made to the Act. The UWMPA requires urban water suppliers servicing 3,000 or more connections or supplying more than 3,000-acre feet (AF) of water annually, to prepare an UWMP.

The purpose of the UWMP is to maintain efficient use of urban water supplies, continue to promote conservation programs and policies, ensure that sufficient water supplies are available for future beneficial use, and provide a mechanism for response during water drought conditions. This report, which was prepared in compliance with the California Water Code (CWC), and as set forth in the guidelines and format established by the DWR, is the City of Livingston's (City) 2020 UWMP.

1.2. Urban Water Management Planning and the California Water Code

Water planning is an essential function of water suppliers, but it is critical as California grapples with ongoing drought and expected long-term climate changes. Prior to the adoption of the UWMPA, there were no specific requirements that water agencies conduct long-term resource planning. While many water agencies had conducted long-term water supply and resource planning prior to the Act, those who had not were left vulnerable to supply disruptions during dry periods or catastrophic events.

1.2.1. Urban Water Management Planning Act of 1983

In 1983, State Assembly Bill (AB) 797 modified the California Water Code Division 6, by creating the UWMPA. Several amendments to the original UWMPA, which were introduced since 1983, have increased the data requirements and planning elements to be included in 2020 UWMP.

Initial amendments to the UWMPA required that total projected water use be compared to water supply sources over the next 20 years, in 5-year increments. Recent DWR guidelines also suggest projecting through a 25-year planning horizon to maintain a 20-year timeframe until the next UWMP update has been completed and for use in developing Water Supply Assessments.

Other amendments require that UWMPs include provisions for recycled water use, demand management measures, and a Water Shortage Contingency Plan (WSCP), set forth therein. Recycled water was added in the reporting requirements for water usage and figures prominently in the requirements for evaluation of alternative water supplies when future projections predict the need for additional water supplies. Each urban water purveyor must coordinate the preparation of the WSCP with other urban water purveyors in the area, to the extent practicable. Each water supplier must also describe their water demand management measures that are being implemented or scheduled for implementation.

In addition to the UWMPA and its amendments, there are several other regulations that are related to the content of the UWMP. In summary, the key relevant regulations are:

- Chapter 1 - AB 1420: Requires implementation of demand management measures (DMMs)/best management practices (BMPs) and meeting the 20 percent reduction by 2020 targets (mandated by SBx7-7) to qualify for water management grants or loans.
- Chapter 2 - AB 1465: Requires water suppliers to describe opportunities related to recycled water use and stormwater recapture to offset potable water use.
- Chapter 3 - Amendments Senate Bill (SB) 610 (Costa, 2001), and SB 221 (Daucher, 2001), which became effective beginning January 1, 2002, require counties and cities to consider information relating to the availability of water to supply large new developments by mandating the preparation of further water supply planning (Daucher) and Water Supply Assessments (Costa).
- Chapter 4 - SB 1087: Requires water suppliers to report single family residential (SFR) and multifamily residential (MFR) projected water use for planned lower income units separately.
- Chapter 5 - Amendment SB 318 (Alpert, 2004) requires the UWMP to describe the opportunities for development of desalinated water, including but not limited to, ocean water, brackish water, and groundwater, as long-term supply.
- Chapter 6 - AB 105 (Wiggins, 2004) requires urban water suppliers to submit their UWMPs to the California State Library.
- Chapter 7 - SBx7-7: Requires development and use of new methodologies for reporting population growth estimates, base per capita use, and water conservation. This water bill also extended the 2010 UWMP adoption deadline for retail agencies to July 1, 2011.

A copy of the current version of the UWMPA, as incorporated in Sections 10610 through 10657 of the California Water Code (CWC), is provided in Appendix A.

1.2.2. Applicable changes to the Water Code since 2015

Table 1-1 provides a summary of the changes to the CWC since 2015:

Table 1-1 Changes to the CWC since 2015

Topic	CWC Section	Legislative Bill	Summary
Five Consecutive Dry-Year Water Reliability Assessment	Section 10635(a)	SB 606 Hertzberg 2018	The Legislature modified the dry-year water reliability planning from a "multiyear" time period to a "drought lasting five consecutive water years" designation. This statutory change requires a Supplier to analyze the reliability of its water supplies to meet its water use over an extended drought period.
Drought Risk Assessment	Section 10635(b)	SB 606 Hertzberg 2019	The Legislature created a new UWMP requirement for drought planning in part because of the significant duration of recent California droughts and the predictions about hydrological variability attributable to climate change. The Drought Risk Assessment requires a Supplier to assess water supply reliability over a five-year period from 2021 to 2025 that examines water supplies, water uses, and the resulting water supply reliability under a reasonable prediction for five consecutive dry years.

Table 1-1 Changes to the CWC since 2015			
Topic	**CWC Section**	**Legislative Bill**	**Summary**
Seismic Risk	Section 10632.5	SB 664 Hertzberg 2015	The Water Code now requires Suppliers to specifically address seismic risk to various water system facilities and to have a mitigation plan.
Energy Use Information	Section 10631.2	SB 606 Hertzberg 2018	The Water Code now requires Suppliers to include readily obtainable information on estimated amounts of energy for their water supply extraction, treatment, distribution, storage, conveyance, and other water uses. The reporting of this information was voluntary in the 2015 UWMP.
Water Loss Reporting for Five Years	Section 10631(d)(3)(C)	AB 1414 Friedman 2019	The Water Code added the requirement to include the past five years of water loss audit reports as part of the 2020 UWMP
Water Shortage Contingency Plan (WSCP)	Section 10632	SB 606 Hertzberg 2019	In 2018, the Legislature modified the UWMP laws to require a WSCP with specific elements. The WSCP is a document that provides a Supplier with an action plan for a drought or catastrophic water supply shortage.
Groundwater Supplies Coordination	Section 10631	AB 1414 Friedman 2019	In 2014, the Legislature enacted the Sustainable Groundwater Management Act (SGMA) to address groundwater conditions throughout California. The Water Code now requires Suppliers' 2020 UWMPs to be consistent with Groundwater Sustainability Plans, in areas where those plans have been completed by Groundwater Sustainability Agencies.
Lay Description	Section 10630.5	SB 606 Hertzberg 2019	The Legislature included a new statutory requirement for Suppliers to include a lay description of the fundamental determinations of the UWMP, especially regarding water service reliability, challenges ahead, and strategies for managing reliability risks.

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

With the adoption of the Water Conservation Act of 2009, also known as SB X7-7, the State of California is required to reduce urban per capita water use by 20 percent by the year 2020. To achieve this statewide objective, the Legislature required each urban supplier to report in their 2015 UWMPs their Base Daily per Capita Water Use (Baseline Gallons per Capita Day (GPCD)), 2015 Interim Urban Water Use Target, 2020 Urban Water Use Target (2020 Target), and Compliance Daily per Capita Water Use. The Legislature stated that the cumulative results of each urban supplier's reduction would meet the statewide legislative requirement.

No new requirements were created for water use targets, baselines, or compliance since the UWMP 2015. However, for this 2020 UWMP, urban suppliers must demonstrate whether they have achieved their 2020 Target as reported in their 2015 UWMP. The City's compliance with their 2020 Confirmed Target is detailed in Chapter 5 of this 2020 UWMP.

1.3. Urban Water Management Plan 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, District and County General Plans, Water Master Plans, Recycled Water Master Plans, integrated resource plans, Integrated Regional Water Management Plans, Groundwater Management Plans, and others.

1.4. 2020 UWMP Organization

The information contained in this 2020 UWMP corresponds to items in the UWMPA and other amendments to the Water Code. This 2020 UWMP has been organized following the DWR's recommended outline and the following is a description of each chapter and a brief description of the content in each chapter:

- **Chapter 1 - Introduction and Overview:** This introductory chapter describes the UWMP Act, the UWMP preparation and adoption process, and amendments to the Water Code since the preparation of the 2015 UWMP. This Chapter also provides a discussion on the importance and extent of the City's water management planning efforts.
- **Chapter 2 - Plan Preparation:** This chapter provides information on the process followed for developing the UWMP, including efforts in coordination and outreach.
- **Chapter 3 - System Description:** This chapter includes a general description of the City's water supply system, including a description of the City's service area, climate, projected population, and other social, economic, and demographic factors.
- **Chapter 4 - System Water Use:** This chapter describes and quantifies the current and projected water uses within City's service area.
- **Chapter 5 – SB X7-7 Baselines, Targets and 2020 Compliance:** This chapter describes the City's compliance with the 2020 per-capita target value that was adopted in 2015 UWMP and states the City's compliance value based on actual 2020 customer water use.
- **Chapter 6 - System Supplies:** This chapter describes and quantifies the current and projected sources of water available to the City. This chapter also includes a description and quantification of potential recycled water uses and supply availability.
- **Chapter 7 - Water Supply Reliability and Drought Risk Assessment:** This chapter presents an assessment of the reliability of the City's water supply and projects the reliability over a 20-year planning horizon, for normal, single dry years, and five consecutive dry years.
- **Chapter 8 - Water Shortage Contingency Plan:** This chapter provides City's staged plan for dealing with water shortages, incorporating prescriptive information and standardized action levels, along with implementation actions in the event of a catastrophic supply interruption.
- **Chapter 9 - Demand Management Measures:** This chapter describes the City's efforts to promote conservation and to reduce demand on its water supply and addresses several demand management measures.

- **Chapter 10 - Plan Adoption, Submittal, and Implementation:** This chapter describes the steps taken to adopt and submit the 2020 UWMP and to make it publicly available. This chapter also includes a discussion of City's plan to implement the UWMP.

CHAPTER 2 - PLAN PREPARATION

2.1. Introduction

This chapter provides the basis for preparing the 2020 UWMP and describes the various levels of regional coordination that City has employed. It also describes the reporting period and the units of measure used by City to report water volumes throughout the 2020 UWMP.

Finally, this chapter also provides a description of the coordination and outreach efforts followed in the preparation of the 2020 UWMP. Coordination and outreach are key elements to developing a useful and accurate UWMP.

2.2. Basis for Preparing a Plan

CWC Section 10617

"Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems.

CWC Section 10620

(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

CWC Section 10621

(a) Each urban water supplier shall update its plan at least once every five years on or before July 1, in years ending in six and one, incorporating updated and new information from the five years preceding each update.

The City of Livingston supplies water for municipal purposes to a population of approximately 26,617 through a total of number of 6,973 metered service connections (as of December 31, 2020). Thus, the City is classified as an "urban water supplier" as defined in Section 10617 of the CWC. In accordance with the CWC, as an urban water supplier, the City is required to update its urban water management plan every five years. The City submitted its first UWMP to the Department of Water Resources (DWR) in 2005. This 2020 UWMP will be the third UWMP submitted by the City of Livingston.

2.2.1. Public Water Systems

CWC Section 10644

(a)(2) The plan, or amendments to the plan, submitted to the department ... shall include any standardized forms, tables, or displays specified by the department.

California Health and Safety Code 116275 (h)

"Public Water System" means a system for the provision of 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.

The City of Livingstonowns and operates a public water system (PWS# CA5010013) that is regulated by the State Water Resources Control Board, Division of Drinking Water (SWRCB-DDW). The SWCRB-DDW requires reporting on public water systems.

The City files electronic Annual Reports to the Drinking Water Program (eARDWP) to the Board, which include annual reports of water usage and other information. The information provided in this UWMP is consistent with the data reported in the eARDWP.

2.2.2. Agencies Serving Multiple Service Areas/Public Water Systems

The City serves only one PWS. Information about that PWS is shown below in Table 2-1.

Table 2-1 Public Water Systems (Submittal Table 2-1)

Public Water System Number	Public Water System Name	Number of Municipal Connections 2020	Volume of Water Supplied 2020 (MG)
CA5010013	City of Livingston	3,523	2,779

2.3. Individual or Regional Planning and Compliance

The City has developed this 2020 UWMP reporting solely on its service area to address all requirements of the CWC. The City's 2020 UWMP was not developed as a Regional Plan.

Table 2-2 Plan Identification (Submittal Table 2-2)

Select Only One	Type of Plan		Name of RUWMP or Regional Alliance
☒	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☐	Water Supplier is also a member of a Regional Alliance	
	Regional Urban Water Management Plan (RUWMP)		

2.4. Fiscal or Calendar Year and Units of Measure

CWC Section 10608.20

(a)(1) Urban retail water suppliers…may determine the targets on a fiscal year or calendar year basis.

2.4.1. Fiscal or Calendar Year

Water suppliers may report on either a fiscal or calendar year basis. DWR prefers that agencies report on a calendar year basis in order to ensure UWMP data is consistent with data submitted for other reports to the State. The City is reporting on a calendar year basis. All data included in this 2020 UWMP is consistent with the calendar year basis.

2.4.2. Reporting Complete 2015 Data

The 2020 UWMPs are required to include the water use and planning data for the entire calendar year of 2020, if an agency is reporting on a calendar year basis. This 2020 UWMP contains information for the entire 2020 year.

2.4.3. Units of Measure

Water agencies use various units of measure when reporting water volumes, such as acre-feet (AF), million gallons (MG), or hundred cubic feet (CCF). Agencies may report volumes of water in any of these units, but must maintain consistency throughout the UWMP. The City is reporting water volumes in million gallons (MG). Table 2-3 shows the type of agency, type of reporting year, and the units of measurement used throughout this 2020 UWMP.

Table 2-3 Supplier Identification (Submittal Table 2-3)

Type of Supplier	
☐	Supplier is a wholesaler
☒	Supplier is a retailer
Fiscal or Calendar Year	
☒	UWMP Tables are in calendar years
☐	UWMP Tables are in fiscal years
Units of measure used in UWMP	
Unit	MG

2.5. Coordination and Outreach

CWC Section 10631 (h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

2.5.1. Wholesale and Retail Coordination

When a water supplier relies upon a wholesale agency for a water supply, both suppliers are required to provide each other with information regarding projected water supply and demand. The projections should be consistent with each agency's supply and demand projections.

The City of Livingstondoes not receive water from any wholesale agency. Standard Table 2-4 is included below indicating that the information requested does not apply to the City of Livingston.

Table 2-4 Water Supplier Information Exchange (Submittal Table 2-4)
The retail Supplier has informed the following wholesale supplier(s) of projected water use in accordance with Water Code Section 10631.
Wholesale Water Supplier Name
Not Applicable

2.5.2. Coordination with Other Agencies and the Community

CWC Section 10620

(d)(3) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

CWC Section 10642

Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of both the plan and the water shortage contingency plan…

In the preparation this 2020 UWMP, the City has coordinated with other appropriate agencies in the area, to the extent practicable. The City has contacted with the following agencies in the preparation of this 2020 UWMP.

- City of Atwater
- City of Merced
- County of Merced
- Merced County Association of Governments
- Merced Irrigation District

Copies of the letters sent to each of those agencies are included in Appendix B.

2.5.3. Notice to Cities and Counties

CWC Section 10621(b)

Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.

- Agencies must notify cities and counties within which they serve water that the UWMP is being updated and reviewed. As indicated above, City of Atwater, City of Merced, County of Merced, Merced County Association of Governments, and Merced Irrigation District have been notified of the preparation of the 2020 UWMP and invited to participate in the process.

CHAPTER 3 - SYSTEM DESCRIPTION

3.1. Introduction

This Chapter provides a general description of the City of Livingston's water supply system, including a description of the service area, climate, projected population, land use, and other social, economic, and demographic factors.

3.2. General Description

CWC Section 10631.

(a) Describe the service area of the supplier, including current and projected population, climate, and other social, economic, and demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available. The description shall include the current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning. Urban water suppliers shall coordinate with local or regional land use authorities to determine the most appropriate land use information, including, where appropriate, land use information obtained from local or regional land use authorities, as developed pursuant to Article 5 (commencing with Section 65300) of Chapter 3 of Division 1 of Title 7 of the Government Code.

The City of Livingston provides potable water service to a population of approximatley 15,448 residents, as well as commercial, industrial, and public facilities within its service area boundary. Located in north central Merced County within the Central Valley of California, the City is approximately 115 miles southeast of San Francisco and 290 northwest of Los Angeles. Incorporated as a City in 1922, Livingston is centrally located between Stockton and Fresno along the State Highway 99 corridor. The Union Pacific Railroad passes through the City along the general alignment of State Highway 99.

The City of Livingston is the governing agency and the sole purveyor of water within City limits. The City owns and operates a public water system that provides water services to 2,779 metered connections. Historically, the City has provided water to residential, commercial/institutional, and industrial customers and for fire protection by use of groundwater wells. The City currently uses eight active wells, Well Nos. 8, 9, 11, 12, 13, 14, 16, and 17, to extract groundwater from the Merced Subbasin. The City's ninth groundwater well, Well No. 15, services as a standby source. The City's groundwater wells have individual capacities ranging from 800 gallons per minute (gpm) to 2,000 gpm.

The groundwater underlying the City is part of the larger San Joaquin Valley Groundwater Basin within the San Joaquin River Hydrologic Region. The San Joaquin Valley Groundwater Basin is further divided into nine subbasins. The City lies within the Merced Subbasin, just south of the boundaries of the Turlock Subbasin. The City's wells currently draw water from the non-adjudicated groundwater subbasin with no limits on pumping and that has been labeled as being in a critical state of overdraft.

Livingston is a highly productive agricultural community, where industry includes both farming and agricultural processing. Foster Farms is the largest employer in Livingston and in Merced County with 3,900 employees. Foster Farms is also the largest water user in the City, accounting for approximatley 66

percent of the City's annual water sales. Foster Farms currently uses an average of approximately 5 MG per day for processing. This annual average consumption has remained relatively constant since 2001.

3.3. Service Area Map

A service area map is included in Appendix C of this 2020 UWMP. The service area map contains the City Limits, the potable water service area boundary (same as the public water system boundary), the location of the water supply wells, and the layout of the distribution system (with pipe sizes).

3.4. Service Area Climate

CWC Section 10631(a)

A plan shall… Describe the service area of the supplier, including … climate…

CWC Section 10630

It is the intention of the Legislature, in enacting this part, to permit levels of water management planning… while accounting for impacts from climate change.

The City is located within the north central portion of Merced County, which is characterized by an inland Mediterranean type of climate. Summers are typically warm and dry, while winters are cool and moist. Nearly nine-tenths of the annual precipitation falls during the period of November through April. Rainfall during the summer is rare and very light. Livingston enjoys a very high percentage of sunshine, receiving more than 80 percent of the possible amount during all but the four months of November, December, January, and February. Reduction of sunshine during these months is caused by fog and short periods of stormy weather.

The Western Regional Climate Center (WRCC) has maintained historical climate records for the past 100 years for the Livingston area. According to the WRCC, average January temperatures are a maximum of 53.7°F and a minimum of 38.1°F. Average July temperatures are a maximum of 94.6°F and a minimum of 62.6°F. According to the WRCC records from the years of 1948 to 2016, annual precipitation within the City's service area averages approximatley 11.88 inches. Snow is a rare occurrence for the City.

Similar to the WRCC, the California Irrigation Management Information System (CIMIS) web site tracks and maintains records of evapotranspiration (ET_o) for select cities only. Since there are no CIMIS stations located in the City of Livingston, the ET_o statistics presented in the table below come from the City of Merced, which is located 16 miles southeast of the City. It assumed that the Merced region station will be a representative of the Livingston distribution area. Table 3-1 below displays the average monthly precipitation, maximum and minimum average temperatures, and average evapotranspiration within the City's service area.

Table 3-1 Climate Data

Month	Avg. Precipitation (in)[1]	Avg. Snowfall (in)[1]	Avg. Max Temp (°F)[1]	Avg. Min Temp (°F)[1]	Avg. Et_o (in)[2]
January	2.28	0.0	53.7	38.1	1.24
February	2.07	0.0	60.6	41.7	2.04
March	1.85	0.0	66.5	44.4	3.63

Table 3-1 Climate Data					
Month	**Avg. Precipitation (in)[1]**	**Avg. Snowfall (in)[1]**	**Avg. Max Temp (°F)[1]**	**Avg. Min Temp (°F)[1]**	**Avg. Et_o (in)[2]**
April	1.05	0.0	72.6	48.5	5.02
May	0.43	0.0	80.1	53.1	6.97
June	0.10	0.0	88.5	58.6	7.98
July	0.01	0.0	94.6	62.6	8.47
August	0.02	0.0	92.6	61.0	7.57
September	0.18	0.0	86.9	57.8	5.56
October	0.59	0.0	76.9	51.6	3.60
November	1.24	0.0	63.9	42.9	1.80
December	2.06	0.0	53.4	38.0	1.08
Annual Total/Average	**11.88**	**0.0**	**74.2**	**49.9**	**54.96**

NOTES:
[1]Data obtained from the WRCC based on records from January 1, 1893 through December 31, 2016 for the Turlock #2, California Station (049073).
[2] Data obtained from the CIMIS, for the Merced Station.

3.5. Service Area Population and Demographics

3.5.1. Service Area Current and Projected Population

CWC Section 10631(a)

Describe the service area of the supplier, including current and projected population …The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

The City of Livingston, along with a number of other communities in the region, have experienced steady population growth created by persons community to work in job centers outside of Merced County. The persistent increase in population is primarily a reflection of the regional growth pressures that are affecting the Central Valley as people living in more expensive regions look for affordable housing in the Valley. Anticipating increased demand from population growth and new enterprise are important aspects of the City's UWMP. The City's UWMP anticipates the effects of increased demand on water resources arising from sustained population growth.

According to the Department of Finance (DOF), population within the City as of January 1, 2021, was 15,448, which was up from 13,058 at the 2010 Census and up from 10,437 at the 2000 Census. According to these population figures, the City has experienced an average annual growth rate of approximatley 1.98 percent over the last 20 years. Table 3-2 shows the population projections for next twenty-five years, in five-year increments, assuming a 1.98 percent annual growth rate through 2045

Table 3-2 Population - Current and Projected (Submittal Table 3-1)						
Population Served	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
	15,448	17,039	18,794	20,730	22,865	25,220
NOTES: (1) An annual growth rate of 1.98% is used to project population growth within the City of Livingston's service area through 2045.						

3.5.2. Other Social, Economic and Demographic Factors

CWC Section 10631

(a) Describe the service area of the supplier, including… other social, economic and demographic factors affecting the supplier's water management planning.

Based on 2015-2019 data provided by the 2019 American Community Survey (ACS), the most represented ethnicity in the City of Livingston is Hispanic or Latino at approximatley 70 percent of the population. The median age of the City's population is roughly 29.9 years old. The Census estimates that approximatley 8.0 percent of the population is under 5 years, 30.0 percent of the population is under 18 years, 70.0 percent of the population is 18 years or older, and 10.7 percent is 65 years or older. Approximatley 1.9 percent of the population consists of veterans, of which 94.8 percent are male and 5.2 percent are female.

According to the 2015-2019 Census data, approximately 18.3 percent of the population within the City have received their high school diploma or equivalent degree, 20.0 percent have received some college experience but no degree, 9.3 percent have received an associate degree, 6.6 percent have received a bachelor's degree, and 3.2 percent have received a graduate or professional degree. The Median Household Income (MHI) for the City is $54,886, which is approximately 68 percent of the statewide average MHI of $80,440. The Census estimates that approximatley 16.4 percent of the population of the City lives in poverty, which is more than double the statewide average of 11.8 percent.

The main industries for the civilian employed population 16 years or older in the City of Livingston consists of manufacturing (20.9 percent), educational services and health care and social assistance (19.0 percent), agriculture, forestry, fishing, hunting, and mining (11.9 percent), transportation and warehousing and utilities (8.6 percent), retail trade (8.5 percent), professional, scientific, and management and administrative and waste management services (7.2 percent), arts, entertainment, and recreations, and accommodation and food services (7.2 percent), construction (5.3 percent), finance and insurance, real estate and rental and leasing (2.4 percent), and public administration (1.5 percent).

3.6. Land Uses Within Service Area

The City of Livingston's adopted the Urban Area General Plan (General Plan) in December 1999. The General Plan delineates potential growth areas and identifies policies directing growth within its sphere of influence (SOI). The City's SOI is determined by the Merced County Local Agency Formation Commission (LAFCO), which is an entity empowered to review and approve proposed boundary changes and annexations by incorporated municipalities. During the preparation of this 2020 UWMP, the City was in the process of updating their General Plan. The City anticipates that the updated General Plan will be available in 2022.

The City controls the use and development of land withing the Livingston city limits. According to the 1999 General Plan, the Livingston's City limits contains 1,844 acres (2.88 square miles). The SOI is a line that is typically situated outside the city limits boundary and marks where the city is expected to grow via annexation. The SOI is a boundary that encompasses lands that are expected to ultimately be annexed by the City, although until annexed it falls under the jurisdiction of the County of Fresno. The City's SOI is determined by the Fresno Local Agency Formation Commission (LAFCO), which is an entity empowered to review and approve proposed boundary changes and annexations by incorporated municipalities. According to the City's General Plan, the existing SOI contains approximately 2,590 acres (4.04 square miles). The SOI is recognized as the ultimate City growth boundary over the life of the City's current General Plan. This 2020 Urban Water Management Plan assumes that the SOI describes the future service area of the City's water system.

The land uses presented in the City's General Plan includes agriculture, orchard, irrigation, residential (low, medium, and high density), Commercial (commercial, highway, and neighborhood), industrial, church, parking, public facility (groundwater wells and wastewater treatment plant), civic center, drainage, park, SPRR, school, and vacant. Orchard is the most predominant land use within Livingston, accounting for approximately 27.5 percent of the total area within the City limits. Residential (low, medium, and high density) is the second most predominant land use within the City accounting for approximately 20.7 percent. Commercial and industrial land uses account for approximatley 1.4 and 5.9 percent respectively.

Table 3-3 summarizes the acreage for each land use designation in both the city limits and SOI, as presented in the City's 2035 General Plan.

Table 3-3 Land Use Designation within City of Livingston

Land Use Designation	Within City Limits		Within Sphere of Influence	
	Acres	Percent of Total	Acres	Percent of Total
Agriculture	300.0	16.3%	977.5	37.7%
Orchard	507.8	27.5%	507.8	19.6%
Irrigation	1.7	0.1%	1.7	0.1%
Low Density Residential	343.3	18.6%	359.1	13.9%
Medium Density Residential	7.7	0.4%	11	0.4%
High Density Residential	30.5	1.7%	31.7	1.2%
Commercial	19.6	1.1%	19.6	0.8%
Highway Commercial	6.0	0.3%	6	0.2%
Neighborhood Commercial	1.1	0.1%	1.1	0.0%
Industrial	109.7	5.9%	111.1	4.3%
Church	15.7	0.9%	15.7	0.6%
Parking	0.8	0.0%	1	0.0%
Public Facility	114.2	6.2%	114.2	4.4%
Civic Center	1.3	0.1%	1.3	0.1%
City Well	0.6	0.0%	0.6	0.0%
Drainage	5.1	0.3%	5.1	0.2%

Table 3-3 Land Use Designation within City of Livingston				
Land Use Designation	Within City Limits		Within Sphere of Influence	
	Acres	Percent of Total	Acres	Percent of Total
Park	19.3	1.0%	19.3	0.7%
Wastewater Treatment Plant	29.0	1.6%	40	1.5%
SPRR	29.2	1.6%	42.1	1.6%
School	73.0	4.0%	73	2.8%
Vacant	228.5	12.4%	251.5	9.7%
TOTAL	**1,844**	**100%**	**2,590**	**100%**

CHAPTER 4 - WATER USE CHARACTERIZATION

4.1. Introduction

This chapter describes and quantifies the City's current water use and future water use projections through the year 2045, as based on currently available information. Water use records, combined with projections of population, provide the basis for estimating future water requirements. The data provided in this chapter will allow the City to accurately analyze the use of the water resources and conduct good resource planning. The future demand estimates presented in this chapter will allow the City to adequately manage the water supply and appropriately plan their infrastructure investments. The terms "water use" and "water demand" will be used interchangeably. These terms will also be used to refer to all the demand sectors listed in Section 4.2.

4.2. Non-Potable Versus Potable Water Use

The City's potable water supply is exclusively groundwater. The City currently does not use recycled water to meet any of their water demands. Currently, the City's wastewater is not treated to tertiary effluent quality where it can be used to meet any of the City's water demands.

4.3. Past, Current, and Projected Water Use by Sector

CWC Section 10635.

(a) Every urban water Supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

Section 10631(d)

(1) For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following…

(2). The water use projections shall be in the same five-year increments described in subdivision (a).

(4)(A) Water use projections, where available, shall display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following: (i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections. (ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances,

or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

This 2020 UWMP includes past, current, and projected water use in five-year increments. The City will determine the reliability of their projected water supply based upon that information.

4.3.1. Water Use Sectors Listed in Water Code

CWC Section 10631(d)

(1) For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following:

(A) Single-family residential.

(B) Multifamily.

(C) Commercial.

(D) Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(J) Distribution system water loss.

This 2020 UWMP also identifies the water use by sector. The City's breaks down metered water deliveries into the following water demand sectors as listed below, per the CWC. The number of water service accounts and volume of water consumed provides insight into the different customer's water use, which can be useful in defining effective water conservation measures. Tables 4-3 and 4-5 provide the City's actual 2020 water demands, and projected water demands through 2045.

- Single-Family Residential – A single-family dwelling unit is a lot with a free-standing building containing one dwelling unit that may include a detached secondary dwelling.
- Multi-Family Residential – Multiple dwelling units contained within one building or several buildings within one complex.
- Commercial/Institutional – The City tracks commercial and institutional customer water uses as one. Commercial customers typically provide or distribute a product or service and institutional water customers are typically public services, such as higher-education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit institutions.
- Industrial – Industrial customers typically manufacture or process materials.

- Landscape – The City tracks the water uses for landscape irrigation, which is provided through metered connections. Potable water is currently used to irrigate the City's public park, medians, and landscape strips.
- Distribution System Losses – Reporting distribution system losses is required by the CWC. Distribution system losses are discussed further in Section 4.3.4.

For this 2020 UWMP, the following sectors are not applicable to the City's water service area:

- Sales to Other Agencies
- Conjunctive Use
- Saline Water Intrusion Barriers
- Agricultural

4.3.2. Water Use Sectors in Addition to Those Listed in Water Code

To provide clarity, the following water use sectors are also not applicable to the City's UWMP:

- Exchanges
- Surface Water Augmentation
- Transfers
- Wetlands or Wildlife Habitat

The City currently meters water usage that is used for flushing activities (directional flushing program, auto flushers and tank cleaning). This type of water usage is considered unbilled, metered authorized consumption that is derived from the summation of manual meter reads calculated from flushing volumes. For this 2020 UWMP, this type of water usage is classified as "other potable."

4.3.3. Past Water Use

Table 4-1 summarizes the City's water usage by water use sector over the past 5 years. These historical volumes are consistent with those presented in the 2015 UWMP, electronic annual reports (EAR), and annual water audit reports submitted to the DWR for the years of 2015 to 2019.

Table 4-1 Historical Water Use by Sector

Use Type	Water Use (MG)				
	2015	2016	2017	2018	2019
Single Family	481	469	533	529	524
Multi-Family	46	45	56	72	59
Commercial	70	99	80	86	89
Industrial	1,495	1,466	1,373	1,403	1,500
Landscape	9	18	66	67	71
Other Potable	0	0.2	5.3	1.2	0.2
Losses	89	94	221	66	151
TOTAL	**2,190**	**2,191**	**2,335**	**2,224**	**2,395**

4.3.4. Distribution System Water Losses

CWC Section 10631(d)(1)

For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following…

(J) Distribution system water loss….

CWC Section 10631(d)(3)

(A) The distribution system water loss shall be quantified for each of the five years preceding the plan update, in accordance with rules adopted pursuant to Section 10608.34.

(B) The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association.

(C) In the plan due July 1, 2021, and in each update thereafter, data shall be included to show whether the urban retail water supplier met the distribution loss standards enacted by the board pursuant to Section 10608.34.

Water distribution system losses are the difference between the actual volume of water treated and delivered into the distribution system and the actual metered consumption. Such apparent losses are always present in a water system due to pipe leaks, unauthorized connections or use, faulty meters, systematic data handling errors, and unmetered services such as water used for dust control for construction activities, fire protection and training.

New regulations require retail water suppliers to include potable distribution system water losses for the preceding five years. Over the last few years, the City has used the American Water Works Association (AWWA) method to annually evaluate its distribution system losses each fiscal year. The City has submitted annual water audit reports to the DWR since 2016. A copy of the City's annual water reports from 2016 to 2019 are included in Appendix D.

Table 4-2 summarizes the water distribution system losses for the last five calendar years. The most recent 12-month period began on January 1, 2019.

Table 4-2 Last Five Years of Water Loss Audit Reporting (Submittal Table 4-4)

Reporting Period Start Date	Volume of Water Loss[(1)]
01/2015	89
01/2016	94
01/2017	221
01/2018	66
01/2019	151

To reduce real and apparent losses, the City's meter replacement program is focused on replacing existing manual read meters with automatic radio read meters (AMRs). According to the Certified Validation Report that was prepared for the 2019 Water Audit, the City estimates that approximately 3 percent of manual read meters are still in place and that these meters will be converted to AMRs by the end of 2021. The City is also focused on replacing AMR meter that is 25 years or older. To reduce future water losses, the City is evaluating the feasibility of implementing an meter testing program that will test all of the groundwater production meters and 5 percent of the customer meter population on an annual basis.

4.3.5. Current Water Use

The City's actual potable water demands for the 2020 calendar year are reported in Table 4-3. All of the City's water connections are metered; approximatley 3 percent of the meter population consists of manual read meters, while the remaining 97 percent of the population consists of AMRs. The City breaks down metered water deliveries into single family residential, multi-family residential, commercial, industrial, landscape irrigation, and other potable (i.e. flushing activities). The City tracks commercial and institutional customer water uses as one.

Water losses are calculated by subtracting the amount of water produced by the City's nine groundwater wells by the total amount of authorized consumption. For the 2020 calendar year, water losses accounted for approximately 5 percent of the water that was produced and distributed.

Table 4-3 Demands for Potable Water - Actual (Submittal Table 4-1)

Use Type	2020 Actual		
	Additional Description	Level of Treatment When Delivered	Volume (MG)
Single Family Residential	3,228 Metered Connection	Drinking Water	580
Multi Family Residential	83 Metered Connection	Drinking Water	58
Commercial[(1)]	175 Metered Connection	Drinking Water	89
Industrial	4 Metered Connection	Drinking Water	1,854
Landscape Irrigation	33 Metered Connection	Drinking Water	61
Other Potable	Manual Meter	Drinking Water	1
Losses	Unaccounted Water	Drinking Water	138
		TOTAL	**2,779**

NOTES:
[(1)]The City tracks commercial and institutional customer water uses as one.

4.3.6. Projected Water Use

CWC Section 10635 (a).

Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled

pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

CWC Section 10631

(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available… The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

CWC Section 10631(d)(4)

(A) Water use projections, where available, shall display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following:

(i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.

(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

Table 4-4 lists the projected number of connections by user type. The number of connections were projected by multiplying the total number of metered accounts for 2020 by the annual average growth rate of 1.98 percent growth rate, which is consistent with the population growth rate determined in Section 3.5.1 of this UWMP. It has been assumed that the projected number of connections for industrial, and landscape irrigation use types will remain constant.

Table 4-4 Projected Number of Total Connections by User Type

Use Type	2025	2030	2035	2040	2045
Single Family Residential	3,560	3,927	4,331	4,777	5,269
Multi Family Residential	92	101	111	122	135
Commercial[(1)]	193	213	235	259	286
Industrial	4	4	4	4	4
Landscape Irrigation	33	33	33	33	33
TOTAL	**3,882**	**4,278**	**4,714**	**5,195**	**5,727**

NOTES:
[(1)]The City tracks commercial and institutional customer water uses as one.

Table 4-5 lists the projected water demands through years 2045. The projected water demands were obtained by multiplying the City's annual average growth rate of 1.98 percent by the user's 2020 annual water consumption. Water losses in the distribution system are difficult to predict. On one hand losses will increase as the distribution system deteriorates over time and residential water fixtures age. However, the City is actively working to replace manual read meters and AMR meters that are 25 years or older. Additionally, the City is evaluating the feasibility of implementing a meter testing program that will test 5 percent of the customer meter population on an annual basis. Implementation of a meter testing program will further reduce water loss in the system. Therefore, the volume of water losses is assumed to remain constant through year 2045.

Table 4-5 Use for Potable Water - Projected (Submittal Table 4-2)

Use Type	Projected Water Use (MG)				
	2025	2030	2035	2040	2045
Single Family Residential	639	705	778	858	946
Multi Family Residential	64	70	78	86	95
Commercial[(1)]	98	108	119	132	145
Industrial	2,045	2,255	2,488	2,744	3,026
Landscape Irrigation	67	74	82	90	99
Other Potable	1	1	1	1	1
Losses	138	138	138	138	138
TOTAL	**3,052**	**3,352**	**3,683**	**4,048**	**4,451**

NOTES:
[(1)]The City tracks commercial and institutional customer water uses as one.

The City's projected water demands through the year 2045 are summarized in Table 4-6. The City's recycled water demands are detailed further in Section 6.6 of this 2020 UWMP. Recycled water is not included in the City's potable water demand and the City does not have any plans to use recycled water as a potable source in the foreseeable future.

Table 4-6 Total Water Use (Potable and Non-Potable) (Submittal Table 4-3)

	2020	2025	2030	2035	2040	2045
Potable Water, Raw, Other Non-potable	2,779	3,052	3,352	3,683	4,048	4,451
Recycled Water Demand	0	0	0	0	0	0
TOTAL WATER USE	**2,779**	**3,052**	**3,352**	**3,683**	**4,048**	**4,451**

4.3.7. Characteristic Five-Year Water Use

CWC Section 10635(b)

Every urban water supplier shall include, as part of its urban water management plan, a drought risk assessment for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the urban water management plan. The urban water supplier may conduct an interim update or updates to this drought risk assessment within the five-year cycle of its urban water management plan update. The drought risk assessment shall include each of the following…

(3) A comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period. [Emphasis added]

(4) Considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.

A critical component of the new statutory language included in CWC Section 10635(b) is the requirement to prepare the five-year Drought Risk Assessment (DRA), which is found in Chapter 7 of this 2020 UWMP. A five-year DRA can also be used to provide the water service reliability assessment for a drought lasting five years. As a first step of the DRA, the DWR recommends that the expected gross water use for the next five years without drought conditions, also known as unconstrained demand, be estimated. Chapter 7 details the DRA, but the City's unconstrained demand projections over the next five years are summarized in Table 4-7. These projections were developed by applying an annual increase of 1.89 percent, that is demonstrated between the actual 2020 water demands and the 2025 projected water demands presented in Tables 4-5 and 4-6 above.

Table 4-7 Five-Year Water Use - Projected

Use Type	Projected Water Use (MG)				
	2021[1]	2022[1]	2023[1]	2024[1]	2025
Potable Water	2,831	2,885	2,939	2,995	3,052

NOTES:
[1]An annual increase of 1.47 percent is applied from the previous year's water usage.

4.4. Water Use for Lower Income Households

Section 10631.1.

(a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.

California Health and Safety Code Section 50079.5 (a)

"Lower income households" means persons and families whose income does not exceed the qualifying limits for lower income families… In the event the federal standards are discontinued, the department shall, by regulation, establish income limits for lower income households for all geographic areas of the state at 80 percent of area median income, adjusted for family size and revised annually.

Urban water suppliers are required to identify water demand required for lower income housing in its water use projections. Livingston's share of regional housing needs originates with the California Department of Housing and Community Development (HCD). HCD first estimates a statewide need for housing, which is broken down into regions, each of which then has an assigned share of estimated housing needs. The Merced County Association of Governments (MCAG) is the local agency mandated by California Government Code §65554(a) to distribute the "Fair Share Allocation" of the regional housing needs to each jurisdiction in Merced County. The "Fair Share Allocation" of housing is a specific number of residential units, in different price ranges, assigned to each local jurisdiction including Livingston.

The MCAG's fifth Regional Housing Needs Allocation (RHNA) Cycle began on January 1, 2014 and will conclude on December 31, 2023. The RHNA Plan allocates to each local government, a share of regional

housing needs for use in their General Plan Housing Element. According to the RHNA Plan, a total of 15,850 housing units will be needed in the County by the end of 2023. The City of Livingston's share of those units is 1,023 or approximately 6.5 percent. The City of Livingston 2016-2024 Housing Element Update estimates that approximately 41.7 percent of the total housing needs are for low-income households. The needs allocation is further classified as low income, very low income, and extremely low income. The extremely low-income families require rental assistance, and these units are assumed to be multi-family residential (MFR) units. The low income and very low income are assumed to be single-family residential (SFR) units.

Based on the projected low-income housing residential unit needs, Table 4-8 lists the projected number of housing units through 2040.

Table 4-8 Projected Number of Additional Low Income Housing Units

Use Type	Income[(1)]	MCAG Allocation	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045
Extremely Low Income	<30%	12.1%	2	1	1	1	2
Very Low Income	31%-50%	12.2%	40	45	49	54	60
Low Income	51%-80%	17.4%	58	64	70	77	85
Moderate Income	81%-120%	15.9%	53	58	64	71	78
Above Moderate Income	>120%	42.4%	141	156	171	189	209
TOTAL		**100.0%**	**294**	**324**	**355**	**392**	**434**

NOTES:
[(1)] As a percentage of the County's Median Household Income

Table 4-9 displays the estimated volume of water needed to meet the projected lower income housing units through 2045. The projected water needed for additional low-income units was estimated by first dividing the gross volume of water delivered to either multi-family or single-family residents by the total number of service connections for each use type, and then multiplied by the projected number of additional housing units determined in Table 4-8

Table 4-9 Projected Water Use Needed for Additional Low Income Housing Units

Use Type	2025	2030	2035	2040	2045
Extremely Low Income	1.4	0.7	0.7	0.7	1.4
Very Low Income	7.2	8.1	8.8	9.7	10.8
Low Income	10.4	11.5	12.6	13.8	15.3
TOTAL	**19.0**	**20.3**	**22.1**	**24.2**	**27.4**

The projected water demands for lower income housing are included in the projections of water demands shown in Tables 4-5 and 4-6. Demand for existing lower income housing is being met and is included in the volumes shown in Tables 4-5 and 4-6.

Table 4-10 Inclusion in Water Use Projections (Submittal Table 4-5)	
Are Future Water Savings Included in Projections?	No

Table 4-10 Inclusion in Water Use Projections (Submittal Table 4-5)	
If "Yes" to above, state the section or page number, in the cell to the right, where citations of the codes, ordinances, or otherwise are utilized in demand projections are found.	
Are Lower Income Residential Demands Included In Projections?	Yes

4.5. Climate Change Considerations

DWR Guidelines recommend that the 2020 UWMP include a discussion of potential climate change impacts on projected demand. The City of Livingston is part of the Merced Integrated Regional Water Management Plan (IRWMP). Appendix E contains the climate change assessment found in Chapter 16 of the Merced IRWMP.

There is mounting scientific evidence that global climate conditions are changing and will continue to change as a result of the continued build-up of greenhouse gases (GHGs) in the Earth's atmosphere. Changes in climate can affect municipal water supplies through modifications in the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. These changes can affect all elements of water supply systems, from watersheds to reservoirs, conveyance systems, and treatment plants.

Indications of climate change have been observed over the last several decades throughout California. Statewide average annual temperatures have risen by approximatley 2°F since the early 20th century. Although the State's weather has followed the expected pattern of a largely Mediterranean climate throughout the past century, no consistent trend in the overall amount of precipitation has been detected, except that a larger proportion of total precipitation is falling as rain instead of snow.

The correlation between temperature and water demand is well documented and understood. The City's largest percentage of the water demand is driven by outdoor irrigation. Higher temperatures will increase evapotranspiration rates and increase demands. Higher temperatures will also extend the duration of the outdoor landscaping growing season increasing the maximum day demands on the spring and fall seasons.

It is evident that climate change adds new uncertainties to the challenges of planning. Changes in weather could significantly affect water supply planning. Since climatic pressures could potentially affect supply reliability, continual attention to this issue will be necessary in the future.

CHAPTER 5 - SB X7-7 BASELINES, TARGETS, AND 2020 COMPLIANCE

5.1. Introduction

In November 2009, the Water Conservation Act of 2009, also known as the SB X7-7, was signed into law as part of a comprehensive water legislation package. This legislation addressed both urban and agricultural water conservation and set a goal of achieving a 20 percent statewide reduction in urban per capita water use by December 31, 2020. To meet the urban water use target requirement, each retail supplier was required to determine its baseline water use, as well as its target water use for the year 2020. Water use is measured in gallons per capita per day (GPCD).

In 2015, the City of Livingston calculated their baselines and targets based on the requirements and methodologies presented in the 2015 UWMP Guidebook. In the 2015 UWMP, the City demonstrated compliance with their interim water use target for the year 2015 and that the City was on track to achieve its 2020 target.

This chapter provides a review of the methodology the City used to calculate its 2020 Urban Water Use Target (2020 Target), its baseline, and how the baseline was calculated. This chapter demonstrates that the City has achieved its 2020 Target. Compliance with the urban water use target requirement is verified in the SB X7-7 2020 Compliance Form, which is included as Appendix F of this Plan.

For additional details on how the per capita goals were established refer to the City of Livingston's 2015 UWMP.

5.2. Overview and Background

The City's compliance with SB X7-7 was first addressed in their 2015 UWMP, in which the City determined its baseline per capita water use and established and adopted its urban water use targets for 2015 and 2020. Actual water usage data and population figures provided by the Census and Department of Finance (DOF) were used to calculate GPCD water use. The City demonstrated that it successfully achieved its 2015 interim target and confirmed its 2020 Target in its 2015 UWMP.

5.3. General Requirements for Baseline and Targets

SB X7-7 required each urban water retailer to determine its baseline daily per capita water use over a 10-year or 15-year baseline period. The 10-year baseline period is defined as a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010. SB X7-7 also defined that urban water retailers that met at least 10 percent of their 2008 water demand using recycled water could extend the baseline GPCD calculation for a maximum of a continuous 15-year baseline period, ending no earlier than December 31, 2004, and no later than December 31, 2010.

Since the City did not use recycled water to meet any of their 2008 water demand, the baseline was calculated over a 10-year period. In their 2015 UWMP, the City selected the 10-year baseline period from 2001 through 2010. SB X7-7 and DWR provided four different methods for calculating an urban water retailer's 2020 Target. Three of these methods are defined in CWC Section 10608.20(a)(1), and the fourth

method was developed by DWR. The 2020 Target may be calculated using one of the following four methods:

- Method 1: 80 percent of the City's base daily per capita water use;
- Method 2: Per capita daily water use estimated using the sum of performance standards applied to indoor residential use; landscaped area water use; and commercial, industrial, and institutional uses;
- Method 3: 95 percent of the applicable State hydrologic region target as stated in the State's April 30, 2009, Draft 20x2020 Water Conservation Plan; or
- Method 4: An approach that considers the water conservation potential from: 1) indoor residential savings, 2) metering savings, 3) commercial, industrial, and institutional savings, and 4) landscape and water loss savings.

In their 2015 UWMP, the City selected Method 1 to calculate its 2020 Target.

5.4. Service Area Population

To correctly calculate its compliance year GPCD, the City must first determine the population that it served in 2020. As stated in Section 3.5.1, the Census reported population within the City as of April 1, 2020, to be 26,617.

5.5. Gross Water Use

Gross water use represents the total volume of water entering a distribution system (but excludes recycled water deliveries, water placed into long term storage, water conveyed to another supplier, water delivered for agricultural use, and process water if there is a substantial percentage used for industrial purposes) over a 12-month period. The City's gross water use amounts are based on the total amount of water produced by the City's nine active groundwater wells and pumped into the distribution system during calendar year 2020 minus the amount of process water .

As reported in Chapter 4 of this UWMP, the amount of water produced and pumped into the distribution system in 2020 was 2,063 MG, as reported in Chapter 4 of this UWMP.

Since industrial process water is greater than 12 percent of the City's gross water usage for 2020, it has been excluded from the City's gross water use provided in the SB X7-7 Verification Form (Table 4). In accordance with CWC Section 596.2, the City has subtracted industrial process water from their grow water use and completed SB X7-7 Verification Form Tables 4-C.1, 4-C.2, 4-C.3, 4-C.4, and 4-D, which are attached in Appendix F. The City's actual gross water use for 2020 was determined to be 926 MG.

5.6. Baseline and Targets Summary

Annual gross water use is divided by annual service area population to calculate the annual per capita water use for each year in the baseline periods. As previously stated, the City calculated its baseline and 2020 Target in their 2015 UWMP. The City's 10-year base daily per capita water use is 207 GPCD. Using Method 1 for 2020 Target calculation as described in Section 5.3, the City's confirmed 2020 compliance target is 165 GPCD. The City's baseline and 2020 Target are summarized in Table 5-1.

Table 5-1 Baselines and Targets Summary From SB X7-7 Verification Form (Submittal Table 5-1)

Baseline Period	Start Year	End Year	Average Baseline (GPCD)	Confirmed 2020 Target (GPCD)
10-15 year	2001	2010	207	165
5 Year	2006	2010	199	

5.7. 2020 Compliance Daily Per Capita Water Use

This section presents the procedure used to meet the requirements of SB X7-7 as defined in the Water Conservation Act of 2009.

5.7.1. 2020 Adjustments for Factors Outside of Supplier's Control

CWC Water Code Section 10608.24

(d)(1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:

(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.

(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.

(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.

(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.

The City has not included any adjustments (including Extraordinary Institutional Water Use, Economic Adjustment (CII) or Weather Norminlization) for their 2020 GPCD compliance.

5.7.2. 2020 Compliance Daily Per Capita Water Use

Sections 5.4 and 5.5 presented the City's 2020 population and gross water use, respectively. The City calculated its actual daily per capita water use for the 2020 calendar year in accordance with DWR's Methodologies document. As shown in Table 5-2, the City's urban per capita water use in 2020 was 164 GPCD, which is below the confirmed 2020 Target of 165 GPCD. Therefore, the City has met its 2020 final water use target.

Table 5-2 2020 Compliance from SB X7-7 2020 Compliance Form (Submittal Table 5-2)

2020 GPCD			2020 Confirmed Target GPCD	Did Supplier Achieve Targeted Reduction for 2020? Y/N
Actual 2020 GPCD	2020 TOTAL Adjustments	Adjusted 2020 GPCD		
164	-	164	165	Yes

The City has also demonstrated compliance with the 2020 Water Use Target by completing the SB X7-7 2020 Compliance Form, attached in Appendix F.

5.8. Regional Alliance

As discussed in Section 2.4, the City's 2020 UWMP was not developed as part of a Regional Alliance. Information from the City's 2020 UWMP is not required to be reported in a Regional Alliance report.

CHAPTER 6 - SYSTEM SUPPLIES CHARACTERIZATION

6.1. Introduction

This chapter presents an analysis of the City's water supplies, as well as an estimate of water-related energy-consumption. The intent of this chapter is to present a comprehensive overview of City of Livingston's water supplies, estimate the volume of available supplies over the UWMP planning horizon, and assess the sufficiency of City's water supplies to meet projected demands under "normal" hydrologic conditions.

6.2. Purchased or Imported Water

The City of Livingston does not purchase water from any other urban water suppliers or other entities.

6.3. Groundwater

Section 10631(b)(4)

If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information:

(A) The current version of any groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720), any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management for basins underlying the urban water supplier's service area.

(B) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For a basin that has not been adjudicated, information as to whether the department has identified the basin as a high- or medium-priority basin in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to coordinate with groundwater sustainability agencies or groundwater management agencies listed in subdivision (c) of Section 10723 to maintain or achieve sustainable groundwater conditions in accordance with a groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720).

(C) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(D) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

The City's sole source of water supply is the underlying groundwater basin. The City currently has nine wells in various locations throughout the community. Well Nos. 8, 9, 11, 12, 13, 14, 16, and 17 currently serve as active sources, while Well No. 15 serves as a standby source. During 2020, no water was produced

from Well No. 15. The production capacity of the wells has decreased over time as a consequence of declining groundwater levels and aging of the wells. Table 6-1 displays the nominal capacity, in gallons per minute (gpm), of each well.

Table 6-1 Groundwater Well Capacity

Well No.	Flowrate (gpm)
8	1,200
9	1,300
11	800
12	1,400
13	1,100
14	1,000
15	900
16	1,200
17	2,000
TOTAL	**10,900**

Water is distributed through approximatley 36 miles of pressurized pipes, ranging from two to 16 inches in diameter in size. System pressure is maintained between 50 and 65 psi with Mercoid pressure switch controls on all of the wells. The water system also includes a 1.0 MG welded steel storage tank that is used for water storage.

6.3.2. Groundwater Basin Description

For planning purposes, DWR has subdivided the State of California into ten separate hydrologic regions, corresponding to the State's major drainage basins. Furthermore, groundwater within the State is divided into distinct groundwater basins; some of which are further divided into smaller interconnected subbasins. The City of Livingston is located within the geomorphic province known as the Central Valley, which is divided into the Sacramento Valley and the San Joaquin Valley. The groundwater underlying the City is part of the larger San Joaquin Valley Groundwater Basin within the San Joaquin River Hydrologic Region. The San Joaquin Valley Groundwater Basin is further divided into nine subbasins. The City extracts its groundwater from the Merced Subbasin (DWR Subbasin 5-22.04).

As part of the San Joaquin Valley Groundwater Basin, the Merced Subbasin covers a surface area of approximately 491,000 acres (767 square miles), includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The Subbasin is bounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The subbasin boundary on the south stretches westerly along the Madera-Merced County line (Chowchilla River) and then between the boundary of the Le Grand-Athlone Water District and the Chowchilla Water District. The boundary continues west along the northern boundaries of Chowchilla Water District and El Nido Irrigation District. The southern boundary then follows the western boundary of El Nido I.D. south to the northern boundary of the Sierra Water District, which is followed westerly to the San Joaquin River.

According to DWR's Bulletin 118, the Subbasin is primarily comprised of consolidated rocks and unconsolidated deposits. The consolidated rocks include the Ione Formation, the Valley Springs Formation, and the Mehrten Formation. The unconsolidated deposits were laid down during the Pliocene to present. From oldest to youngest, these deposits include continental deposits, lacustrine and marsh deposits, older alluvium, younger alluvium, and floodbasin deposits. The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits (which include the Corcoran, or "E-" Clay), and the floodbasin deposits yield little water to wells, and the younger alluvium in most places probably yields only moderate quantities of water to wells. DWR Bulletin 118 – Update 2006, attached in Appendix G, contains a detailed description of the Merced Subbasin and its characteristics and conditions.

According to the Merced Groundwater Subbasin Groundwater Sustainability Plan (GSP), the Subbasin contains three principal aquifers that are defined by their relationship to the Corcoran Clay aquitard, a laterally-extensive silt and clay layer that underlies approximately the western half of the Subbasin and acts as a significant confining layer. The Above Corcoran Principal Aquifer includes all aquifer units that exist above the Corcoran Clay Aquitard and generally contains moderate to large hydraulic conductivities and yields for domestic and irrigation uses. The Below Corcoran Principal Aquifer includes all aquifer units that exist below the Corcoran Clay Aquitard and contains hydraulic conductivities and yields ranging from small to large for irrigation as well as some domestic and municipal uses. The Outside Corcoran Principal Aquifer includes all aquifers that exist outside of the eastern lateral extent of the Corcoran Clay. The Outside Corcoran Principal Aquifer is connected laterally with the Above Corcoran Principal Aquifer at shallower depths and the Below Corcoran Principal Aquifer at deeper depths. Major uses of water in the Outside Corcoran Principal Aquifer include irrigation, domestic, and municipal uses. The Principal Aquifers are underlain by a deep aquifer with higher salinity relative to the principal aquifers.

6.3.3. Multiple Groundwater Basins

The City only utilizes the groundwater supply from the Delta-Mendota subbasin and does not utilize groundwater from multiple basins.

6.3.4. Groundwater Sustainability Plan

On September 16, 2014, Governor Jerry Brown signed into law a three-bill package collectively known as the Sustainable Groundwater Management Act (SGMA) of 2014, which codified in Section 10720 et seq. of the CWC. This legislation requires local governments and water agencies of high and medium priority basins to halt groundwater overdraft and bring groundwater basins into balance levels of pumping and recharge. SGMA established a framework for local governments and water agencies to develop a Groundwater Sustainability Agency (GSA) and sustainably manage groundwater through implementation of a Groundwater Sustainability Plan (GSP). Under SGMA, high and medium priority basins should reach sustainability within 20 years of implementing their sustainability plans.

The County of Merced and water districts and cities within the Merced Subbasin formed three GSAs in accordance with SGMA: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1). The City of Livingston is a member of the MIUGSA, which was formed by an MOU between the Merced Irrigation District, City of Merced, City of Atwater, City of

Livingston, Le Grand Community Services District, Planada Community Services District, and Winton Water and Sanitary District. In accordance with the 2014 legislation, the three GSAs coordinated efforts to develop a GSP for the Subbain in November 2019. The GSP's goal is to achieve sustainable groundwater management on a long-term average basis by increasing recharge and/or reducing groundwater pumping, while avoiding undesirable results. A copy of the GSP can be found at the following website: Merced SGMA | Resources.

According to the GSP, the GSA's sustainability goal will be achieved by allocating a portion of the estimated Subbasin sustainable yield to each of the three GSAs and coordinating the implementation of programs and projects to increase both direct and in-lieu groundwater recharge, which will in turn increase the groundwater and/or surface water available in the Subbasin. SGMA identifies six sustainability indicators to be monitored and reported in order to document sustainability: chronic lowering groundwater levels, reduction of groundwater storage, seawater intrusion, degraded groundwater quality, land subsidence, and depletions of interconnected surface water. According to the GSP, there are two sustainability indicators deemed not applicable to the Merced Subbasin. Undesirable results related to significant and unreasonable depletions of groundwater storage are not present and not likely to occur in the Subbasin, since historical reductions have been insignificant relative to the total volume of freshwater water storage in the Subbasin. Seawater intrusion is not an applicable sustainability indicator because seawater intrusion is not present and is not likely to occur due to the distance between the Subbasin and the Pacific Ocean. For the remaining sustainability indicators, sustainable management criteria were established to be protective of Subbasin beneficial uses. These sustainable management criteria are described in more detail in Chapter 3 of the GSP.

6.3.5. Overdraft Conditions

SGMA directs the DWR to identify groundwater basins and subbasins in conditions of critical overdraft. As defined by SGMA, "a basin is subject to critical overdraft when continuation of present water management practices would probably result in significant adverse overdraft related environmental, social, or economic impacts." The Merced Subbasin is currently considered to be in a state of critical overdraft per the DWR Bulletin 118 Interim 2016 Update. According to the MSGSA, water budgets provide quantitative accounting of water entering and leaving the Merced Subbasin and can be used to help estimate the extent of overdraft occurring now and in the future. Consistent with SGMA requirements, water budgets for historical, current, projected, and sustainable conditions were developed for the Merced Subbasin using the Merced Water Resources Model (MercedWRM), a fully integrated surface and groundwater flow model developed and calibrated specifically for the Subbasin. As detailed in the GSP, the historical conditions water budget shows an annual average rate of overdraft of 192,000 acre-feet per year (AFY) over water years 2006 through 2015. This overdraft or "change in storage" represents the average annual decline in storage resulting from the Subbasin outflows, which are primarily groundwater pumping.

As stated in Section the GSP, the MercedWRM was used to estimate historical change in storage of the Merced Subbasin from 1995-2015. In 2015, the total fresh groundwater storage was estimated to be approximately 45 million acre-feet (MAF). Additionally, an analysis of the groundwater storage demonstrated a cumulative change in storage of less than -3 MAF over the 20-year period of 1995-2015. This cumulative change in storage, which includes both representative dry and wet years, reflects a rate

of overdraft of approximately 0.3% per year. However, the GSP concludes that it is not reasonable to expect that the available groundwater in storage would be exhausted.

SGMA defines Sustainable Yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the Basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. According to the GSP the Sustainable Yield for Merced Subbasin was estimated by using the MercedWRM simulations for projected basin conditions and reducing pumping until the long-term average change in storage is zero. This analysis ultimately determined the Sustainable Yield of the Basin to be approximately 570,000 AFY.

A portion of the groundwater in the Merced Subbasin originates as surface water supplies imported from outside the Subbasin. This water belongs to the entities that developed the surface supplies and is referred to in the GSP as "Developed Supply." Developed Supply is specifically defined by the GSP as "water for which a credit is derived is water from outside the watershed or water which is captured that would have been otherwise lost to the subbasin and which is recharged into the groundwater basin." For the MSGSA's GSP, the Developed Supply reaching the groundwater basin was estimated based on seepage from unlined canals conveying surface water. The agencies that import developed surface water into the Basin and experience seepage due to conveyance via unlined canals are: Merced Irrigation District (MID), Stevinson Water District (SWD), and Turner Island Water District (TIWD). The estimate of Developed Supply reaching the Subbasin aquifer via seepage from unlined conveyance canals was based on information provided by MID, TIWD, and SWD, and calculated to be approximately 130,000 AFY. This portion of Developed Supply that reaches the groundwater basin is then subtracted from the Sustainable Yield estimate and the result is an estimate of the Sustainable Yield of Native Groundwater available for allocation to Subbasin users. According to the GSP, the Sustainable Yield of Native Groundwater was calculated to be approximately 440,000 AFY.

To balance with the Sustainable Yield of Native Groundwater in the basin, the Merced Subbasin GSA's consumptive use from current pumping will need to decrease substantially. The MSGSA evaluated their ability to meet demands within the basin wide Sustainable Yield of Native Groundwater and has recognized there is an annual deficit when compared to current groundwater use. To remedy this deficit and work toward sustainability, the MSGSA plans to implement a demand reduction program to gradually reduce pumping at a consistent annual rate during the 20-year implementation period in order to reach the Native Groundwater allocation objective by 2040. According to the GSP, the MSGSA will immediately begin with outreach and educational efforts in 2020 to begin achieving voluntary reductions. Formalized methods to achieve the desired GSA-wide reductions may be in place by 2025. The MSGSA anticipates reductions will incrementally increase annually for the entire MSGSA area, until the total annual reduction achieves the needed balance. Achieving these reductions will likely require the MSGSA to utilize available methods, which may include: establishing a per-acre pumping allocation for water users in the MSGSA, possibly with a trading market; establishing fee structures tied to extracted volumes; and establishing easement or contract programs to pay for reduced groundwater use.

6.3.6. Historical Groundwater Pumping

The total annual volume of groundwater pumped by the City's wells for the period between 2016 to 2020 is presented in Table 6-2. Pumping of City wells during this period averaged 2,385 MG/year, which is

approximatley 1.16 percent more than the annual average for the five years (2011-2015) preceding this timeframe. For the 2011-2015 period, pumping averaged 2,358 MG/year.

Table 6-2 Groundwater Volume Pumped (Submittal Table 6-1)						
☐	Supplier does not pump groundwater. The supplier will not complete the table below.					
☐	All or part of the groundwater described below is desalinated.					
Groundwater Type	**Location or Basin Name**	**2016**	**2017**	**2018**	**2019**	**2020**
Alluvial Basin	Merced Subbasin	2,191	2,335	2,224	2,395	2,779
	TOTAL	**2,191**	**2,335**	**2,224**	**2,395**	**2,779**

6.4. Surface Water

As previously stated, the City's sole water supply source is groundwater provided by municipal wells. Currently, the City of Livingston does not use self-supplied surface water as part it its water supply. However, the City would like to evaluate the feasibility of incorporating surface water to meet further water supply demands. The City's proposed surface water source would be the Merced River. The MID strongly supports the City's proposal and has expressed preference to provide water from an intake constructed on the Merced River. MID has existing water rights permits for the river and there is existing infrastructure that could potentially be reused for a river intake serving the City.

6.5. Stormwater

According to the City's 2018 Municipal Service Review, Livingston's storm water is managed through a program with the MID. Storm water is temporarily stored in detention basins, which serve as watersheds within the urbanized area. Each watershed has a lift station that drains the storm water at a controlled rate to available MID canals. The detention basins store storm runoff during peak periods, allowing the pump stations to discharge over a longer period of time to the MID canals.

6.6. Wastewater and Recycled Water

6.6.1. Recycled Water Coordination

CWC Section 10633

The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:

(a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.

(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

The City owns and operates a citywide wastewater collection and treatment system. The City does not currently recycle effluent discharged from their wastewater treatment facilities. While the wide-scale systematic direct use of recycled water in the City is technically feasible, it is not currently economically supported. Since the current Wastewater Treatment Plant (WWTP) is located northwest of the City and no recycled water distribution infrastructure currently exists between the City and the WWTP, the cost to develop piping from the WWTP to areas throughout the City is substantial. Additionally, there are no large-scale users that would benefit in proportion to the cost of installing separate distribution systems.

6.6.2. Wastewater Collection, Treatment, and Disposal

CWC Section 10633(a)

A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

The City provides wastewater collection and treatment for a combination of residential, commercial, and industrial users. The existing sewer collection system is comprised of a network of approximately 29 miles of sewer pipelines ranging from six to 27 inches in diameter. The system also includes nine lift stations, the largest of which is the Highway 99 Lift Station. The Highway 99 Lift Station pumps wastewater collected from the east side of Highway 99 and discharges it on the west side of the highway into the Vinewood sewer trunk line near the intersection of First Street and B Street. Four of the nine sewer lift stations are located east of Highway 99 and five are located south of Highway 99. The pumping capacity of the existing lift stations ranges from 3.34 MGD for the Highway 99 Lift Station to a low of 0.43 MGD at the Hammat Way Lift Station. Wastewater is conveyed by the sewer collection system to the City's Domestic WWTP, located northwest of the City

The City's first Domestic WWTP was constructed in 1963, and consisted of screening, grit removal, primary clarification, anaerobic digestion, solar sludge drying, and six treatment/percolation ponds. In 2004, Livingston completed an upgrade to the facility that included a new oxidation ditch, two new secondary clarifiers, four new influent pumps, and a mechanical bar screen. Discharges from the WWTP are currently

regulated by Waste Discharge Requirements (WDRs) Order R5-2014-0147, which allows for the discharge of up to 2.0 million gallons per day (MGD) of undisinfected secondary effluent to evaporation/percolation ponds located on 40 acres of City owned land adjacent to the WWTP.

The City also owns an industrial wastewater treatment plant. The industrial WWTP was used in the past to treat wastewater generated solely from the Foster Farms poultry processing plant. However, this facility has been abandoned and Foster Farms has now constructed an on-site wastewater treatment plant. The onsite WWTP consists of fine screening, flow equalization, and extended aeration. Treated effluent is used by Foster Farm to irrigate crops within their own land.

Table 6-3 summarizes the information of the collection of wastewaters generated within the City's service area in 2020.

Table 6-3 Wastewater Collected Within Service Area in 2020 (Submittal Table 6-2)

☐	There is no wastewater collection system. The supplier will not complete the table below.
100%	Percentage of 2020 service area covered by wastewater collection system.
100%	Percentage of 2020 service area population covered by wastewater collection system.

Wastewater Collection			Recipient of Collected Wastewater			
Name of Wastewater Collection Agency	**Wastewater Volume Metered or Estimated?**	**Volume of Wastewater Collected from UWMP Service Area 2020**	**Name of Wastewater Treatment Agency Receiving Collected Wastewater**	**Treatment Plant Name**	**Is WWTP Located Within UWMP Area?**	**Is WWTP Operation Contracted to a Third Party?**
City of Livingston	Metered	457	City of Livingston	Domestic WWTP	Yes	No
Total Wastewater Collected from Service Area in 2020:		**457**				

Table 6-4 identifies the wastewater treated and disposed of within the City's service area in 2020. As discussed above, the City's Domestic WWTP's is located within the City's water service area and provides primary and secondary treatment of wastewater generated within the City. During 2020, 457 MG of undisinfected secondary effluent from the Domestic WWTP was discharged to plant's evaporation/percolation ponds that are located on 40 acres of City owned land.

6.6.3. Recycled Water System

CWC Section 10633 (c)

A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

Table 6-5 displays the current and projected recycled water uses through the year 2045. The City does not currently treat any wastewater to disinfected tertiary water standards to allow it to be used as a component of its water supply. However, the City's domestic wastewater is treated and disposed of in percolation ponds, which percolates into the soil and is used to recharge the groundwater table. By way

Table 6-4 Wastewater Treatment and Discharge Within Service Area in 2020 (Submittal Table 6-3)

☐ No wastewater is treated or disposed of within the UWMP service area.

Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Method of Disposal	Does This Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level	2020 Volumes				
						Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
City of Livingston	City of Livingston	Domestic WWTP	Percolation ponds	No	Secondary, Undisinfected	457	457	0	0	0
					TOTAL	**457**	**457**	**0**	**0**	**0**

Table 6-5 Recycled Water Direct Beneficial Uses Within Service Area (Submittal Table 6-4)											
☒	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.										
Name of Supplier Producing (Treating) the Recycled Water:		City of Livingston									
Name of Supplier Operating the Recycled Water Distribution System:		City of Livingston									
Supplemental Water Added in 2020 (volume)		0 MG									
Source of 2020 Supplemental Water											
Beneficial Use Type	**Potential Beneficial Uses of Recycled Water**	**Amount of Potential Uses of Recycled Water**	**General Description of 2020 Uses**	**Level of Treatment**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
Agricultural irrigation										
Landscape irrigation (exc golf courses)										
Golf course irrigation										
Commercial use										
Industrial use										
Geothermal and other energy production										
Seawater intrusion barrier										
Recreational impoundment										
Wetlands or wildlife habitat										
Groundwater recharge (IPR)										
Reservoir water augmentation (IPR)										
Direct potable reuse										
Other (Description Required)										
				TOTAL						

of this process, the majority of the treated domestic wastewater is recycled as groundwater recharge and subsequently pumped for local crop irrigation.

6.6.4. Potential, Current, and Projected Recycled Water Uses

CWC Section 10633

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

As previously stated in the above sections, the City's treated undisinfected secondary effluent is discharged to evaporation/percolation ponds, which percolates into the soil and is used to recharge the groundwater table. While the direct use of recycled water technically feasible, it is not currently economically supported. Since the existing WWTP is located northwest of the City and there is no recycled water infrastructure currently in place, the cost associated with the construction of distribution piping from the WWTP to areas throughout the City is cost prohibitive. Additionally, there are no large-scale users that would benefit in proportion to the cost of installing separate distribution systems.

While the current method of disposal provides basin recharge, there are more direct ways to obtain water supply benefit through recycling of wastewater. These options include treatment and exchange of recycled water whereby the City would receive good quality surface water and the recycled water would be used more regionally for a broad range of agricultural uses. If the use of surface water becomes financially feasible, the potential for exchange of recycled water for a surface water supply will be investigated.

Treatment for use in landscape and park irrigation within the community is also an option currently not economical since this reuse opportunity is limited and presently the WWTP is not capable of producing recycled water meeting the standards required for urban water uses and no recycled water distribution facilities have been constructed. The City has explored alternatives to expand water recycling, such as upgrading the existing WWTP to produce tertiary treated recycled water for reuse on adjacent orchards. However, the cost to produce tertiary treated wastewater is currently higher than the cost of pumping groundwater and the agricultural users around the WWTP are not interested in paying a premium for recycled water. The City will continue investigating opportunities and the potential for implementing a recycled water system and the findings of those investigations will be included in subsequent UWMPs.

The City's 2015 UWMP did not contain recycled water projections over the planning horizon, and Table 6-6 reflects both the current non-use and 2015 projected non-use of recycled water by use type.

Table 6-6 2015 UWMP Recycled Water Use Projection Compared to 2020 Actual (Submittal Table 6-5)		
☒	Recycled water was not used in 2015 nor projected for use in 2020. The supplier will not complete the table below. If recycled water was not used in 2020, and was not predicted to be in 2015, then check the box and do not complete the table.	
Beneficial Use Type	**2015 Projection for 2020**	**2020 Actual Use**
Agricultural irrigation		
Landscape irrigation (exc golf courses)		
Golf course irrigation		
Commercial use		
Industrial use		
Geothermal and other energy production		
Seawater intrusion barrier		
Recreational impoundment		
Wetlands or wildlife habitat		
Groundwater recharge (IPR)		
Reservoir water augmentation (IPR)		
Direct potable reuse		
Other (Description Required)		
TOTAL	**0**	**0**

6.6.5. Actions to Encourage and Optimize Future Recycled Water Use

CWC Section 10633

The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier… and shall include the following:

(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

As previously stated in the above sections, the City's water recycling options have been determined to be infeasible or too expensive. Therefore, the City is not planning to change recycled water use in the near future. Given the current usage of treated wastewater for recharge purposes, there is no hydrological benefits to increasing such recycling use. Since recycled water options have been determined to be infeasible at this time, Table 6-7 shows no methods to expand the City's recycled water use.

Table 6-7 Methods to Expand Future Recycled Water Use (Submittal Table 6-6)			
☒	Supplier does not plan to expand recycled water use in the future. Supplier will not complete the table below but will provide narrative explanation.		
	Provide page location of narrative in UWMP		
Name of Action	**Description**	**Planned Implementation Year**	**Expected Increase in Recycled Water Use**
		TOTAL	**0**

6.7. Desalinated Water Opportunities

CWC Section 10631(g)

Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.

The UWMPA requires water agencies to consider options for desalination. The City of Livingston is located a considerable distance from the Pacific Ocean, so constructing a transmission main to move either sea water or desalinated water directly to the City is not feasible and cost prohibitive.

6.8. Water Exchanges or Transfers

CWC Section 10631(c)

Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

The municipal groundwater system that supplies the City's water has historically been a consistent, reliable source of water; therefore, the City has not had to exchange or transfer water to meet its demands. Additionally, the City does not currently have access to purchase water through MID or other agencies.

In the event that untreated groundwater can no longer provide a consistent potable water source, new wells, well head treatment and a treated surface water supply will be used as needed to avoid a supply shortfall. The purchase and delivery of any surface water supplies to the City may first be used for groundwater recharge or for non-potable uses since the City presently does not have a surface water treatment plant (SWTP). It would not be practical to use surface water on a short-term or emergency basis. These water source options are being evaluated for their use in meeting future water demands, and the City is exploring the procurement of a surface water supply through various arrangements. However, at this time there are no plans for transferring or exchanging water.

6.9. Future Water Projects

CWC Section 10631 (f)

Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use, as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in normal and single dry water years and for a period of

drought lasting five consecutive water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

As previously stated, the City currently relies solely on groundwater for its water supply. Currently, the City is in the process of constructing various centralized groundwater treatment facilities to address TCP issues in the groundwater supply. The City also plans to bring two new wells into service within the next few years. It is estimated that the each of the new wells will have a capacity of 1,200 gpm.

In November 2021, during the preparation of this 2020 UWMP, the City submitted an application to the DWR's 2021 Urban and Multibenefit Drought Relief Grant Program, requesting grant funding for the construction of an alternative surface water source. The proposed surface water source would augment the City's existing groundwater supplies, while providing an additional water supply source during dry years. Reduced pumping during wet years could potentially reduce overdraft conditions of the Merced Subbasin and allow the underground aquifer to recover.

The proposed project will consist of the acquisition of approximately 3 acres of property for the construction of a new Horizontal Collector Well and Surface Water Treatment Plant (SWTP). The new Horizontal Collector Well will be installed along the bottom of the Merced River and a new 2 MGD SWTP will be constructed on the property. Approximatley 1,500 of 20-inch raw water conveyance pipeline will be constructed from the Horizontal Collector Well to the new SWTP. Additionally, approximatley 4,000 feet of 20-inch treated water pipeline will be installed to transfer water from the SWTP to the City's water distribution system.

Table 6-8 lists the City's forthcoming water supply projects, which include the construction of Well Nos. 18 and 19 and the new Horizontal Collector Well and SWTP.

Table 6-8 Expected Future Water Supply Projects or Programs (Submittal Table 6-7)

☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.
☐	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.
	Provide page location of narrative in the UWMP

Name of Future Projects or Programs	Joint Project with other suppliers?	Planned Implementation Year	Planned for Use in Year Type	Expected Increase in Water Supply to Supplier
New Well No. 18	No	2023	Single-Dry Year	1,200 gpm
New Well No. 19	No	2023	Single-Dry Year	1,200 gpm
New Horizontal Collector Well and SWTP	No	2024	Average Year	2 MGD

6.10. Summary of Existing and Planned Sources

CWC Code 10631

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a), providing supporting and related information, including all of the following…

(b)(2) When multiple sources of water supply are identified, a description of the management of each supply in correlation with the other identified supplies.

(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

Water pumped form the City's underlying groundwater basin has historically been the only source of potable water supply. During 2020, the City's water supply was obtained using eight active wells; Well Nos. 8, 9, 11, 12, 13, 14, 16, and 17. No water was produced from the City's ninth well, Well No. 15, during 2020. Water is distributed through a network approximatley 36 miles of pressurized pipes, ranging from two to 16 inches in diameter in size. System pressure is maintained between 50 and 65 psi with Mercoid pressure switch controls on all of the wells. The water system also includes a 1.0 MG welded steel storage tank that is used for water storage.

The City's annual treated water supply for 2020 is summarized in Table 6-9 below.

Table 6-9 Water Supplies (Submittal Table 6-8)

Water Supply	Additional Detail on Water Supply	2020		
		Actual Volume	Water Quality	Total Right or Safe Yield
Groundwater (not desalinated)	Well Nos. 8, 9, 11, 12, 13, 14, 15, 16, and 17	2,779	Drinking Water	5,729
TOTAL		**2,779**	**-**	**5,729**

As population and development within the City increases, additional wells and storage tanks will be added to the water system to meet the growing demand. As stated above, the City is currently in the process of constructing various centralized groundwater treatment facilities that will address TCP issues in the groundwater supply. Within the next UWMP planning period, the anticipates placing two new groundwater wells in operation. It is estimated that each well will be capable of producing 1,200 gpm.

While groundwater will continue to be utilized as a primary source, the City has determined that an additional water supply source is needed. The City has submitted an application to DWR requesting grant funding for the construction of an alternative surface water source. The proposed surface water source

would augment the City's existing groundwater supplies and provide an additional water supply source during dry years.

Table 6-10 summarizes the future projected water supplies for the City. Within the next UWMP planning period, the anticipates placing two new groundwater wells in operation and constructing a new Horizontal Collector Well and SWTP. It is estimated that the new water supply sources will increase the City's water available capacity from 5,729 MGY to 7,720 MGY. As shown in Table 6-10, the City's estimated available water supply will be sufficient to meet projected water demands through 2040.

6.11. Climate Change Impacts to Water Supply

The climatic conditions of the central San Joaquin Valley demand careful water management practices because of the typically low amount of rainfall and short rainy season and because of the high temperatures that frequently occur in the summer months. The average annual precipitation for the Livingston area is 11.8 inches. The rainy season typically runs from the beginning of November till the end of April. Drought conditions are not uncommon and can last for multiple years. Summer water consumption varies directly with daily temperature maximums and the Livingston region can experience temperatures over 90 degrees during these months.

The City overlies the Merced groundwater Subbasin within the San Joaquin Valley Groundwater Basin. Much of the recharge on this basin occurs from river, stream, and canal seepage, percolation of irrigation water, and intentional recharge. Drought periods will reduce the availability of surface water and will limit the amount of recharge. The reduced recharge in combination with increased pumping will cause groundwater levels to decline. Additionally, climate change impacts may cause increased evapotranspiration and a longer growing season, further exacerbating groundwater overdraft and high salinity levels. A copy of the Merced IRWMP Climate Change Vulnerability Assessment is included in Appendix E.

6.12. Energy Use

CWC Section 10631.2. (a)

In addition to the requirements of Section 10631, an urban water management plan shall include any of the following information that the urban water supplier can readily obtain:

(1) An estimate of the amount of energy used to extract or divert water supplies.

(2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.

(3) An estimate of the amount of energy used to treat water supplies.

(4) An estimate of the amount of energy used to distribute water supplies through its distribution systems.

(5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.

(6) An estimate of the amount of energy used to place water into or withdraw from storage.

(7) Any other energy-related information the urban water supplier deems appropriate.

For this 2020 UWMP, suppliers are required to include information that could be used to calculate the energy intensity of their water service, as listed in Water Code Section 10631.2(a). Energy intensity is defined as the amount of energy used to collectively divert, store, convey, treat, and distribute each unit

Table 6-10 Water Supplies — Projected (Submittal Table 6-9)										
Water Supply	Projected Water Supply									
	2025		2030		2035		2040		2045	
	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield
Groundwater (not desalinated)	3,052	7,720	3,352	7,720	3,683	7,720	4,048	7,720	4,451	7,720
TOTAL	**3,052**	**7,720**	**3,352**	**7,720**	**3,683**	**7,720**	**4,048**	**7,720**	**4,451**	**7,720**

volume of water. For the City of Livingston's water system, this means the energy required to pump water from the underlining groundwater basin and into the distribution system. These processes are metered for electricity use in kilowatt-hours (kWh).

In accordance with the CWC Section 10631.2(a), an energy intensity analysis was performed for the reporting period of January 1, 2020, through December 31, 2020. The energy intensity analysis for the water system is shown below in Table 6-11. The final calculated energy intensity for the water system is 1,744 kilowatt-hours per million gallons (kWh/MG). The City does not generate any electricity to offset their electricity use for the water system.

Table 6-11 Recommended Energy Reporting - Total Utility Approach (DWR Table O-1B:)

Enter Start Date for Reporting Period	1/1/2020	Urban Water Supplier Operational Control		
End Date	12/30/2020			
☐ Is upstream embedded in the values reported?		Sum of All Water Management Processes	Non-Consequential Hydropower	
		Total Utility	Hydropower	Net Utility
Volume of Water Entering Process (MG)		2,779	0	2,779
Energy Consumed (kWh)		4,848,012	0	4,848,012
Energy Intensity (kWh/MG)		**1,744**	**0**	**1,744**

As discussed in Section 6.6, the City collects, treats, and discharges wastewater generated from a combination of residential, commercial, and industrial sources. The energy intensity associated with the City's wastewater treatment and disposal systems for the reporting period of January 1, 2020, through December 31, 2020, is provided in Table 6-12. The final calculated energy intensity for the wastewater system is 3,181 kWh/MG. The City does not generate any electricity to offset their electricity use for the water system.

Table 6-12 Recommended Energy Reporting - Wastewater & Recycled Water (DWR Table O-2:)

Enter Start Date for Reporting Period	1/1/2020	Urban Water Supplier Operational Control			
End Date	12/30/2020				
☐ Is upstream embedded in the values reported?		Water Management Process			
		Collection/ Conveyance	Treatment	Discharge/ Distribution	Total
Volume of Wastewater Entering Process (MG)		0	457	0	457
Wastewater Energy Consumed (kWh)		0	1,452,331	0	1,452,331
Wastewater Energy Intensity (kWh/MG)		**0**	**3,181**	**0**	**3,181**
Volume of Recycled Water Entering Process (MG)		0	0	0	0
Recycled Water Energy Consumed (kWh)		0	0	0	0
Recycled Water Energy Intensity (kWh/MG)		**0**	**0**	**0**	**0**

The City's energy intensity tables and associated narratives are provided in Appendix H.

CHAPTER 7 - WATER SUPPLY RELIABILITY AND DROUGHT RISK ASSESSMENT

7.1. Introduction

Assessing water service reliability is the fundamental purpose for an urban water supplier to prepare and update their UWMP. Water service reliability reflects the supplier's ability to meet the water needs of its customers with water supplies under varying conditions. This 2020 UWMP considers the reliability of meeting customer water use by analyzing plausible hydrological variability, regulatory variability, climate conditions, and other factors that could affect the City's water supply and its customers' water uses. The UWMPA also requires that a supplier's UWMP include information on the quality of water supplies and how this affects management strategies and supply reliability. In addition, this chapter includes a new requirement for a Drought Risk Assessment (DRA) that enables the City to evaluate risk under a severe drought period lasting for the next five consecutive years.

7.2. Water Service Reliability Assessment

CWC Section 10635(a)

Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

The water service reliability assessment presented in the following sections summarizes the City's expected water service reliability for a normal year, single dry year, and five consecutive dry year projections for 2025, 2030, 2035, and at least through 2040.

7.2.1. Constraints on Water Sources

Section 10631 (b)(1)

A detailed discussion of anticipated supply availability under a normal water year, single dry year, and droughts lasting at least five years, as well as more frequent and severe periods of drought, as described in the drought risk assessment. For each source of water supply, consider any information pertinent to the reliability analysis conducted pursuant to Section 10635, including changes in supply due to climate change.

There are a variety of factors that can impact water supply reliability. These factors include water quality, legal constraints, and climatic issues. A brief discussion on each of these factors is provided below.

7.2.1.1. Water Quality

The City conducts periodic sampling of the water quality from all water supply wells. Table 7-1 below contains a summary of the City's most recent water quality results from each of the water supply wells.

Table 7-1 Groundwater Quality by Well

Constituent	Raw Water									MCL
	Well 8	Well 9	Well 11	Well 12	Well 13	Well 14	Well 15	Well 16	Well 17	
Primary										
Aluminum, µg/L	0	0	0	0	0	0	300	0	0	1,000
Antimony, µg/L	0	0	0	0	0	0	0	0	0	6
Arsenic, µg/L	3.7	6	7	7.5	9.3	4.3	3.3	19	11	10
Barium, µg/L	140	0	0	120	0	0	0	0	0	1,000
Beryllium, µg/L	0	0	0	0	0	0	0	0	0	4
Cadmium, µg/L	0	0	0	0	0	0	0	0	0	5
Chromium, µg/L	0	0	0	0	0	0	0	0	0	50
Cyanide, µg/L	NR	NR	NR	NR	NR	NR	NR	NR	NR	10
Fluoride, mg/L	0.1	0.13	0.15	0.12	0.19	0.13	0.15	0.11	0.13	2
Hexavalent chromium, µg/L	0	0	0	0	0	1.1	0	0	0	10
Mercury, µg/L	0	0	0	0	0	0	0	0	0	2
Nickel, µg/L	0	0	0	0	0	0	0	0	0	100
Nitrate (as Nitrogen), mg/L	8.9	1.8	0	5.6	1.4	6.2	0	3	0.71	10
Nitrate + Nitrite (sum as Nitrogen), mg/L	7.9	1.8	0.61	5.2	1.4	6.5	0.82	3.1	0.64	10
Nitrite (as nitrogen), mg/L	0	0	0	0	0	0	0	0	0	10
Perchlorate, µg/L	0	0	0	0	0	0	0	0	0	6
Selenium, µg/L	0	0	0	0	0	0	0	0	0	50
Thallium, µg/L	0	0	0	0	0	0	0	0	0	2
Secondary										
Color, Units	0	0	0	0	0	0	35	0	0	15
Copper, µg/L	0	0	0	0	0	0	0	0	0	1,000.0
Foaming Agents (MBAS), mg/L	0	0	0	0	0	0	0	0	0	0.5
Iron, µg/L	0	0	0	0	0	0	1,400	0	0	300
Manganese, µg/L	0	30	37	34	32	0	170	34	46	50
Methyl-tert-butyl ether (MTBE), µg/L	0	0	0	0	0	0	0	0	0	13
Odor (Threshold at 60°C), Ton	0	0	0	0	0	0	1.2	0	0	3
Silver, µg/L	0	0	0	0	0	0	0	0	0	100
Thiobencarb, µg/L	0	NR	0	0	NR	0	0	0	NR	70
Turbidity, NTU	0.17	0.11	0.28	0.12	0.14	0.19	4.2	0.25	0.42	5
Zinc, µg/L	0	0	0	0	0	0	0	0	0	5,000
Total Dissolved Solids, mg/L	NR	NR	NR	NR	NR	NR	NR	NR	NR	1,000
Specific Conductance, µS/L	550	370	420	430	370	290	400	380	420	1,600
Chloride, mg/L	41	27	48	20	36	7.1	47	34	77	500
Sulfate, mg/L	45	24	18	39	24	24	20	12	9.9	500

In recent years, the City's groundwater quality has declined due to human activities and the increased regulation of naturally occurring constituents has resulted in the majority of the City's wells producing water at or above the regulated maximum contaminant level (MCL) for at least one regulated contaminant. The groundwater quality of the City's eight active wells includes a range of both natural and manmade contaminants at various levels. The primary contaminants of concern above MCL's include 1,2,3-trichloropropane (TCP), arsenic, and manganese.

In 2017, the SWRCB DDW established a drinking water Maximum Contaminant Level (MCL) for TCP of 0.005 micrograms per liter (µg/l). On April 20, 2018, the SWRCB DDW issued the City Compliance Order No. 03_11_18R_013 (CO) for exceeding the 1,2,3-TCP MCL in eight of the City's groundwater wells (Well Nos. 9, 11, 12, 13, 14, 15, 16 and 17). To address compliance with TCP, the City is implementing several centralized TCP treatment systems at several well sites. The City recently completed construction on centralized TCP treatment system at Well No. 16. The project consisted of constructing approximatley 3,100 linear feet of conveyance pipeline between Well Nos. 14 and 16 and four Granular Activated Carbon (GAC) trains that can handle the combined flows of both wells.

The City is currently in the process of requesting funding from the SWRCB for the construction of additional centralized TCP treatment system. The City is proposing to construct a second centralized TCP treatment system at Arakelian Park to treat the raw water from Well Nos. 12, 13 and 17, and a third centralized TCP treatment system at Well No. 8 that will treat the combined flows from Well Nos. 8 and 9, as well as the new proposed Well No. 19. Additionally, a TCP treatment system will likely need to be constructed at the well site of the proposed new Well No. 18.

The City's wells also have arsenic and manganese levels at or above the MCL. As shown in Table 6-1, Well No. 16 has the highest level of arsenic, over three times the MCL. The City completed construction of a groundwater treatment plant to reduce arsenic at Well No. 16 using an adsorption media. Well No. 13 also produces groundwater with an arsenic concentration above the MCL. The City recently completed an arsenic removal treatment system at Well No. 13. Additionally, Well Nos. 16 and 17 also contain elevated levels of arsenic; Well No. 16 is approximatley 90 percent above the MCL, while Well No. 17 is at approximatley 10 percent above the MCL. Manganese is also a contaminant of concern, with Well No. 15 containing elevated levels. Well No. 17 has tested just below the MCL. The progressive degradation of local underlying groundwater has led the City to explore surface water alternatives and acquiring a secondary water source to augment the existing groundwater supply.

7.2.1.2. Climatic Changes

The climatic conditions of the central San Joaquin Valley demand careful water management practices because of the typically low amount of rainfall and short rainy season and because of the high temperatures that frequently occur in the summer months. The average annual precipitation for the Livingston area is 11.8 inches. The rainy season runs from November through April. Drought conditions are not uncommon and can last for multiple years. Summer water consumption varies directly with daily temperature maximums and the Livingston region can experience temperatures over 90 degrees during these months.

The reliability and vulnerability of the City's water supply to seasonal or climactic changes can be easily qualified, but reliability and vulnerability are difficult to quantify. Because the City relies entirely on

groundwater using multiple extraction wells, the intermittent overdraft will obviously be more severe during drought periods. To date, water levels in the Subbasin have shown the ability to recover from reduced rainfall (drought) and reduced surface water deliveries. However, due to the recent drought conditions, loss of storage capacity in the groundwater aquifer has caused land subsidence in localized areas of Merced County. As growth in the area continues and increased demands are placed on the groundwater resources of the area, a condition of sustained overdraft may be reached but this condition is not expected to occur for many years. Recharge, conservation, and seeking a secondary water source, such as surface water, will all reduce vulnerability and increase reliability. The effectiveness of recharge in those areas that have experienced land subsidence may be reduced as a consequence of the loss of storage capacity in the aquifer caused by the compaction of the water bearing strata.

7.2.1.3. Legal Constraints

Legal factors, such as pumping limitations in adjudicated groundwater basins and surface water contracts, are capable of affecting the reliability of a water distribution system. The City's sole source of water supply, the Merced Subbasin, is not an adjudicated groundwater basin. Therefore, adjudication-related legal limitations are unlikely to affect the amount of groundwater that the City can extract from this sub basin.

7.2.2. Year Type Characterization

Water supply reliability is assessed based on the characteristics of the City's water supplies during various water year water year types which are provided in this section. CWC Section 10635(a) requires that the City's water service reliability be assessed based on the following three water year types:

- Normal Year – This condition represents the water supplies the City considers available during normal conditions. This could be a single year or averaged range of years that most closely represents the average water supply available to the Supplier. To determine the amount of water available during a normal year, the City evaluated the average volume of water supplied during the years of 2002 to 2006. During this period, the average volume of water supplied was 2,392 MG.
- total volume of water supplied over the last twenty years. From 2001 to 2020 the City's maximum water usage occurred during 2020. Therefore, the average year selected is 2020, when 2,779 MG of water was supplied.
- Single Dry Year – The single dry year is recommended to be the year that represents the lowest water supply available. The year 2010 represents the single dry year for the City, during which, the City supplied 2,101 MG of water.
- Five-Consecutive Year Drought – The driest five-year historical sequence for the supplier, which may be the lowest average water supply available for five years in a row. For the five-year drought period, the City evaluated the average volume of water that was supplied during the State's most recent drought period, which occurred during the years of 2012 to 2016. During this period, the average volume of water that was supplied was approximatley 2,336 MG. Between 2012 and 2016, the volume of water supplied decreased at an average annual rate of approximatley 2.4 percent.

Table 7-2 summarizes the City's historical supply reliability during the water years described above. The available supplies columns specify the volume and percentage of the City's total water supply expected if the hydrology from that type of year were to repeat.

Table 7-2 Basis of Water Year Data (Reliability Assessment) (Submittal Table 7-1)

Year Type	Base Year	Available Supplies if Year Type Repeats	
		☐	**Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location** _____
		☒	**Quantification of available supplies is provided in this table as either volume only, percent only, or both.**
		Volume Available (MG)	**% of Average Supply**
Average Year	2002-2006	2,392	100%
Single-Dry Year	2010	2,101	88%
Consecutive Dry Years 1st Year	2012	2,336	98%
Consecutive Dry Years 2nd Year[(1)]	2013	2,281	95%
Consecutive Dry Years 3rd Year[(1)]	2014	2,227	93%
Consecutive Dry Years 4th Year[(1)]	2015	2,174	91%
Consecutive Dry Years 5th Year[(1)]	2016	2,123	89%

NOTES:
[(1)]Assumes a 2.4 percent decrease in the available water supply from previous year.

7.2.3. Supply and Demand Comparison

CWC Section 10635(a)

Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

The following sections compare City's projected water demands, as presented in Chapter 4 of this 2020 UWMP, with the projected water supplies available during normal, single, and multiple dry years to assess the reliability of City's water supply. Under the various water year types, the total water supply that is available on an annual basis is compared to the total annual projected water use for the City service area from 2025 to 2045 in five-year increments.

7.2.3.1. Normal Year

The reliability of the City's water supply and lack of vulnerability to seasonal or climatic shortage is discussed in Chapter 6 of this UWMP. As previously stated, based on the resiliency of the groundwater basin and if potable groundwater can be extracted by the City wells, which are individual sources in certain respects, it is not anticipated that a single or multiple dry year period will critically reduce the availability of water supply to the City. Groundwater has and will continue to provide drought protection for the City. However, the City has engaged in extensive emergency planning in preparation for potential service interruptions and has prepared a Water Shortage Contingency Plan (WSCP) that will be implemented during drought conditions. The City's WSCP is presented in Chapter 8 of the UWMP.

Table 7-3 displays the projected supply and demand totals for a normal year. The supply and demands totals are consistent with those in Table 6-9 and Table 4-6, respectively. The City is expected to have adequate water supplies during normal years to meet its projected demands through 2045.

Table 7-3 Normal Year Supply and Demand Comparison (Submittal Table 7-2)

	2025	2030	2035	2040	2045
Supply Totals (From Table 6-9)	3,052	3,352	3,683	4,048	4,451
Demand Totals (From Table 4-6)	3,052	3,352	3,683	4,048	4,451
Difference	0	0	0	0	0

7.2.3.2. Single Dry Year

Single-dry year effects are simulated through a methodology which assumes that the supply and demand totals will decrease by approximately 12 percent below normal year demands as a consequence of mandatory water use restrictions. As shown in Table 7-4, it is not anticipated that a single dry year period will reduce the availability of water supply to the City.

Table 7-4 Single Dry Year Supply and Demand Comparison (Submittal Table 7-3)

	2025	2030	2035	2040	2045
Supply Totals	2,680	2,944	3,234	3,555	3,909
Demand Totals	2,680	2,944	3,234	3,555	3,909
Difference	0	0	0	0	0

7.2.3.3. Five Consecutive Dry Years

Table 7-4 shows the projected supply and demands totals for multiple dry year period extending five consecutive years over the planning period. The City assumes that the supply and demand totals will decrease below normal year demands by approximately 2 percent in the first year, 5 percent in the second year, 7 percent in the third year, 9 percent in the fourth year, and 11 percent in the fifth year.

Table 7-5 Multiple Dry Years Supply and Demand Comparison (Submittal Table 7-4)

		2025	2030	2035	2040	2045
First year	Supply totals	2,979	3,273	3,596	3,952	4,345
	Demand totals	2,979	3,273	3,596	3,952	4,345
	Difference	0	0	0	0	0
Second year	Supply totals	2,909	3,195	3,511	3,859	4,243

Table 7-5 Multiple Dry Years Supply and Demand Comparison (Submittal Table 7-4)						
		2025	2030	2035	2040	2045
	Demand totals	2,909	3,195	3,511	3,859	4,243
	Difference	0	0	0	0	0
Third year	Supply totals	2,840	3,120	3,428	3,768	4,143
	Demand totals	2,840	3,120	3,428	3,768	4,143
	Difference	0	0	0	0	0
Fourth year	Supply totals	2,773	3,046	3,347	3,679	4,045
	Demand totals	2,773	3,046	3,347	3,679	4,045
	Difference	0	0	0	0	0
Fifth year	Supply totals	2,708	2,974	3,268	3,592	3,949
	Demand totals	2,708	2,974	3,268	3,592	3,949
	Difference	0	0	0	0	0

As shown in Tables 7-2, 7-3, and 7-4, anticipated groundwater supplies are sufficient to meet all demands through year 2045 even under drought conditions. To continue to utilize groundwater, it is essential that City continue its current efforts towards conservation.

7.2.4. Description of Management Tools and Options

CWC Section 10620(f)

An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

The City recognizes the importance of maintaining a high quality, reliable water supply. Although water is a renewable resource, there is a limit on the amount of water that can be sustainably drawn from a given supply source (e.g., groundwater basins, surface water sources). As discussed in Section 6.10 of this 2020 UWMP, groundwater will continue to be utilized by the City as a primary source; however, the City has determined that an additional water supply source is needed. In order to secure a secondary water supply source, the City has requested grant funding from the DWR for the construction of a new Horizontal Collector Well and 2.0 MGD SWTP. The proposed surface water source would augment the City's existing groundwater supplies and provide an additional water supply source during dry years.

Determining the supply reliability for the City is difficult because of the complex factors that accompany groundwater use in general. The City's existing wells currently draw water from a non-adjudicated groundwater basin (Merced Subbasin) with no limits on pumping; however, the Subbasin has been labeled as being in a critical state of overdraft. Therefore, reliability of the groundwater supply will depend on the long-term balance between groundwater extraction and recharge for the Subbasin as a whole.

To minimize its contribution to groundwater depletion, sustainable use of groundwater supply sources is the primary focus of the City's urban water management activities extending into the future. Consequently, a focus for the City is to maximize the efficient use of water and to promote conservation. This will be accomplished through the implementation of demand management measures (DMMs) that have not been implemented by the City, continued implementation of DMMs that have currently been implemented by the City, and other conservation activities.

7.3. Drought Risk Assessment

CWC Section 10635(b)

Every urban water supplier shall include, as part of its urban water management plan, a drought risk assessment for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the urban water management plan. The urban water supplier may conduct an interim update or updates to this drought risk assessment within the five-year cycle of its urban water management plan update. The drought risk assessment shall include each of the following:

(1) A description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts five consecutive water years, starting from the year following when the assessment is conducted.

(2) A determination of the reliability of each source of supply under a variety of water shortage conditions. This may include a determination that a particular source of water supply is fully reliable under most, if not all, conditions.

(3) A comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.

(4) Considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.

New to the 2020 UWMP, CWC 10635 (b) now requires a Drought Risk Assessment (DRA). The DRA provides a quick snapshot of the anticipated supply surplus or deficit should a five-consecutive year drought occur in the next five years. The DRA can be modified or updated outside of the UWMP's five-year plan cycle, so a description of the data, methodology, and basis for shortage conditions must be included in this 2020 UWMP. The DRA evaluates each water supply's reliability and compares available water supplies and projected demands during a five consecutive dry years scenario. This short-term analysis can help water suppliers foresee undesired risks, such as upcoming shortages, and provide time to evaluate and implement the necessary response actions needed to mitigate shortages in a less impactful manner to the community and environment. If demands cannot be met by the expected available supply, shortage response actions from the City's WSCP may be implemented.

The following assumptions were considered during the preparation of the City's DRA for the next five consecutive years:

- The five consecutive year drought period associated with this 2020 UWMP is based on five consecutive dry years from 2012 to 2016, which represents the most recent and historical five consecutive year drought. During this period, the average volume of water that was supplied was approximatley 2,336 MG. Between 2012 and 2016, the volume of water supplied decreased at an average annual rate of approximatley 2.4 percent.
- It has been assumed that the projected water supplies available during this five consecutive year period will decrease below normal year demands by approximately 2 percent in the first year, 5 percent in the second year, 7 percent in the third year, 9 percent in the fourth year, and 11 percent in the fifth year.

- The projected demands during this five consecutive year drought are based on the unconstrained projected water demands presented in Table 4-7, which is included in Section 4.3.7 of this 2020 UWMP.
- The projected demands were compared to the projected supplies to identify potential water supply deficits which will require implementation of the City's WSCP. To adequately meet water demands during this five consecutive drought year period, the City will need to implement Stage 1 of the WSCP during the third and fourth years of the drought period and Stage 2 of the WSCP during the fifth year. Conservation measures associated with each Stage are further discussed in Chapter 8 of this 2020 UWMP.

As shown in Table 7-5, during a five-year drought beginning in 2021, the City can adequately meet projected demands through 2025 with the implementation of water conservation measures.

Table 7-6 Five-Year Drought Risk Assessment Tables to address Water Code Section 10635(b) (Submittal Table 7-5)

2021	**Total**
Total Water Use	2,831
Total Supplies	2,979
Surplus/Shortfall w/o WSCP Action	148
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	
Revised Surplus/(shortfall)	148
Resulting % Use Reduction from WSCP action	0%
2022	**Total**
Total Water Use	2,885
Total Supplies	2,909
Surplus/Shortfall w/o WSCP Action	24
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	11
Revised Surplus/(shortfall)	35
Resulting % Use Reduction from WSCP action	0%
2023	**Total**
Total Water Use	2,939
Total Supplies	2,840
Surplus/Shortfall w/o WSCP Action	(99)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	99
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	3%
2024	**Total**

Table 7-6 Five-Year Drought Risk Assessment Tables to address Water Code Section 10635(b) (Submittal Table 7-5)	
Total Water Use	2,995
Total Supplies	2,773
Surplus/Shortfall w/o WSCP Action	(222)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	222
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	7%
2025	839
Total Water Use	3,052
Total Supplies	2,708
Surplus/Shortfall w/o WSCP Action	(344)
Planned WSCP Actions (use reduction and supply augmentation)	
WSCP - supply augmentation benefit	
WSCP - use reduction savings benefit	344
Revised Surplus/(shortfall)	0
Resulting % Use Reduction from WSCP action	11%

CHAPTER 8 - WATER SHORTAGE CONTINGENCY PLAN

8.1. Introduction

CWC Section 10632.3

It is the intent of the Legislature that, upon proclamation by the Governor of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions, the board defer to implementation of locally adopted water shortage contingency plans to the extent practicable.

This chapter describes the Water Shortage Contingency Plan (WSCP) developed for the City of Livingston as required by Section 10632.3 of the CWC. Water shortage contingency planning is a strategic planning process to prepare for and respond to water shortages. The WSCP includes the stages of response to a water shortage, such as a drought, that occur over a period of time, as well as catastrophic supply interruptions which occur suddenly. The primary objective of the WSCP is to ensure that the City has in place the necessary resources and management responses needed to protect health and human safety, minimize economic disruption, and preserve environmental and community assets during water supply shortages and interruptions. This locally developed plan will be the first point of reference and implementation during (1) an Agency declared water shortage, (2) a City or County proclamation of a local water supply emergency, or (3) a declared statewide drought emergency.

In response to the severe drought of 2012 to 2016, new legislation in 2018 created a WSCP mandate replacing the water shortage contingency analysis under former law. While overlapping aspects of the prior law, the new requirements have several prescriptive elements an urban water supplier's WSCP must now include, such as:

- Key attributes of its Water Supply Reliability Analysis conducted pursuant to Water Code Section 10635.
- Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage.
- Locally appropriate "shortage response actions" for each shortage level, with a corresponding estimate of the extent the action will address the gap between supplies and demands.
- Procedures for conducting an annual water supply and demand assessment with prescribed elements.
- Under Water Code Section 10632.1, urban water Suppliers are required to submit, by July 1 of each year, beginning in the year following adoption of the 2020 UWMP, an annual water shortage assessment report to the DWR.
- Communication protocols and procedures to inform customers, the public, and government entities of any current or predicted water shortages and associated response actions.
- Monitoring and reporting procedures to assure appropriate data is collected to monitor customer compliance and to respond to any state reporting requirements.
- A reevaluation and improvement process to assess the functionality of its WSCP and to make appropriate adjustments as may be warranted.

As part of the 2020 UWMP update, CWC Section 10632 requires urban water suppliers to prepare and adopt a WSCP that consist of the following elements:

8.1 Water Supply Reliability Analysis

8.2 Annual Water Supply and Demand Assessment Procedures

8.3 Six Standard Water Shortage Stages

8.4 Shortage Response Actions

8.5 Communication Protocols

8.6 Compliance and Enforcement

8.7 Legal Authorities

8.8 Financial Consequences of WSCP Activation

8.9 Monitoring and Reporting

8.10 WSCP Refinement Procedures

8.11 Special Water Feature Distinction

8.12 Plan Adoption, Submittal, and Availability

8.2. Water Supply Reliability Analysis

CWC Section 10632(a)(1)

The analysis of water supply reliability conducted pursuant to Section 10635.

As part of the 2020 UWMP requirements, Chapter 7 of this UWMP includes a supply reliability analysis for the following scenarios: normal year, single-dry year, and five-year consecutive dry years. The City expects to meet demands under all water year scenarios with groundwater, while promoting water conservations measures, and where feasible, develop projects and management actions to offset groundwater extractions above the City's sustainable yield and protect the Merced subbasin. The City anticipates utilizing between approximately 2,680 MG to 4,451 MG of groundwater from the Merced subbasin, depending on the year type and population. It is anticipated that this range of supply volume will be available to meet the City's demands.

Chapter 7 also includes the required Drought Risk Assessment (DRA), that analyzes supply reliability for period of 2021 to 2025. The DRA analyzes historical data to allow the City to view patterns and more reliably determine if there could be any water shortages within a given time frame. The DRA looks at historical consumption data by customer class, populated from billing records, and historical supply data by source from groundwater production reports. Future demand and supply estimates for the planning period are then analyzed to determine if there are any gaps between supply and demand. As mentioned above, the City does not anticipate a supply shortage.

Since the City sole source of water supply is currently obtained from the critical overdraft Merced subbasin, the City is committed to promoting water conservation measures to maintain the reliability of the groundwater basin.

On May 5, 2015, the Livingston City Council adopted Resolution No. 2015-23 declaring a local drought emergency and adopting mandatory water conservation measures so that the water supply could be conserved for the greater public benefit. Per the requirements of the UWMPA, the City's 2015 UWMP included a WSCP, which described the mandatory use restrictions that would be required to prepare for and respond to various levels of water shortages. On October 26, 2016, the City Council's adopted Resolution No. 2016-55, which rescinded Resolution 2015-23 and replaced it with the WSCP contained in the 2015 UWMP. A copy of the Resolutions are included in Appendix I.

To meet the new requirements established by the DWR for this 2020 UWMP, this Chapter presents the City's 2020 Water Shortage Contingency Plan (WSCP). The intention of the 2020 WSCP is to build upon the City's 2015 WSCP, while implementing new elements mandated by Section 10635 of the CWC. A significant change from the 2015 WSCP to the 2020 WSCP is the expansion of the Water Conservation Stages from four stages to six stages, which is a requirement of the State.

8.3. Annual Water Supply and Demand Assessment Procedures

CWC Section 10632(a)(2)

The procedures used in conducting an annual water supply and demand assessment that include, at a minimum, both of the following:

(A) The written decision-making process that an urban water supplier will use each year to determine its water supply reliability.

(B) The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year, including all of the following:

(i) Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.

(ii) Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The annual supply and demand assessment may consider more than one dry year solely at the discretion of the urban water supplier.

(iii) Existing infrastructure capabilities and plausible constraints.

(iv) A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment.

(v) A description and quantification of each source of water supply.

CWC Section 10632.1.

An urban water supplier shall conduct an annual water supply and demand assessment pursuant to subdivision (a) of Section 10632 and, on or before July 1 of each year, submit an annual water shortage assessment report to the department with information for anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier's water shortage contingency plan. An urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by July 1 of each year, whichever is later.

If the groundwater supply provided by the City's municipal groundwater wells continues to meet the water demand of the City's customers without supply shortages, there is no further action required. However, if in any given year, if the typical customer demand appears to be great than available supply, the Public Works Director, or his or her designated representative, is authorized to implement the provisions of the WSCP upon the determination that water conservation measures are necessary to protect the public welfare and safety. The Public Works Director, or his or her designated representative, will evaluate several data sources, including but not limited to internal and external hydrologic data, as well as all customer consumption records. Per Title Nine, Chapter 5, Section 72 of the Livingston Municipal Code, water use restrictions will then be established through the adoption of a Resolution by City Council.

A water shortage emergency may be declared based on several conditions, including:

- An actual or potential local water supply restriction or emergency affecting the City's water system.
- A formal water supply shortage notification by the Governor.

A water conservation stage will normally be implemented in a progressive manner; however, it may be necessary for the City to skip stages outlined in the WSCP in response to catastrophic supply reductions. In general, conservation/use reduction stages will be set according to the anticipated reduction in available water supplies. The City may use one or more of the following measures to determine actual reductions in water consumption:

- Establish an average water use baseline.
- Review customer meter records on a more frequent basis.
- Perform leak detections and repair on more frequent basis.
- Perform meter checking and repair on more frequent basis.
- Perform periodic water system audit.

8.3.1. Decision Making Process

In accordance with CWC 10632 the City will conduct an annual water supply and demand assessment, or annual assessment by July 1st of each year. The Annual Assessment team will consist of the Public Works Director and the City Engineer. This team will draft and prepare a written report that discusses the results of the Annual Water Supply and Demand Assessment (Annual Assessment). This Annual Assessment will be presented to the City Council annually during a regular City Council meeting that is held during the month of May each year. The final Annual Assessment will be provided to DWR no later than July 1 of each year.

The Annual Assessments will be instrumental in providing guidance to the City for decisions regarding potential declarations of a water supply shortage and implementation of water conservation stages, instituting mandatory water restrictions, promoting water use efficiency and conservation programs, water rates, and the necessity of pursuing alternative water supplies. This process will help ensure that adequate water supplies resources are available to the City.

8.3.2. Data and Methodologies

The key data inputs and methodologies which will be evaluated by the City during the preparation of the Annual Assessment will include the following:

- Evaluation Criteria – The locally applicable evaluation criteria used to prepare the Annual Assessment will be identified. The evaluation criteria will include, but is not limited to, an analysis of current local hydrology (including rainfall and groundwater levels), current water demands, a review of water system improvement plans which may impact infrastructure availability, and water quality regulations which may impact groundwater availability.
- Water Supply – A description of each available water supply source will be provided. The descriptions will include a quantification of each available water supply source and will be based on review of current production capacities, historical production, UWMPs, and prior water supply studies (including Water Supply Assessments and/or Master Plans).
- Unconstrained Water Demand – The potential unconstrained water demands during the current year and the upcoming (potential single dry) year, prior to any special shortage response actions, will be reviewed. The review will include factors such as weather, existing and projected land uses and populations, actual customer consumption and water use factors, Urban Water Supplier Monthly Reports, and existing water shortage levels.
- Planned Water Use for Current Year Considering Dry Subsequent Year – The water supplies available to meet the demands during the current year and the upcoming (potential single dry) year will be considered and identified for each source of supply. The evaluation will include factors such as estimated water demands, weather, groundwater basin operating safe yields, water quality results, existing available pumping capacities, regulatory issues, use of emergency interconnections, and the costs associated with producing each water supply source.
- Infrastructure Considerations – The capabilities of the water distribution system infrastructure to meet the water demands during the current year and the upcoming (potential single dry) year will be considered. Available production capacities and distribution system water losses will be reviewed. In addition, capital improvement and replacement projects, as well as potential projects which may increase water system and production capacities will be considered.
- Other Factors – Additional local considerations, if any, which can affect the availability of water supplies will be described.

The City will begin to collect and evaluate the water supply availability in January of each year and will submit the Annual Assessment report to the DWR by July 1st of each year.

8.4. Six Standard Water Shortage Stages

CWC Section 10632(a)(3)

(A) Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events.

(B) An urban water supplier with an existing water shortage contingency plan that uses different water shortage levels may comply with the requirement in subparagraph (A) by developing and including a cross-reference relating its existing categories to the six standard water shortage levels.

In accordance with CWC Section 10632(a)(3) and the 2020 UWMP Guidebook, all urban water supplier's WSCP must include at least six standard water shortage stages and cover a possible reduction in supply of more than 50 percent. The purpose of this new requirement of the CWC is to provide a consistent regional and statewide approach to measure water supply shortage conditions in the State.

The WSCP presented in this Chapter updates the City's previous WSCP presented in Chapter 8 of the 2015 UWMP and adopted by Resolution No. 2016-55. The City's 2015 WSCP included only five stages of mandatory water conservation measures. For this 2020 WSCP, each of the six water shortage stages represent an increasing gap between the City's estimated water supplies and the unconstrained demand as determined in the Annual Assessment or the gap between supply and demand at any time due to an unforeseen event that interrupts water supplies. The six shortage stages correspond to 10, 20, 30, 40, 50 percent, and greater than 50 percent shortage compared to the normal reliability conditions.

As stated in CWC Section 10632(a)(3) and the 2020 UWMP Guidebook, an urban water supplier's existing WSCP that uses different water shortage levels may comply with these six levels by developing a cross-reference relating the existing categories to the six standard water shortage levels. Table 8-1 displays the City's existing water conservation stages and their relationship to the six standard water shortage states prescribed by the CWC and the 2020 UWMP Guidebook.

Table 8-1 Cross Reference for Mandated State and Existing Livingston Water Shortage Levels

Mandated State Standard Levels		Cross Walk	Livingston Corresponding Shortage Levels		
Shortage Level	Percent Shortage Range		Newman Shortage Level	Percent Supply Reduction	Shortage Response Actions
1	Up to 10%	→	1	Between 0% & 10%	Voluntary
2	Up to 20%	→	2	Between 10% & 20%	Mandatory
3	Up to 30%	→	3	Between 20% & 30%	Mandatory
4	Up to 40%	→	4	Between 30% & 40%	Mandatory
5	Up to 50%	→	5	Between 40% & 50%	Mandatory
6	>50%	→			

8.5. Shortage Response Actions

CWC Section 10632 (a)(4)

Shortage response actions that align with the defined shortage levels and include, at a minimum, all of the following:

(A) Locally appropriate supply augmentation actions.

(B) Locally appropriate demand reduction actions to adequately respond to shortages.

(C) Locally appropriate operational changes.

(D) Additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions.

(E) For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action

In accordance with CWC Section 10632(a)(4), this section describes the response action that may be implemented or considered for each water shortage stage to minimize social and economic impacts to the community. The City expects to mitigate supply shortages through a variety of response actions including demand reduction actions, conservation, operational changes, outreach, and mandatory prohibitions.

This 2020 WSCP identifies various actions to be considered by the City during water shortage conditions. In the event of a water shortage, the City will evaluate the cause of the shortage to help inform which response actions should be implemented. Depending on the nature of the water shortage, the City may elect to implement a combination of response actions to mitigate the shortage and reduce gaps between supply and demand. It should be noted that implementation of each stage is cumulative; meaning that implementation of a higher stage shall also include implementation of all previous stages. If necessary, the City may enact additional actions that are not listed in this WSCP. The stages determined by the percent water supply shortage are summarized in Table 8-2.

Table 8-2 Water Shortage Contingency Plan Levels (Submittal Table 8-1)

Shortage Level	Percent Shortage Range	Severity	Shortage Response Actions
1	Up to 10%	Potential Shortage	Up to a 10% reduction in the City's water supply due to any combinations of conditions.
2	Up to 20%	Minor Shortage	Between a 10% and 20% reduction in the City's water supply due to any combinations of conditions.
3	Up to 30%	Moderate Shortage	Between a 20% and 30% reduction in the City's water supply due to any combinations of conditions.
4	Up to 40%	Severe Shortage	Between a 30% and 40% reduction in the City's water supply due to any combinations of conditions.
5	Up to 50%	Critical Shortage	Between a 40% and 50% reduction in the City's water supply due to any combinations of conditions.
6	> 50%	Extreme Emergency Shortage	More than 50% reduction in the City's surface water supply due to any combinations of conditions.

Depending on the stage of the water shortage, the City may implement a combination of demand reductions, operational changes, and mandatory restrictions. Demand reductions required for each stage are included in Table 8-3 below.

Table 8-3 Water Usage Reduction by State		
Shortage Level	**Mandatory or Voluntary Percent Demand Reduction**	**Severity**
1	5%	Potential Shortage
2	10%	Minor Shortage
3	20%	Moderate Shortage
4	30%	Severe Shortage
5	50%	Critical Shortage
6	60%	Extreme Emergency Shortage

8.5.2. Demand Reductions

The narrative below describes the specific rationing measures associated with each WSCP stage reported in this 2020 WSCP. The specific rationing measures for the six stages are summarized in Table 8-4.

The City's water customers will be required to comply with the applicable water conservation measures of the stage in effect. Mandatory conservation measures reported in the City's 2015 WSCP were used a reference; however, the six states described below have been modified and updated to meet the new requirements of the CWC.

State 1 – Potential Shortage

Stage 1 will consist of mandatory water conservation measures that will be implemented during a potential water supply shortage. Stage 1 calls for a low level of informational outreach and enforcement of the City's permanent water use ordinances. The City will direct water customers to limit the amount of water used on a year-round basis. During Stage 1, there is up to a 10 percent water supply shortage and a 5 percent or greater reduction in demand is suggested. The following conservation measures will be implemented by the City during this stage:

- Customers are prohibited from wasting City water. Water waste through inappropriate use, leaks or other wasteful use must be stopped within forty-eight (48) hours' notice by the City.
    - No excessive water flow or runoff onto pavement, sidewalks, gutters, or ditches from watering or irrigating landscapes or vegetation of any kind.
- Outdoor irrigation of ornamental landscapes or turf or car washing with potable water is prohibited between the hours of 11am to 8pm, except for drip irrigation.
- No outdoor irrigation is permitted within forty-eight (48) hours of a storm event.
- The washing of vehicles, building exteriors, sidewalks, driveways, parking areas, tennis courts, patios, or other paved areas without the use of a positive shut-off nozzle on the hose which results in excessive runoff is prohibited.
- The use of "slip-n-slides" and other recreational activities requiring a constant flow of water are prohibited.

State 2 – Minor Shortage

During Stage 2 of a water supply shortage, there is between a 10 to 20 percent water supply shortage and a 10 percent or greater mandatory reduction in water usage is required for the City to meet the immediate

needs of its customers. Water alert conditions are declared, the water shortage situation is explained to the public, and consumers are asked for a 10 percent or greater mandatory water use reduction. In addition to Stage 1 conservation measures, the City will implement the following conservation measures during State 2:

- Outdoor irrigation of ornamental landscapes or turf with potable water shall be limited to three (3) days per week in accordance with the following schedule with addresses ending in:
    - Outdoor irrigation for even numbered addresses is permitted only on Tuesday, Thursday and Saturday.
    - Outdoor irrigation for odd numbered addresses is permitted only on Wednesday, Friday and Sunday.
    - No outdoor irrigation watering will take place on Monday.
- Large commercial landscapes and City parks shall have individual watering schedules approved by the Public Works Department.
- No car washing is allowed on Mondays except for commercial car washes equipped with a recirculating system. Car washing (except commercial car washes) shall be done by using a hand-held bucket or a hand-help hose equipped with a positive self-closing water shut-off nozzle.

State 3 – Moderate Shortage

During Stage 3, the water supply shortage is between 20 and 30 percent. The City aggressively continues its public information outreach and education programs. Consumers are asked for a 20 percent or greater mandatory water use reduction. All requirements of Stages 1 and 2 remain in effect. Additional requirements include the following:

- Outdoor irrigation of ornamental landscapes or turf with potable water shall be limited to two (2) days per week in accordance with the following schedule with addresses ending in:
    - Outdoor irrigation for even numbered addresses is permitted only on Tuesday and Saturday.
    - Outdoor irrigation for odd numbered addresses is permitted only on Wednesday and Sunday.
    - No outdoor irrigation watering will take place on Monday, Thursday, and Friday.
- Large commercial landscapes and City parks shall also be limited to two days per week, as scheduled by the Public Works Department.
- No car washing is allowed on Mondays, Thursdays and Fridays except for commercial car washes equipped with a recirculating system. Car washing (except commercial car washes) shall be done by using a hand-held bucket or a hand-help hose equipped with a positive self-closing water shut-off nozzle.
- The application of potable water to driveways and sidewalks is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency.
- Restaurants shall serve water only upon customer request.
- Hotels, motels, and lodges must offer guests the option of not having towels and linens laundered daily by displaying notices prominently in each guestroom.

- The City will contact its highest water users to encourage use of water conservation methods.
- The City will evaluate its water use for main flushing to see if reductions are possible.

State 4 – Severe Shortage

During Stage 4 of a water supply shortage, the shortage is between 30 and 40 percent and a 30 percent or greater reduction in water usage is required for the City to meet the immediate needs of its customers. The City aggressively continues its public information outreach and education programs, and consumers are asked for a 30 percent or greater mandatory water use reduction. All requirements of Stages 1 through 3 remain in effect. Additional requirements include the following:

- Outdoor irrigation of ornamental landscapes or turf with potable water shall be limited to two one (1) day per week in accordance with the following schedule with addresses ending in:
    - Outdoor irrigation for even numbered addresses is permitted only on Saturday.
    - Outdoor irrigation for odd numbered addresses is permitted only on Sunday.
    - No outdoor irrigation watering will take place on Monday through Friday.
- Large commercial landscaping and City parks shall be limited to one (1) day per week, as scheduled by the Public Works Department.
- Filling newly constructed or drained swimming pools with City water shall be prohibited.
- Construction water from City fire hydrants shall be banned but treated effluent water from the wastewater treatment plant may be made available for construction water purposes.
- Further use of decorative fountains or reflection ponds shall be discontinued until further notice.
- Washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment not occurring upon the immediate premises of commercial car washes and commercial service stations and not in immediate interest of the public health, safety, and welfare is prohibited.
- Main flushing is only done on a sand, odor, or taste complaint basis or due to contamination and public health reasons

State 5 – Critical Shortage

During Stage 5, there is between a 40 to 50 percent water supply shortage and a 50 percent or greater reduction in water usage is required for the City to meet the immediate needs of its customers. The City aggressively continues its public information outreach and education programs, and consumers are asked for a 50 percent or greater mandatory water use reduction. All requirements of Stages 1 through 4 remain in effect. Additional requirements include the following:

- Immediately notify appropriate media outlets and post local road signage notifying the public of the current water use restrictions.
- All outdoor irrigation of ornamental landscapes or turf with potable water is prohibited. This includes multipurpose commercial landscapes and City parks and median strips.
- Industry and commercial businesses are required to curtail consumption to maintain adequate supplies of water for health and safety.
- Use of water for dust control, earth compaction, and other outdoor construction activities is prohibited.

- Fire hydrants shall be used only for emergency purposes.
- If there is total well failure, disaster relief from outside the City of Livingston shall be required.

State 6 – Extreme Emergency Shortage

During Stage 6, the water supply shortage is over 50 percent and a 60 percent or greater reduction in water usage is required for the City to meet the immediate needs of its customers. The City aggressively continues its public information outreach and education programs and asks customers for a 60 percent or greater mandatory water use reduction. All requirements of Stages 1 through 5 remain in effect. Additional requirements include the following:

- Commercial kitchens are required to use pre-rinse spray valves.
- Potable water service will not be provided to new land development projects except under the following circumstances:
    - A valid building permit has been issued for the project, or
    - The project is necessary to protect public health, safety, and welfare, or
    - The applicant provides evidence that the project will include conservation offsets prior to the provision of new water service.
- Additional restrictions may be implemented as determined by the Public Works Director, after notice to customers.

Table 8-4 summarizes the demand reduction actions that will be implemented during each stage of water conservation.

Table 8-4 Demand Reduction Actions (Submittal Table 8-2)

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
1	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	10%	Water waste through inappropriate use, leaks or other wasteful use must be stopped within forty-eight (48) hours' notice by the City.	Yes
1	Landscape - Limit landscape irrigation to specific times	10%	All outdoor irrigation or car washing with potable water is prohibited between the hours of 11am to 8pm, except for drip irrigation.	Yes
1	Landscape - Other landscape restriction or prohibition		No outdoor irrigation is permitted within forty-eight (48) hours of a storm event.	Yes

Table 8-4 Demand Reduction Actions (Submittal Table 8-2)

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
1	Other - Require automatic shut of hoses	10%	Washing of vehicles, building exteriors, sidewalks, driveways, parking areas, tennis courts, patios, or other paved areas without the use of a positive shut-off nozzle on the hose which results in excessive runoff is prohibited.	Yes
1	Other	10%	The use of "slip-n-slides" and other recreational activities requiring a constant flow of water are prohibited.	Yes
2	Landscape - Limit landscape irrigation to specific days	20%	Outdoor landscape watering shall be limited to three times per week on an odd-even basis.	Yes
2	Landscape - Limit landscape irrigation to specific days	20%	Large commercial landscapes and City parks shall have individual watering schedules approved by the Public Works Department.	Yes
2	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	20%	No car washing is allowed on Mondays except for commercial car washes equipped with a recirculating system. Car washing (except commercial car washes) shall be done by using a hand-held bucket or a hand-help hose equipped with a positive self-closing water shut-off nozzle.	Yes
3	Landscape - Limit landscape irrigation to specific days	30%	Outdoor landscape watering shall be limited to two times per week.	Yes
3	Landscape - Limit landscape	30%	Large commercial landscapes and City parks shall also be	Yes

Table 8-4 Demand Reduction Actions (Submittal Table 8-2)

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
	irrigation to specific days		limited to two days per week, as scheduled by the Public Works Department.	
3	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	30%	No car washing is allowed on Mondays, Thursdays and Fridays except for commercial car washes equipped with a recirculating system. Car washing (except commercial car washes) shall be done by using a hand-held bucket or a hand-help hose equipped with a positive self-closing water shut-off nozzle.	Yes
3	Other - Prohibit use of potable water for washing hard surfaces	30%	Application of potable water to driveways and sidewalks is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency.	Yes
3	CII - Restaurants may only serve water upon request	30%	Restaurants shall serve water only upon customer request.	Yes
3	CII - Lodging establishment must offer opt out of linen service	30%	Hotels, motels, and lodges must offer guests the option of not having towels and linens laundered daily by displaying notices prominently in each guestroom.	Yes
3	Reduce System Water Loss	30%	The City will contact its highest water users to encourage use of water conservation methods.	Yes

Table 8-4 Demand Reduction Actions (Submittal Table 8-2)

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
3	Decrease Line Flushing	30%	The City will evaluate its water use for main flushing to see if reductions are possible.	Yes
4	Landscape - Limit landscape irrigation to specific days	40%	Outdoor landscape watering shall be limited to one day per week.	Yes
4	Landscape - Limit landscape irrigation to specific days	40%	Large commercial landscaping and City parks shall be limited to one day per week, as scheduled by the Public Works Department.	Yes
4	Other water feature or swimming pool restriction	40%	Filling newly constructed or drained swimming pools with City water shall be prohibited.	Yes
4	Other - Prohibit use of potable water for construction and dust control	40%	Construction water from City fire hydrants shall be banned.	Yes
4	Water Features - Restrict water use for decorative water features, such as fountains	40%	Further use of decorative fountains or reflection ponds shall be disconnected until further notice.	Yes
4	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	40%	Washing of automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment not occurring upon the immediate premises of commercial car washes and commercial service stations and not in immediate interest of the public health, safety, and welfare is prohibited.	Yes

Table 8-4 Demand Reduction Actions (Submittal Table 8-2)

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
4	Decrease Line Flushing	40%	Main flushing is only done on a sand, odor, or taste complaint basis or due to contamination and public health reasons	Yes
5	Expand Public Information Campaign	50%	Immediately notify appropriate media outlets, and post local road signage notifying the public of the current water use restrictions.	Yes
5	Landscape - Prohibit all landscape irrigation	50%	All outdoor landscape watering shall be prohibited.	Yes
5	CII - Other CII restriction or prohibition	50%	Industry and commercial businesses shall be required to curtail consumption to maintain adequate supplies of water for health and safety.	Yes
5	Other - Prohibit use of potable water for construction and dust control	50%	Use of water for dust control, earth compaction, and other outdoor construction activities is prohibited.	Yes
5	Other	50%	Fire hydrants shall be used only for emergency purposes.	Yes
6	CII - Commercial kitchens required to use pre-rinse spray valves	>50%	Commercial kitchens are required to use pre-rinse spray valves.	Yes
6	Moratorium or Net Zero Demand Increase on New Connections	>50%	Potable water service will not be provided to new land development projects	Yes

8.5.3. Supply Augmentation

Given the City's sufficient groundwater supply, the City does not have any immediate plans to augment supply in response to shortages.

8.5.4. Operational Changes

During shortage conditions, operations may be affected by demand reduction responses. Operational changes to address a short-term water shortage may be implemented based on the severity of the reduction goal. The City will maximize its supply by implementing operational strategies and demand reduction measures.

As part of the Annual Assessment process, the City will consider their operational procedures at the time of a shortage to identify changes that can be implemented to address water shortage on a short-term basis, including but not limited to:

- Expansion of public information campaign to educate and inform customers of the water shortage emergency and required water savings.
- Decrease water main flushing to only on a compliant basis.
- Review water metering devices for accuracy.
- Implement water waste patrols by recruiting staff from other departments, if necessary.
- Implement or modify drought rate structure or surcharge or water emergency tiered pricing, pursuant to the requirements of Proposition 218 and in accordance with California Law.
- Contact the highest water users to encourage use of water conservation methods.
- Monitor construction meters and fire hydrant meters for efficient water use if a meter identified wastes water.

8.5.5. Emergency Response Plan

Water Code Section 10632(c) requires development of an Emergency Response Plan (ERP) documenting actions to be undertaken by a water supplier to prepare for and implement during a catastrophic interruption of water supplies. A catastrophic event that constitutes a proclamation of a water shortage would be any event, either natural or manmade, that causes a severe shortage of water. Water shortages may result from variations in weather, natural disasters, or unanticipated situations (i.e. systems failures, acts of terror).

The City has included emergency conditions as a triggering action for advancement to a subsequent shortage level. A catastrophic interruption could be considered an emergency condition. In 2013, the City implemented an Emergency Response Plan (ERP) for the water system, and the Plan was subsequently updated in 2000. The purpose of the ERP is to prepare for an interruption in the drinking water supply and potential consequences to water system's integrity and public health. The ERP contains procedures for the distribution of potable water in a disaster and are consistent with guidelines prepared by the California State Office of Emergency Services. During the preparation of this 2020 UWMP, the City was in the process of preparing an update to their ERP.

8.5.6. Seismic Risk Assessment and Mitigation Plan

Section 10632.5.(a)

In addition to the requirements of paragraph (3) of subdivision (a) of Section 10632, beginning January 1, 2020, the plan shall include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities.

(b) An urban water supplier shall update the seismic risk assessment and mitigation plan when updating its urban water management plan as required by Section 10621.

(c) An urban water supplier may comply with this section by submitting, pursuant to Section 10644, a copy of the most recent adopted local hazard mitigation plan or multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multihazard mitigation plan addresses seismic risk.

The City's water system infrastructure, including the groundwater wells, pump stations, storage tanks, and pipelines, could be damaged during a strong earthquake. Although the City is not located within a highly active seismic zone, some facilities could be damaged as the result of an earthquake up to a magnitude of 6.0 on the Richter scale. The City has planned for this potential by constructing redundancy into its water system. The City's use of groundwater as its primary water source creates redundancy to limit dependence of a geographic area on a single water supply source (i.e., areas are served by multiple groundwater wells). In the event of a regional power outage, the groundwater wells would be powered using emergency generators. The City maintains redundant power supplies for each of its well sites through the use of emergency power generators.

In the event of an earthquake, the City may experience a regional power outage and the water distribution system may suffer breaks at multiple locations. The City's distribution system contains valves to isolate portions of the distribution system in the event of water main breaks. During declared emergency, or when a shortage declaration appears imminent, the Public Works Department and Utilities Division will implement emergency actions. Table 8-5 report the emergency actions that will be implemented during a water supply catastrophe.

Table 8-5 Emergency Actions from Emergency Response Plan

Situation	Steps to be Taken by City
Leak or Service Interruption (Result of earthquake, etc.)	Isolate leak. Turn power or flow off, if necessary, to control leak. Repair or isolate break to allow service to the maximum system population possible. Disinfect as per attached AWWA Standards; increase system disinfectant residual as precaution, until normal service is resumed. Do Bacteriological sampling until 3 good consecutive samples are confirmed. Reestablish normal service.
Low Pressure (Result of earthquake, fire, storm, etc.)	Increase production, if possible, to provide maximum system output. Increase disinfectant residual as precaution to potential contamination.

Power Outage	Generator will automatically go on line to provide Increase disinfectant residual as precaution to potential contamination.

8.5.7. Shortage Response Action Effectiveness

As previously stated throughout this UWMP, all of the City water supply sources and customer connections are metered. These meters record the amount of water consumed at each location. Customer consumption totals are tallied on a monthly basis for billing purposes. The City's billing staff will inform the Public Works Director of any increase in water consumed or decrease in water supplies. The Public Works Director will then make recommendations to the City Manager and City Council on whether to change the water shortage stage and will provide supporting reports of consumption or supply as required.

Under normal water supply conditions, water supply and consumption figures are reported, at minimum, monthly. From this information, month-to-month and year-to-year statistics can be calculated to track water use and subsequent increases or reductions in consumption levels. This data allows the City to determine the effectiveness of the implemented shortage response actions. If reduction goals are not being met, the Public Works Director will make the necessary decisions for corrective actions to be taken.

During water shortages, savings are measured in comparison to what is considered to be normal year demand or in reference to a specific base year as may be dictated by Statewide requirements. Estimates of the effectiveness for actions has been included in Table 8-4. It is assumed that each water supply shortage addressed in each stage can be met by quantifiable measures and the remainder of shortage can be addressed by unquantifiable measures or operational changes. It is expected that response action effectiveness is also a result of successful communication and outreach efforts made by the City.

8.6. Communication Protocols

Section 10632 (a)(5)

Communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding, at a minimum, all of the following:

(A) Any current or predicted shortages as determined by the annual water supply and demand assessment described pursuant to Section 10632.1.

(B) Any shortage response actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1.

(C) Any other relevant communications

Communications regarding water shortage and conservation efforts will be sent to individual customers and will be available through media and the City's website. When conservation measures are needed, the City will create a bill insert with conservation information, post additional conservation information on its website and host informational sessions to inform the public of water shortage and conservation efforts. The insert, online campaign, and informational sessions will focus on providing examples of ways consumers can reduce their water usage and optional programs they can take part in such as home reuse

of greywater, maintenance of leaks, and high efficiency fixture installation. Additional information will be provided on water usage reduction and any water shortage surcharge that may be implemented.

When a water shortage stage is enacted or changed, a notice will be mailed to customers and posted on the City's website. Additionally, a notice may be published in a newspaper of general circulation. The declaration of any stage beyond State 1 will be reported to the City Council at its next regular meeting. Based on the severity of the shortage, the City may also advertise on the local radio, hang door tags, or send additional mail notifications to all its customers.

8.7. Compliance and Enforcement

CWC Section 10632 (a)(6)

For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption procedures for triggered shortage response actions as determined pursuant to Section 10632.2.

The Public Works Director authorized to implement water conservation measures and enact a water shortage stage. The Public Works Director is also authorized to make minor or limited exceptions to prevent undue hardships or unreasonable restrictions, provided that water shall not be wasted or used unreasonable and the purpose of the WSCP can be accomplished.

Per California Code of Regulations (CCR) Title 23, Section 864, the taking of any action prohibited in the City's WSCP, is an infraction, punishable by a fine of up to five hundred dollars ($500.00) for each day in which the violation occurs. Consistent with Section 864, violators will be assessed fines, after an initial warning, in accordance with the following schedule:

- Warning for the first violation
- A $100 for the second violation
- A $200 for the third violation
- A $500 for the fourth violation and any other violation within a 12-month period.

8.8. Legal Authorities

CWC Section 10632 (a)(7)

(A) A description of the legal authorities that empower the urban water supplier to implement and enforce its shortage response actions specified in paragraph (4) that may include, but are not limited to, statutory authorities, ordinances, resolutions, and contract provisions.

(B) A statement that an urban water supplier shall declare a water shortage emergency in accordance with Chapter 3 (commencing with Section 350) of Division 1. [see below]

(C) A statement that an urban water supplier shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

Water Code Section Division 1, Section 350

Declaration of water shortage emergency condition. The governing body of a distributor of a public water supply, whether publicly or privately owned and including a mutual water company, shall declare a water shortage emergency condition to prevail within the area served by such distributor whenever it

finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.

Implementation of the WSCP and the mandatory water conservation stages shall be determined by the Public Works Director. The Public Works Director is authorized to implement water conservation measures and enact a water shortage stage upon a determination that it is necessary to protect the public welfare and safety.

8.9. Financial Consequences of WSCP Activation

CWC Section 10632(a)(8)

A description of the financial consequences of, and responses for, drought conditions, including, but not limited to, all of the following:

(A) A description of potential revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(B) A description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(C) A description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1. [retail urban suppliers only]

As previously stated, all of the City's water service connections are metered; therefore, the City's water fund operating revenue will be closely tied to water use and significantly impacted by the water conservation measures in the WSCP. With the implementation of the WSCP, expenditures may increase due to an increase in the water consumption reduction methods described in this Chapter and revenue from water bills may decrease due to the reduction in water use encouraged in the WSCP's stages. To counteract the financial impact of conservation, the City institute an increase in the rate structure so that lower projected water consumption would generate added revenue needed by the City's water fund. Another option would be the use of reserve funds to minimize the need for additional rate increases. A full analysis of the water rates based on the financial conditions at the time water reduction would occur would be presented to the City Council for their approval. Additionally, the City may consider temporarily increasing water rates or delaying capital improvements until the shortage has ended.

8.10. Monitoring and Reporting

CWC Section 10632(a)(9)

For an urban retail water supplier, monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements.

In accordance with CWC Section 10632(a)(9), this section describes the reporting requirements and monitoring procedures required to implement the WSCP and track and evaluate the response actions effectives. As previously stated in Section 8.2, the City intends to track its groundwater production volumes and customer's water demands on an annual basis, and if a supply shortage is projected, the City will implement the appropriate stage of their WSCP, as declared by the Public Works Director. Monitoring

customer water demands will be essential to ensure that the WSCP's response actions are adequately meeting reductions and decreasing the supply/demand gap. This will also help to analyze the effectiveness of the WSCP or identify the need to activate additional response actions or implement a subsequent stage.

Water savings associated with the implementation of the WSCP will be determined based on customer's monthly water metered records which will be compared to meter records from prior months or the same period of the prior year. At first, the customer's cumulative consumption records will be evaluated for reaching target demand reduction levels. If needed, individual customer accounts will be monitored. Weather and other possible influences may be accounted for in the evaluation.

City staff will report the impact of demand reductions actions to the City Council and to the State, if required. The City will also update its customers as to the impact of the actions taken as part of their customer outreach program.

8.11. WSCP Refinement Procedures

CWC Section 10632 (a)(10)

Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed.

This WSCP is best prepared and implemented as an adaptive management plan. The City will use results obtained from their Annual Assessment and monitoring and reporting program described above to evaluate any needs for revisions. The WSCP is used to provide guidance to City staff, the City Council, and the public by identifying response actions to allow for efficient management of any water shortage with predictability and accountability.

To maintain a useful and efficient standard of practice in water shortage conditions, the requirements, criteria, and response actions need to be continually evaluated and improved upon to ensure that its shortage risk tolerance is adequate, and the shortage response actions are effective and up-to-date based on lessons learned from implementing the WSCP's stages. Potential changes to the WSCP that would warrant an update include, but are not limited to, any changes to shortage level triggers, changes to the shortage level structure, and/or changes to the response actions. Any prospective changes to the WSCP would need to be presented at a regular City Council meeting, where City staff would obtain any comments from the public and the City Council. The City Council would then formally approve the updated WSCP through the adoption of a Resolution.

8.12. Special Water Feature Distinction

CWC Section 10632 (b)

For purposes of developing the water shortage contingency plan pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

CWC 10623 (b) now requires that suppliers analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas,

as defined in subdivision (a) of Section 115921 of the Health and Safety Code. Non-pool or non-spa water features may use or be able to use recycled water, whereas pools and spas must use potable water for health and safety considerations, so limitations to pools and spas may require different considerations compared to non-pool or non-spa water features.

For the purposes of the WSCP, water features are not categorized under defined terminology. Pools, spas, recreational ponds, decorative fountains, and the like will all be called out specifically during each stage that requires their decrease or fully terminated use.

8.13. Plan Adoption, Submittal, and Availability

CWC Section 10632 (c)

The urban water supplier shall make available the water shortage contingency plan prepared pursuant to this article to its customers and any city or county within which it provides water supplies no later than 30 days after adoption of the water shortage contingency plan.

The WSCP followed the same development process as the City's 2020 UWMP. The WSCP shall be adopted, submitted, implemented, and amended alongside the City's UWMP. The City had a public review period of the 2020 UWMP, which included the WSCP, from_____, 2022 to _____, 2022. The Final UWMP and WSCP were presented to the City Council for approval on _____, 2022 and were adopted. The Final 2020 UWMP and WSCP were submitted to the California Department of Water Resources on _____, 2022. The City will make the Final 2020 UWMP and WSCP publicly available through the City's website no later than 30 days after it is adopted. The public will also be notified of any amendments to the WSCP which will be made public available once adopted.

CHAPTER 9 - DEMAND MANAGEMENT MEASURES

9.1. Introduction

Demand management measures (DMMs) are specific actions a water supplier takes to support its water conservation efforts. The goal of this Chapter is to provide a comprehensive description of the water conservation programs that the City has implemented, is currently implementing, and plans to implement in order to meet its urban water use reduction targets.

The section of the CWC addressing DMMs was significantly modified in 2014, based on recommendations from the Independent Technical Panel (ITP) to the legislature. The ITP was formed by DWR to provide information and recommendations to DWR and the Legislature on new demand management measures, technologies and approaches to water use efficiency. In its report to the Legislature, the ITP recommended that the UWMP Act should be amended to simplify, clarify, and update the DMM reporting requirements. The ITP recommended, and the legislature enacted, streamlining the retail agency requirements from 14 specific measures to six more general requirements plus an "other" category.

The City realizes the importance of DMMs to ensure a reliable future water supply. The City is committed to implementing water conservation programs to maximize sustainability in meeting future water needs for its customers. The following sections provide a description of the City's DMMs.

9.2. Demand Management Measures for Retail Agencies

CWC Section 10631

(e)Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1)(A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measure that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.

(B) The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:

(i) Water waste prevention ordinances.

(ii) Metering.

(iii) Conservation pricing.

(iv) Public education and outreach.

(v) Programs to assess and manage distribution system real loss.

(vi) Water conservation program coordination and staffing support.

(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day, including innovative measures, if implemented.

The UWMP Act requires a discussion of DMMs, including a description of each of the DMMs currently being implemented/scheduled for implementation, the schedule of implementation for all DMMs, and the methods, if any, the City will use to evaluate the effectiveness of DMMs.

9.2.1. Water Waste Prevention Ordinance

This DMM consists of adopting and enforcing a water waste ordinance that explicitly states that the waste of water is to be prohibited. On May 5, 2015, the City adopted Ordinance No 623 which established Title Nine (9), Chapter Five (5), Section 71 of the Livingston Municipal Code. The purpose of the Ordinance is to minimize water waste and reduce unnecessary consumption of the City's potable water supply. Per the Ordinance, water waste through inappropriate use, leaks or other wasteful use must be stopped within forty-eight (48) hours' notice by the city. The Ordinance also states that the City Council can declare what is considered water waste via the adoption of a resolution.

Over the last decade, the City has expanded its public outreach and education on water conservation and has increased enforcement of water waste prohibitions within its service area. Water wasting within the City is prevented by prohibiting runoff from private sprinkler systems onto the City streets, establishing a 48-hour time frame limit to fix leaks or breaks, requiring the use of outdoor hoses with a shut off nozzle and prohibiting the use of "slip-n-slides" and other recreational activities requiring a constant flow of water.

9.2.2. Metering

CWC Section 526

(a) Notwithstanding any other provisions of law, an urban water supplier that, on or after January 1, 2004, receives water from the federal Central Valley Project under a water service contract or subcontract... shall do both of the following:

(1) On or before January 1, 2013, install water meters on all service connections to residential and nonagricultural commercial buildings... located within its service area.

Water Code Section 527

(a) An urban water supplier that is not subject to Section 526 shall do both the following:

(1) Install water meters on all municipal and industrial service connections located within its service area on or before January 1, 2025.

This DMM requires that water meters be installed for all new connections to allow billing by volume of use. This program also applies to retrofitting any existing unmetered connections. Title Nine (9), Chapter Five (5), Section 37 of the Livingston Municipal Code requires that all water delivered by the City to its customers be metered through water meters owned and maintained by the City. Section 9-5-37 of the Livingston Municipal Code goes on to state that the size, type, location and right to own and control all meters installed or used by consumers shall be determined by the Livingston Public Works Department.

As previously stated, all of the City's water service connections are currently metered. According to the Certified Validation Report that was prepared for the 2019 Water Audit, approximatley 3 percent of the meter population consists of manual read meters, while the remaining 97 percent of the population consists of AMRs. The City estimates that all manuals read meters will be converted to AMRs by the end

of 2021. In addition to replacing manual read meters, the City is also focusing on replacing any AMR meter that is 25 years or older.

9.2.3. Conservation Pricing

All of the City's water accounts that are charged for water service are metered, and the City encourages water conservation through its water rate structure. The Livingston City Council approve the current water rates on October 5, 2021, and the rates became effective on November 4, 2021. A copy of the rate structure is provided in Appendix K.

The City charges for water service based on the quantity of water consumed, which encourages water conservation. The City's existing tiered rate structure consists of a (1) monthly fixed base charge based on the size of the customer's meter, (2) a monthly fixed meter fee based on the size of the customer's meter, and (3) and a charge based on the total volume water consumed by the customer during the billing period. For example, a residential customer with a meter size of 1-inch or smaller currently pays a fixed base charge of $28.64 and a fixed meter fee of $3.30. Attached residential units are given a monthly water consumption allowance of 10,000 gallons. Any water consumption in excess of this allowance is then charged a rate of $1.67 per 1,000 gallons of water. The excess consumption amount is added to customer's the monthly bill.

At this time, the City has not considered pursuing a water budget based on conservation pricing. A water budget-based pricing would become much more complex with various rates needed for various size single-family lots, multi-family parcels, different types of commercial businesses and industrial users.

9.2.4. Public Education and Outreach

The City distributes public information regarding water issues in mass mailings to all water service customers, through the City's website, and directly to walk-in customers at City Hal. Also, when warranted, time-critical public information is dispersed through the local print media, radio station announcements, and public events.

Water use regulations and the annual Drinking Water Consumer Confidence Report (water quality report) are mailed each year to all customers. The City takes advantage of these mailings when necessary to provide its customers with additional information on water conservation and other demand management measures. Display cases and bulletin boards at City Hall augment the mailings by providing a permanent posting of the most current mailings.

Additionally, the City's monthly water bill that is distributed to all water service customers is another vehicle used for public education purposes. The bill mailing also contains public service announcements that are used to remind citizens of conservation and demand management measures.

9.2.5. Programs to Assess and Manage Distribution System Real Loss

The City recognizes distribution system leakage can be a primary type of loss. While it is essential to control losses, the initial step is to assemble a water audit to identify the nature and volumes of losses and financial impacts that these losses exert. A water audit is a process of reviewing water use throughout a water system in order to quantify the volume of water not accounted for by the metering system of the water customers, which is typically the difference between metered well production, in the case of the City of Livingston, and metered usage on a system-wide basis.

The Public Works Department surveys and repairs water pipelines on an as-needed basis or at the request of the customer. City staff also review the volume of groundwater produced versus the volume of water sold to customers monthly. This internal review assists the City in identifying problems, such as leaks and meter problems in the system.

9.2.6. Water Conservation Program Coordination and Staffing Support

The City's Public Works Director is the designated Water Conservation Coordinator. In addition, staff supports the coordinator and the water conservation activities of the City and its customers. The Water Conservation Coordinator's responsibilities include:

- Coordination with internal departments and the community at large to promote the principles of responsible water resource stewardship.
- Monitoring the practice and application of DMMs.
- Supervising the activities of the Water Patrol (only if in place).
- Planning and participating in community water conservation education projects.

The Water Conservation Coordinator has authorized use of City funds to support water conservation efforts. The water conservation activities are part of the full-time Public Works Director position, and the City does not track expenditures or time spent associated with water conservation activities separately within the budget for the position.

9.2.7. Other Demand Management Measures

9.2.7.1. Residential Plumbing Retrofit

This program benefits existing customers by reducing their water consumption while minimizing the impact of their lifestyle. State legislation requires the installation of efficient plumbing in new construction, and effective 1994 requires that only Ultra Low Flush Toilets be sold in California.

Several studies suggest that savings resulting from miscellaneous interior retrofit fixtures can range between 25 and 65 gallons per day per housing unit. The studies also suggest that installation of retrofit fixtures in older single-family homes tend to produce more savings, while newer multi-family homes tend to produce less savings per housing unit.

This program is not currently implemented in the City. However, the City will seek funding to offer customers new water savings devices such as faucet aerators, water-saving showerheads and toilet tanks.

9.2.7.2. High-Efficiency Washing Machine Rebate Program

This program generally provides a financial incentive (rebate offer) to qualifying customers who install high efficiency washing machines in their home. Other regional municipalities that performed an economic analysis on this program concluded that it would have a low benefit-to-cost ratio. This program is not currently implemented in the City. However, the City will seek grant funding when available to offer rebate programs to customers.

9.3. Reporting Implementation

9.3.1. Implementation over the Past Five Years

CWC Section 10631

(e) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1)(A) For an urban retail water supplier,…a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years.

The following is a description of the water conservation efforts that City has implemented over the last five years:

I. Ordinance

In 2015, the City adopted Ordinance No 623 which established Title Nine (9), Chapter Five (5), Section 71 of the Livingston Municipal Code. The purpose of the Ordinance is to minimize water waste and reduce unnecessary consumption of the City's potable water supply. Per the Ordinance, water waste through inappropriate use, leaks or other wasteful use must be stopped within forty-eight (48) hours' notice by the city. The Ordinance also states that the City Council can declare what is considered water waste via the adoption of a resolution. The Ordinance is in place at all times and is not dependent of any stages of the City's WSCP or restrictions when there is a water shortage.

II. Metering

As discussed in Section 9.2.2, all of the City's water service connections are currently metered. Approximatley 97 percent of the meter population consists of AMRs, while the remaining 3 percent consist of manual read meter. The City is currently in the process of replacing all remaining manual read meters with new AMR meters, and it is estimated that all manual read meters will be replaced by the end of 2021.

III. Conservation Pricing

As discussed in 9.2.3, the City has not considered pursuing a water budget based on conservation pricing. The tiered water rates have the same allocations for residential, commercial, and industrial. A water budget-based pricing would become much more complex with various rates needed for various size single-family lots, multi-family parcels, different types of commercial businesses and industrial users. Currently, the City's rate structure includes a monthly fixed base charge based on the size of the customer's meter, a monthly fixed meter fee based on the size of the customer's meter, and a charge based on the total volume water consumed by the customer during the billing period (over the allowance of 10,000 gallons per month).

IV. Public Education and Outreach

The programs described above were either expanded or started in the last five years.

V. Water Distribution System Losses

The City's Public Works Department surveys and repairs pipelines on an as-needed basis or at the request of the customer. customer. City staff also review the volume of groundwater produced versus the volume of water sold to customers monthly. This internal review assists the City in identifying problems, such as leaks and meter problems in the system.

VI. Water Conservation Program Coordination and Staffing Support

The City has enlisted the assistance of all staff in any City department that is in the field for purposes of reporting running water or potential waste. These outside working staff are to report such observations to the Public Works Department.

9.3.2. Implementation to Achieve Water Use Targets

CWC Section 10631

(e)(1)(A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measure that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.

Over the last decade, the City has valued and promoted conservation measures and will continue to do so in the future. As a result, the City water use is below target objectives set by the State. Despite meeting their 2020 Target, the City will continue to implement existing conservation programs and DMMS and explore additional programs to avoid substantial increases in demands.

9.4. Water Use Objectives (Future Requirements)

Within the next year, the City plans to begin working with the DWR to develop Water Use Objectives pursuant to AB 1668 and SB 606. Beginning in 2024, water agencies, including the City, are required to begin reporting compliance of their Water Use Objectives consisting of indoor residential water use, outdoor residential water use, commercial, industrial and institutional, irrigation with dedicated meters, water loss, and other unique local uses. The City plans to meet its Water Use Objectives through continued implementation of the water conservation measure and DMMs discussed in this 2020 UWMP.

CHAPTER 10 - PLAN ADOPTION, SUBMITTAL, AND IMPLEMENTATION

10.1. Inclusion of all 2020 Data

This 2020 UWMP includes the water use and planning data for the entire calendar year 2020.

10.2. Notice of Public Hearing

Water suppliers must hold a public hearing prior to adopting the 2020 UWMP. The public hearing provides an opportunity for the public to provide input on the Plan before it is adopted. The Livingston City Council shall consider all public input before the 2020 UWMP is adopted.

10.2.1. Notice to Cities and Counties

CWC Section 10621

(b) Every urban water supplier required to prepare a plan shall…at least 60 days prior to the public hearing on the plan…notify any city or county within which the supplier provides waters supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.

CWC Section 10642

…The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies. Notices by a local public agency pursuant to this section shall be provided pursuant to Chapter 17.5 (commencing with Section 7290) of Division 7 of Title 1 of the Government Code. A privately owned water supplier shall provide an equivalent notice within its service area…

The City of Livingston is the sole water supplier and water management agency for its service area. For this reason, the City did not participate in an area, regional, watershed, or basin wide UWMP. While preparing the 2020 UWMP, however, City coordinated its efforts with relevant agencies to ensure that the data and issues discussed in the UWMP are presented accurately.

The City provided formal written notification to the City of Atwater, City of Merced, County of Merced, Merced County Association of Governments, and Merced Irrigation District that City's 2020 UWMP was being prepared. Copies of the Notification letters are included in Appendix B. Copies of the final UWMP will be provided to these agencies no later than 30 days after its submission to DWR.

10.2.1.1.60-Day Notification

As discussed in Section 2.5, the City coordinated the preparation of this 2020 UWMP with the City of Atwater, City of Merced, County of Merced, Merced County Association of Governments, and Merced Irrigation District. The City notified these agencies, at least sixty (60) days prior to the public hearing, invited them to review and provide comments on the draft 2020 UWMP and WSCP. A copy of the notification letters sent to these agencies is provided in Appendix K.

10.2.1.2. Notice of Public Hearing

Government Code Section 7291

…every local public agency… serving a substantial number of non-English-Speaking people, shall employ a sufficient number of qualified bilingual persons in public contact positions or as interpreters to assist those in such positions, to ensure provision of information and services in the language of the non-English-speaking person."

The City published a notice of the public hearing in the City's local newspaper, _____, on_____, 2022, and _____, 2022. A copy of the publication is provided in Appendix L.

10.2.1.3. Submittal Tables

Table 10-1 summarizes the cities and counties which were provided notifications by the City.

Table 10-1 Notification to Cities and Counties (Submittal Table 10-1)

City Name	60 Day Notice	Notice of Public Hearing
City of Atwater	Yes	Yes
City of Merced	Yes	Yes
County Name	**60 Day Notice**	**Notice of Public Hearing**
Fresno Merced	Yes	Yes

10.2.2. Notice to Public

CWC Section 10642

…Prior to adopting either [the plan or water shortage contingency plan], the urban water supplier shall make both the plan and the water shortage contingency plan available for public inspection and shall hold a public hearing or hearings thereon. Prior to any of these hearings, notice of the time and place of the hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code [see below]. The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies.

Government Code section 6066

Publication of notice pursuant to this section shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. The period of notice commences upon the first day of publication and terminates at the end of the fourteenth day, including therein the first day.

The City encouraged the active involvement of the population within its service area prior to and during the preparation of the UWMP. Pursuant to Section 6066 of the Government Code, the City published a notice of public hearing in the local newspaper during the weeks _____, 2022, and _____, 2022. A notice of public hearing was also posted on the City's website. A copy of the published notice is provided in Appendix L.

10.3. Public Hearing and Adoption

CWC Section 10642

…Prior to adopting either, the [plan or water shortage contingency plan], the urban water supplier shall make both the plan and the water shortage contingency plan available for public inspection and shall hold a public hearing or hearings thereon.

Water Code Section 10608.26

(a) In complying with this part, an urban retail water supplier shall conduct at least one public hearing to accomplish all of the following:

(1) Allow community input regarding the urban retail water supplier's implementation plan for complying with this part.

(2) Consider the economic impacts of the urban retail water supplier's implementation plan for complying with this part.

(3) Adopt a method, pursuant to subdivision (b) of Section 10608.20 for determining its urban water use target.

Pursuant to the requirements of the UWMPA, this section summarizes the adoption, submittal, and implementation of City's 2020 UWMP.

10.3.1. Public Hearing

Prior to adopting the draft 2020 UMWP and the WSCP, the City held a public hearing on _____, 2022, which included input from the community regarding the City's draft 2020 UWMP and WSCP.

10.3.2. Adoption

CWC Section 10642

…After the hearing or hearings, the plan or water shortage contingency plan shall be adopted as prepared or as modified after the hearing or hearings.

Following the public hearing, the City adopted both the draft 2020 UWMP and draft 2020 WSCP (included in Chapter 8 of the UWMP). A copy of the resolution adopting the 2020 UWMP and the 2020 WSCP is provided in Appendix M.

10.4. Plan Submittal

CWC Section 10621

(e) Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021…

Water Code Section 10644

(a)(1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption.

Water Code Section 10635

(c) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

The City's submittal process for its 2020 UWMP is discussed below.

10.4.1. Submitting a UWMP and Water Shortage Contingency Plan to DWR

The Livingston City Council adopted the 2020 UWMP on _____, 2022, and within 30 days of adoption, the City submitted the adopted 2020 UWMP (including the WSCP) to DWR. The 2020 UWMP was submitted through DWR's "Water Use Efficiency (WUE) Data Portal" website.

The DWR developed a checklist which was used by the City to assist DWR with its determination that the City's 2020 UWMP has addressed the requirements of the CWC. The City has completed the DWR checklist by indicating where the required CWC elements can be found within the City's 2020 UWMP, and it is included in Appendix N.

10.4.2. Electronic Data Submittal

Section 10644 (a)(2)

The plan, or amendments to the plan, submitted to the department … shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.

Within 30 days of adoption of the 2020 Plan, the City submitted all data tables associated with the 2020 UWMP through DWR's "Water Use Efficiency Data Portal" website.

10.4.3. Submitting UWMP, including WSCP, to the Cities and Counties

Within 30 days of adoption of the 2020 UWMP by the City Council, a copy (CD or hardcopy) of the 2020 UWMP was submitted to the State of California Library. A copy of the letter to the State Library will be maintained in the City's file. The 2020 UWMP will be mailed to the following address if sent by regular mail:

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

10.4.4. Submitting UWMP to the Cities and Counties

Within 30 days of adoption of the 2020 UWMP by the City Council, a copy of the 2020 was submitted to the Central California Irrigation District, Merced Irrigation District, City of Gustine, City of Patterson, City of Turlock, Stanislaus County, and Merced County.

10.5. Public Availability

CWC Section 10645

(a) Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

(b) Not later than 30 days after filing a copy of its water shortage contingency plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

Within 30 days after submittal of the 2020 UWMP to the DWR, the City made the final 2020 UWMP (including the WSCP) available for public review at City Hall during normal business hours. In addition, a copy of the final 2020 UWMP will also be posted on the City's website.

10.6. Notification to Public Utilities Commission

CWC Section 10621 (c)

An urban water supplier regulated by the Public Utilities Commission shall include its most recent plan and water shortage contingency plan as part of the supplier's general rate case filings.

The City is not regulated by the California Public Utilities Commission

10.7. Amending an Adopted Plan

Section 10621

(d) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).

Water Code Section 10644

(a)(1) Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

The City's amendment process for the 2020 UWMP and WSCP is discussed below.

10.7.1. Amending a UWMP

If major changes are made to this 2020 UWMP, the amended UWMP will undergo adoption by the City Council. Within 30 days of adoption, the amended Plan will then be submitted to DWR, the State of California Library, and Stanislaus County.

10.7.2. Amending a Water Shortage Contingency Plan

Section 10644 (b)

If an urban water supplier revises its water shortage contingency plan, the supplier shall submit to the department a copy of its water shortage contingency plan prepared…no later than 30 days after adoption, in accordance with protocols for submission and using electronic reporting tools developed by the department.

If the City amends the adopted 2020 UWMP (including the WSCP), the amended UWMP (and WSCP) will undergo adoption by the City Council. Within 30 days of adoption, the amended Plan will then be submitted to DWR, the State of California Library, and Stanislaus County.

APPENDIX A
LEGISLATIVE REQUIREMENTS

WATER CODE - WAT

DIVISION 6. CONSERVATION, DEVELOPMENT, AND UTILIZATION OF STATE WATER RESOURCES [10000 - 12999]
(Heading of Division 6 amended by Stats. 1957, Ch. 1932.)

PART 2.55. SUSTAINABLE WATER USE AND DEMAND REDUCTION [10608 - 10609.42] *(Part 2.55 added by Stats.2009, 7th Ex. Sess., Ch. 4, Sec. 1.)*

CHAPTER 1. General Declarations and Policy [10608 - 10608.8] *(Chapter 1 added by Stats. 2009, 7th Ex. Sess., Ch. 4, Sec. 1.)*

10608.

The Legislature finds and declares all of the following:

(a) Water is a public resource that the California Constitution protects against waste and unreasonable use.

(b) Growing population, climate change, and the need to protect and grow California's economy while protecting and restoring our fish and wildlife habitats make it essential that the state manage its water resources as efficiently as possible.

(c) Diverse regional water supply portfolios will increase water supply reliability and reduce dependence on the Delta.

(d) Reduced water use through conservation provides significant energy and environmental benefits, and can help protect water quality, improve stream flows, and reduce greenhouse gas emissions.

(e) The success of state and local water conservation programs to increase efficiency of water use is best determined on the basis of measurable outcomes related to water use or efficiency.

(f) Improvements in technology and management practices offer the potential for increasing water efficiency in California over time, providing an essential water management tool to meet the need for water for urban, agricultural, and environmental uses.

(g) The Governor has called for a 20 percent per capita reduction in urban water use statewide by 2020.

(h) The factors used to formulate water use efficiency targets can vary significantly from location to location based on factors including weather, patterns of urban and suburban development, and past efforts to enhance water use efficiency.

(i) Per capita water use is a valid measure of a water provider's efforts to reduce urban water use within its service area. However, per capita water use is less useful for measuring relative water use efficiency between different water providers. Differences in weather, historical patterns of urban and suburban development, and density of housing in a particular location need to be considered when assessing per capita water use as a measure of efficiency.

(*Added* by Stats. 2009, 7th Ex. Sess., Ch. 4, Sec. 1. (SB 7 7x) Effective February 3, 2010.)

10608.4

It is the intent of the Legislature, by the enactment of this part, to do all of the following:

(a) Require all water suppliers to increase the efficiency of use of this essential resource.

(b) Establish a framework to meet the state targets for urban water conservation identified in this part and called for by the Governor.

(c) Measure increased efficiency of urban water use on a per capita basis.

(d) Establish a method or methods for urban retail water suppliers to determine targets for achieving increased water use efficiency by the year 2020, in accordance with the Governor's goal of a 20-percent reduction.

(e) Establish consistent water use efficiency planning and implementation standards for urban water suppliers and agricultural water suppliers.

(f) Promote urban water conservation standards that are consistent with the California Urban Water Conservation Council's adopted best management practices and the requirements for demand management in Section 10631.

(g) Establish standards that recognize and provide credit to water suppliers that made substantial capital investments in urban water conservation since the drought of the early 1990s.

(h) Recognize and account for the investment of urban retail water suppliers in providing recycled water for beneficial uses.

(i) Require implementation of specified efficient water management practices for agricultural water suppliers.

(j) Support the economic productivity of California's agricultural, commercial, and industrial sectors.

(k) Advance regional water resources management.

(Added by Stats. 2009, 7th Ex. Sess., Ch. 4, Sec. 1. (SB 7 7x) Effective February 3, 2010.)

10608.8

(a) (1) Water use efficiency measures adopted and implemented pursuant to this part or Part 2.8 (commencing with Section 10800) are water conservation measures subject to the protections provided under Section 1011.

(2) Because an urban agency is not required to meet its urban water use target until 2020 pursuant to subdivision (a) of Section 10608.24, an urban retail water supplier's failure to meet those targets shall not establish a violation of law for purposes of any state administrative or judicial proceeding prior to January 1, 2021. Nothing in this paragraph limits the use of data reported to the department or the board in litigation or an administrative proceeding. This paragraph shall become inoperative on January 1, 2021.

(3) To the extent feasible, the department and the board shall provide for the use of water conservation reports required under this part to meet the requirements of Section 1011 for water conservation reporting.

(b) This part does not limit or otherwise affect the application of Chapter 3.5 (commencing with Section 11340), Chapter 4 (commencing with Section 11370), Chapter 4.5 (commencing with Section 11400), and Chapter 5 (commencing with Section 11500) of Part 1 of Division 3 of Title 2 of the Government Code.

(c) This part does not require a reduction in the total water used in the agricultural or urban sectors, because other factors, including, but not limited to, changes in agricultural economics or population growth may have greater effects on water use. This part does not limit the economic productivity of California's agricultural, commercial, or industrial sectors.

(d) The requirements of this part do not apply to an agricultural water supplier that is a party to the Quantification Settlement Agreement, as defined in subdivision (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the Quantification Settlement Agreement remains in effect. After the expiration of the Quantification Settlement Agreement, to the extent conservation water projects implemented as part of the Quantification Settlement Agreement remain in effect, the conserved water created as part of those projects shall be credited against the obligations of the agricultural water supplier pursuant to this part.

(Added by Stats. 2009, 7th Ex. Sess., Ch. 4, Sec. 1. (SB 7 7x) Effective February 3, 2010.)

WATER CODE - WAT

DIVISION 6. CONSERVATION, DEVELOPMENT, AND UTILIZATION OF STATE WATER RESOURCES [10000 - 12999] *(Heading of Division 6 amended by Stats. 1957, Ch. 1932.)*

PART 2.55. SUSTAINABLE WATER USE AND DEMAND REDUCTION [10608 - 10609.42] *(Part 2.55 added by Stats. 2009, 7th Ex. Sess., Ch. 4, Sec. 1.)*

CHAPTER 9. Urban Water Use Objectives and Water Use Reporting [10609 - 10609.38] *(Chapter 9 added by Stats. 2018, Ch. 15, Sec. 7.)*

10609. (a) The Legislature finds and declares that this chapter establishes a method to estimate the aggregate amount of water that would have been delivered the previous year by an urban retail water supplier if all that water had been used efficiently. This estimated aggregate water use is the urban retail water supplier's urban water use objective. The method is based on water use efficiency standards and local service area characteristics for that year. By comparing the amount of water actually used in the previous year with the urban water use objective, local urban water suppliers will be in a better position to help eliminate unnecessary use of water; that is, water used in excess of that needed to accomplish the intended beneficial use.

(b) The Legislature further finds and declares all of the following:

(1) This chapter establishes standards and practices for the following water uses:

(A) Indoor residential use.

(B) Outdoor residential use.

(C) CII water use.

(D) Water losses.

(E) Other unique local uses and situations that can have a material effect on an urban water supplier's total water use.

(2) This chapter further does all of the following:

(A) Establishes a method to calculate each urban water use objective.

(B) Considers recycled water quality in establishing efficient irrigation standards.

(C) Requires the department to provide or otherwise identify data regarding the unique local conditions to support the calculation of an urban water use objective.

(D) Provides for the use of alternative sources of data if alternative sources are shown to be as accurate as, or more accurate than, the data provided by the department.

(E) Requires annual reporting of the previous year's water use with the urban water use objective.

(F) Provides a bonus incentive for the amount of potable recycled water used the previous year when comparing the previous year's water use with the urban water use objective, of up to 10 percent of the urban water use objective.

(3) This chapter requires the department and the board to solicit broad public participation from stakeholders and other interested persons in the development of the standards and the adoption of regulations pursuant to this chapter.

(4) This chapter preserves the Legislature's authority over long-term water use efficiency target setting and ensures appropriate legislative oversight of the implementation of this chapter by doing all of the following:

(A) Requiring the Legislative Analyst to conduct a review of the implementation of this chapter, including compliance with the adopted standards and regulations, accuracy of the data, use of alternate data, and other

issues the Legislative Analyst deems appropriate.

(B) Stating legislative intent that the director of the department and the chairperson of the board appear before the appropriate Senate and Assembly policy committees to report on progress in implementing this chapter.

(C) Providing one-time-only authority to the department and board to adopt water use efficiency standards, except as explicitly provided in this chapter. Authorization to update the standards shall require separate legislation.

(c) It is the intent of the Legislature that the following principles apply to the development and implementation of long-term standards and urban water use objectives:

(1) Local urban retail water suppliers should have primary responsibility for meeting standards-based water use targets, and they shall retain the flexibility to develop their water supply portfolios, design and implement water conservation strategies, educate their customers, and enforce their rules.

(2) Long-term standards and urban water use objectives should advance the state's goals to mitigate and adapt to climate change.

(3) Long-term standards and urban water use objectives should acknowledge the shade, air quality, and heat-island reduction benefits provided to communities by trees through the support of water-efficient irrigation practices that keep trees healthy.

(4) The state should identify opportunities for streamlined reporting, eliminate redundant data submissions, and incentivize open access to data collected by urban and agricultural water suppliers.

(Amended by Stats. 2019, Ch. 497, Sec. 287. (AB 991) Effective January 1, 2020.)

10609.2. (a) The board, in coordination with the department, shall adopt long-term standards for the efficient use of water pursuant to this chapter on or before June 30, 2022.

(b) Standards shall be adopted for all of the following:

(1) Outdoor residential water use.

(2) Outdoor irrigation of landscape areas with dedicated irrigation meters in connection with CII water use.

(3) A volume for water loss.

(c) When adopting the standards under this section, the board shall consider the policies of this chapter and the proposed efficiency standards' effects on local wastewater management, developed and natural parklands, and urban tree health. The standards and potential effects shall be identified by May 30, 2022. The board shall allow for public comment on potential effects identified by the board under this subdivision.

(d) The long-term standards shall be set at a level designed so that the water use objectives, together with other demands excluded from the long-term standards such as CII indoor water use and CII outdoor water use not connected to a dedicated landscape meter, would exceed the statewide conservation targets required pursuant to Chapter 3 (commencing with Section 10608.16).

(e) The board, in coordination with the department, shall adopt by regulation variances recommended by the department pursuant to Section 10609.14 and guidelines and methodologies pertaining to the calculation of an urban retail water supplier's urban water use objective recommended by the department pursuant to Section 10609.16.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.4. (a) (1) Until January 1, 2025, the standard for indoor residential water use shall be 55 gallons per capita daily.

(2) Beginning January 1, 2025, and until January 1, 2030, the standard for indoor residential water use shall be the greater of 52.5 gallons per capita daily or a standard recommended pursuant to subdivision (b).

(3) Beginning January 1, 2030, the standard for indoor residential water use shall be the greater of 50 gallons per capita daily or a standard recommended pursuant to subdivision (b).

(b) (1) The department, in coordination with the board, shall conduct necessary studies and investigations and may jointly recommend to the Legislature a standard for indoor residential water use that more appropriately reflects best practices for indoor residential water use than the standard described in subdivision (a). A report on the results of the studies and investigations shall be made to the chairpersons of the relevant policy committees of each house of the Legislature by January 1, 2021, and shall include information necessary to support the recommended standard, if there is one. The studies and investigations shall also include an analysis of the benefits and impacts of how the changing standard for indoor residential water use will impact water and wastewater

management, including potable water usage, wastewater, recycling and reuse systems, infrastructure, operations, and supplies.

(2) The studies, investigations, and report described in paragraph (1) shall include collaboration with, and input from, a broad group of stakeholders, including, but not limited to, environmental groups, experts in indoor plumbing, and water, wastewater, and recycled water agencies.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.6. (a) (1) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, standards for outdoor residential use for adoption by the board in accordance with this chapter.

(2) (A) The standards shall incorporate the principles of the model water efficient landscape ordinance adopted by the department pursuant to the Water Conservation in Landscaping Act (Article 10.8 (commencing with Section 65591) of Chapter 3 of Division 1 of Title 7 of the Government Code).

(B) The standards shall apply to irrigable lands.

(C) The standards shall include provisions for swimming pools, spas, and other water features. Ornamental water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, shall be analyzed separately from swimming pools and spas.

(b) The department shall, by January 1, 2021, provide each urban retail water supplier with data regarding the area of residential irrigable lands in a manner that can reasonably be applied to the standards adopted pursuant to this section.

(c) The department shall not recommend standards pursuant to this section until it has conducted pilot projects or studies, or some combination of the two, to ensure that the data provided to local agencies are reasonably accurate for the data's intended uses, taking into consideration California's diverse landscapes and community characteristics.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.8. (a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, standards for outdoor irrigation of landscape areas with dedicated irrigation meters or other means of calculating outdoor irrigation use in connection with CII water use for adoption by the board in accordance with this chapter.

(b) The standards shall incorporate the principles of the model water efficient landscape ordinance adopted by the department pursuant to the Water Conservation in Landscaping Act (Article 10.8 (commencing with Section 65591) of Chapter 3 of Division 1 of Title 7 of the Government Code).

(c) The standards shall include an exclusion for water for commercial agricultural use meeting the definition of subdivision (b) of Section 51201 of the Government Code.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.9. For purposes of Sections 10609.6 and 10609.8, "principles of the model water efficient landscape ordinance" means those provisions of the model water efficient landscape ordinance applicable to the establishment or determination of the amount of water necessary to efficiently irrigate both new and existing landscapes. These provisions include, but are not limited to, all of the following:

(a) Evapotranspiration adjustment factors, as applicable.

(b) Landscape area.

(c) Maximum applied water allowance.

(d) Reference evapotranspiration.

(e) Special landscape areas, including provisions governing evapotranspiration adjustment factors for different types of water used for irrigating the landscape.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.10. (a) The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, performance measures for CII water use for adoption by the board in accordance with this chapter.

(b) Prior to recommending performance measures for CII water use, the department shall solicit broad public participation from stakeholders and other interested persons relating to all of the following:

(1) Recommendations for a CII water use classification system for California that address significant uses of water.

(2) Recommendations for setting minimum size thresholds for converting mixed CII meters to dedicated irrigation meters, and evaluation of, and recommendations for, technologies that could be used in lieu of requiring dedicated irrigation meters.

(3) Recommendations for CII water use best management practices, which may include, but are not limited to, water audits and water management plans for those CII customers that exceed a recommended size, volume of water use, or other threshold.

(c) Recommendations of appropriate performance measures for CII water use shall be consistent with the October 21, 2013, report to the Legislature by the Commercial, Industrial, and Institutional Task Force entitled "Water Use Best Management Practices," including the technical and financial feasibility recommendations provided in that report, and shall support the economic productivity of California's commercial, industrial, and institutional sectors.

(d) (1) The board, in coordination with the department, shall adopt performance measures for CII water use on or before June 30, 2022.

(2) Each urban retail water supplier shall implement the performance measures adopted by the board pursuant to paragraph (1).

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.12. The standards for water loss for urban retail water suppliers shall be the standards adopted by the board pursuant to subdivision (i) of Section 10608.34.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.14. (a) The department, in coordination with the board, shall conduct necessary studies and investigations and, no later than October 1, 2021, recommend for adoption by the board in accordance with this chapter appropriate variances for unique uses that can have a material effect on an urban retail water supplier's urban water use objective.

(b) Appropriate variances may include, but are not limited to, allowances for the following:

(1) Significant use of evaporative coolers.

(2) Significant populations of horses and other livestock.

(3) Significant fluctuations in seasonal populations.

(4) Significant landscaped areas irrigated with recycled water having high levels of total dissolved solids.

(5) Significant use of water for soil compaction and dust control.

(6) Significant use of water to supplement ponds and lakes to sustain wildlife.

(7) Significant use of water to irrigate vegetation for fire protection.

(8) Significant use of water for commercial or noncommercial agricultural use.

(c) The department, in recommending variances for adoption by the board, shall also recommend a threshold of significance for each recommended variance.

(d) Before including any specific variance in calculating an urban retail water supplier's water use objective, the urban retail water supplier shall request and receive approval by the board for the inclusion of that variance.

(e) The board shall post on its Internet Web site all of the following:

(1) A list of all urban retail water suppliers with approved variances.

(2) The specific variance or variances approved for each urban retail water supplier.

(3) The data supporting approval of each variance.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.15. To help streamline water data reporting, the department and the board shall do all of the following:

(a) Identify urban water reporting requirements shared by both agencies, and post on each agency's Internet Web site how the data is used for planning, regulatory, or other purposes.

(b) Analyze opportunities for more efficient publication of urban water reporting requirements within each agency, and analyze how each agency can integrate various data sets in a publicly accessible location, identify priority actions, and implement priority actions identified in the analysis.

(c) Make appropriate data pertaining to the urban water reporting requirements that are collected by either agency available to the public according to the principles and requirements of the Open and Transparent Water Data Act (Part 4.9 (commencing with Section 12400)).

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.16. The department, in coordination with the board, shall conduct necessary studies and investigations and recommend, no later than October 1, 2021, guidelines and methodologies for the board to adopt that identify how an urban retail water supplier calculates its urban water use objective. The guidelines and methodologies shall address, as necessary, all of the following:

(a) Determining the irrigable lands within the urban retail water supplier's service area.

(b) Updating and revising methodologies described pursuant to subparagraph (A) of paragraph (1) of subdivision (h) of Section 10608.20, as appropriate, including methodologies for calculating the population in an urban retail water supplier's service area.

(c) Using landscape area data provided by the department or alternative data.

(d) Incorporating precipitation data and climate data into estimates of a urban retail water supplier's outdoor irrigation budget for its urban water use objective.

(e) Estimating changes in outdoor landscape area and population, and calculating the urban water use objective, for years when updated landscape imagery is not available from the department.

(f) Determining acceptable levels of accuracy for the supporting data, the urban water use objective, and compliance with the urban water use objective.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.18. The department and the board shall solicit broad public participation from stakeholders and other interested persons in the development of the standards and the adoption of regulations pursuant to this chapter. The board shall hold at least one public meeting before taking any action on any standard or variance recommended by the department.

(Added by Stats. 2018, Ch. 15, Sec. 7. (AB 1668) Effective January 1, 2019.)

10609.20. (a) Each urban retail water supplier shall calculate its urban water use objective no later than January 1, 2024, and by January 1 every year thereafter.

(b) The calculation shall be based on the urban retail water supplier's water use conditions for the previous calendar or fiscal year.

(c) Each urban water supplier's urban water use objective shall be composed of the sum of the following:

(1) Aggregate estimated efficient indoor residential water use.

(2) Aggregate estimated efficient outdoor residential water use.

(3) Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.

(4) Aggregate estimated efficient water losses.

(5) Aggregate estimated water use in accordance with variances, as appropriate.

(d) (1) An urban retail water supplier that delivers water from a groundwater basin, reservoir, or other source that is augmented by potable reuse water may adjust its urban water use objective by a bonus incentive calculated pursuant to this subdivision.

(2) The water use objective bonus incentive shall be the volume of its potable reuse delivered to residential water users and to landscape areas with dedicated irrigation meters in connection with CII water use, on an acre-foot basis.

(3) The bonus incentive pursuant to paragraph (1) shall be limited in accordance with one of the following:

(A) The bonus incentive shall not exceed 15 percent of the urban water supplier's water use objective for any potable reuse water produced at an existing facility.

(B) The bonus incentive shall not exceed 10 percent of the urban water supplier's water use objective for any potable reuse water produced at any facility that is not an existing facility.

(4) For purposes of this subdivision, "existing facility" means a facility that meets all of the following:

(A) The facility has a certified environmental impact report, mitigated negative declaration, or negative declaration on or before January 1, 2019.

(B) The facility begins producing and delivering potable reuse water on or before January 1, 2022.

(C) The facility uses microfiltration and reverse osmosis technologies to produce the potable reuse water.

(e) (1) The calculation of the urban water use objective shall be made using landscape area and other data provided by the department and pursuant to the standards, guidelines, and methodologies adopted by the board. The department shall provide data to the urban water supplier at a level of detail sufficient to allow the urban water supplier to verify its accuracy at the parcel level.

(2) Notwithstanding paragraph (1), an urban retail water supplier may use alternative data in calculating the urban water use objective if the supplier demonstrates to the department that the alternative data are equivalent, or superior, in quality and accuracy to the data provided by the department. The department may provide technical assistance to an urban retail water supplier in evaluating whether the alternative data are appropriate for use in calculating the supplier's urban water use objective.

(Amended by Stats. 2019, Ch. 239, Sec. 2. (AB 1414) Effective January 1, 2020.)

10609.21. (a) For purposes of Section 10609.20, and notwithstanding paragraph (4) of subdivision (d) of Section 10609.20, "existing facility" also includes the North City Project, phase one of the Pure Water San Diego Program, for which an environmental impact report was certified on April 10, 2018.

(b) This section shall become operative on January 1, 2019.

(Added by Stats. 2018, Ch. 453, Sec. 4. (SB 875) Effective September 17, 2018. Section operative January 1, 2019, by its own provisions.)

10609.22. (a) An urban retail water supplier shall calculate its actual urban water use no later than January 1, 2024, and by January 1 every year thereafter.

(b) The calculation shall be based on the urban retail water supplier's water use for the previous calendar or fiscal year.

(c) Each urban water supplier's urban water use shall be composed of the sum of the following:

(1) Aggregate residential water use.

(2) Aggregate outdoor irrigation of landscape areas with dedicated irrigation meters in connection with CII water use.

(3) Aggregate water losses.

(Amended by Stats. 2019, Ch. 239, Sec. 3. (AB 1414) Effective January 1, 2020.)

10609.24. (a) An urban retail water supplier shall submit a report to the department no later than January 1, 2024, and by January 1 every year thereafter. The report shall include all of the following:

(1) The urban water use objective calculated pursuant to Section 10609.20 along with relevant supporting data.

(2) The actual urban water use calculated pursuant to Section 10609.22 along with relevant supporting data.

(3) Documentation of the implementation of the performance measures for CII water use.

(4) A description of the progress made towards meeting the urban water use objective.

(5) The validated water loss audit report conducted pursuant to Section 10608.34.

(b) The department shall post the reports and information on its internet website.

(c) The board may issue an information order or conservation order to, or impose civil liability on, an entity or individual for failure to submit a report required by this section.

(Amended by Stats. 2019, Ch. 239, Sec. 4. (AB 1414) Effective January 1, 2020.)

10609.25. As part of the first report submitted to the department by an urban retail water supplier no later than January 1, 2024, pursuant to subdivision (a) of Section 10609.24, each urban retail water supplier shall provide a

narrative that describes the water demand management measures that the supplier plans to implement to achieve its urban water use objective by January 1, 2027.

(Added by Stats. 2019, Ch. 239, Sec. 5. (AB 1414) Effective January 1, 2020.)

10609.26. (a) (1) On and after January 1, 2024, the board may issue informational orders pertaining to water production, water use, and water conservation to an urban retail water supplier that does not meet its urban water use objective required by this chapter. Informational orders are intended to obtain information on supplier activities, water production, and conservation efforts in order to identify technical assistance needs and assist urban water suppliers in meeting their urban water use objectives.

(2) In determining whether to issue an informational order, the board shall consider the degree to which the urban retail water supplier is not meeting its urban water use objective, information provided in the report required by Section 10609.24, and actions the urban retail water supplier has implemented or will implement in order to help meet the urban water use objective.

(3) The board shall share information received pursuant to this subdivision with the department.

(4) An urban water supplier may request technical assistance from the department. The technical assistance may, to the extent available, include guidance documents, tools, and data.

(b) On and after January 1, 2025, the board may issue a written notice to an urban retail water supplier that does not meet its urban water use objective required by this chapter. The written notice may warn the urban retail water supplier that it is not meeting its urban water use objective described in Section 10609.20 and is not making adequate progress in meeting the urban water use objective, and may request that the urban retail water supplier address areas of concern in its next annual report required by Section 10609.24. In deciding whether to issue a written notice, the board may consider whether the urban retail water supplier has received an informational order, the degree to which the urban retail water supplier is not meeting its urban water use objective, information provided in the report required by Section 10609.24, and actions the urban retail water supplier has implemented or will implement in order to help meet its urban water use objective.

(c) (1) On and after January 1, 2026, the board may issue a conservation order to an urban retail water supplier that does not meet its urban water use objective. A conservation order may consist of, but is not limited to, referral to the department for technical assistance, requirements for education and outreach, requirements for local enforcement, and other efforts to assist urban retail water suppliers in meeting their urban water use objective.

(2) In issuing a conservation order, the board shall identify specific deficiencies in an urban retail water supplier's progress towards meeting its urban water use objective, and identify specific actions to address the deficiencies.

(3) The board may request that the department provide an urban retail water supplier with technical assistance to support the urban retail water supplier's actions to remedy the deficiencies.

(d) A conservation order issued in accordance with this chapter may include requiring actions intended to increase water-use efficiency, but shall not curtail or otherwise limit the exercise of a water right, nor shall it require the imposition of civil liability pursuant to Section 377.

(Amended by Stats. 2019, Ch. 239, Sec. 6. (AB 1414) Effective January 1, 2020.)

10609.27. Notwithstanding Section 10609.26, the board shall not issue an information order, written notice, or conservation order pursuant to Section 10609.26 if both of the following conditions are met:

(a) The board determines that the urban retail water supplier is not meeting its urban water use objective solely because the volume of water loss exceeds the urban retail water supplier's standard for water loss.

(b) Pursuant to Section 10608.34, the board is taking enforcement action against the urban retail water supplier for not meeting the performance standards for the volume of water losses.

(Added by Stats. 2019, Ch. 203, Sec. 1. (SB 134) Effective January 1, 2020.)

10609.28. The board may issue a regulation or informational order requiring a wholesale water supplier, an urban retail water supplier, or a distributor of a public water supply, as that term is used in Section 350, to provide a monthly report relating to water production, water use, or water conservation.

(Added by Stats. 2018, Ch. 14, Sec. 12. (SB 606) Effective January 1, 2019.)

10609.30. On or before January 10, 2024, the Legislative Analyst shall provide to the appropriate policy committees of both houses of the Legislature and the public a report evaluating the implementation of the water use efficiency

standards and water use reporting pursuant to this chapter. The board and the department shall provide the Legislative Analyst with the available data to complete this report.

(a) The report shall describe all of the following:

(1) The rate at which urban retail water users are complying with the standards, and factors that might facilitate or impede their compliance.

(2) The accuracy of the data and estimates being used to calculate urban water use objectives.

(3) Indications of the economic impacts, if any, of the implementation of this chapter on urban water suppliers and urban water users, including CII water users.

(4) The frequency of use of the bonus incentive, the volume of water associated with the bonus incentive, value to urban water suppliers of the bonus incentive, and any implications of the use of the bonus incentive on water use efficiency.

(5) The early indications of how implementing this chapter might impact the efficiency of statewide urban water use.

(6) Recommendations, if any, for improving statewide urban water use efficiency and the standards and practices described in this chapter.

(7) Any other issues the Legislative Analyst deems appropriate.

(Added by Stats. 2018, Ch. 14, Sec. 13. (SB 606) Effective January 1, 2019.)

10609.32. It is the intent of the Legislature that the chairperson of the board and the director of the department appear before the appropriate policy committees of both houses of the Legislature on or around January 1, 2026, and report on the implementation of the water use efficiency standards and water use reporting pursuant to this chapter. It is the intent of the Legislature that the topics to be covered include all of the following:

(a) The rate at which urban retail water suppliers are complying with the standards, and factors that might facilitate or impede their compliance.

(b) What enforcement actions have been taken, if any.

(c) The accuracy of the data and estimates being used to calculate urban water use objectives.

(d) Indications of the economic impacts, if any, of the implementation of this chapter on urban water suppliers and urban water users, including CII water users.

(e) The frequency of use of the bonus incentive, the volume of water associated with the bonus incentive, value to urban water suppliers of the bonus incentive, and any implications of the use of the bonus incentive on water use efficiency.

(f) An assessment of how implementing this chapter is affecting the efficiency of statewide urban water use.

(Added by Stats. 2018, Ch. 14, Sec. 14. (SB 606) Effective January 1, 2019.)

10609.34. Notwithstanding Section 15300.2 of Title 14 of the California Code of Regulations, an action of the board taken under this chapter shall be deemed to be a Class 8 action, within the meaning of Section 15308 of Title 14 of the California Code of Regulations, provided that the action does not involve relaxation of existing water conservation or water use standards.

(Added by Stats. 2018, Ch. 14, Sec. 15. (SB 606) Effective January 1, 2019.)

10609.36. (a) Nothing in this chapter shall be construed to determine or alter water rights. Sections 1010 and 1011 apply to water conserved through implementation of this chapter.

(b) Nothing in this chapter shall be construed to authorize the board to update or revise water use efficiency standards authorized by this chapter except as explicitly provided in this chapter. Authorization to update the standards beyond that explicitly provided in this chapter shall require separate legislation.

(c) Nothing in this chapter shall be construed to limit or otherwise affect the use of recycled water as seawater barriers for groundwater salinity management.

(Added by Stats. 2018, Ch. 14, Sec. 16. (SB 606) Effective January 1, 2019.)

10609.38. The board may waive the requirements of this chapter for a period of up to five years for any urban retail water supplier whose water deliveries are significantly affected by changes in water use as a result of damage from a disaster such as an earthquake or fire. In establishing the period of a waiver, the board shall take into

consideration the breadth of the damage and the time necessary for the damaged areas to recover from the disaster.

(Added by Stats. 2018, Ch. 14, Sec. 17. (SB 606) Effective January 1, 2019.)

DIVISION 6. CONSERVATION, DEVELOPMENT, AND UTILIZATION OF STATE WATER RESOURCES [10000 - 12999]
(Heading of Division 6 amended by Stats. 1957, Ch. 1932.)

PART 2.6. URBAN WATER MANAGEMENT PLANNING [10610 - 10657] *(Part 2.6 added by Stats. 1983, Ch. 1009, Sec..)*

CHAPTER 1. General Declaration and Policy [10610 - 10610.4] ***(Chapter 1 added by Stats. 1983, Ch. 1009, Alec. 1.)***

10610 This part shall be known and may be cited as the "Urban Water Management Planning Act."
(Added by Stats. 1983, Ch. 1009, Sec. 1.)

10610.2. (a) The Legislature finds and declares all of the following:

(1) The waters of the state are a limited and renewable resource subject to ever-increasing demands.

(2) The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level.

(3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate, and increasing long-term water conservation among Californians, improving water use efficiency within the state's communities and agricultural production, and strengthening local and regional drought planning are critical to California's resilience to drought and climate change.

(4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years now and into the foreseeable future, and every urban water supplier should collaborate closely with local land-use authorities to ensure water demand forecasts are consistent with current land-use planning.

(5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.

(6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require specific water quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.

(7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.

(8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.

(9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.

(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

(Amended by Stats. 201B, Ch. 14, Sec. 18. (SB 606) Effective January 1, 201 9.)

10610.4 The Legislature finds and declares that it is the policy of the state as follows:

(a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.

CHAPTER 2. Definitions [10611 - 1 0618] ***(Chapter 2 added by Stats. 1983, Ch. 1009, iec. 1.)***

10611. Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

(Added by Stats. 1983, Ch. 1009, Sec. 1.)

10611.3 "Customer" means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

Added by renumbering Section 10612 by Stats. 2018, Ch. 14, Sec. 20. (SB 606) Effective January 1, 2019.)

10611.5 "Demand management" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies.

(Amended by Stats. 1995, Ch. 854, Sec. 3. Effective January 1, 1996.)

10612 "Drought risk assessment" means a method that examines water shortage risks based on the driest five- year historic sequence for the agency's water supply, as described in subdivision (b) of Section 10635.

(Added by Stats. 2018, Ch. 14, Sec. 21. (SB 606) Effective January 1, 201 9.)

10613. "Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

(Added by :3tats. 1983, Ch. 1009, Exec. 1.)

10614. "Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.

(Added by Stats. 1983, Ch. 1009, Sec. 1.)

10615. "Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.

(Amended by Stats. 1995, *Ch. 854, Sec. 4. Effective January 1, 1996.)*

10616. "Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.

(Added by Stats. 1983, Ch. 1009, Sec. 1.)

10616.5 "Recycled water" means the reclamation and reuse of wastewater for beneficial use.

(Added by Stats. 1995, Ch. 854, Sec. 5. Effective January 1, 1996)

10617. "Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water

supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

(Amended by Stats. 1996, *Ch. 1023, Sec. 428. Effective January 29, 1996.)*

10617.5. "Water shortage contingency plan" means a document that incorporates the provisions detailed in subdivision (a) of Section 10632 and is subsequently adopted by an urban water supplier pursuant to this article.

(Added by Stats. 2018, Ch. 14, Sec. 22. (SB 606) Effective January 1, 2019)

10618 "Water supply and demand assessment" means a method that looks at current year and one or more dry year supplies and demands for determining water shortage risks, as described in Section 10632.1.

(Added by Stats. 2018, Ch. 14, Sec. 23 (SB 606). Effective January 1, 2019)

CHAPTER 3. Urban Water Management Plans [10620 - 10645] *(Chapter 3 added by* Stabs. *1983, Ch. 1009, Sec. 1.)*

ARTICLE 1. General Provisions [10620 - 1 0621] *(Article 1 added by Stats. 1 983, Ch. 1009, Sec. 1.)*

10620. (a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).

(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.

(c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.

(d) (I) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation, efficient water use, and improved local drought resilience.

(2) Notwithstanding paragraph (1), each urban water supplier shall develop its own water shortage contingency plan, but an urban water supplier may incorporate, collaborate, and otherwise share information with other urban water suppliers or other governing entities participating in an areawide, regional, watershed, or basinwide urban water management plan, an agricultural management plan, or groundwater sustainability plan development.

(3) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.

(e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.

(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

(Amended by Stats. 2018, Ch. 14, Sec. 24. (SB 606) Effective January 1, 2019.)

10621 (a) Each urban water supplier shall update its plan at least once every five years on or before July 1, in years ending in six and one, incorporating updated and new information from the five years preceding each update.

(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.

(c) An urban water supplier regulated by the Public Utilities Commission shall include its most recent plan and water shortage contingency plan as part of the supplier's general rate case filings.

(d) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640)

(e) Each urban water supplier shall update and submit its 2015 plan to the department by July1, 2016

(f) Each urban water supplier shall update and submit its 2020 plan to the department by July 1,2021

(Amended by Stats. 2019, Ch. 239, Sec. 7. (AB 1414) Effective January 1, 2020.)

CHAPTER 3. Urban Water Management Plans [10620 - 10645] ***(Chapter 3 added by Stats. 1983, Ch. 1009, Sec. 1.)***

ARTICLE 2. Contents of Plans [10630 - 1 0634] ***(Article 2 added by Stats. 1 983, Ch. 1009, Sec. 1.)***

10630 It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied, while accounting for impacts from climate change.

(Amended by Stats. 2018, Ch. 14, Sec. 26. (SB 606) Effective January 1, 201 9.)

10630.5 Each plan shall include a simple lay description of how much water the agency has on a reliable basis, how much it needs for the foreseeable future, what the agency's strategy is for meeting its water needs, the challenges facing the agency, and any other information necessary to provide a general understanding of the agency's plan.

(Added by Stats. 2018, Ch. 14, Sec. 27. (SB 606) Effective January 1, 2019.)

10631 A plan shall be adopted in accordance with this chapter that shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other social, economic, and demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available. The description shall include the current and projected land uses within the existing or anticipated service area affecting the supplier's water management planning. Urban water suppliers shall coordinate with local or regional land use authorities to determine the most appropriate land use information, including, where appropriate, land use information obtained from local or regional land use authorities, as developed pursuant to Article 5 (commencing with Section 65300) of Chapter 3 of Division 1 of Title 7 of the Government Code.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a), providing supporting and related information, including all of the following:

(1) A detailed discussion of anticipated supply availability under a normal water year, single dry year, and droughts lasting at least five years, as well as more frequent and severe periods of drought, as described in the drought risk assessment. For each source of water supply, consider any information pertinent to the reliability analysis conducted pursuant to Section 10635, including changes in supply due to climate change.

(2) When multiple sources of water supply are identified, a description of the management of each supply in correlation with the other identified supplies.

(3) For any planned sources of water supply, a description of the measures that are being undertaken to acquire and develop those water supplies.

(4) If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information:

The current version of any groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720), any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management for basins underlying the urban water supplier's service area.

(A) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For a basin that has not been adjudicated, information as to whether the department has identified the basin as a high- or medium-priority basin in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to coordinate with groundwater sustainability agencies or groundwater management agencies listed in subdivision (c) of Section 10723 to maintain or achieve sustainable groundwater conditions in accordance with a groundwater sustainability plan or alternative adopted pursuant to Part 2.74 (commencing with Section 10720).

(B) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(C) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(d) (I) For an urban retail water supplier, quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, based upon information developed pursuant to subdivision (a), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following:

(A) Single-family residential.

(B) Multifamily.

(C) Commercial.

(D) Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(J) Distribution system water loss.

(2) The water use projections shall be in the same five-year increments described in subdivision (a).

(3) (A) The distribution system water loss shall be quantified for each of the five years preceding the plan update, in accordance with rules adopted pursuant to Section 10608.34.

(B) The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association.

(C) In the plan due July 1, 2021, and in each update thereafter, data shall be included to show whether the urban retail water supplier met the distribution loss standards enacted by the board pursuant to Section 10608.34.

(4) (A) Water use projections, where available, shall display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use

plans identified by the urban water supplier, as applicable to the service area.

(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following:

(i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.

(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.

(e) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) (A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measures that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.

(B) For the supplement required of urban retail water suppliers by paragraph (2) of subdivision (f) of Section 10621, a narrative that describes the water demand management measures that the supplier plans to implement to achieve its urban water use objective by January 1, 2027, pursuant to Chapter 9 (commencing with Section 10609) of Part 2.55.

(C) The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:

(i) Water waste prevention ordinances.

(ii) Metering.

(iii) Conservation pricing.

(iv) Public education and outreach.

(v) Programs to assess and manage distribution system real loss.

(vi) Water conservation program coordination and staffing support.

(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day, including innovative measures, if implemented.

(2) For an urban wholesale water supplier, as defined in Section 10608.12, a narrative description of the items in clauses (ii), (iv), (vi), and (vii) of subparagraph (C) of paragraph (1), and a narrative description of its distribution system asset management and wholesale supplier assistance programs.

(f) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use, as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in normal and single-dry water years and for a period of drought lasting five consecutive water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(g) Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.

(h) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (f). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (f).

(Amended by Stats. 2018, Ch. 14, Sec. 28. (SB 606) Effective January 1, 2019.)

10631 1 (a) The water use projections required by Section 10631 shall include projected water use for single- family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.

(b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under Section 65589.7 of the Government Code to grant a priority for the provision of service to housing units affordable to lower income households.

(Added by Stats. 2005, Ch. 727, Sec. 2. Effective January 1, 2006.)

10631.2. (a) In addition to the requirements of Section 10631, an urban water management plan shall include any of the following information that the urban water supplier can readily obtain:

(1) An estimate of the amount of energy used to extract or divert water supplies.

(2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.

(3) An estimate of the amount of energy used to treat water supplies.

(4) An estimate of the amount of energy used to distribute water supplies through its distribution systems.

(5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.

(6) An estimate of the amount of energy used to place water into or withdraw from storage.

(7) Any other energy-related information the urban water supplier deems appropriate.

(b) The department shall include in its guidance for the preparation of urban water management plans a methodology for the voluntary calculation or estimation of the energy intensity of urban water systems. The department may consider studies and calculations conducted by the Public Utilities Commission in developing the methodology.

(c) The Legislature finds and declares that energy use is only one factor in water supply planning and shall not be considered independently of other factors.

(Amended by Stats. 2018, Ch. 14, Sec. 29. *(SB* 606a *Effective January 1, 2019.)*

10632 (a) Every urban water supplier shall prepare and adopt a water shortage contingency plan as part of its urban water management plan that consists of each of the following elements:

(1) The analysis of water supply reliability conducted pursuant to Section 10635.

(2) The procedures used in conducting an annual water supply and demand assessment

that include, at a minimum, both of the following:

(A) The written decision making process that an urban water supplier will use each year to determine its water supply reliability.

(B) The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year, including all of the following:

(i) Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable.

(ii) Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The annual supply and demand assessment may consider more than one dry year solely at the discretion of the urban water supplier.

(iii) Existing infrastructure capabilities and plausible constraints.

(iv) A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment.

(v) A description and quantification of each source of water supply.

(3) (A) Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events.

(B) An urban water supplier with an existing water shortage contingency plan that uses different water shortage levels may comply with the requirement in subparagraph (A) by developing and including a cross-reference relating its existing categories to the six standard water shortage levels.

(4) Shortage response actions that align with the defined shortage levels and include, at a minimum, all of the following:

(A) Locally appropriate supply augmentation actions. Locally appropriate demand reduction actions to adequately respond to shortages.

(B) Locally appropriate operational changes.

(C) Additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions.

(D) For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

(5) Communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding, at a minimum, all of the following:

(A) Any current or predicted shortages as determined by the annual water supply and demand assessment described pursuant to Section 10632.1.

(B) Any shortage response actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1.

(C) Any other relevant communications.

(6) For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption

procedures for triggered shortage response actions as determined pursuant to Section 10632.2.

(7) (A) A description of the legal authorities that empower the urban water supplier to implement and enforce its shortage response actions specified in paragraph (4) that may include, but are not limited to, statutory authorities, ordinances, resolutions, and contract provisions.

(B) A statement that an urban water supplier shall declare a water shortage emergency in accordance with Chapter 3 (commencing with Section 350) of Division 1.

(C) A statement that an urban water supplier shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

(8) A description of the financial consequences of, and responses for, drought conditions, including, but not limited to, all of the following:

(A) A description of potential revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(B) A description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions described in paragraph (4).

(C) A description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1.

(9) For an urban retail water supplier, monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements.

(10) Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed.

(b) For purposes of developing the water shortage contingency plan pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

(c) The urban water supplier shall make available the water shortage contingency plan prepared pursuant to this article to its customers and any city or county within which it provides water supplies no later than 30 days after adoption of the water shortage contingency plan.

(Repealed and added by Stats. 2018, Ch. 14, Sec. 32. (SB 606) Effective January 1, 2019.)

10632.1 An urban water supplier shall conduct an annual water supply and demand assessment pursuant to subdivision (a) of Section 10632 and, on or before June 1 of each year, submit an annual water shortage assessment report to the department with information for anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions consistent with the supplier's water shortage contingency plan. An urban water supplier that relies on imported water from the State Water Project or the Bureau of Reclamation shall submit its annual water supply and demand assessment within 14 days of receiving its final allocations, or by June 1 of each year, whichever is later.

(Added by Stats. 2018, Ch. 14, Sec. 33. (SB 606) Effective January 1, 2019.)

10632.2. An urban water supplier shall follow, where feasible and appropriate, the prescribed procedures and implement determined shortage response actions in its water shortage contingency plan, as identified in subdivision

(a) of Section 10632, or reasonable alternative actions, provided that descriptions of the alternative actions are submitted with the annual water shortage assessment report pursuant to Section

10632.1. Nothing in this section prohibits an urban water supplier from taking actions not specified in its water shortage contingency plan, if needed, without having to formally amend its urban water management plan or water shortage contingency plan.

(Added by Stats. 2018, Ch. 14, Sec. 34. (SB 606) Effective January 1, 2019.)

10632.3 It is the intent of the Legislature that, upon proclamation by the Governor of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions, the board defer to implementation of locally adopted water shortage contingency plans to the extent practicable.

(Added by Stats. 2018, Ch. 14, Sec. 35. (SB 606) Effective January 1, 2019.)

10632.5 (a) In addition to the requirements of paragraph (3) of subdivision (a) of Section 10632, beginning January 1, 2020, the plan shall include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities.

(b) An urban water supplier shall update the seismic risk assessment and mitigation plan when updating its urban water management plan as required by Section 10621.

(c) An urban water supplier may comply with this section by submitting, pursuant to Section 10644, a copy of the most recent adopted local hazard mitigation plan or multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multihazard mitigation plan addresses seismic risk.

(Added by Stats. 2015, Ch. 681, Sec. 1. (SB 664a *Effective January 1, 2OJ* 6.g

10633 The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:

(a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.

(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.

(c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.

(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.

(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.

(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.

(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

(Amended by Stats. 2009, Ch. 534, Sec. 2. (AB 1465) Effective January 1, 2010.)

10634 The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

(Added by Stats. 2001, Ch. 644, Sec. 3. Effective January 1, 2002.)

CHAPTER 3. Urban Water Management Plans [10620 - 10645] ***(Chapter 3 added by* Stabs. *1983, Ch. 1009, Sec. 1.)***

ARTICLE 2.5. Water Service Reliability [10635- 10635.] ***(Article 2.5 added by Stats. 1995, Ch. 854, Sec. 11.)***

10635. (a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the long-term total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and a drought lasting five consecutive water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.

(b) Every urban water supplier shall include, as part of its urban water management plan, a drought risk assessment for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the urban water management plan. The urban water supplier may conduct an interim update or updates to this drought risk assessment within the five-year cycle of its urban water management plan update. The drought risk assessment shall include each of the following:

(1) A description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts five consecutive water years, starting from the year following when the assessment is conducted.

(2) A determination of the reliability of each source of supply under a variety of water shortage conditions. This may include a determination that a particular source of water supply is fully reliable under most, if not all, conditions.

(3) A comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.

(4) Considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.

(c) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.

(d) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(e) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers

(Amended by Stats. 2018, Ch. 14, Sec. 36. (SB 606) Effective January 1, 2019.)

CHAPTER 3. Urban Water Management Plans [10620 - 10645] ***(Chapter 3 added by* Stabs. *1983, Ch. 1009, Sec. 1.)***

ARTICLE 3. Adoption and Implementation of Plans [1 0640 - 10645] ***Article 3 added by Stats. 1983, Ch. 1009, Sec. 1.)***

10640. (a) Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630). The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

(b) Every urban water supplier required to prepare a water shortage contingency plan shall prepare a water shortage contingency plan pursuant to Section 10632. The supplier shall likewise periodically review the water shortage contingency plan as required by paragraph (10) of subdivision (a) of Section 10632 and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

(Amended by Stats. 2018, Ch. 14, Sec. 37. (SB 606a *Effective January 1, 2OJ* 9.g

10641 An urban water supplier required to prepare a plan or a water shortage contingency plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

(Amended by Stats. 2018, Ch. 14, Sec. 38. (SB 606a *Effective January 1, 20J* 9.g

10642. Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of both the plan and the water shortage contingency plan. Prior to adopting either, the urban water supplier shall make both the plan and the water shortage contingency plan available for public inspection and shall hold a public hearing or hearings thereon. Prior to any of these hearings, notice of the time and place of the hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of a hearing to any city or county within which the supplier provides water supplies. Notices by a local public agency pursuant to this section shall be provided pursuant to Chapter 17.5 (commencing with Section 7290) of Division 7 of Title 1 of the Government Code. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing or hearings, the plan or water shortage contingency plan shall be adopted as prepared or as modified after the hearing or hearings.

(Amended by Stats. 2018, Ch. 14, Sec. 39. (SB 606$ *Effective January 1, 70J* 9.g

10643 An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

(Added by Stats. 1983, Ch. 1009, Sec. 1.)

10644 (a) (1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption.Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.

(2) The plan, or amendments to the plan, submitted to the department pursuant to paragraph (1)

shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.

(b) If an urban water supplier revises its water shortage contingency plan, the supplier shall submit to the department a copy of its water shortage contingency plan prepared pursuant to subdivision (a) of Section 10632 no later than 30 days after adoption, in accordance with protocols for submission and using electronic reporting tools developed by the department.

(c) (1) (A) Notwithstanding Section 10231.5 of the Government Code, the department shall prepare and submit to the Legislature, on or before July 1, in the years ending in seven and two, a report summarizing the status of the plans and water shortage contingency plans adopted pursuant to this part. The report prepared by the department shall identify the exemplary elements of the individual plans and water shortage contingency plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan and water shortage contingency plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans and water shortage contingency plans submitted pursuant to this part.

(B) The department shall prepare and submit to the board, on or before September 30 of each year, a report summarizing the submitted water supply and demand assessment results along with appropriate reported water shortage conditions and the regional and statewide analysis of water supply conditions developed by the department. As part of the report, the department shall provide a summary and, as appropriate, urban water supplier specific information regarding various shortage response actions implemented as a result of annual supplier-specific water supply and demand assessments performed pursuant to Section 10632.1.

(C) The department shall submit the report to the Legislature for the 2015 plans by July 1, 2017, and the report to the Legislature for the 2020 plans and water shortage contingency plans by July 1, 2022.

(2) A report to be submitted pursuant to subparagraph (A) of paragraph (1) shall be submitted in compliance with Section 9795 of the Government Code.

(d) The department shall make available to the public the standard the department will use to identify exemplary water demand management measures.

(Amended by Stats. 2018, Ch. 14, Sec. 40. (SB 606) Effective January 1, 2019.)

10645. (a) Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

(b) Not later than 30 days after filing a copy of its water shortage contingency plan with the department, the urban

water supplier and the department shall make the plan available for public review during normal business hours.

(Amended by Stats. 2018, Ch. 14, Sec. 41. (SB 606) Effective January 1, 201 9.)

CHAPTER 4. Miscellaneous Provisions [1 0650 - 10657] ***(Chapter 4 added by :itats. 1 983, Ch. 1009, iec. 1.)***

10650 Any actions or proceedings, other than actions by the board, to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:

(a) An action or proceeding alleging failure to adopt a plan or a water shortage contingency plan shall be commenced within 18 months after that adoption is required by this part.

(b) Any action or proceeding alleging that a plan or water shortage contingency plan, or action taken pursuant to either, does not comply with this part shall be commenced within 90 days after filing of the plan or water shortage contingency plan or an amendment to either pursuant to Section 10644 or the taking of that action.

(Amended by Stats. 2018, Ch. 14, Sec. 42. (SB 606) Effective January 1, 2019.)

10651 In any action or proceeding to attack, review, set aside, void, or annul a plan or a water shortage contingency plan, or an action taken pursuant to either by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.

(Amended by Stats. 2018, Ch. 14, Sec. 43. (SB 606) *Effective January 1, 2019*

10652 The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.

(Amended by Stats. 1995, Ch. 854, Sec. 6. *Effective January 1, 1996.)*

10653 The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the board and the Public Utilities Commission, for the preparation of water management plans, water shortage contingency plans, or conservation plans; provided, that if the board or the Public Utilities Commission requires additional information concerning water conservation, drought response measures, or financial conditions to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan that complies with analogous federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.

(Amended by Stats. 2018, Ch. 14, Sec. 45. (SB 606) *Effective January 1, 2019)*

10654 An urban water supplier may recover in its rates the costs incurred in preparing its urban water management plan, its drought risk assessment, its water supply and demand assessment, and its water shortage contingency plan and implementing the reasonable water conservation measures included in either of the plans.

(Amended by Stats. 2018, Ch. 14, Sec. 44. (SB 606) *Effective January 1, 2019)*

10655 If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.

(Amended by Stats. 1983, Ch. 1009, Sec. 1)

10656 An urban water supplier is not eligible for a water grant or loan awarded or administered by the state unless the urban water supplier complies with this part.

(Amended by Stats. 2018, Ch. 14, Sec. 46. (SB 606) *Effective January 1, 2019)*

10657 The department may adopt regulations regarding the definitions of water, water use, and reporting periods, and may adopt any other regulations deemed necessary or desirable to implement this part. In developing regulations pursuant to this section, the department shall solicit broad public participation from stakeholders and other interested persons.

(Amended by Stats. 2018, Ch. 14, Sec. 47. (SB 606) *Effective January 1, 2019)*

APPENDIX B
NOTICE OF PLAN PREPARATION

City of Livingston
1416 C Street
Livingston, CA 95334

December 14, 2021

City of Atwater
Lori Waterman
City Manager
750 Bellevue Road
Atwater, CA 95301

Subject: 2020 Urban Water Management Plan Update

Dear Ms. Waterman,

Existing State law requires each urban water supplier to prepare and adopt an Urban Water Management Plan (UWMP) at least once every 5 years. The city of Livingston (City) is currently preparing an update to their 2015 UWMP in compliance with the 2020 UWMP Guidebook. The UWMP documents the City's plans to ensure adequate water supplies to meet existing and future demands for water under a range of water supply conditions.

In conformance with California Water Code Section 10621(b), the City is notifying agencies and cities in the area that the City's 2020 UWMP is being renewed and updated. We invite your participation in this process. A draft plan will be made available for public review within the next month. Public hearings will be scheduled sixty (60) days before adoption of the 2020UWMP by the City Council.

Please contact me if you have any questions or would like more information regarding the City's 2020 UWMP update.

Sincerely,

Vanessa Portillo
City of Livingston
Interim City Manager
1416 C Street
Livingston, CA 95334
Office: (209) 394-5550
E-mail: citymanager@livingstoncity.com

City of Livingston
1416 C Street
Livingston, CA 95334

December 14, 2021

Merced Irrigation District
John Sweigard
General Manager
744 West 20th Street
Merced, CA 95340

Subject: 2020 Urban Water Management Plan Update

Dear Mr. Sweigard,

Existing State law requires each urban water supplier to prepare and adopt an Urban Water Management Plan (UWMP) at least once every 5 years. The city of Livingston (City) is currently preparing an update to their 2015 UWMP in compliance with the 2020 UWMP Guidebook. The UWMP documents the City's plans to ensure adequate water supplies to meet existing and future demands for water under a range of water supply conditions.

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Sincerely,

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City of Livingston
Interim City Manager
1416 C Street
Livingston, CA 95334
Office: (209) 394-5550
E-mail: citymanager@livingstoncity.com

City of Livingston
1416 C Street
Livingston, CA 95334

December 14, 2021

County of Merced
Yorel Ackerman
Deputy Director
715 Martin Luther King Jr. Way
Merced, CA 95340

Subject: 2020 Urban Water Management Plan Update

Dear Mr. Ackerman,

Existing State law requires each urban water supplier to prepare and adopt an Urban Water Management Plan (UWMP) at least once every 5 years. The city of Livingston (City) is currently preparing an update to their 2015 UWMP in compliance with the 2020 UWMP Guidebook. The UWMP documents the City's plans to ensure adequate water supplies to meet existing and future demands for water under a range of water supply conditions.

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Please contact me if you have any questions or would like more information regarding the City's 2020 UWMP update.

Sincerely,

Vanessa Portillo
City of Livingston
Interim City Manager
1416 C Street
Livingston, CA 95334
Office: (209) 394-5550
E-mail: citymanager@livingstoncity.com

City of Livingston
1416 C Street
Livingston, CA 95334

December 14, 2021

City of Merced
Ken Elwin
Director of Public Works
1776 Grogan Avenue
Merced, CA 95341

Subject: 2020 Urban Water Management Plan Update

Dear Mr. Elwin,

Existing State law requires each urban water supplier to prepare and adopt an Urban Water Management Plan (UWMP) at least once every 5 years. The city of Livingston (City) is currently preparing an update to their 2015 UWMP in compliance with the 2020 UWMP Guidebook. The UWMP documents the City's plans to ensure adequate water supplies to meet existing and future demands for water under a range of water supply conditions.

In conformance with California Water Code Section 10621(b), the City is notifying agencies and cities in the area that the City's 2020 UWMP is being renewed and updated. We invite your participation in this process. A draft plan will be made available for public review within the next month. Public hearings will be scheduled sixty (60) days before adoption of the 2020UWMP by the City Council.

Please contact me if you have any questions or would like more information regarding the City's 2020 UWMP update.

Sincerely,

Vanessa Portillo
City of Livingston
Interim City Manager
1416 C Street
Livingston, CA 95334
Office: (209) 394-5550
E-mail: citymanager@livingstoncity.com

City of Livingston
1416 C Street
Livingston, CA 95334

December 14, 2021

Merced County Association of Government
Stacie Guzman
Executive Director
368 West 18th Street
Merced, CA 95340

Subject: 2020 Urban Water Management Plan Update

Dear Ms. Guzman,

Existing State law requires each urban water supplier to prepare and adopt an Urban Water Management Plan (UWMP) at least once every 5 years. The city of Livingston (City) is currently preparing an update to their 2015 UWMP in compliance with the 2020 UWMP Guidebook. The UWMP documents the City's plans to ensure adequate water supplies to meet existing and future demands for water under a range of water supply conditions.

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Please contact me if you have any questions or would like more information regarding the City's 2020 UWMP update.

Sincerely,

Vanessa Portillo
City of Livingston
Interim City Manager
1416 C Street
Livingston, CA 95334
Office: (209) 394-5550
E-mail: citymanager@livingstoncity.com

APPENDIX C
SERVICE AREA MAPS

NORTH

SCALE IN FEET

0 1000

WELL #11

WELL #8

WELL #16

WELL #14

WELL #15

WELL #9

WELL #7

WELL #13

WELL #10

WELL #12

1 MG TANK

CRESSEY ROAD

DWIGHT WY

OLIVE AVE

WALNUT AVE

WINTON PKWY

HIGHWAY 99

F ST

ROBIN AVE

HAMMATT AVE

MAIN ST

PEACH AVE

LEGEND

	SYMBOL
8" WATER LINE	
10" WATER LINE	
12" WATER LINE	
16" WATER LINE	
CITY WELL	W
CITY TANK	
AREA WITHIN CITY LIMITS	

City of Livingston

MAP OF WATER SYSTEM FACILITIES

GOUVEIA ENGINEERING, INC.
CONSULTING ENGINEERS
456 Sixth Street • Gustine, California 95322 • Telephone (209) 854-3300

Mar 17, 2014 - 10:50am
V:\COL\city_map\utility_maps\util_base_wtrNF.dwg

APPENDIX D
ANNUAL WATER AUDIT REPORTS

American Water Works Association
California-Nevada Section

CA-NV AWWA Water Loss Technical Assistance Program

Wave 4 Water Audit Level 1 Validation Document

Validator Provided

Audit Information:

Utility: Livingston PWS ID: 2410004

System Type: Potable Audit Period: Calendar 2016

Utility Representation: Tony Avina (Lead Operator), Anthony Chavarria (PW Superintendent)

Validation Date: 9/26/2017 Call Time: 8:30 am Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 55 Data Validity Band (Level): Band III (51-70)

ILI: 2.96 Real Loss: 31.63 (gal/conn/day) Apparent Loss: 47.84 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 3.3%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Drew Blackwell / Larry Lewison (support) Validator Qualifications: Contractor for CA-NV AWWA Water Loss TAP

WSO | CAVANAUGH
Stewardship Through Innovation

American Water Works Association
California-Nevada Section

CA-NV AWWA Water Loss Technical Assistance Program

Wave 4 Water Audit Level 1 Validation Document

Utility Provided

Water System Name: **Water System ID Number:** **Water Audit Period:** Select

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

<<Information to be completed by Utility>>

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Anthony Chavarria	Public Works Director		12.20.18
Executive Name (Print)	Executive Position	Signature	Date

WSO | CAVANAUGH Stewardship Through Innovation

AWWA Free Water Audit Software v5.0

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:	TONY AVINA
Email Address:	tavina@livingstoncity.com
Telephone | Ext.:	1(209)394-8044
Name of City / Utility:	city of livingston
City/Town/Municipality:	Livingston
State / Province:	California (CA)
Country:	USA
Year:	2016 Calendar Year
Audit Preparation Date:	9/1/2017
Volume Reporting Units:	Acre-feet
PWSID / Other ID:	241004

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 livingston (241004)

Reporting Year: 2016 1/2016 - 12/2016

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: ACRE-FEET 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.

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED

					Pcnt:	Value:	
Volume from own sources:	5	6,725.000	acre-ft/yr				acre-ft/yr
Water imported:	n/a	0.000	acre-ft/yr				acre-ft/yr
Water exported:	n/a	0.000	acre-ft/yr				acre-ft/yr

Enter negative % or value for under-registration

Enter positive % or value for over-registration

WATER SUPPLIED: 6,725.000 acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:	
Billed metered:	7	6,435.000	acre-ft/yr			
Billed unmetered:	n/a	0.000	acre-ft/yr			
Unbilled metered:	n/a	0.000	acre-ft/yr			
Unbilled unmetered:		84.063	acre-ft/yr	1.25%		acre-ft/yr

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

AUTHORIZED CONSUMPTION: 6,519.063 acre-ft/yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

205.938 acre-ft/yr

Apparent Losses

				Pcnt:	Value:	
Unauthorized consumption:		16.813	acre-ft/yr	0.25%		acre-ft/yr
Customer metering inaccuracies:	3	0.000	acre-ft/yr			acre-ft/yr
Systematic data handling errors:		16.088	acre-ft/yr	0.25%		acre-ft/yr

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

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

Apparent Losses: 32.900 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 173.038 acre-ft/yr

WATER LOSSES: 205.938 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 290.000 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	7	36.0	miles
Number of active AND inactive service connections:	7	3,100	
Service connection density:		86	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: 5 50.0 psi

COST DATA

Total annual cost of operating water system:	10	$2,215,817	$/Year
Customer retail unit cost (applied to Apparent Losses):	4	$1.04	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	5		$/acre-ft

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 55 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: Customer metering inaccuracies

3: Customer retail unit cost (applied to Apparent Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.

Water Audit Report for: city of livingston (241004)

Reporting Year: 2016 | 1/2016 - 12/2016

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 55 out of 100 *****

System Attributes:

	Apparent Losses:	32.900	acre-ft/yr
+	Real Losses:	173.038	acre-ft/yr
=	**Water Losses:**	**205.938**	acre-ft/yr
?	Unavoidable Annual Real Losses (UARL):	36.95	acre-ft/yr
	Annual cost of Apparent Losses:	$11,149	
	Annual cost of Real Losses:		Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	4.3%	
	Non-revenue water as percent by cost of operating system:	4.4%	Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:	9.47	gallons/connection/day
	Real Losses per service connection per day:	49.83	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.00	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	173.04	acre-feet/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.68	

* 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

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:	

Audit Item	Comment
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 livingston (241004)
Reporting Year:	2016 1/2016 - 12/2016
Data Validity Score:	55

Own Sources (Adjusted for known errors)
6,725.000

Water Imported
0.000

System Input
6,725.000

Water Supplied
6,725.000

Water Exported
0.000

Authorized Consumption
6,519.063

Billed Water Exported
0.000

Billed Authorized Consumption
6,435.000

Billed Metered Consumption (water exported is removed)
6,435.000

Billed Unmetered Consumption
0.000

Unbilled Authorized Consumption
84.063

Unbilled Metered Consumption
0.000

Unbilled Unmetered Consumption
84.063

Water Losses
205.938

Apparent Losses
32.900

Unauthorized Consumption
16.813

Customer Metering Inaccuracies
0.000

Systematic Data Handling Errors
16.088

Real Losses
173.038

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

Revenue Water
0.000

Revenue Water
6,435.000

Non-Revenue Water (NRW)
290.000

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

American Water Works Association.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

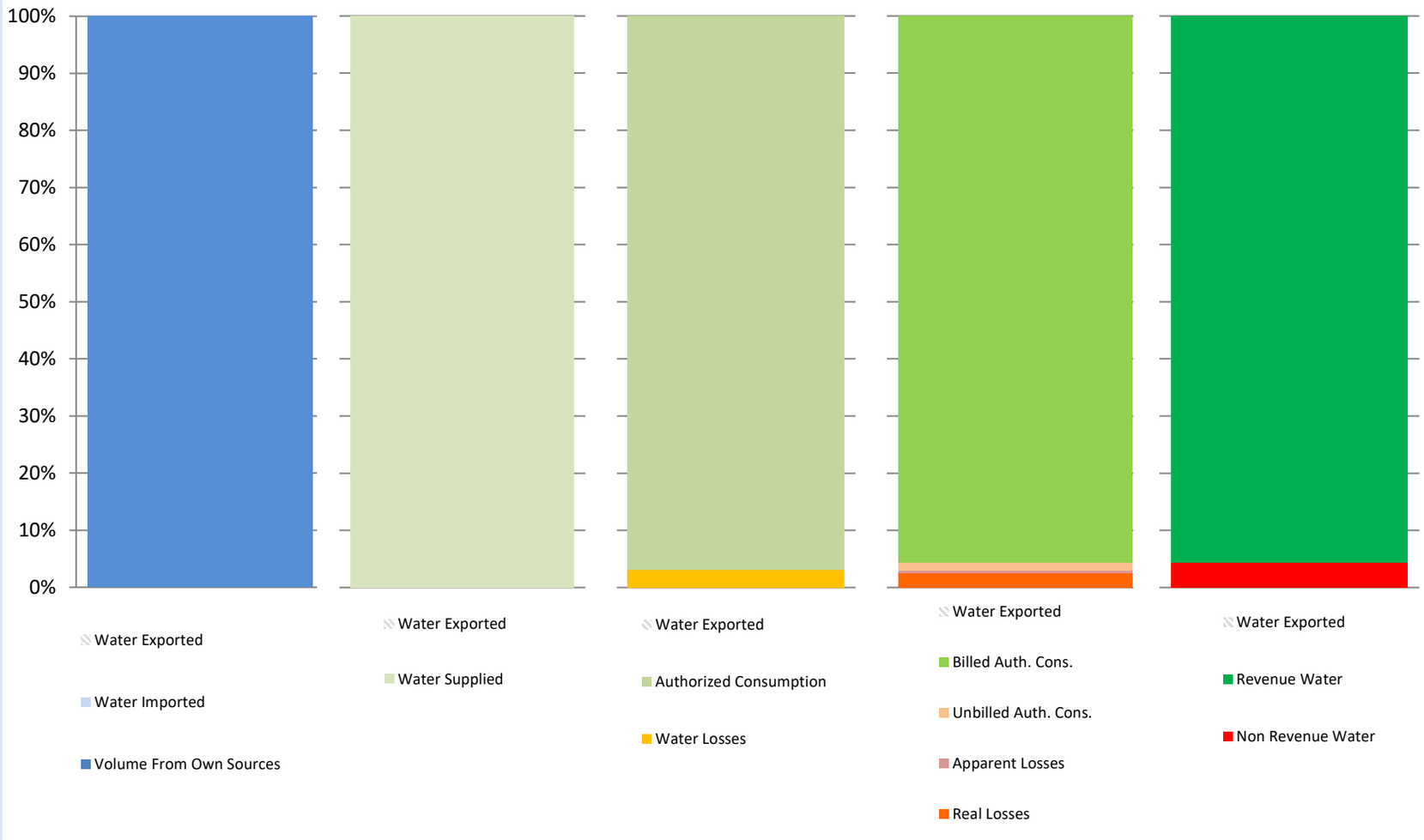
Water Audit Report for: city of livingston (241004)

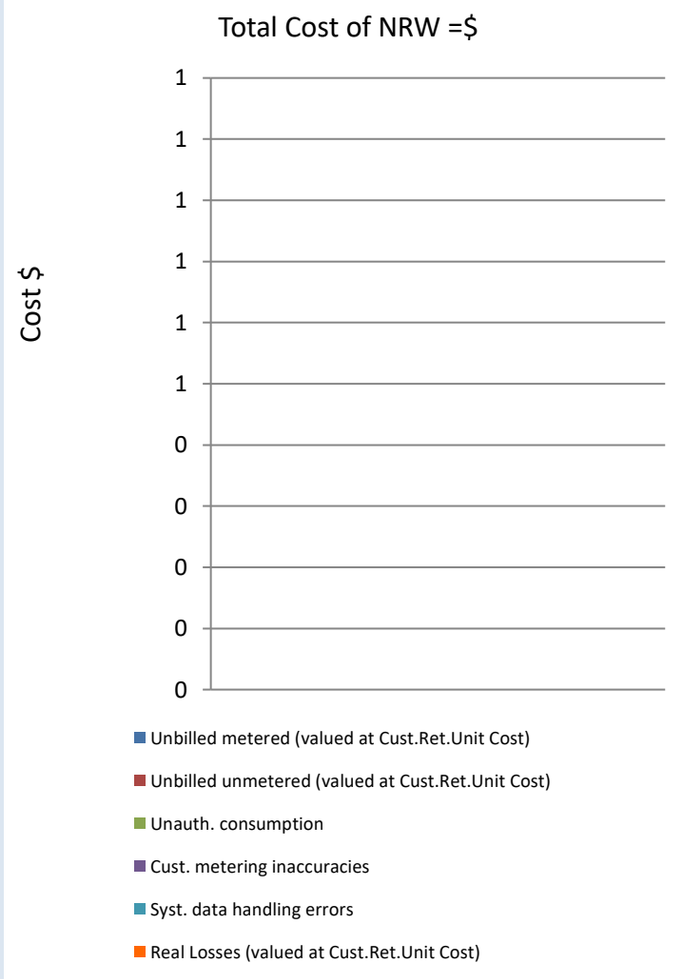
Reporting Year: 2016 | 1/2016 - 12/2016

Data Validity Score: 55

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

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, or 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:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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, remainding 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 eixst, 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 conducting 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; or 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; or 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.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not 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 does 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 does 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 does 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 does 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 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, umetered consumption is usually a relatively small quatity 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 quality 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. 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 Geographical 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. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	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 breech 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 breech 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 real-time 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 <u>all</u> applicable marginal supply costs - serves as the variable production cost. If <u>all</u> 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 knowledgable 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

CAVANAUGH
Stewardship Through Innovation

AWWA Water Audit Level 1 Validation Document

Validator Provided

Audit Information:

Utility: Livingston PWS ID: 2410004

System Type: Potable Audit Period: Calendar 2017

Utility Representation: Tony Avina (Lead Operator), Anthony Chavarria (PW Superintendent), Happy Bains (Senior Accountant)

Validation Date: 1/30/2019 Call Time: 11:30 am Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 61 Data Validity Band (Level): Band III (51-70) ILI: 0.75 Real Loss: 8.02 (gal/conn/day)

Apparent Loss: 37.64 (gal/conn/day) Non-revenue water as percent of cost of operating system: 2.7%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Drew Blackwell Validator Qualifications: Contractor for California Water Loss TAP

2017 AWWA Water Audit Level 1 Validation

Water System Name: **Water System ID Number:** **Water Audit Period:**

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

<<Information to be completed by Utility>>

1. We are in the process of doing meter change outs from manual reads to radio read meters and anything over 25 years old is also being replaced with radio read meters.
2. The City is also in the middle of multi-million main water line replacement and new service line replacements.
3. Our 1M Water Storage Tank is in the process of being renovated inside and outside.
4. The City is researching to try to go onto a fixed base radio read unit to read all meters throughout the City.

Utility Provided

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Anthony Chavarria	Public Works Director		2.26.19
Executive Name (Print)	Executive Position	Signature	Date

AWWA Free Water Audit Software v5.0

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:	TONY AVINA
Email Address:	tavina@livingstoncity.com
Telephone | Ext.:	1(209)394-8044
Name of City / Utility:	CITY OF LIVINGSTON
City/Town/Municipality:	LIVINGSTON
State / Province:	California (CA)
Country:	USA
Year:	2017 Calendar Year
Audit Preparation Date:	
Volume Reporting Units:	Acre-feet
PWSID / Other ID:	241004

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 LIVINGSTON (241004)

Reporting Year: 2017 1/2017 - 12/2017

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: ACRE-FEET PER YEAR

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

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED

				Pcnt:	Value:	
Volume from own sources:	5	7,166.600	acre-ft/yr			acre-ft/yr
Water imported:	n/a	0.000	acre-ft/yr			acre-ft/yr
Water exported:	n/a	0.000	acre-ft/yr			acre-ft/yr

Enter negative % or value for under-registration

Enter positive % or value for over-registration

WATER SUPPLIED: **7,166.600** acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:	
Billed metered:	7	6,487.000	acre-ft/yr		
Billed unmetered:	n/a	0.000	acre-ft/yr		
Unbilled metered:	n/a	0.000	acre-ft/yr		
Unbilled unmetered:		89.583	acre-ft/yr	1.25%	acre-ft/yr

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

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION: **6,576.583** acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

590.018 acre-ft/yr

Apparent Losses

			Pcnt:	Value:	
Unauthorized consumption:		17.917	acre-ft/yr	0.25%	acre-ft/yr

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

Customer metering inaccuracies:	3	0.000	acre-ft/yr		acre-ft/yr
Systematic data handling errors:		16.218	acre-ft/yr	0.25%	acre-ft/yr

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

Apparent Losses: **34.134** acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **555.884** acre-ft/yr

WATER LOSSES: **590.018** acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: **679.600** acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	7	36.0	miles
Number of active AND inactive service connections:	7	3,065	
Service connection density:		85	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: 5 50.0 psi

COST DATA

Total annual cost of operating water system:	10	$2,709,132	$/Year
Customer retail unit cost (applied to Apparent Losses):	4	$1.57	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	5		$/acre-ft

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 55 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: Customer metering inaccuracies

3: Customer retail unit cost (applied to Apparent Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.

Water Audit Report for: CITY OF LIVINGSTON (241004)

Reporting Year: 2017 | 1/2017 - 12/2017

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 55 out of 100 *****

System Attributes:

	Apparent Losses:	34.134	acre-ft/yr
+	Real Losses:	555.884	acre-ft/yr
=	**Water Losses:**	**590.018**	acre-ft/yr
?	Unavoidable Annual Real Losses (UARL):	36.66	acre-ft/yr
	Annual cost of Apparent Losses:	$17,463	
	Annual cost of Real Losses:		Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	9.5%	
	Non-revenue water as percent by cost of operating system:	12.8%	Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:	9.94	gallons/connection/day
	Real Losses per service connection per day:	161.91	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	3.24	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	555.88	acre-feet/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	15.16	

* 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

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:	

Audit Item	Comment
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 LIVINGSTON (241004)
Reporting Year:	2017 1/2017 - 12/2017
Data Validity Score:	55

Own Sources (Adjusted for known errors)
7,166.600

Water Imported
0.000

System Input
7,166.600

Water Exported
0.000

Water Supplied
7,166.600

Authorized Consumption
6,576.583

Billed Authorized Consumption
6,487.000

Billed Water Exported

Billed Metered Consumption (water exported is removed)
6,487.000

Billed Unmetered Consumption
0.000

Unbilled Authorized Consumption
89.583

Unbilled Metered Consumption
0.000

Unbilled Unmetered Consumption
89.583

Water Losses
590.018

Apparent Losses
34.134

Unauthorized Consumption
17.917

Customer Metering Inaccuracies
0.000

Systematic Data Handling Errors
16.218

Real Losses
555.884

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

Revenue Water
0.000

Revenue Water
6,487.000

Non-Revenue Water (NRW)
679.600

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

American Water Works Association.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

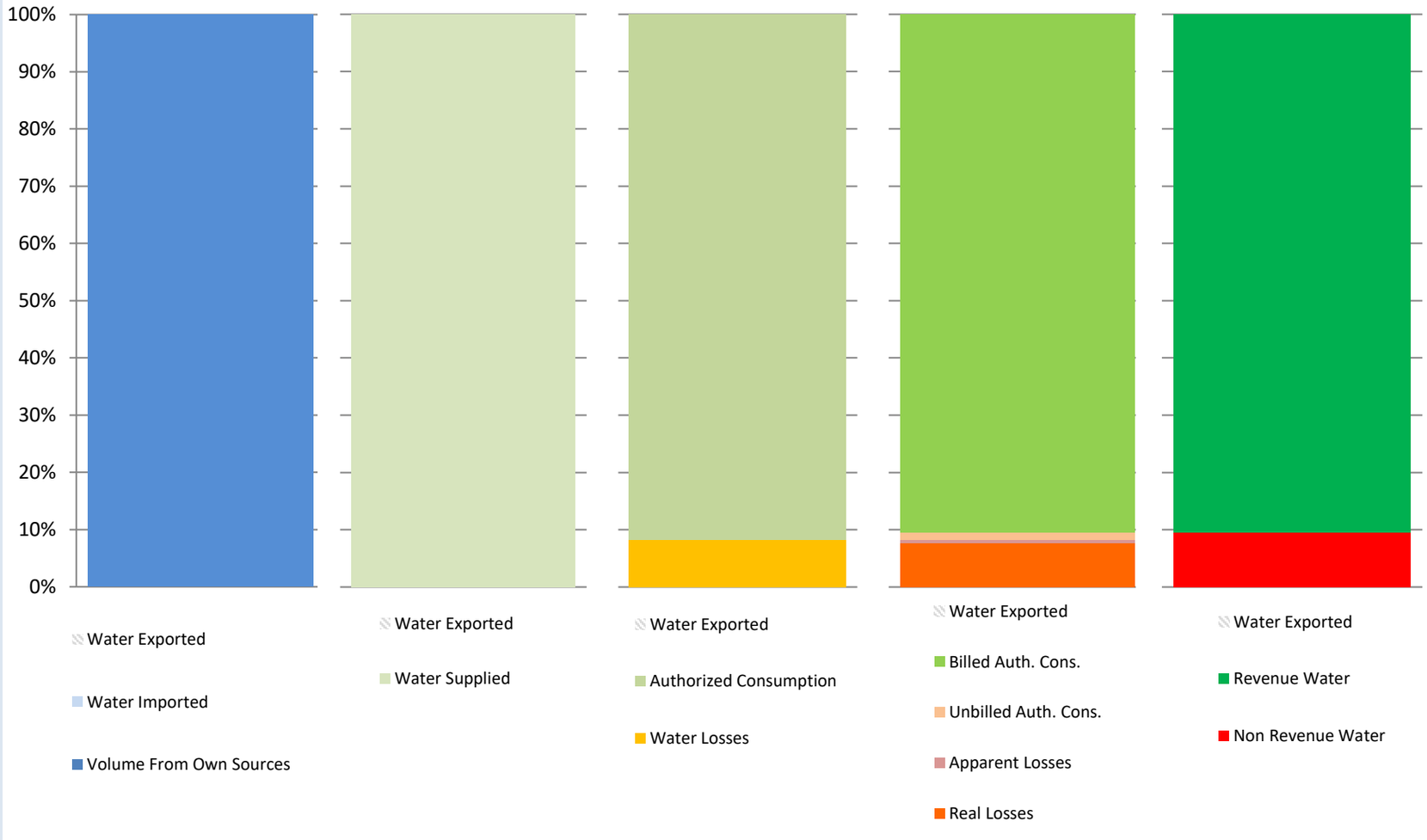
Water Audit Report for: CITY OF LIVINGSTON (241004)

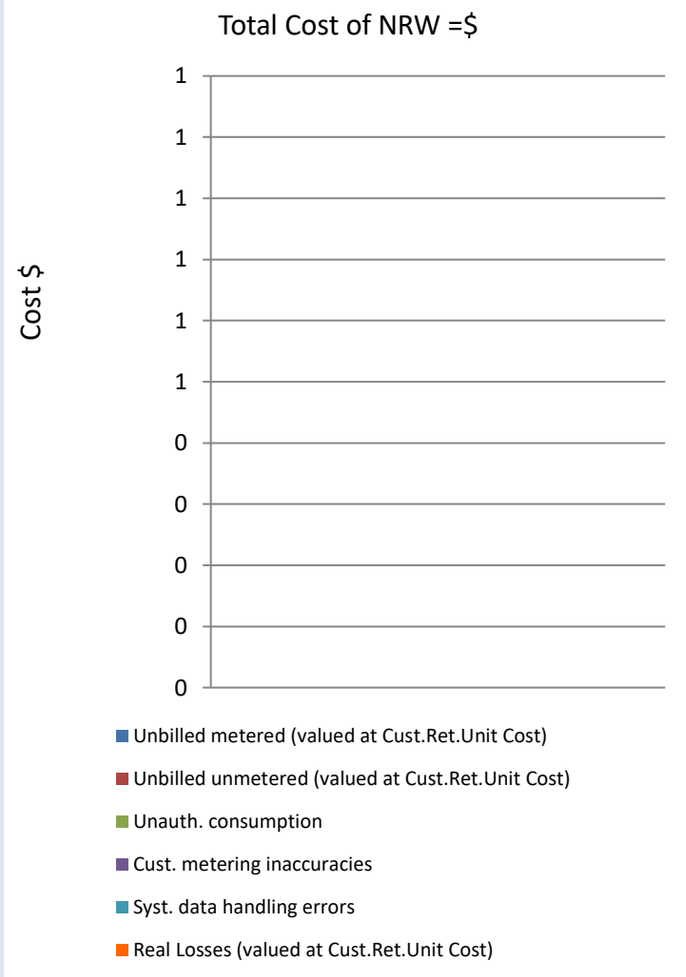
Reporting Year: 2017 | 1/2017 - 12/2017

Data Validity Score: 55

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





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, or 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:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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, remainding 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 eixst, 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 conducting 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; or 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; or 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.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not 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 does 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 does 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 does 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 does 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 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, umetered consumption is usually a relatively small quatity 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 quality 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. 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 Geographical 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. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	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 breech 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 breech 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 real-time 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 <u>all</u> applicable marginal supply costs - serves as the variable production cost. If <u>all</u> 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 knowledgable 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

VALIDATOR PROVIDED INFROMATION

Certified Validation Report

Audit Information

Water Supplier Information: City of Livingston

PWS ID: CA2410004

System Type: Potable

Audit Period: January - December 2018

Utility Representation: Tony Avina (Public Works Superintendent), Anthony Chavarria (Public Works Director), Jesus Chavez (Operator), and Mayra Dheri (Accont Clerk)

Validation Date: December 16, 2019

Interview Time: 10:30 am

Validation Findings & Confirmation Statement

Key Audit Metrics

Data Validity Score: 60

Data Validity Band (Level): III (51-70)

ILI: 0.36

Real Loss: 4.04 gallons/connection/day

Non-Revenue Water as Percentage of Cost of Operating System: 1.5%

Apparent Loss: 24.15 gallons/connection/day

Certification Statement By Validator

This water loss audit report has been Level One (1) validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on the volume derivation and Data Validity Grades were incorporated into the water audit
If not, rejected recommendations are included here:

Validator Information

Water Audit Validator: Angela Hall

Qualifications: Water Audit Validator Certificate issued by the CA-NV Section of the AWWA

UTILITY PROVIDED INFROMATION

Water Supplier Name: City of Livingston

Water Supplier ID Number: CA2410004

Water Audit Period: January - December 2018

Water Audit & Water Loss Improvement Steps:

Utility to provide steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

1. The City is still in the process of doing meter change outs from manual reads to radio meter reads and any meter 25 years or older is being replaced with radio read meters.
2. The City will perform electronic calibrations on all groundwater wells at least on an annual basis.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audit and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Name (Print): ALFONSO MANRIQUE

Title: ALTERNATE CITY ENGINEER

Signature: 

Date: 12/17/19

AWWA Free Water Audit Software v5.0

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:	Odi Ortiz, Assisant City Manager
Email Address:	oortiz@livingstoncity.com
Telephone | Ext.:	209-394-8041 Ext. 115
Name of City / Utility:	City of Livingston
City/Town/Municipality:	City
State / Province:	California (CA)
Country:	Merced
Year:	2018 Calendar Year
Audit Preparation Date:	11/20/2019
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	CA2410004

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 Livingston (CA2410004)

Reporting Year: 2018 1/2018 - 12/2018

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.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

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

Volume from own sources:	+ ?	5	2,223.982	MG/Yr	+ ?	3			MG/Yr
Water imported:	+ ?	n/a	0.000	MG/Yr	+ ?				MG/Yr
Water exported:	+ ?	n/a	0.000	MG/Yr	+ ?				MG/Yr

Enter negative % or value for under-registration

Enter positive % or value for over-registration

WATER SUPPLIED: 2,223.982 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:	
Billed metered:	+ ?	7	2,157.947	MG/Yr			
Billed unmetered:	+ ?	n/a	0.000	MG/Yr			
Unbilled metered:	+ ?	n/a	0.000	MG/Yr			
Unbilled unmetered:	+ ?	3	27.800	MG/Yr	1.25%		MG/Yr

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

AUTHORIZED CONSUMPTION: ? 2,185.747 MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 38.235 MG/Yr

Apparent Losses

					Pcnt:	Value:	
Unauthorized consumption:	+ ?		5.560	MG/Yr	0.25%		MG/Yr
Customer metering inaccuracies:	+ ?	3	21.797	MG/Yr	1.00%		MG/Yr
Systematic data handling errors:	+ ?		5.395	MG/Yr	0.25%		MG/Yr

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

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

Apparent Losses: ? 32.752 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ? 5.483 MG/Yr

WATER LOSSES: 38.235 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: ? 66.035 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+ ?	7	36.0	miles
Number of active AND inactive service connections:	+ ?	9	3,715	
Service connection density:	?		103	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: + ? 8 55.0 psi

COST DATA

Total annual cost of operating water system:	+ ?	10	$4,381,658	$/Year	
Customer retail unit cost (applied to Apparent Losses):	+ ?	8	$1.61	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	+ ?	6	$393.36	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 60 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: Customer metering inaccuracies

3: Billed metered

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.

Water Audit Report for: City of Livingston (CA2410004)

Reporting Year: 2018 | 1/2018 - 12/2018

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 60 out of 100 *****

System Attributes:

	Apparent Losses:	32.752	MG/Yr
+	Real Losses:	5.483	MG/Yr
=	**Water Losses:**	**38.235**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	15.10	MG/Yr
	Annual cost of Apparent Losses:	$52,731	
	Annual cost of Real Losses:	$2,157	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	3.0%	
	Non-revenue water as percent by cost of operating system:	1.5%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	24.15	gallons/connection/day
	Real Losses per service connection per day:	4.04	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.07	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	5.48	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.36	

* 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

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:	The City of Livingston's water source is exclusively groundwater from nine active domestic supply wells. 100% of treated water production sources are metered. The City conducted electronic calibration on Well No. 9 during 2017; however, no meter testing or calibration was done on the nine active wells during the audit period. Since “occasional” meter calibration occurs, a DVG of 5 has been applied.
Vol. from own sources: Master meter error adjustment:	Meter readings are manually collected and then logged into an electronic format by City staff on a daily basis. Production meter data is then reviewed at least on a monthly basis with necessary correction implemented, if applicable. No corrections were made to the meter production data during the audit period. Storage tank levels are tracked automatically by the system’s SCADA system; however, no net change in storage was included in the volume adjustment. Since no net change in storage for the audit reporting year was provided, a DVG of 3 has been applied.
Water imported:	Not applicable, the City does not imprort potable water. No additional comments.
Water imported: master meter error adjustment:	Not applicable, the City does not imprort potable water. No additional comments.
Water exported:	Not applicable, the City does not export potable water. No additional comments.
Water exported: master meter error adjustment:	Not applicable, the City does not export potable water. No additional comments.
Billed metered:	100% of customers are metered. At least 95% of customers meter reading are collected through by automatic meter reading (AMR) and 5% are manually collected. Good customer meter records exist; however, the City follows a limited meter accuracy testing program. The City estimates that approximately 10 small meters were tested during the audit period, a smaller amount was tested for larger meters. The City’s meter replacement program is ongoing and focuses on changing out older meter that are 25 years or older. Staff estimates that approximately 250 to 300 meters were replaced during the audit period. Computerized billing records exist with auditing of data conducted by staff at least on a monthly basis. For these reasons, a DVG of 7 has been applied.
Billed unmetered:	Not applicable. All water is metered in the City of Livingston.
Unbilled metered:	No unbilled metered accounts exist. This Section is not applicable to the City of Livingston.

Audit Item	Comment
Unbilled unmetered:	All water usage is metered. This Section is not applicable to the City of Livingston.
Unauthorized consumption:	Default Grade Applied
Customer metering inaccuracies:	Since customer meter accuracy testing is only preformed on problem meters and consumption flags, a DVG has been 3 applied.
Systematic data handling errors:	Default Grade Applied
Length of mains:	Sound written policy and procedures exist for permitting and installing new water mains. Electronic recordkeeping such as a digital water plat map exists to determine the total amount of water mains; however, the City does not utilize an asset management system that tracks condition assessment characteristics (break history, date of installation, etc.). For this reason, a DVG of 7 has been applied.
Number of active AND inactive service connections:	Policies and procedures for new account activation and billing operations are written and well structured and managed. Computerized billing system keeps track of all active connections, inactive connections were verified through field investigation. Internal system audits are conducted on an basis. The City estimates that counts of connections are less than 2% in error. For these reasons, a DVG of 9 has been applied.
Average length of customer service line:	Default input and grade applice, as customer meters are typically located at the property boundary.
Average operating pressure:	All groundwater wells and the storage tank are on pressure transducers which keeps the average water pressure at about 55 PSI. A Realtime monitoring system (SCADA) exists to monitor the system and collect data, including real time pressure readings. The AOP is determined from reliable monitoring system data. Pressure data is collected on an hourly basis through the SCADA system. For these reasons, a DVG of 8 has been applied.
Total annual cost of operating water system:	Average annual operating costs were obtained from the City of Livingston's FY 19/20 budget. Reliable electronic, industry standard cost accounting system (Springbrook) in place, with all pertinent water system operating costs tracked. Financial data is audited monthly by staff and annually by a third-party CPA. For these reasons, a DVG of 10 has been applied.
Customer retail unit cost (applied to Apparent Losses):	Rate sturcture: classes, tiered rates. Input derivation: this value was calcualted from the total customer consumption water revenues ($3,471,674.54) divided by total billed consumption (2,157.947 MG). Sewer charges are not included. Input calculations have not been reviewed by an M36 water loss expert. For this reason a DVG of 8 has been applied.
Variable production cost (applied to Real Losses):	The input includes the electrical costs to operate the source water pumps to treat the raw water and to maintain distribution pressure ($592,712), costs associated with treatment such as chemical cost, media costs, and analytical testing ($240,257), and costs associated with the water distribution system such as water main line repair, service line repair, and analytical testing within the distribution system ($41,854). The total production cost of $874,823 includes both primary and secondary cost.Since both primary and secondary cost have also been included, a DVG of 6 has been applied.

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	City of Livingston (CA2410004)
Reporting Year:	2018 — 1/2018 - 12/2018
Data Validity Score:	60

Own Sources (Adjusted for known errors)
2,223.982

Water Imported
0.000

System Input
2,223.982

Water Supplied
2,223.982

Water Exported
0.000

Authorized Consumption
2,185.747

Billed Authorized Consumption
2,157.947

Billed Water Exported

Billed Metered Consumption (water exported is removed)
2,157.947

Billed Unmetered Consumption
0.000

Unbilled Authorized Consumption
27.800

Unbilled Metered Consumption
0.000

Unbilled Unmetered Consumption
27.800

Water Losses
38.235

Apparent Losses
32.752

Unauthorized Consumption
5.560

Customer Metering Inaccuracies
21.797

Systematic Data Handling Errors
5.395

Real Losses
5.483

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

Revenue Water
0.000

Revenue Water
2,157.947

Non-Revenue Water (NRW)
66.035

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

American Water Works Association.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

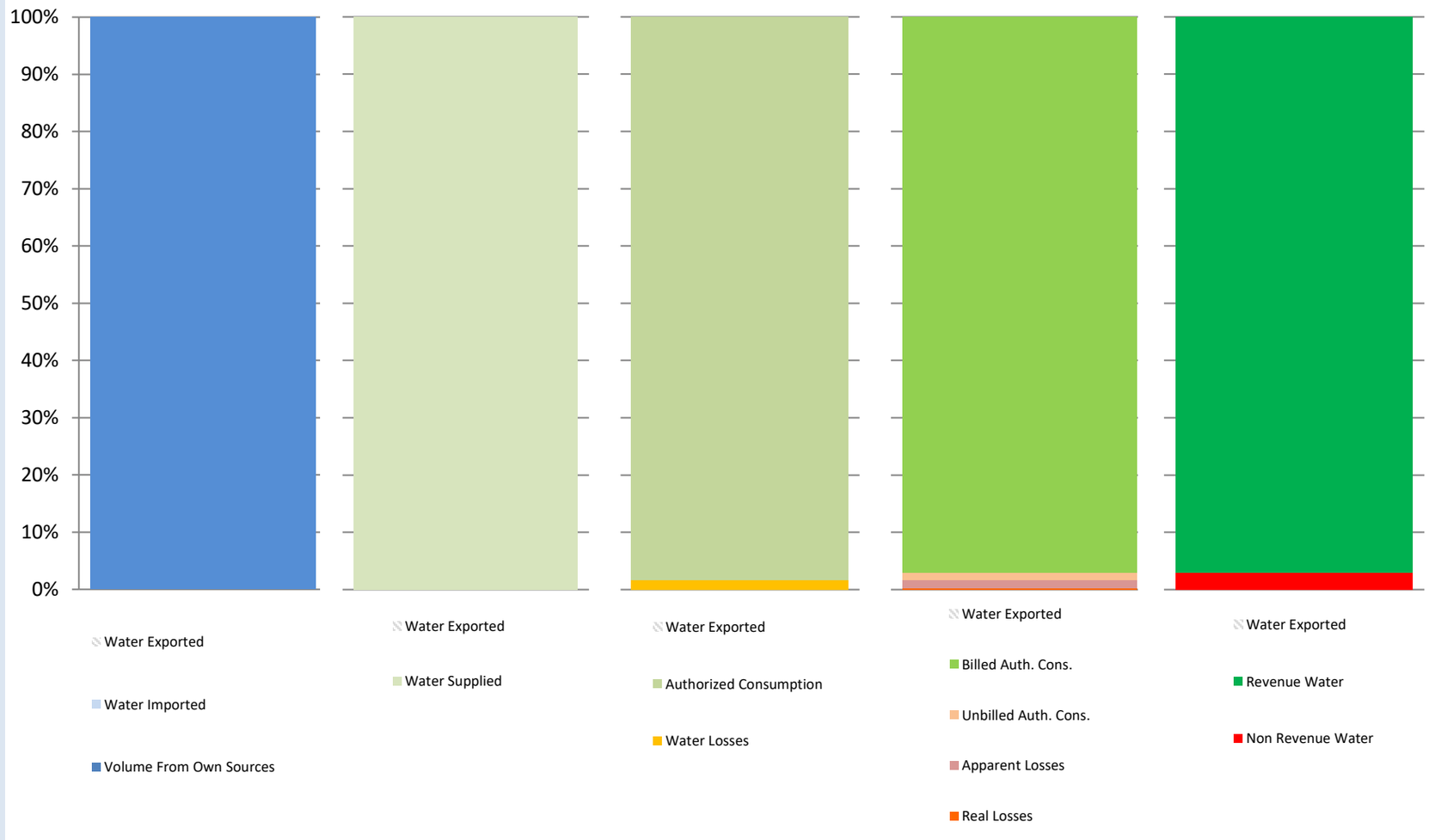
Water Audit Report for: City of Livingston (CA2410004)

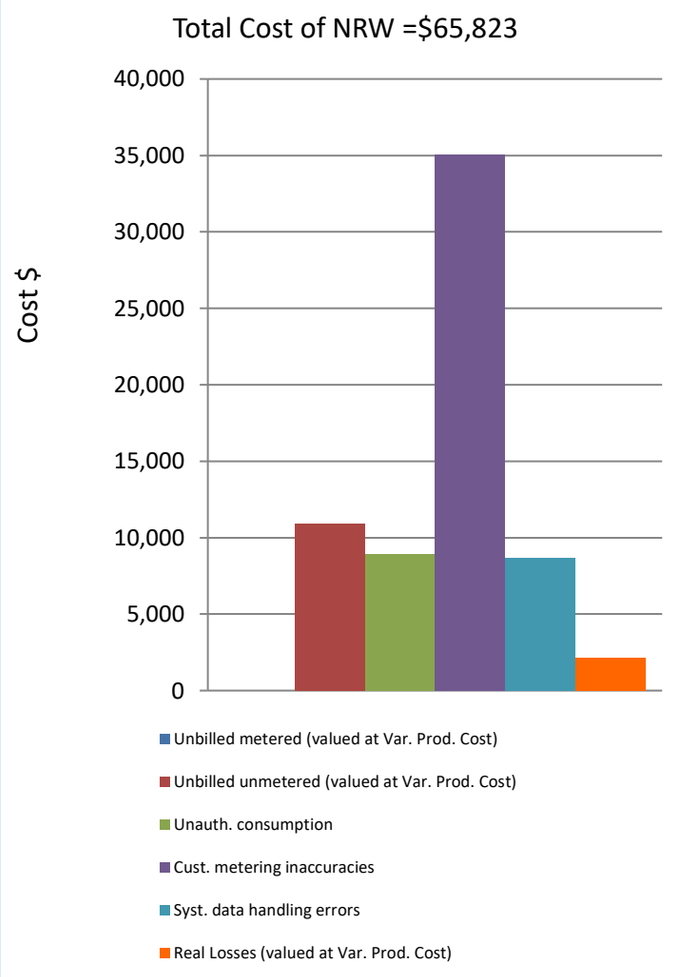
Reporting Year: 2018 | 1/2018 - 12/2018

Data Validity Score: 60

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

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, or 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:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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, remainding 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 eixst, 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 conducting 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; or 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; or 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.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not 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 does 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 does 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 does 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 does 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 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, umetered consumption is usually a relatively small quatity 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 quality 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. 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 Geographical 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. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	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 breech 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 breech 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 real-time 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:		to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8: 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.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10: 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 not be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: 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.		to qualify for 8: 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 knowledgable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

VALIDATOR PROVIDED INFROMATION

Certified Validation Report

Audit Information

Water Supplier Information: City of Livingston

PWS ID: CA2410004

System Type: Potable

Audit Period: January - December 2019

Utility Representation: Anthony Chavarria (Public Works Director) and Tony Avina (Public Works Superintendent)

Validation Date: December 18, 2020

Interview Time: 9:00am

Validation Findings & Confirmation Statement

Key Audit Metrics

Data Validity Score: 60

Data Validity Band (Level): III (51-70)

ILI: 5.77

Real Loss: 64.38 gallons/connection/day

Non-Revenue Water as Percentage of Cost of Operating System: 1.9%

Apparent Loss: 25.41 gallons/connection/day

Certification Statement By Validator

This water loss audit report has been Level One (1) validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on the volume derivation and Data Validity Grades were incorporated into the water audit

If not, rejected recommendations are included here:

Validator Information

Water Audit Validator: Angela Hall

Qualifications: Water Audit Validator Certificate issued by the CA-NV Section of the AWWA

UTILITY PROVIDED INFROMATION

Water Supplier Name: City of Livingston

Water Supplier ID Number: CA2410004

Water Audit Period: January - December 2019

Water Audit & Water Loss Improvement Steps:

Utility to provide steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

1. The City is still in the process of doing customer meter change outs from manual reads to automatic radio meter reads and any meter 25 years or older is being replaced with radio read meters. The City estimates that approximately 3% of manual read meters are still in place. The City estimates that all meters will be converted to AMRs by 2021. The City will then focus on replacing any AMR meter that is 25 years or older.
2. The City will examine the feasibility of performing electronic calibrations and/or accuracy testing on their groundwater on an annual basis. Due to Due to available funding, the City may examine implementing a meter testing program on their well production meters where only half of the groundwater meters are tested one year and the remain groundwater meters are tested the following year.
3. For customer meters, the City will examine the feasibility of implementing a meter testing program where approximately 5% of customer meters will be tested on an annual basis.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audit and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Name (Print)	Title
Anthony Chavarria	Public Works Director
Signature	**Date**
	12/18/20

AWWA Free Water Audit Software v5.0

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:	Odi Ortiz, Assisant City Manager
Email Address:	oortiz@livingstoncity.com
Telephone | Ext.:	209-394-8041 Ext. 115
Name of City / Utility:	City of Livingston
City/Town/Municipality:	City
State / Province:	California (CA)
Country:	Merced
Year:	2019 Calendar Year
Audit Preparation Date:	11/20/2019
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	2410004

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 Livingston (2410004)

Reporting Year: 2019 1/2019 - 12/2019

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.

Master Meter and Supply Error Adjustments

WATER SUPPLIED

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

Volume from own sources:	+ ?	5	2,394.994	MG/Yr	+ ?	3			MG/Yr
Water imported:	+ ?	n/a	0.000	MG/Yr	+ ?				MG/Yr
Water exported:	+ ?	n/a	0.000	MG/Yr	+ ?				MG/Yr

Enter negative % or value for under-registration

Enter positive % or value for over-registration

WATER SUPPLIED: 2,394.994 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:	
Billed metered:	+ ?	7	2,243.990	MG/Yr			
Billed unmetered:	+ ?	n/a	0.000	MG/Yr			
Unbilled metered:	+ ?	n/a	0.000	MG/Yr			
Unbilled unmetered:	+ ?		29.937	MG/Yr	1.25%		MG/Yr

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

AUTHORIZED CONSUMPTION: ? 2,273.927 MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 121.067 MG/Yr

Apparent Losses

					Pcnt:	Value:	
Unauthorized consumption:	+ ?		5.987	MG/Yr	0.25%		MG/Yr

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

Customer metering inaccuracies:	+ ?	3	22.667	MG/Yr	1.00%		MG/Yr
Systematic data handling errors:	+ ?		5.610	MG/Yr	0.25%		MG/Yr

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

Apparent Losses: ? 34.264 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ? 86.803 MG/Yr

WATER LOSSES: 121.067 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: ? 151.004 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	+ ?	7	36.0	miles
Number of active AND inactive service connections:	+ ?	9	3,694	
Service connection density:	?		103	conn./mile main

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

(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line: + ?

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

Average operating pressure: + ? 8 55.0 psi

COST DATA

Total annual cost of operating water system:	+ ?	10	$4,792,419	$/Year	
Customer retail unit cost (applied to Apparent Losses):	+ ?	8	$1.19	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	+ ?	6	$445.93	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 60 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: Customer metering inaccuracies

3: Billed metered

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

American Water Works Association.

Water Audit Report for: City of Livingston (2410004)

Reporting Year: 2019 | 1/2019 - 12/2019

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 60 out of 100 *****

System Attributes:

	Apparent Losses:	34.264	MG/Yr
+	Real Losses:	86.803	MG/Yr
=	**Water Losses:**	**121.067**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	15.03	MG/Yr
	Annual cost of Apparent Losses:	$40,774	
	Annual cost of Real Losses:	$38,708	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:

Non-revenue water as percent by volume of Water Supplied:	6.3%	
Non-revenue water as percent by cost of operating system:	1.9%	Real Losses valued at Variable Production Cost

Operational Efficiency:

Apparent Losses per service connection per day:	25.41	gallons/connection/day
Real Losses per service connection per day:	64.38	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	1.17	gallons/connection/day/psi
From Above, Real Losses = Current Annual Real Losses (CARL):	86.80	million gallons/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	5.77	

* 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

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:	The City of Livingston's water source is exclusively groundwater from nine active domestic supply wells. 100% of treated water production sources are metered. No meter testing or calibration was done on the nine active wells during the audit period. Since “occasional” meter calibration occurs, a DVG of 5 has been applied.
Vol. from own sources: Master meter error adjustment:	Meter readings are manually collected and then logged into an electronic format by City staff on a daily basis. Production meter data is then reviewed at least on a monthly basis with necessary correction implemented, if applicable. No corrections were made to the meter production data during the audit period. Storage tank levels are tracked automatically by the system’s SCADA system; however, no net change in storage was included in the volume adjustment. Since no net change in storage for the audit reporting year was provided, a DVG of 3 has been applied. In addition, the City believes that some additional water is lossed at during the pump to waste mode at the groundwater wells.
Water imported:	Not applicable, the City does not import potable water. No additional comments.
Water imported: master meter error adjustment:	Not applicable, the City does not import potable water. No additional comments.
Water exported:	Not applicable, the City does not export potable water. No additional comments.
Water exported: master meter error adjustment:	Not applicable, the City does not export potable water. No additional comments.
Billed metered:	100% of customers are metered. At least 95% of customers meter reading are collected through by automatic meter reading (AMR) and 5% are manually collected. Good customer meter records exist; however, the City follows a limited meter accuracy testing program. The City’s meter replacement program is ongoing and focuses on changing out older meter that are 25 years or older. Staff estimates that approximately 100 1" meters were replaced during the audit period. Computerized billing records exist with auditing of data conducted by staff at least on a monthly basis. For these reasons, a DVG of 7 has been applied.
Billed unmetered:	Not applicable. All water is metered in the City of Livingston.
Unbilled metered:	No unbilled metered accounts exist. This Section is not applicable to the City of Livingston.

Audit Item	Comment
Unbilled unmetered:	Default value has been applied. Unbilled unmetered consumption has been calculated to be 1.25% of total water supplied.
Unauthorized consumption:	Default Grade Applied
Customer metering inaccuracies:	Since customer meter accuracy testing is only preformed on problem meters and consumption flags, a DVG has been 3 applied.
Systematic data handling errors:	Default Grade Applied
Length of mains:	Sound written policy and procedures exist for permitting and installing new water mains. Electronic recordkeeping such as a digital water plat map exists to determine the total amount of water mains; however, the City does not utilize an asset management system that tracks condition assessment characteristics (break history, date of installation, etc.). For this reason, a DVG of 7 has been applied.
Number of active AND inactive service connections:	Policies and procedures for new account activation and billing operations are written and well structured and managed. Computerized billing system keeps track of all active connections, inactive connections were verified through field investigation. Internal system audits are conducted on an basis. The City estimates that counts of connections are less than 2% in error. For these reasons, a DVG of 9 has been applied.
Average length of customer service line:	Default input and grade applice, as customer meters are typically located at the property boundary.
Average operating pressure:	All groundwater wells and the storage tank are on pressure transducers which keeps the average water pressure at about 55 PSI. A Realtime monitoring system (SCADA) exists to monitor the system and collect data, including real time pressure readings. The AOP is determined from reliable monitoring system data. Pressure data is collected on an hourly basis through the SCADA system. For these reasons, a DVG of 8 has been applied.
Total annual cost of operating water system:	Average annual operating costs were obtained from the City of Livingston's FY 18/19 and 19/20 budgets (provided in the FY 19-20 adopted budget). Reliable electronic, industry standard cost accounting system (Springbrook) in place, with all pertinent water system operating costs tracked. Financial data is audited monthly by staff and annually by a third-party CPA. For these reasons, a DVG of 10 has been applied.
Customer retail unit cost (applied to Apparent Losses):	Rate structure: classes, tiered rates. Input derivation: this value was calculated from the total customer consumption water revenues ($2,664,293.88) divided by total billed consumption (2,243.99 MG). For this reason a DVG of 8 has been applied.
Variable production cost (applied to Real Losses):	The input includes the electrical costs to operate the source water pumps to treat the raw water and to maintain distribution pressure ($585.000), costs associated with treatment such as chemical cost, media costs, and analytical testing ($433,000), and costs associated with the water distribution system such as water main line repair, service line repair, and analytical testing within the distribution system ($50,000). The total production cost of $1,068,000 includes both primary and secondary cost. Since both primary and secondary cost have also been included, a DVG of 6 has been applied. All costs were developed by averaging the Fiscal Year (FY) 18/19 and FY 19/20 budgeted values.

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	City of Livingston (2410004)
Reporting Year:	2019 — 1/2019 - 12/2019
Data Validity Score:	60

Own Sources (Adjusted for known errors)
2,394.994

Water Imported
0.000

System Input
2,394.994

Water Exported
0.000

Water Supplied
2,394.994

Authorized Consumption
2,273.927

Billed Authorized Consumption
2,243.990

Billed Water Exported

Billed Metered Consumption (water exported is removed)
2,243.990

Billed Unmetered Consumption
0.000

Unbilled Authorized Consumption
29.937

Unbilled Metered Consumption
0.000

Unbilled Unmetered Consumption
29.937

Water Losses
121.067

Apparent Losses
34.264

Unauthorized Consumption
5.987

Customer Metering Inaccuracies
22.667

Systematic Data Handling Errors
5.610

Real Losses
86.803

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

Revenue Water
0.000

Revenue Water
2,243.990

Non-Revenue Water (NRW)
151.004

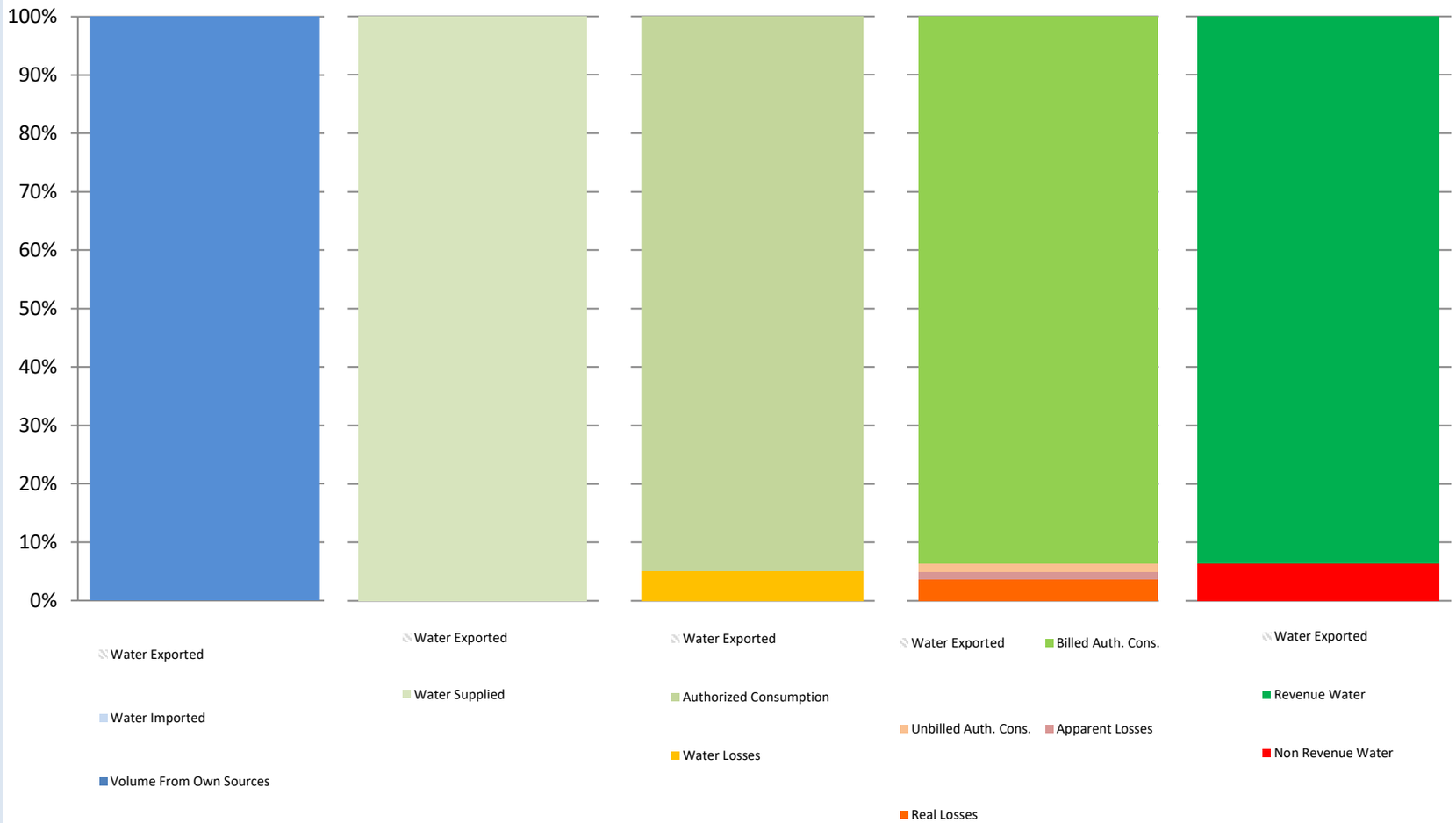
AWWA Free Water Audit Software:
Dashboard

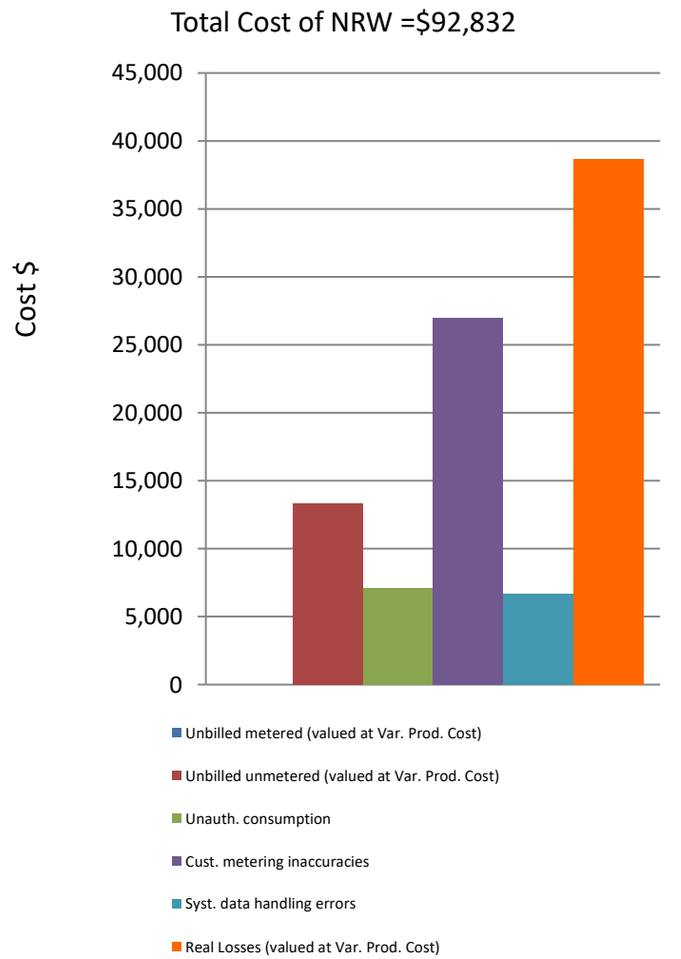
WAS v5.0
American Water Works Association.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for: City of Livingston (2410004)
Reporting Year: 2019 | 1/2019 - 12/2019
Data Validity Score: 60

○ Show me the VOLUME of Non-Revenue Water
◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

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, or 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:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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.*)		to qualify for 2: 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.	To qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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, remainding 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 eixst, 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 conducting 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; or 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; or 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.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: 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.		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: 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.		to maintain 10: 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 not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not 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 does 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 does 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 does 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 does 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 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, umetered consumption is usually a relatively small quatity 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 quality 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. 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 Geographical 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. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	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 breech 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 breech 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 real-time 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:		to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8: 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.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: 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:		to qualify for 2: 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.	to qualify for 4: 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.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10: 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 not be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: 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.		to qualify for 8: 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 knowledgable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

APPENDIX E

MERCED AUTHORITY INTEGRATED REGIONAL WATER MANAGEMENT PLAN CLIMATE CHANGE VULNERABILITY ASSESSMENT

Chapter 16 Climate Change

Chapter 16: Climate Change addresses both adaptation to the effects of climate change and mitigation of GHG emissions, and includes the following items as required by the IRWM Plan Climate Change Standard (DWR, 2016):

- ✓ A discussion of the potential effect of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses to those vulnerabilities. The evaluation of vulnerabilities must, at a minimum, be equivalent to the vulnerability assessment contained in the Climate Change Handbook for Regional Water Planning, Section 4 and Appendix B (CDM, 2011).
- ✓ A process that considers GHG emissions when choosing between project alternatives (provided in Chapter 6 Project Review Process).
- ✓ A list of prioritized vulnerabilities based on the vulnerability assessment and the IRWM's decision making process.
- ✓ A plan, program, or methodology for further data gathering and analysis of the prioritized vulnerabilities.

As discussed previously, there is mounting scientific evidence that global climate conditions are changing and will continue to change as a result of the continued build-up of GHGs in the Earth's atmosphere. Changes in climate can affect water supplies through modifications in the timing, amount, and form of precipitation, as well as water demands and the quality of surface runoff. These changes can affect all elements of water supply systems, from watersheds to reservoirs, conveyance systems, and treatment plants.

Planning for and adapting to anticipated changes in climate will be essential to ensuring water supply reliability for all users and to protecting sensitive infrastructure and habitats against more frequent and extreme precipitation and wildfire events. This chapter summarizes anticipated climate change impacts on the State of California and the Merced Region, evaluates the impacts of those changes with regard to water resource management, assesses the vulnerability of the Region to anticipated climate change impacts, and provides recommended adaptation and mitigation strategies to address uncertainty and reduce GHG emissions. In addition, a plan for ongoing data collection to fill data gaps and monitor the frequency and magnitude of local hydrologic and atmospheric changes is provided.

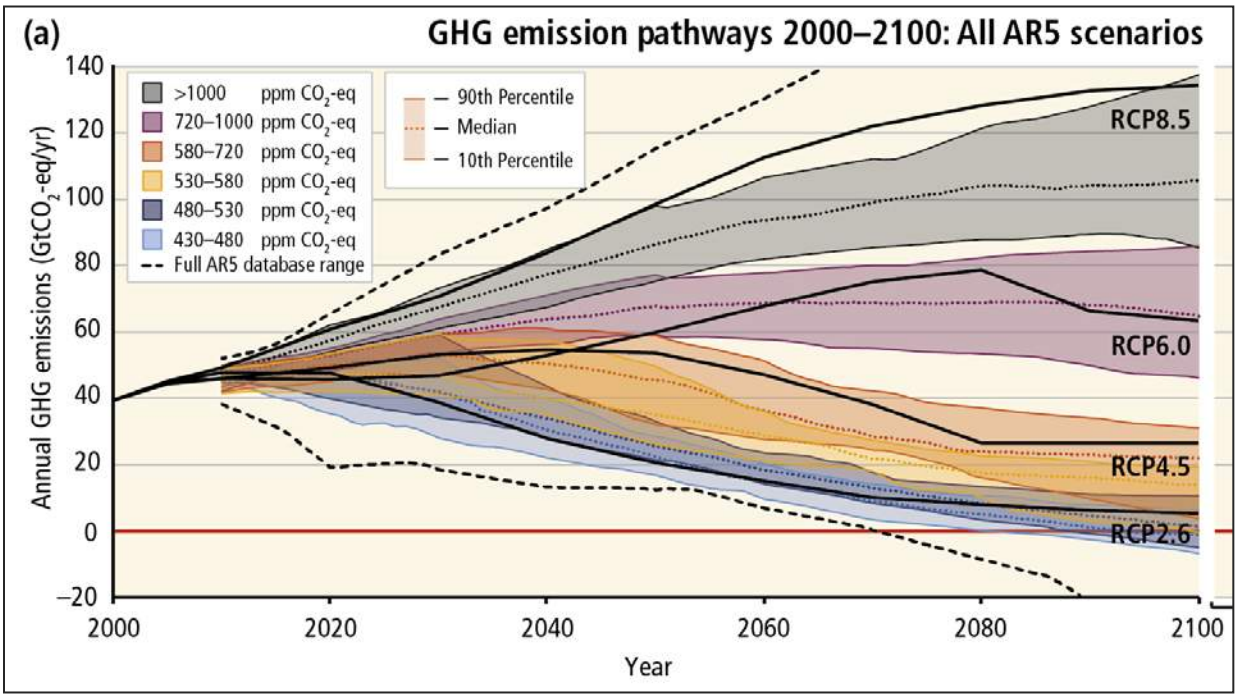
16.1 Statewide Observation and Projections

Indications of climate change have been observed over the last several decades throughout California. Statewide average temperatures have increased by about 1.7°F in the last century, with the greatest warming in the Sierra Nevada (Moser et al., 2012). Although the State's weather has followed the expected pattern of a largely Mediterranean climate throughout the past century, no consistent trend in the overall amount of precipitation has been detected, except that a larger proportion of total precipitation is falling as rain instead of snow (USEPA, 2016).

Multiple models have been developed and run to evaluate global and regional climate change impacts. General Circulation Models (GCMs) have been used to simulate a range of potential future GHG emission scenarios, reflecting possible population increases and human behavioral patterns. The Intergovernmental Panel on Climate Change (IPCC) has established Representative Concentration Pathways (RCPs) or

scenarios for making projections based on population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy. The RCPs describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use, and include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and one scenario with very high GHG emissions (RCP8.5) (see Figure 16-1). Scenarios without additional efforts to constrain emissions ("baseline" or "business as usual" scenarios) lead to pathways ranging between RCP6.0 and RCP8.5. RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures (IPCC, 2014).

Figure 16-1: IPCC Climate Change Scenarios



Source: IPCC, 2014

16.1.1 Temperature and Precipitation Changes

While California's average temperature has increased by over 1°F in the last one hundred years, trends are not uniform across the State (Moser et al., 2012). The Central Valley has actually experienced a slight cooling trend in the summer, likely due to an increase in irrigation (CEC, 2008). Higher elevations and Southern California have experienced the highest temperature increases. Many of the state's rivers have seen increases in peak flows in the last 50 years (DWR, 2008).

GCMs project that in the first 30 years of the 21st century, overall summertime temperatures in California will increase by 0.9 °F – 3.6°F (CAT, 2009) and average temperatures will increase by 3.6°F – 10.8°F by the end of this century (Cayan et al., 2006). Increases in temperature are not likely to be felt uniformly across California. Models generally project that warming will be greater in California in the summer than in the winter (CAT, 2009) and inland areas will experience more extreme warming than coastal areas

(CNRA, 2009). These non-uniform warming trends are among the reasons that regional approaches to addressing climate change are important.

While historical trends in precipitation do not show a statistically significant change in average precipitation over the last century, regional precipitation data show a trend of increasing annual precipitation in Northern California (DWR, 2006) and decreasing annual precipitation throughout Southern California over the last 30 years (DWR, 2008). A key change in precipitation patterns has been more winter precipitation falling as rain instead of snow (CNRA, 2012), leading to increased streamflow in the winter and decreased streamflow in the spring and summer, when water demands are the greatest. Rising temperatures that cause earlier snowmelt also contribute to this issue. This increased streamflow variability could lead to increased risks of flooding, levee failure, saline water intrusion and flood- or drought-induced habitat destruction.

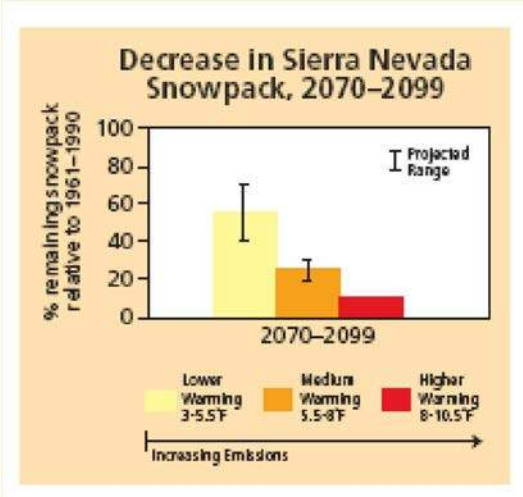
While temperature projections exhibit high levels of agreement across various models and emissions scenarios, projected changes in precipitation are more varied. Taken together, downscaled GCM results show little, if any, change in average precipitation for California before 2050 (DWR, 2006), with a drying trend emerging after 2050 (USBR 2011; CCSP, 2009). While little change in precipitation is projected by the GCMs as a group, individual GCM results are considerably varied. Climate projections therefore imply an increase in the uncertainty of future precipitation conditions.

16.1.2 Sea-level Rise, Snowpack Reduction, and Extreme Events

In the last century, the California coast has seen a sea level rise of seven to eight inches (California Coastal Commission, 2018). The average April 1st snowpack in the Sierra Nevada region has decreased in the last half century (Howat and Tulaczyk 2005; CCSP 2008), and wildfires are becoming more frequent, longer, and more widespread (CCSP, 2008).

As the climate warms, the Sierra Nevada's snowpack (a primary storage mechanism for California's water supply) is anticipated to continue to shrink. Based on simulations conducted to date, Sierra Nevada snowpack is projected to shrink by 30% between 2070 and 2099 (see Figure 16-2), with drier, higher warming scenarios putting that number as high as 80% (Kahrl and Roland-Holst, 2008). Additionally, extreme events are expected to become more frequent, including wildfires, floods, droughts, and heat waves. In contrast, freezing spells are expected to decrease in frequency over most of California (CNRA, 2009). While GCM projections may indicate little, if any, change in average precipitation moving into the future, extreme precipitation events are expected to become more commonplace (CBO, 2009). The combination of drier and warmer weather compounds expected impacts on water supplies and ecosystems in the Southwestern United States, with wildfires expected to continue to increase in both frequency and severity (CCSP, 2009).

Figure 16-2: Projected Snowpack Changes in the Sierra Nevada



Source: Hopmans et al. 2008

16.2 Legislative and Policy Context

The IRWM analysis of climate change impacts and corresponding response actions must be framed in the context of State legislation and policies that have been formed to address climate change. The following summarizes the legislation and policies that were considered as part of this IRWM Plan.

Executive Order (EO) S-3-05 (2005)

EO S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, is a key piece of legislation that has laid the foundation for California's climate change policy. This legislation recognized California's vulnerabilities to the impacts of climate change, including vulnerabilities of water resources. EO S-3-05 established three GHG reduction targets for California:

- By 2010, reduce GHG emissions to 2000 California levels
- By 2020, reduce GHG emissions to 1990 California levels
- By 2050, reduce GHG emissions to 80 percent below 1990 California levels

In addition to establishing GHG reduction targets for California, EO S-3-05 required the head Secretary of the California Environmental Protection Agency to establish the Climate Action Team (CAT) for State agencies to coordinate oversight of efforts to meet these targets. As laid out in the EO, the CAT submits biannual reports to the governor and State legislature describing progress made toward reaching the targets.

There are currently 12 sub-groups within CAT, one of which is the Water-Energy group (also known as WET-CAT). WET-CAT was tasked with coordinating the study of GHG effects on California's water supply system, including the development of GHG mitigation strategies for energy consumption related to water use. Since the adoption of the AB 32 Scoping Plan (see the following section), WET-CAT has been working on the implementation and analyses of six water-related measures identified in the Scoping Plan:

1. Water Use Efficiency
2. Water Recycling
3. Water System Energy Efficiency
4. Reuse Urban Runoff

5. Increase Renewable Energy Production
6. Public Goods Charge for Water

Assembly Bill 32: The California Global Warming Solutions Act of 2006 (2006)

Assembly Bill 32 (AB 32), the California Global Warming Solutions Act of 2006, laid the foundation for California's response to climate change. In 2006, AB 32 was signed by Governor Schwarzenegger to codify the mid-term GHG reduction target established in EO S-3-05 (reduce GHG emissions to 1990 levels by 2020). AB 32 directed the California Air Resources Board (CARB) to develop discrete early actions to reduce GHG emissions by 2007, and to adopt regulations to implement early action measures by January 1, 2010.

Climate Change Scoping Plan (2008, 2014, 2017)

AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The AB 32 Climate Change Scoping Plan, adopted by CARB in December 2008, recommends specific strategies for different business sectors, including water management, to achieve the 2020 GHG emissions limit. The first update to the Scoping Plan was approved by CARB in 2014. The 2014 update identified next steps for California to reduce GHG emissions beyond 2020 and reviewed the progress made to date. The 2017 update built on the programs established in previous scoping plans, focusing on achieving the interim goal of reducing emissions 40% below 1990 levels by 2030. This plan update proposes measures to strengthen major programs that have been successful in reducing the State's GHG emissions while further integrating efforts to reduce both GHGs and air pollution.

Senate Bill 97 (2007)

SB 97 recognized the need to analyze GHG emissions as part of the CEQA process. SB 97 directed the Governor's Office of Planning and Research to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines to address the analysis and mitigation of GHG emissions. On December 31, 2009, the Natural Resources Agency adopted amendments to the CEQA Guidelines and sent them to the California Office of Administrative Law for approval and filing with the Secretary of State (http://resources.ca.gov/ceqa/). The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water (2008)

DWR, in collaboration with the SWRCB, other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2008, DWR released the first state-level climate change adaptation strategy for water resources in the United States, and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, the report details how climate change is currently affecting the state's water supplies and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources.

Central to these adaptation efforts will be the full implementation of IRWM plans, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

Executive Order S-13-08 (2008)

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. This order required the preparation of the first California Sea Level Rise Assessment Report (by the National Academy of Sciences) to inform the State as to how California should plan for future sea level rise; required all state agencies to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess potential vulnerabilities of proposed projects and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise; and required the Climate Action Team to develop state strategies for climate adaptation, water adaptation, ocean and coastal resources adaptation, infrastructure adaptation, biodiversity adaptation, working landscapes adaptation, and public health adaptation.

California Climate Adaptation Strategy (2009)

In response to the passage of EO S-13-08, the Natural Resource Agency wrote the report entitled *2009 California Climate Adaptation Strategy* to summarize the best-known science on climate change impacts in the state, to assess vulnerability, and to outline possible solutions that can be implemented within and across the state agencies to promote climate change resilience. The document outlined a set of guiding principles that were used in developing the strategy, and resulted in the preparation of 12 key recommendations as follows:

1. Appoint a Climate Adaptation Advisory Panel to assess the greatest risks to California from climate change and to recommend strategies to reduce those risks, building on the Climate Change Adaptation Strategy.
2. Implement the 20x2020 water use reductions and expand surface and groundwater storage; implement efforts to fix Delta water supply, quality and ecosystems; support agricultural water use efficiency; improve statewide water quality; improve Delta ecosystem conditions; and stabilize water supplies as developed in the Bay Delta Conservation Plan.
3. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected from flooding, wildfire, and erosion due to climate change.
4. Prepare, as appropriate, agency-specific adaptation plans, guidance or criteria.
5. For all significant state projects, including infrastructure projects, consider the potential impacts of locating such projects in areas susceptible to hazards resulting from climate change.
6. The Climate Adaptation Advisory Panel and other agencies will assess California’s vulnerability to climate change, identify impacts to state assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal and My Hazards Website, as well as other appropriate sites.
7. Identify key California land and aquatic habitats that could change significantly during this century due to climate change.
8. The California Department of Public Health will develop guidance for use by local health departments and other agencies to assess mitigation and adaptation strategies, which include impacts on vulnerable populations and communities, and assessment of cumulative health impacts.
9. Communities with General Plans and Local Coastal Plans should begin, when possible, to amend their plans to assess climate change impacts, identify areas most vulnerable to these impacts, and

develop reasonable and rational risk reduction strategies using the *2009 California Climate Adaptation Strategy* as guidance.

10. State firefighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts.
11. State agencies should meet projected population growth and increased energy demand with greater energy conservation and an increased use of renewable energy.
12. New climate change impact research should be broadened and funded.

Safeguarding California: Reducing Climate Risk, An Update to the 2009 California Climate Adaptation Strategy (2014)

The California Natural Resources Agency prepared the *Safeguarding California Plan* as an update to, but not a replacement of, the 2009 California Climate Adaptation Strategy. The plan provides policy guidance for state decision makers, delineating climate risks in nine sectors in California and making recommendations within each sector. Within the water resources sector, the plan lists the following actions needed to prepare for climate risks:

1. Vigorously prepare California for flooding
2. Support regional groundwater management for drought resiliency
3. Diversify local supplies and increase water use efficiency
4. Reduce Sacramento-San Joaquin Delta climate change vulnerability
5. Prepare California for hotter and dryer conditions and improve water storage capacity
6. Address water-related impacts of climate change on vulnerable and disadvantaged populations and cultural resources
7. Continue to mainstream climate considerations into water management
8. Utilize low impact development and other methods in State and regional stormwater permits to restore the natural hydrograph
9. Require closer collaboration and coordination of land use and water planning activities to ensure that each reinforces sustainable development that is resilient to climate changes
10. Protect and restore water resources for important ecosystems
11. Better understand climate risks to California water and develop tools to support efforts to prepare for climate risks

GHG Reporting Rule (2009)

While California has taken the lead in climate change policy and legislation, there have been several recent developments at the federal level affecting climate change legislation. On September 22, 2009, USEPA released the Mandatory Reporting of Greenhouse Gases Rule (74FR56260, Reporting Rule), which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States. Starting in 2010, facility owners that emit 25,000 metric tons of GHGs or more per year are required to submit to the USEPA an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

Senate Bill 375 (2008)

The Sustainable Communities and Climate Protection Act of 2008 (SB 375) was passed to enhance the State's ability to reach its AB 32 goals by promoting good planning with a goal of more sustainable

communities. SB 375 required the CARB to develop regional GHG emission reduction targets for passenger vehicles and 2020 and 2035 GHG emission targets for each region covered by one of the State's 18 California's metropolitan planning organizations (MPOs). Each of the MPOs then prepares a sustainable communities strategy that demonstrates how the region will meet its GHG reduction target through integrated land use, housing and transportation planning. Once adopted, these sustainable communities strategies are incorporated into the region's federally enforceable regional transportation plan.

California Water Plan Update (2013)

The California Water Plan provides a collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academics, stakeholders, and the public to develop findings and recommendations and make informed decisions for California's water future. The plan, updated every five years, presents the status and trends of California's water-dependent natural resources, water supplies, and agricultural, urban, and environmental water demands for a range of plausible future scenarios and evaluates different combinations of regional and statewide resource management strategies to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship. Last updated in 2013, the California Water Plan Update provided statewide water balances for 13 water years (1998 through 2010), demonstrating the state's water demand and supply variability. The updated plan built on the framework and resource management strategies outlined in the California Water Plan Update 2009 promoting IRWM and improved statewide water and flood management systems. The California Water Plan Update 2013 provided the following 17 objectives to help achieve the California Water Plan goals:

1. Strengthen integrated regional water management
2. Use and reuse water more efficiently
3. Expand conjunctive management of multiple supplies
4. Protect and restore surface water and groundwater quality
5. Practice environmental stewardship
6. Improve flood management using an integrated water management approach
7. Manage the Delta to achieve the coequal goals for California
8. Prepare Prevention, Response and Recovery Plans
9. Reduce the carbon footprint of water systems and water uses
10. Improve data, analysis, and decision-support tools
11. Invest in water technology and science
12. Strengthen Tribal/State relations and natural resources management
13. Ensure equitable distribution of benefits
14. Protect and enhance public access to the State's waterways, lakes, and beaches
15. Strengthen alignment of land use planning and integrated water management
16. Strengthen alignment of government processes and tools
17. Improve integrated regional water management finance strategy and investments

The plan projects an uncertain future with respect to population, land use, irrigated crop area, environmental water and background water conservation, water demands, and climate variability. The California Water Plan Update 2013 presents 30 resource management strategies to provide a range of choices and building blocks in addressing future uncertainty. Finally, the California Water Plan Update 2013 provides regional

reports that summarize water conditions, provide a water balance summary, describe regional water quality, and describe water/flood planning and management on a hydrologic region basis. The regional summaries then provide a summary of challenges facing each of the hydrologic regions and provide future scenarios for the region.

The 2018 California Water Plan Update is currently being prepared.

Climate Ready Utilities (2010, 2015)

In the fall of 2009, the USEPA convened a Climate Ready Water Utilities Working Group under the National Drinking Water Advisory Council. This working group prepared a report that documents 11 findings and 12 recommendations relating to the development of a program enabling water and wastewater utilities to prepare long-range plans that account for climate change impacts. The report, delivered to USEPA in 2010, also included an adaptive response framework to guide climate readiness activities, and the identification of needed resources and possible incentives to support and encourage utility climate readiness. This report resulted in the preparation of the USEPA's Climate Ready Water Utilities Program and the development of tools and resources to support water and wastewater utilities in their planning. These tools and resources include:

- Climate Resilience Evaluation and Awareness Tool – a software tool to assist utility owners and operators in understanding potential climate change impacts and in assessing the related risks to their utilities.
- Climate Ready Water Utilities Toolbox – a searchable toolbox that contains resources that support all states of the decision process, from basic climate science through integration of mitigation and adaptation into long-term planning.
- Adaptation Strategies Guide – an interactive guide to assist utilities in gaining a better understanding of what climate-related impacts they may face in their region and what adaptation strategies can be used to prepare their system for those impacts.
- Climate Ready Water Utilities and Climate Ready Estuaries – USEPA initiative working to coordinate their efforts and support climate change risk assessment and adaptation planning.

In 2015, the USEPA released an update to the report, entitled *Adaptation Strategies Guide for Water Utilities*. The guide is intended to provide adaptation options for drinking water, wastewater, and stormwater utilities. Utilities can use the information in the guide to identify the most relevant challenges to their specific region, and to develop an adaptation plan.

National Water Program 2012 Strategy: Response to Climate Change (2012)

The USEPA has prepared and released its Draft *National Water Program 2012 Strategy: Response to Climate Change* to address climate change impacts on water resources and the USEPA's water programs. The report identifies core programmatic elements of the strategy in the form of programmatic visions, goals and strategic actions, with each long-term vision (or outcome) documented with an identified set of goals that reflect the same long-term timeframe as the vision and several strategic actions to be implemented in the next three to eight years to pursue the longer-term goals and visions. The draft report also includes ten guiding principles for implementing the strategy outlined in the vision, goals and strategic actions and recommendations for cross-cutting program support.

Executive Order B-30-15 (2015)

In 2014, the IPCC released its Fifth Assessment Report which identified limiting global warming to 2°C or less by 2050 as necessary to avoid potentially catastrophic climate change impacts. In response to this assessment, Governor Edmund G. Brown, Jr. issued Executive Order B-30-15. This order established an interim GHG reduction goal (to be achieved prior to the established 2050 goal) of reducing GHG emissions to 40 percent below 1990 levels by 2030. This Executive Order also included guidance for state agencies regarding implementation and strategy.

16.3 Regional Climate Change Projections and Impacts

The Merced Region lies within the San Joaquin River Hydrologic Region and contains the San Joaquin River, Merced River, Bear Creek and Owens Creek. The Merced River watershed of 660,000 acres is the smallest of all watersheds contributing to the San Joaquin River upstream of the Delta. Approximately 122 miles of the Merced River are designated as Wild and Scenic; however, none of this designation applies to reach of the Merced River within the Region. MID owns two hydroelectric and three mini-hydro facilities in the Region with an online capacity of 115 megawatts. MID also owns two dams (New Exchequer Dam and McSwain Dam) with a total water storage capacity of over 1 million AF.

16.3.1 Recent Regional Studies and Research

At present, the Upper Merced River watershed is the focus of several research projects linked to the impacts of climate change on hydrology in the California Sierra Nevada. Examples of studies currently underway or recently completed include:

- Impacts of climate change on the Lyell and Maclure Glaciers in Yosemite National Park (Stock, 2015)
- Quantifying changes in glaciers in the Sierra Nevada (Fountain, 2011)
- The role of atmospheric rivers in extreme events in Northern California (USGS, 2018)
- Impacts of climate changes on soil properties and habitats in the Sierra Nevada (UC Merced and USGS)
- Study of the effects of climate change on hydrology and stream temperatures in the Sierra Nevada (Maurer, 2007)
- Impacts of climate change on hydrology and watershed in California's Sierra Nevada (Null et al., 2010)
- Impacts of climate warming on water supply reliability in the Tuolumne and Merced River Basins (Kiparsky et al., 2014)
- Impacts of climate change on MID (Dewberry, 2017)

In general, these studies are multi-year endeavors and are either in progress or have yielded data that are currently being evaluated. While preliminary study reports appear to support other climate change impact observations and modeling simulations, the final published conclusions of these studies are, for the most part, not yet available.

16.3.2 Regional Climate Change Projections

In general, regional climate change modeling simulations project temperature increases throughout California with significant uncertainty associated with future precipitation patterns and water supply projections statewide. In general, changes in precipitation correlate with changes in water supply, with decreased precipitation correlating to decreased stream flows and decreased groundwater percolation. A study conducted by the University of California, Davis Center for Watershed Sciences in 2010 (Null et al.,

2010) evaluated the hydrologic response and watershed sensitivity to climate change for the Sierra Nevada watersheds, including that of the Merced River. This study used a climate-forced rainfall-runoff model to explicitly simulate intra-basin hydrologic dynamics and understand localized sensitivity to climate warming. Using the Stockholm Environmental Institute's Water Evaluation and Planning System (WEAP21), the researches simulated anticipated 2°C, 4°C and 6°C temperature increases and evaluated changes from baseline for three key parameters – mean annual flow, centroid timing, and low flow duration – to highlight relative differential responses across the Sierra Nevada watersheds and in relation to water resource development (water supply, hydropower and mountain meadow habitat, respectively).

In more recent years, a similar study, published in January of 2014, also used the WEAP platform to present an integrated hydrology and water operations simulation model of the Tuolumne and Merced River Basins (Kiparsky et al., 2014). Like the 2010 study discussed above, modelers evaluated impacts and hydrological responses to 2°C, 4°C and 6°C temperature increases according to a historical baseline (1981 – 1999).

In October, 2017, MID released its own *Climate Change Impact Report* assessing how the irrigation district would be affected by climate projections (Dewberry, 2017). This analysis utilized a precipitation-runoff model from the MID Hydrologic and Hydraulic Optimization model. MID ran three future scenarios, evaluating responses to 3°C, 5°C and 10°C temperature increases. Therefore, the results simulate more dramatic climate change circumstances.

Although exact numerical results vary amongst the studies, the general conclusions of all three studies remain consistent. All studies found decreases in mean annual flow, a shift to an earlier snowmelt and runoff, a longer low flow duration, and an overall reduction in surface water reliability in the Merced River watershed.

Impacts on Mean Annual Flow

Both 2010 and 2014 studies found that modeled changes of climate warming in the Merced River watershed resulted in reductions in mean annual flow (MAF). Specifically, UC Davis's 2010 study found that there were approximately 3%, 6% and 8% decreases in mean annual flow on the Merced River resulting from 2°C, 4°C and 6°C increases in air temperature, respectively (Null et al., 2010). Kiparsky's 2014 study also determined that there were decreases in the magnitude of streamflow due to the effects of increased temperature (such as increased evapotranspiration) (Kiparsky et al., 2014). As shown in Table 16-1, model results from the 2014 study showed more dramatic percent decreases in streamflow magnitude than the 2010 study (4%, 8.5%, and 12% for 2°C, 4°C and 6°C increases, respectively).

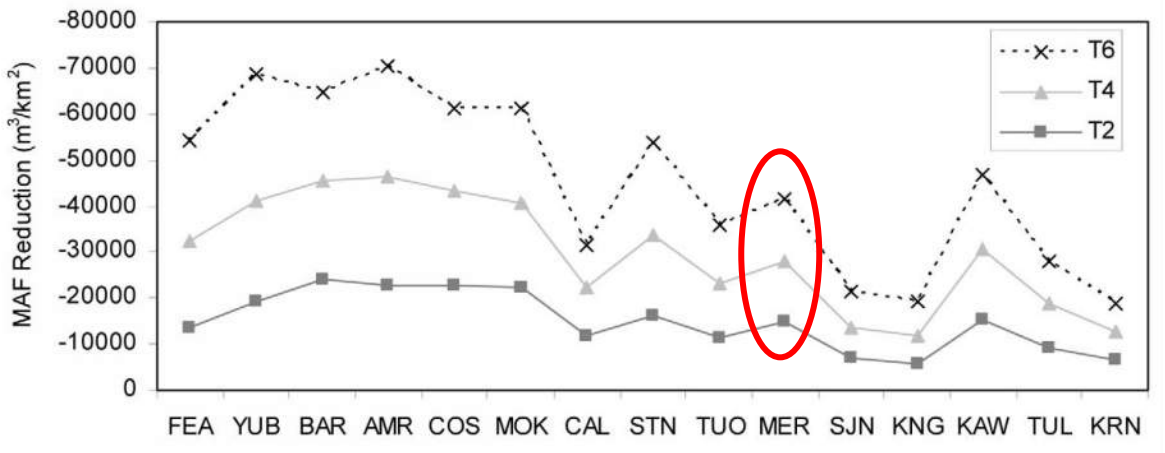
Table 16-1: Mean Annual Flow Projections (2014 Model)

Watershed	Historical MAF (10^6 m^3) (1981 – 1999)	Simulated MAF (10^6 m^3) (1981 – 1999)	Simulated MAF (10^6 m^3) (2°C)	Simulated MAF (10^6 m^3) (4°C)	Simulated MAF (10^6 m^3) (6°C)
TUO	2,608	2,609	2,506 (-3.9%)	2,418 (-7.3%)	2,323 (-11%)
MER	1,363	1,361	1,303 (-4.3%)	1,245 (-8.5%)	1.195 (-12.1%)

Notes:
TUO – Tuolumne River Basin
MER – Merced River Basin
Percentages in parentheses indicate the percent decreases in magnitude of streamflow.
Source: Kiparsky et al., 2014

These reductions in mean annual flow impact instream conditions and habitat for aquatic and riparian ecosystems. As pictured in Figure 16-3, relative to other Sierra watersheds, the Merced River simulations experienced a moderate change in MAF due to climate change and was therefore considered to be less vulnerable to climate warming based on total water stored and changes in MAF than more northern watersheds (such as the American, Yuba, Bear, Mokelumne and Cosumnes Rivers) (Null et al., 2010).

Figure 16-3: Reduction in Mean Annual Flow from Base Case by Watershed

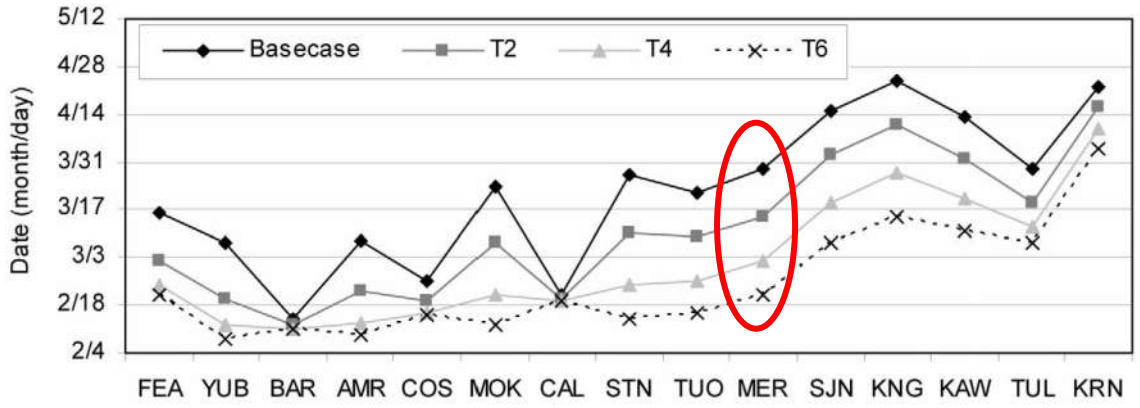


Notes:
MER – Merced River watershed
Source: Null et al., 2010

Impacts on Runoff Centroid Timing

The 2010 modeling results showed that runoff centroid timing (CT) was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2°C, 4°C and 6°C increases in air temperature. These results are shown in Figure 16-4.

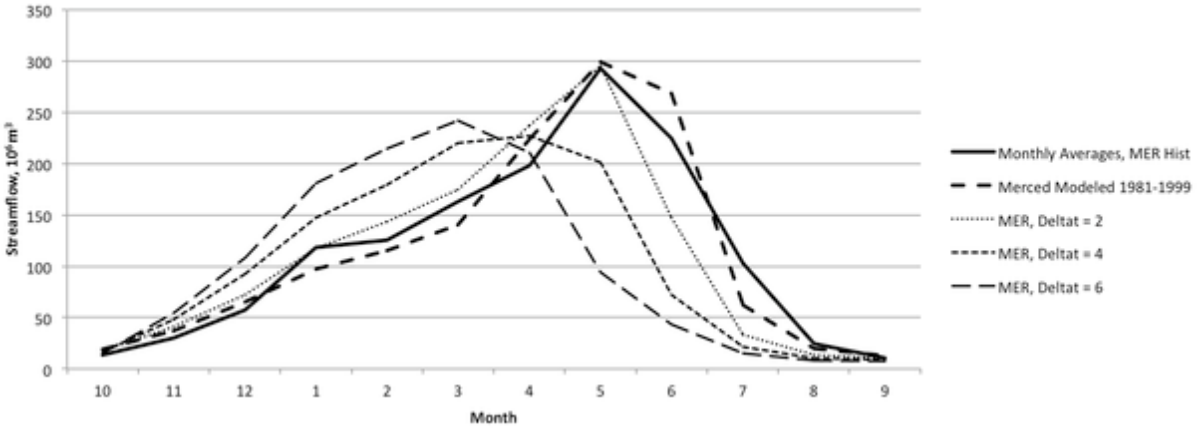
Figure 16-4: Average Annual Centroid Timing by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

Kiparsky's 2014 study also found an earlier snowmelt and resulting shift of peak flows to earlier in the water year. This is demonstrated in Figure 16-5, which plots the streamflow results for the Merced River, as calibrated in response to the 2°C, 4°C and 6°C increases in temperature.

Figure 16-5: Simulated Streamflow for the Merced River (2014 Model)



Source: Kiparsky et al., 2014

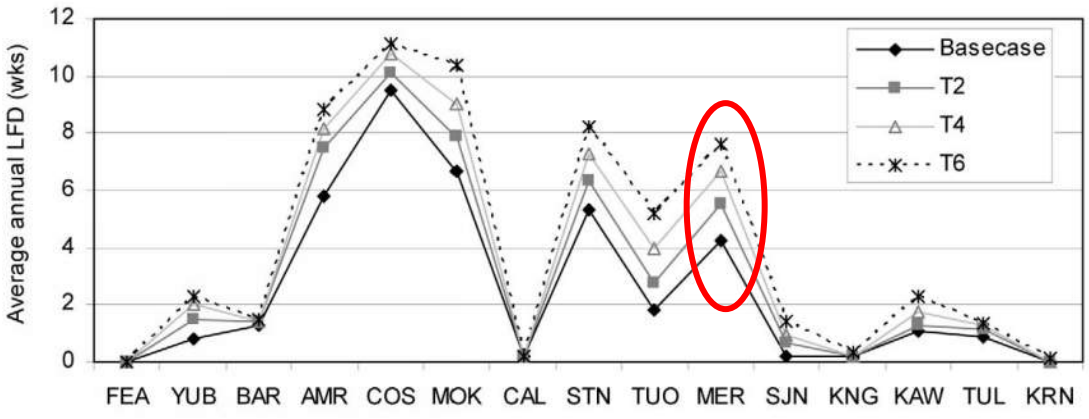
Finally, MID's impact report concurred with these results, finding large differences in the timing of peak flow with warming air temperatures. For the lowest temperature increase modeled ("T+3" scenario), peak discharge occurs at least one month earlier than the historical baseline. In addition, other impacts to runoff timing were observed. For example, the magnitude of precipitation events increased since higher air temperatures caused more precipitation to fall as rain rather than snow. This led to higher immediate runoff, which caused higher risks of flooding in the winter and early spring. Impacts on snowpack were also discussed; the snow water equivalent and snow-covered areas across the Merced River watershed were significantly reduced (Dewberry, 2017).

Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Using online hydropower capacity as a measure of impact, watersheds that rely on hydropower generation may face substantial changes in runoff timing with climate warming. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows. While the Merced River demonstrated changes in CT due to climate warming, the limited generating capacity of the river (relative to that on other Sierra Nevada rivers) makes it one of the less vulnerable watersheds state-wide (Null et al., 2010).

Impacts on Low Flow Duration

The UC Davis 2010 study evaluated the average low flow duration (LFD) for the Sierra Nevada watersheds relative to climate change. For the Merced River, average low flow duration lasted 2, 3 and 4 weeks longer for the 2°C, 4°C and 6°C increases in air temperature, respectively (see Figure 16-6, Null et al., 2010). Changes in LFD were considered a surrogate for montane ecosystems in the study as persistent low flow conditions deplete meadow groundwater reserves and soil moisture, reducing the downstream benefits of meadows. Meadows provide ecosystem services such as maintaining summertime flow during dry periods and reducing floods in winter; providing aquatic and riparian habitat for birds, fish, amphibians, and insects; promoting riparian vegetation rather than conifer or dry shrub vegetation that increases wildfire risks; and improving downstream water quality. Merced River was considered vulnerable to LFD. Along with Yosemite and its meadows upstream, the Merced River could experience habitat loss as a result of climate change (Null et al., 2010).

Figure 16-6: Average Annual Low Flow Duration by Watershed



Notes:
MER – Merced River watershed
Source: Null et al. 2010

Impacts on Surface Water Supply Reliability

In addition to the other climate change impact metrics discussed above, Kiparsky's 2014 study also modeled surface water supply reliability in the Merced River Basin. The study framed reliability as a function of changes in agricultural water demands and hydrology in relation to the modeled behaviors of existing storage, conveyance, and irrigation systems. For each temperature iteration, the "reliability metric" assigns a binary metric where a given time point is determined either to be a failure or success based on an

established demand threshold. The reliability then represents a probabilistic measure of rate of success. The formula used in the 2014 study measures the degree of failure based on the amount of shortfall below the demand threshold. This metric is calculated where *i* represents a given demand point (or group of demand points), and *j* symbolizes timesteps:

$$R_{ij} = 1 - \frac{(Demand_{ij} - Delivery_{ij})}{Demand_{ij}} \; if \; Demand_{ij} \geq Delivery_{ij};$$

$$if \; not \; R_{ij} = 1.$$

Overall, for the agricultural districts simulated, surface supply reliability is reduced with increasing temperature, driven in part by changes in streamflow. For MID, supply reliability decreased for each incremental increase in temperature (See Table 16-2). These results do not account for the potential for other physical (e.g. plant physiological response) or behavioral changes (e.g. changes in irrigation technology or cropping patterns) (Kiparsky et al., 2014).

Table 16-2: Modeled Supply Reliability at Major Irrigation Districts in the Merced River Basin

Irrigation District	DT = 0°C	DT = 2°C	DT = 4°C	DT = 6°C
Modesto Irrigation District	0.84	0.82	0.79	0.75
Turlock Irrigation District	0.86	0.85	0.82	0.79
Merced Irrigation District	0.90	0.86	0.81	0.75

Source: Kiparsky et al., 2014

16.4 Regional Water Resource Vulnerability

Primary water users in the Merced Region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Merced (predominantly), Turlock and Chowchilla Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Merced, Chowchilla, and San Joaquin Rivers. Declining Sierra Nevada snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places. This will, in turn, affect critical natural resource issues in the Region, such as agricultural land conversion, population growth, air, water and soil quality concerns, and loss of habitat land.

Other anticipated regional impacts resulting from climate change (increased air temperatures and variable precipitation) include changes to water quality; increased flooding, wildfires and heat waves; and impacts to ecosystem health. Earlier springtime runoff will increase the risk of winter flooding since capturing

earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space. This forces a choice between winter flood prevention and maintaining water storage for summer and fall dry-period use. Under the 'business-as-usual' climate change scenario (A2), wildfires could increase by 100% or more by the end of the century (CNRA, 2009). Some of these impacts on water resources management are already being observed within the Region.

The 2011 Climate Change Handbook outlines seven categories of key climate change vulnerabilities that are anticipated in California's water resources (CDM, 2011). These include:

- Water Demand
- Water Supply
- Water Quality
- Sea Level Rise
- Flooding
- Ecosystem and Habitat Vulnerability
- Hydropower

These identified vulnerabilities and their applicability to the Merced Region are summarized in Table 16-3 and further described in the following sections.

Table 16-3: Merced Region Vulnerabilities

Vulnerability	Description
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands exacerbating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.
Sea Level Rise	Due to its inland location, sea level rise is not a direct potential climate change impact to the Merced Region.
Flooding	Vulnerable to more severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.
Ecosystem and Habitat Vulnerability	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.
Other	Vulnerable to impacts on recreation and tourism industries (such as Yosemite National Park and ski resorts) that support the Region's economy.

16.4.1 Water Demand

Land use patterns in the Merced Region are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees, all of which rely heavily on water purveyors/districts and private groundwater and surface water supply sources. In general, irrigation water demand varies based on precipitation, and may or may not increase under future climate change conditions. Groundwater pumping is anticipated to increase as more irrigators and agricultural water users turn to groundwater to meet crop water requirements and farming needs (depending on surface water availability). In addition, groundwater salinity increases are projected due to conditions such as drier climate, increased groundwater pumping, and lower induced water tables (Schoups et al., 2010). The effects of increased air temperatures on agriculture will include faster plant development, shorter growing seasons, changes to reference evapotranspiration and possible heat stress for some crops. Without accounting for evapotranspiration rates, agricultural crop and urban outdoor demands are expected to increase in the Sacramento Valley by as much as 6% in the future (Chung et al., 2009). In addition, fruit crops are more climate-sensitive than other crop types and may require additional water as the climate warms. Therefore,

more water may be necessary to maintain yield and quality in future years of apricot or peach crops, for example, in the Merced Region.

When more water is required to maintain yield and potentially reduced supplies available, the agricultural community may respond to these climate-induced changes by increasing the acreage of land fallowing and retirement, augmenting crop water requirements by groundwater pumping, improving irrigation efficiency, and shifting to high-value and salt-tolerant crops (Schoups et al., 2010). However, agricultural impacts resulting from climate changes are anticipated to be significant in the Region, as Merced County ranks 5th in the state in agricultural production with a value of over $3.4 billion (Merced County, 2017). For example, dairy production has the potential to be greatly impacted by changes in climate. Heat stress can have a variety of effects on livestock, including reduced milk production and reproduction in dairy cows (Valtorta, 2002). Models have found that rising temperatures could reduce milk production by 7% - 10% under the B1 scenario and by 11% - 22% under the A1 scenario (Hayhoe et al., 2004).

Based upon each urban water supplier's most recent UWMP and the Merced County General Plan Update, the anticipated total water demand in the Merced IRWM Region is anticipated to be 450,000 AF in 2040. Table 16-4 provides an overview of the total anticipated demands in 2040, categorized by demand type. For a more detailed breakdown of anticipated water demands through 2040, including the demand's corresponding jurisdiction, see Chapter 2 Region Description, Table 2-5.

Table 16-4: Anticipated Total Applied Water Demand in the Merced Subbasin in 2040

Demand Type	AF	Percentage of Total
Municipal[1]	81,398	18%
Agricultural[2]	369,653	82%
TOTAL	451,051	100%

Notes:
1. Demand based on data reported in most recent UWMPs for the City of Atwater (Boyle Engineering Corp., 2007), the City of Livingston (AM Consulting Engineers, 2016), and the City of Merced (Carollo, 2017). Unincorporated demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update (Nolte Associates, 2009).
2. Water demand projections assume the existing demands remain constant through 2040. Existing demands are based on the *Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum* prepared for the Merced County General Plan Update (Nolte Associates, 2009), the MID AWMP (MID, 2016), and communication with Stevinson Water District (R. Kelley, personal communication, August 17, 2018).

Groundwater modeling completed for MID which indicated that groundwater demands are highest during dry years, likely due to the fact that groundwater is primarily used for agricultural irrigation (MID, 2016). The seasonal variability of water demands is projected to increase with climate change as droughts become more common and more severe (DWR, 2008). Other seasonal uses of water resources, such as landscape, irrigation, and cooling demands, are also expected to increase as a result of climate change (DWR, 2008). Identification of industrial cooling tower demands and the demands of similar facilities will help the Region gain better understanding of the potential increases in seasonal demands.

16.4.2 Water Supply and Quality

The Merced Region's water supplies include groundwater, local surface water, and imported surface water from the CVP in the case of CWD. In general, impacts on urban users will be a function of behavioral response of individuals and organizations as well as hydrology. Additional water storage will be required to ensure water supply reliability. Without additional storage, it will be difficult to capture and retain excess

runoff for use after April 1st without reducing the amount of flood storage space left in reserve. Both the need for empty storage for flood protection and the need for carryover storage for drought protection reflect the uncertainty about future weather conditions and the level of regional risk aversion (Hayhoe et al., 2004).

Currently, approximately 75% of total water use statewide currently occurs between April and September when lawns and crops are being irrigated (Hayhoe et al., 2004). Decreased summertime flows will likely result in increased groundwater pumping (and potential overdraft conditions) due to increased groundwater use to offset surface water shortages. Additionally, rising temperatures are projected to increase the frequency of heat waves, which could also lead to increased water use and further exacerbate low flow conditions (Hayhoe et al., 2004).

Changes in water availability and timing will also affect the value of water rights statewide, as mid- and late-season natural stream flow water rights become less valuable and the value of rights to stored water (which has a higher degree of reliability) increase in value. Senior users without access to storage could face unprecedented shortages due to reduced summertime flows (Hayhoe et al., 2004). These same changes will also affect the level of hydropower generation on the Merced River, especially in the summer, when hydropower generation is needed most to meet peak demand (Moser et al., 2012).

Finally, climate change impacts may affect water quality in a multitude of ways.

- Water quality can be impacted by both extreme increases and decreases in precipitation. Increases in storm event severity may result in increased turbidity in surface water supplies while decreases in summertime precipitation may leave contaminants more concentrated in streamflows (DWR, 2008).
- Higher water temperatures may exacerbate reservoir water quality issues associated with reduced dissolved oxygen levels and increased algal blooms (DWR, 2008).

Water quality concerns not only impact drinking water supplies, but also environmental uses and wastewater treatment processes. The altered assimilative capacity of receiving waters may increase treatment requirements, and collection systems could be inundated in flooding events. More prevalent wildfires could result in aerial deposition and runoff of pollutants into water bodies, impacting surface water quality. Declining Sierra Nevada snowpack, earlier runoff and reduced spring and summer stream flows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places.

Groundwater Supply and Quality

The Merced Region overlies three groundwater subbasins within the San Joaquin Valley Groundwater Basin as recognized by DWR in Bulletin 118 (*California's Groundwater*); these include the entirety of the Merced Subbasin and portions of the Chowchilla and Turlock Subbasins. According to the *Merced Groundwater Basin Management Plan Update*, groundwater elevations in the Merced Subbasin have been monitored by DWR, MID, and other entities since the 1950s (AMEC Geomatrix, Inc., 2008). This monitoring data demonstrates that, since 1980, average groundwater levels beneath the Merced Subbasin have declined, on average, approximately 14 feet, with most of this decline occurring between 1980 and 1996. As such, the Merced Subbasin is considered to be in a state of mild long-term groundwater level decline. In addition to dropping groundwater levels, the Merced Subbasin has high concentrations of TDS, generally at depths between 400 and 800 feet below the ground surface, that increase in concentration from east to west. The San Joaquin River acts as a natural saline barrier, so generally, TDS concentrations are greater on the west side of the River and less on the east side. Reduced streamflows in the San Joaquin River could reduce the effect of the natural barrier and allow for further migration of salinity in the

groundwater basin. Additionally, climate change impacts may cause increased evapotranspiration and a longer growing season, further exacerbating groundwater overdraft and high salinity levels.

Portions of the groundwater subbasins are subject to high nitrate concentrations, elevated iron and manganese concentrations, and contamination with MTBE, DBCP and other contaminants which can impact the beneficial use of groundwater. Lastly, the variation in precipitation and streamflow in the future will influence how and when the groundwater subbasins are recharged in the Merced Region.

Surface Water Supply and Quality

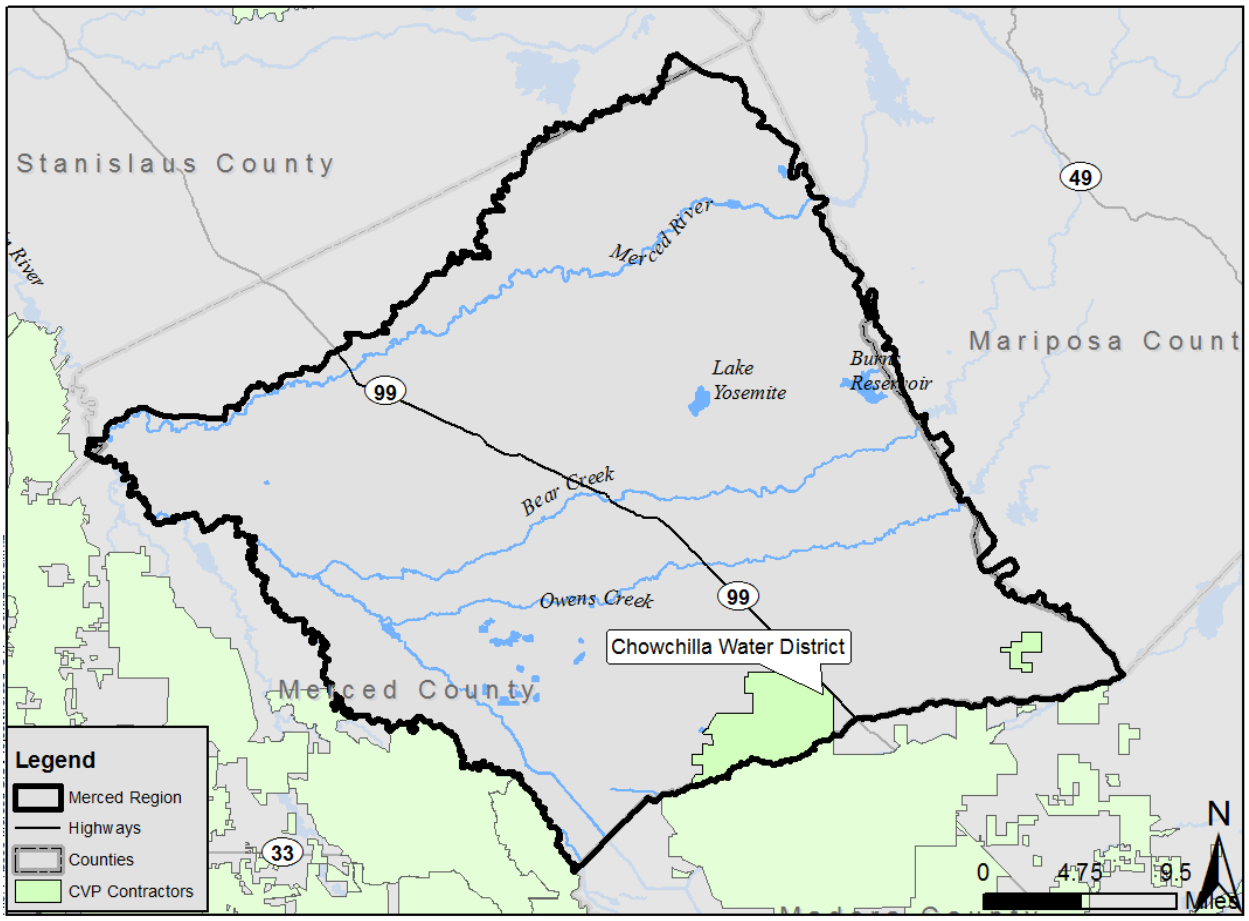
The CVRWQCB compiled the 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins that suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of TMDLs. The Lower Merced River (from McSwain Reservoir to the San Joaquin River) is included on this list. Irrigated agriculture has been identified as a significant anthropogenic source of both nitrate and sediment loading in surface water bodies. Additional sources of sediment loading include erosion, mining, and grazing, among others. Current climate change scenarios project lower stream flows and higher agricultural water use that could pose significant challenges in implementing the defined TMDLs and meeting water quality goals.

As the occurrence of wildfires increases, additional sediment could be deposited into water bodies, and turbidity could likely become more of a concern. Sediment and pollutants collected from upstream could be concentrated downstream, leading to water quality issues and the disturbance of critical habitats. In addition, earlier snowmelt and more intense precipitation events will likely increase turbidity in source waters. Shifts in the timing of runoff have already been observed, and the total annual runoff is projected to decrease by as much as 8.7% in San Joaquin watershed by 2050 (USBR, 2011). Increased flooding may lead to sewage overflows, resulting in higher pathogen loading in the source waters. Increased water temperatures and shallower reservoirs may result in more prevalent eutrophic conditions in storage reservoirs, increasing the frequency and locations of cyanobacterial blooms. These potential changes could result in challenges for surface water treatment plants and require additional monitoring to quantify changes in source water quality and better control of finished water quality (CUWA, 2007).

Imported Surface Water Supply

As shown in Figure 16-7, less than 20% of the CWD service area lies within the Merced Region and it is the only portion of the Merced Region that receives imported water supplies via the CVP. Surface water supplies are delivered to CWD through contracts with the USBR that provides 24,000 AFY from Buchanan Dam and 55,000 AFY of Class 1 Water and 160,000 AFY of Class 2 Water from Friant Dam.

Figure 16-7: CVP Contractors within the Merced Region



Due to delivery reductions by the USBR, the long-term average annual available CVP supply for agricultural and municipal and industrial (M&I) usage is estimated to be 53% and 83% of the contracted amount, respectively. On December 15, 2008, the USFWS released its final Biological Opinion on CVP and SWP Operations Criteria and Plan. In this Biological Opinion, USFWS determined that continued operation of these two water projects would likely adversely affect critical habitat for the delta smelt, a threatened species under the Endangered Species Act. Implementation of recommendations contained in this study has faced legal action, resulting in a 2010 district court ruling that the 2008 Biological Opinion was "arbitrary and capricious". Meanwhile, in 2014, the U.S. Court of Appeals for the Ninth Circuit reversed in part and affirmed in part the district court's judgement on the 2008 Biological Opinion (U.S. Court of Appeals for the Ninth Court, 2014). Long-term implementation of the USFWS's 2008 Biological Opinion could impact the long-term availability of CVP supplies.

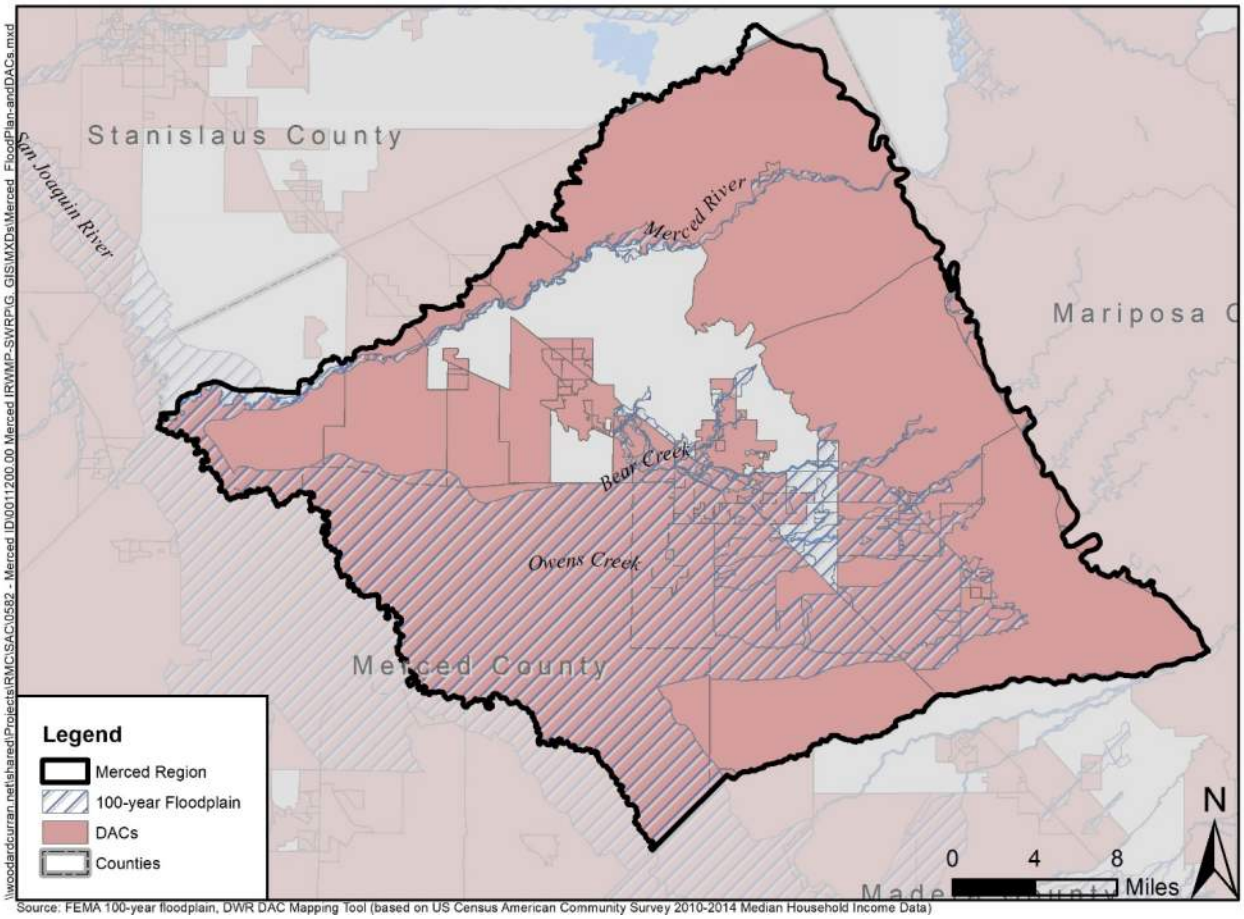
As a result of the increased temperature, DWR anticipates a 20% to 40% decrease in the state's snowpack by mid-century (DWR, 2008). This reduction in snowpack impacts the SWP, CVP and water systems that rely on the San Joaquin River and its tributaries. The SWP 2009 Delivery Reliability Report (DWR, 2010b) indicates that Delta exports may be reduced by up to 25% by the end of the century.

16.4.3 Flooding

Sea level rise is not a direct potential climate change impact to the Merced Region. Sea level rise will result in increased coastal flooding; severity of non-coastal flooding will also increase in the future due to climate change. Changes in the amount, intensity, timing and variability of runoff, as well as extreme precipitation events, will become more common, increasing the likelihood of extreme weather events and floods. Rising snowlines will also increase the surface area in watersheds receiving precipitation as rain instead of snow (DWR, 2008), thereby increasing storm-related runoff. The Merced Region experienced three major flood events in recent years (1998, 2006 and 2017) that caused significant damage to homes, bridges, roads, and other structures, as well as geomorphic impacts to nearby creeks. These events could increase under anticipated future conditions.

There are significant portions of the Merced Region that lie within FEMA designated 100-year and 500-year flood zones. Low-lying DACs will be particularly vulnerable to flooding damages causing temporary and/or permanent displacement. Some of the DACs within the Merced Region lie within the 100-year floodplain as shown in Figure 16-8.

Figure 16-8: DACs within 100-year Floodplain



16.4.4 Ecosystem and Habitat

Eastern Merced County supports the largest unfragmented blocks of high-density vernal pool grasslands remaining in California. These vernal pools contain numerous rare and endangered species such as fairy shrimp, tadpole shrimp and several rate Orcutt tribe grasses (Economic & Planning Systems, Inc., 2009). These species and others that are susceptible to heat waves, droughts, and flooding may be in danger and invasive species may become even more challenging to manage (CCSP, 2009). Conservation efforts in the Region include work by UC Merced, in which the University placed the vernal pools and grassland reserve to the north and east of campus in the UC Reserve System in 2014, conserving a large block of vernal pool grasslands.

Climate change impacts on the environment within the Merced Region also include changes in vegetation distribution and increases in ecosystem stress. Specifically, temperature-induced declines in alpine/subalpine forests are expected to occur in addition to major shifts from evergreen conifer forests to mixed evergreen conifer forests and expansion of grasslands (Hayhoe et al., 2004). Increasing stress on ecosystems resulting from rising temperatures will reduce capacity to resist pest attacks while increasing pest survival rates, accelerating their development and allowing them to expand their range. Increasing temperatures will also result in warmer freshwater temperatures which, along with changes in seasonal stream flows, are projected to cause sharp reductions in salmon populations and increased risks of extinction for some Central Valley subpopulations (Ackerman and Stanton, 2011).

Projected hotter and possibly drier future conditions will also increase the frequency and extent of wildfires, worsen pest outbreaks, and stress precarious sensitive populations. Wildfires will play a significant role in converting woodlands to grassland as decreases in moisture shift the competitive balance in favor of the more drought-tolerant grasses and increases in grass biomass provide more fine fuels to support more frequent fires. Increased wildfires also favor grasses, which re-establish more rapidly than slower growing woody life forms after burning (Hayhoe et al., 2004)

Finally, decreases in precipitation will directly affect both surface water and groundwater quality. Warmer surface water will result in lower dissolved oxygen concentrations, which can directly impact aquatic and riparian habitats. Decreased precipitation and associated decreased groundwater percolation will result in increased dissolved concentrations of constituents in groundwater.

16.4.5 Hydropower

MID has generated wholesale electric power at its hydroelectric facilities for over 75 years. In 1967, McSwain and New Exchequer Dams were completed in Mariposa County, downstream of Lake McClure. The combined hydroelectric output for these two facilities is over 107 megawatts, and MID produces an average of approximately 330 million kilowatts per year (MID, 2018). Although the hydroelectric facilities and New Exchequer and McSwain Dams are outside the Merced regional boundary, they are operated by MID and currently provide power to the State's open grid. The Merced River Hydroelectric Project is operated to provide water supply, flood control, recreation and hydropower, and it is a component of MID's water portfolio. Power generation depends on gravity-driven water flow from the Lake McClure Reservoir into the New Exchequer powerhouse. Turbines then harness this gravity flow and create clean hydroelectric power. Within the past few years, MID also completed an upgrade to the McClure powerhouse which improved the process efficiency by 8 percent (MID, 2018).

Lake McClure and the Merced River are supplied primarily by snowmelt from the Sierra Nevada. Changing volumes of snowfall and snowpack in the Sierra Nevada and the changing seasonal melting patterns may require changes in dam operation. As the timing of snowmelt shifts in the spring, hydroelectric power

generation may also shift to accommodate enhanced flood control operations. Additionally, increasing temperatures will also increase energy demands, especially during peak demand times (DWR, 2008). As previously described, the modeling completed as described in the Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada, showed that runoff centroid timing (CT) on the Merced River was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2°C, 4°C and 6°C increases in air temperature, respectively. Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows (Null, et. al. 2010).

16.4.6 Other

Climate change will also affect the Region in other ways, including impacting recreation and the tourism industries (and therefore the Region's economy). As one of the gateways to Yosemite National Park, the City of Merced and surrounding communities rely on this industry as part of its economy. Stressed environments and increased wildfire will put these natural resources at risk. Projections of decreased snowpack have the potential to affect the ski industry as the State's 34 ski resorts are based between 6,500 and 8,200 feet, well into the elevations impacted by temperature increases. These same temperature increases will also delay the start of ski season and impact the economic viability of the industry (Hayhoe et al. 2004).

16.4.7 Prioritized Vulnerabilities

The Merced Region's vulnerabilities to anticipated climate changes were prioritized based on discussion with the RWMG and the RAC considering regional understanding and sensitivities and identified regional goals and objectives. The prioritized vulnerabilities for the Region were as follows:

1. Water Supply/Water Quality
2. Flooding
3. Hydropower
4. Water Demand
5. Ecosystem and Habitat Vulnerabilities

The rationale behind the prioritization acknowledges that the groundwater basin is already in overdraft condition and that increasing demands, combined with additional water supply reductions, will exacerbate this condition. Changes in the amount, intensity, timing, quality and variability of runoff (e.g. earlier springtime runoff and/or lower annual flows) will result in significant changes in river flows, potentially impacting both regional flooding and hydropower operations. Flooding and flood management is a major issue for the Region at present, and a flashier river/stream system is only going to worsen this condition. Finally, while ecosystem and habitat issues are important, they derive from the other issues/vulnerabilities (e.g., water supply and quality, which is exacerbated by demand and flood issues), therefore ranking a lower vulnerability.

16.5 Strategies for Climate Change Adaptation and Mitigation

Global climate modeling carries a significant degree of uncertainty resulting from varying sensitivity to changes in atmospheric forcing (e.g. CO_2, aerosol compounds), unpredictable human responses, and incomplete knowledge about the underlying geophysical processes of global change. Even though current scenarios encompass the "best" and "worst" cases to the greatest degree possible based on current knowledge, significant uncertainty associated with future global GHG emission levels remains, especially

as timescales approach the end of the century. The historical data for calibrating global circulation models (GCMs) are not available worldwide and are spatially biased towards developed nations.

Considering the great deal of uncertainty associated with climate change projections, a prudent approach to addressing climate change incorporates a combination of adaptation and mitigation strategies. Climate adaptation includes strategies (policies, programs or other actions) that bolster community resilience in the face of unavoidable climate impacts (CNRA, 2012), where mitigation strategies include BMPs or other measures that are taken to reduce GHG emissions.

16.5.1 Climate Change Adaptation RMS

In accordance with the 2016 IRWM Guidelines (DWR, 2016), RMS are being considered in the Merced IRWM planning process to meet the Region's objectives. Application of various RMS diversifies water management approaches, and many of the RMS apply to climate change adaptation and mitigation. As a result, the Region has evaluated RMS in their ability to eliminate or minimize the vulnerabilities resulting from climate change, especially those impacting water infrastructure systems. Categories of applicable RMS include:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers
- Increase Water Supply
- Improve Water Quality
- Improve Flood Management
- Practice Resource Stewardship
- People and Water
- Other Strategies

This section discusses each of these RMS categories and how each can be utilized to address to climate change impacts. This analysis was conducted as part of the Region's Climate Change Study (RMC, 2013d).

Reduce Water Demand

Reducing existing and future water demands can reduce pressure on water sources of limited supply and help the Region to adapt to the potential climate change impacts of less precipitation, shifting of springtime snowmelt, and overall uncertainty. The Reduce Water Demand RMS includes both agricultural and urban water use efficiency.

Agricultural Water Use Efficiency

As discussed in Chapter 5, Section 5.4.1 Reduce Water Demand, the Merced Region is already implementing many agricultural water use efficiency efforts. For example, MID, the Region's primary agricultural water supplier, has identified and is currently implementing Efficient Water Management Practices as part of its AWMP (MID, 2016). The following are some of the Efficient Water Management Practices that MID is in the process of implementing:

- **Infrastructure Upgrade:** Evaporation loss from irrigation ditches and canals is a function of temperature and other climate variables. Depending on different emission scenarios, the operation of these facilities may be impacted by climate change, leading to increased water loss. One of the Efficient Water Management Practices is to convert irrigation canals and ditches to piping. This water conservation method prevents evaporative losses, which will only increase as temperatures rise. This approach could help the Merced Region adapt to climate change by expanding water

supplies and making existing water supplies less vulnerable to climate change impacts. Canal lining is identified as a less capital-intensive method to reduce seepage into the ground, although it does not reduce water evaporation and does reduce groundwater recharge that occurs as a result of this seepage. In addition, canal automation can increase water supply reliability and flexibility to deliver water at the time, quantity, and duration required by the grower, and can facilitate conversion to more efficient irrigation methods such as micro-irrigation (MID, 2016; RMC, 2013d).

- **Water Management:** Water suppliers and users must take advantage of new technologies and hardware to optimize management of water-related infrastructure. SCADA systems enable water managers to collect data to a centralized location and operate automated canals to achieve desired water levels, pressures or flow rate, and also increase the efficiency in reservoir operation. In addition, automated control will free water system operators from manual operation and allow them to plan, coordinate system operations, and potentially reduce costs. Such systems improve communications and provide for flexible water delivery, distribution, measurement, and accounting. On-farm practices can also be improved. Furrow, basin, and border irrigation methods have been improved to ensure that watering meets crop water requirements while limiting runoff and deep percolation. Using organic or plastic mulch can reduce non-essential evaporation of applied water. Advanced irrigation systems include GIS, GPS and satellite crop and soil moisture sensing systems and can all improve overall farm water management (MID, 2016; RMC, 2013d).

Urban Water Demand Reduction

DWR's *20x2020 Water Conservation Plan* includes urban water conservation measures that can be employed to improve water use efficiency. According to the 20x2020 Plan, approximately one third of urban water use is dedicated to landscape irrigation (DWR, 2010a); as such, the greatest potential for urban water use reduction is in reduced landscape irrigation. New landscapes could be designed to be efficient and suitable for the local climate, and existing high-water-using landscapes could be transformed into lower, more efficient alternatives. Weather-based irrigation is a cost-effective measure to improve landscape watering efficiency. Irrigation restrictions can limit landscape irrigation to two days per week or less, encouraging climate-appropriate landscapes and reducing over-irrigation. The 20x2020 Plan also recommends mandating the landscape irrigation BMPs and requiring water-efficient landscapes at all state-owned properties (DWR, 2010a; RMC, 2013d).

Improve Operational Efficiency and Transfers

Water supply system operations need to be optimized in order to maximize efficiency. Existing infrastructure for regional and local conveyance, including facilities that connect to the CVP system, must be maintained and improved as their useful lives are reached. Well-maintained conveyance infrastructure improves water supply reliability and enhances regional adaptability to climate change impacts. Addressing aging infrastructure, increasing existing capacity, and/or adding new conveyance facilities can improve existing conveyance systems and operational efficiency (CDM, 2011).

Through system reoperation, the Merced Region may be able to adapt to less reliable water supplies and/or increased water demands by maintaining conveyance infrastructure, as well as adapting to climate change impacts on hydropower production, flooding, habitat, and water quality.

The Region is currently investigating and implementing water transfers. For example, as discussed in Chapter 5, Section 5.4.3 Increase Water Supply, the City of Merced and MID are developing an MOU to formalize the exchange of tertiary-treated wastewater effluent from the City of Merced for surface water from MID. This will help the Region adapt to climate change by providing additional climate resilient water

supplies. As such, transfers can improve supply reliability when other supplies are projected to have reduced reliability due to climate change impacts.

An example of a performance metric to quantify this RMS is the amount of new supply created through regional water transfers (CDM, 2011; RMC, 2013d).

Increase Water Supply

As water demands increase due to longer growing seasons, higher temperatures, and longer droughts, and the future of existing water supplies sources becomes less certain, the Merced Region will need to enhance existing water supplies to meet demands. Increasing water supply can be accomplished through the implementation of conjunctive management of surface and groundwater supplies as well as through groundwater storage, recycled water use, and increased surface water storage, as appropriate. Diversifying the region's water supply portfolio and adding drought-resistant sources is an adaptation measure that will help address increased water demands and/or decreased supply reliability. Performance metrics for measuring the effectiveness of this RMS could include additional supply created, amount of potable water offset, and supply reliability (CDM, 2011).

Conjunctive Management and Surface and Groundwater Storage

MAGPI, the former Merced RWMG, developed and has been implementing the *Merced Groundwater Basin Groundwater Management Plan*, which promotes conjunctive surface water and groundwater management to improve the long-term sustainability of the Merced Groundwater Basin (AMEC Geomatrix, Inc., 2008). MAGPI was formed in 1997 (consisting of water purveyors in the Merced Groundwater Basin in addition to Merced County and EMRCD), recognizing the potential benefits regional planning would create when considering surface water and groundwater management in the basin. The Merced Region continues to investigate conjunctive management to increase surface and groundwater use, improve groundwater quality, and adapt to climate change. Increased storage and conjunctive use may increase resilience to shifting runoff patterns, providing more storage for early runoff, reducing or eliminating the potential climate change impacts from flooding and on hydropower production, and offsetting decreases in snowpack storage. This strategy is valuable as weather patterns change in frequency and timing and more extreme events occur.

Developing a project to provide additional local surface storage is a possible adaptation strategy for climate change impacts on water supply and associated reliability. Storage provides a way of adjusting a water system to altered peak streamflow timing resulting from earlier snowpack melting. Additional storage capacity could also help the Merced Region adapt to the anticipated increased precipitation variability. It would also facilitate water transfers between basins from upstream reservoirs to receiving regions that have additional storage for the transferred water. Added storage provides greater flexibility for capturing surface water runoff, managing supplies to meet seasonal water demands, helping manage floods from extreme storm events, and adapt to extreme weather conditions such as droughts.

In addition to new storage, agencies could consider the potential to develop water purchasing agreements to buy water from other agencies that own existing storage reservoirs with substantial water supplies. Rehabilitation and possible enlargement of existing dams and infrastructure can potentially eliminate the need for new reservoir storage.

Finally, implementing conjunctive management and groundwater storage can provide benefits similar to additional surface storage, in addition to increased water management flexibility while also reducing groundwater overdraft. There is the potential to bank imported water, flood flows, runoff, and/or recycled water for dry seasons in groundwater basins. Conjunctive management is highly dependent on how well

surface water and groundwater are managed as a single source to adapt to the changing climate system (RMC, 2013d).

Desalination (Brackish and Sea Water)

Because the Merced Region is not a coastal region, desalinating seawater is not an option and therefore not a reasonable climate change adaptation strategy. Desalination of deep connate groundwater is a possibility; however, the potential for land subsidence and brine discharge pose significant challenges to implementing this as a cost-effective adaptation strategy (RMC, 2013d).

Municipal Recycled Water Use

The *California Recycled Water Policy*, developed by the SWRCB in 2009, includes a goal of substituting as much recycled water for potable water as possible by the year 2030. Recycled water is a sustainable, climate-resilient local water resource that could significantly help the Merced Region meet water management goals and objectives and assist in meeting the seasonal water demands of agriculture. Water recycling also provides a local supply that generally uses less energy than other water supplies, helping to mitigate climate change impacts through associated reductions in GHG emissions. Recycled water will continue to be used for agricultural purposes and urban landscape irrigation in the Region (Carollo, 2017), and expanded use will be encouraged and explored (RMC, 2013d).

Improve Water Quality

Improving drinking water treatment and distribution, groundwater remediation, matching water quality to use, pollution prevention, salt and salinity management, and urban runoff management can help improve water quality. These strategies may help the Region adapt to drinking water and ecosystem-related water quality impacts from climate change. They may also contribute to providing additional supplies; for example, stormwater capture and reuse would reduce pollution and also provide a seasonal source of irrigation water for urban landscaping or groundwater recharge. Water quality performance metrics for this RMS could include stream temperature, dissolved oxygen content, and pollutant concentrations (CDM, 2011).

Drinking Water Treatment and Distribution

Climate change impacts can pose challenges for surface water treatment plants in a number of ways, including increased monitoring and treatment flexibility necessary to quantify and treat for source water quality changes in order to maintain finished water quality. Continued growth statewide will result in increased stress on the limited water resources available for domestic, agricultural, and industrial uses. Improving water treatment technologies and matching quality to end use can provide the flexibility required to meet uncertain future conditions (RMC, 2013d).

Groundwater Remediation

Removing contaminants and pollutant plumes in current groundwater sources will provide additional water supply by allowing an otherwise unusable source to become usable. Combined with matching water quality and quantity to water demand type, this adaptation strategy will help reduce the need for imported water supplies with higher capital costs and greater associated GHG emissions.

Local government and agencies with land use responsibility should limit potentially contaminating activities in areas where recharge takes place (recharge zone protection) and work together with entities currently undergoing long-term groundwater remediation to develop a sustainable, long-term water supply for beneficial reuse (RMC, 2013d).

Pollution Prevention

In recent years, as point sources of pollution have become regulated and controlled, "non-point source" pollution has become a primary concern for water managers. Non-point source pollution is generated from land use activities associated with agricultural development, forestry practices, animal grazing, uncontrolled urban runoff from development activities, discharges from marinas and recreational boating activities, and other land uses that contribute pollution to adjacent surface and groundwater sources.

Pollution prevention and management of water quality impairments should incorporate a watershed approach. DWR recommends the following approach to reduce non-point source pollution to existing surface and groundwater sources (DWR, 2013):

- Establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination.
- Identify communities that rely on groundwater contaminated by anthropogenic sources as their drinking water source and take appropriate regulatory or enforcement action against the responsible party.
- Address improperly destroyed, abandoned, or sealed wells in these communities that may serve as potential pathways for contaminants to reach groundwater.

Public education can also reduce non-point source pollution to surface and groundwater sources. Protecting water supply sources will help to ensure that long-term sustainability of those supplies (RMC, 2013d).

Salt and Salinity Management

Accumulation of salts in soil can impair crop productivity, making salinity management a critical concern for the Region's highly productive agricultural industry. Salinity management strategies establish or improve salinity management in the Region based on an understanding of salt loading and transport mechanisms. Several potential benefits of establishing or improving salt and salinity management include protecting water resources and improving water supplies, securing, maintaining, expanding, and recovering usable water supplies, and avoiding future significant costs of treating water supplies and remediating soils. Salt and salinity management strategies identified by the *California Water Plan Update 2013* include (DWR, 2013):

- Develop a regional salinity management plan, and interim and long-term salt storage, salt collection, and salt disposal management projects;
- Monitor to identify salinity sources, quantifying the level of threat, prioritizing necessary mitigation action, and working collaboratively with entities and authorities to take appropriate actions;
- Review existing policies to address salt management needs and ensure consistency with long-term sustainability;
- Collaborate with other interest groups to optimize resources and effectiveness; and
- Identify environmentally acceptable and economically feasible methods for closing the loop on salt.

As discussed in Chapter 5, Section 5.4.4 Improve Water Quality, the Region developed a salt and nutrient management plan as part of the Merced IRWM planning process. This plan identifies specific salt and salinity challenges within the Region and strategies to help adapt to climate change by mitigating potential salinity increases associated with climate change (RMC, 2013b; RMC, 2013d).

Urban Stormwater Runoff Management

Urban stormwater runoff management, including Low Impact Development (LID), encompasses a broad range of activities to manage both stormwater and dry weather runoff. Stormwater capture and reuse projects can reduce the burden on wastewater treatment plants and potable water supplies, helping a region adjust to climate change impacts on water quality and water supply (CDM, 2011). The Merced Region should investigate and implement LID techniques and opportunities where appropriate and integrate urban runoff management with other RMS (RMC, 2013d).

Improve Flood Management

Increased frequency and severity of storm events will require the Merced Region to collaborate and accelerate flood protection projects in order to adapt to increased flooding risks due to climate change. Flood management involves emergency planning, general planning activities, and policy changes. Improving flood management can help a region adapt to not only potential flooding, but many other climate change impacts including ecosystem and water quality vulnerabilities. Performance metrics could include acres of meadows restored or volume of natural flood storage provided (CDM, 2011).

As discussed in Chapter 5, Section 5.4.5 Improve Flood Management, the Merced Region, as part of its IRWM planning process, completed an Integrated Flood Management Study to improve flood management. This study addresses flooding throughout the Merced Region and helps to identify strategies to implement to contribute to this RMS and help adapt to climate change impacts (RMC, 2013a).

Structural Improvement

Local flood jurisdictions should establish long-term buyback programs to acquire properties immediately adjacent to levees and other structural facilities to facilitate the eventual removal or relocation of these structures and enhance the potential for setback levees and floodplain restoration where feasible. Planning for structural projects should be integrated into a comprehensive integrated flood management program that takes a watershed approach (DWR, 2013; RMC, 2013d).

Disaster Preparedness, Response, and Recovery

The vulnerability assessment previously described in Section 16.4, Regional Water Resource Vulnerability, helps identify the resources that are most susceptible to climate change impacts. Flood control districts and other relevant jurisdictions should analyze potential flood risks and make this information publicly available. The public should be provided with sufficient information about potential flood risks to make informed decisions that safeguard their lives, property, and critical facilities. Flood control districts should also incorporate the potential effects of climate change into planning for future flood events. Until more refined projections are developed, DWR recommends using a 20% higher peak flow reference for planning purposes (DWR, 2013; RMC, 2013d).

Practice Resource Stewardship

Resource stewardship includes overseeing and protecting land, wildlife, and water by way of conservation and preservation, ecosystem restoration and forest management, watershed management, flood attenuation, and water-dependent recreation. Restoring and preserving habitat and wetlands has multiple benefits, including promoting biodiversity and habitat enhancement as well as improved flood management, as the natural storage provided by riparian wetlands can serve as buffers that absorb peak flows and provide slow releases after storm events (DWR, 2008). Because the scope of resource stewardship includes all resources, these strategies can help adapt to climate change impacts in various ways, depending on project-specific details (CDM, 2011).

Agricultural Lands Stewardship

Counties should adopt agricultural general plan elements and designate supportive agricultural districts that enhance agricultural land stewardship on high priority, productive agricultural lands. The focus of these districts should be for:

- Regulatory assistance through county agricultural ombudsmen;
- Local agricultural infrastructure investment, marketing assistance, and the development of agricultural lands stewardship practices and strategies in cooperation with local, State and federal agricultural conservation entities;
- Land protection instruments, such as the Williamson Act and agricultural conservation easements; and
- Engagement of resource organizations such as resource conservation districts, the American Farmland Trust, and Ag Futures Alliances (via Ag Innovations Network), and be integrated with IRWMPs and HCPs where appropriate.

This recommendation should be implemented over the long-term as each county general plan is updated (CDM, 2011; RMC, 2013d).

Ecosystem Restoration

Climate change is predicted to further fragment, stress and shrink California's ecosystems. Appropriate corrective actions should be designed to expand and reconnect them, preventing or reversing these effects. As water managers in the region identify adaptation strategies for water and flood management, they should consider strategies that will also benefit ecosystems as follows.

1. Establish large biological reserve areas that connect or reconnect habitat patches.
2. Promote multidisciplinary approaches to water and flood management.
3. Expand financial incentives for farmers to grow and manage habitat.
4. Improve instream flow needs (CDM, 2011).

Improved and enhanced aquatic and riparian habitats can provide significant water resource benefits through promoting groundwater recharge, protecting and improving water quality, and contributing to flood protection (RMC, 2013d).

Forest Management

Although local water agencies that comprise MIRWMA, the Merced Region's RWMG do not have responsibility to manage the upland forested areas that drain to the Region, protection of those lands is important for ensuring high quality surface runoff supplies. Proper forest management would improve water quality, help reduce wildfires, and improve ecosystem and habitat within the Region.

Additional stream gages and precipitation stations upstream of the Region (as well as within the Region itself) could help establish and confirm climate trends and evaluate hydroclimatic and geologic conditions. Water quality and sediment monitoring stations would allow quantification of the effects of climate change as well as forest management activities on surface water quality (CDM, 2011; RMC, 2013d).

Land Use Planning and Management

General plans should be updated to reflect increased future flood risks; these should be updated as hydrologic projections change. Land use elements should identify and review flood-prone areas established

by FEMA or DWR. Also, revised general plans and regulations should reflect an integrated flood management approach.

Local land use agencies should not allow new critical public facilities, meaning those facilities that are required to maintain public health and safety, to be constructed within the 200-year floodplain. Existing critical facilities located in flood-prone areas should be noted in the Emergency Plans prepared by local agencies, with evacuation routes clearly identified.

Promoting the preservation of existing floodplains, restoration of natural floodplain functions where feasible, and careful analysis of the interface between natural floodplains and flood management structures can help prevent erosion and debris deposition from creating undue hazards to downstream facilities and property (DWR, 2013; RMC, 2013d).

People and Water

Climate change can be a polarizing and confusing topic that is difficult to communicate to many people. Oftentimes, the public can view climate impacts as global rather than local. Regardless of how these environmental issues are perceived, water management systems are vulnerable to and are being affected by ongoing changes in climate. Therefore, outreach and engagement are vital aspects of society's process of adapting to these impacts. This RMS is critical to improving communications between different groups of people and public agencies about the importance of climate adaptation and mitigation efforts. Promoting the benefits of improving air quality, public health, and water supply reliability is a significant part of encouraging public acceptance and investment in mitigation activities. In addition, water-dependent recreation will need to evolve as the climate changes. Due to increased temperatures, more people may seek water-dependent recreation for cooling. Meanwhile, increased variability in precipitation patterns will affect the quality of recreational water bodies, and armoring of coastlines due to sea level rise may pose safety risks and affect recreational access to beaches (DWR, 2013; RMC, 2013d).

Other Strategies

Additional conservation and demand reduction measures, such as crop idling, irrigated land retirement, and rainfed agriculture, could be implemented as climate change adaptive management strategies under this RMS (RMC, 2013d).

16.5.2 Applicability of RMS to Climate Change Adaptation

In order to further understand the potential synergies between the Region's RMS and climate change, the 2011 Climate Change Handbook outlines eight areas of climate change adaptation that must be considered to establish overall system resiliency (CDM, 2011). These include:

- Habitat Protection
- Flood Control
- Water Supply Reliability
- Additional Water Supply
- Water Demand Reduction
- Sea Level Rise
- Water Quality Protection
- Hydropower

The Climate Change Handbook then uses a table to demonstrate the overlap between these areas of climate change adaptation and RMS. This table is replicated and customized for the Region in Table 16-5, representing the overlap between climate change adaptation and individual RMS deemed appropriate for the Region. As more vulnerability tools and assessments are developed related to the impacts that climate change may have on water resources, additional adaptation strategies will be identified to address the potential region-specific impacts of climate change.

Table 16-5: Applicability of RMS to Climate Change Adaptation

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Water Quality Protection	Hydropower
Reduce Water Demand							
Agricultural Water Use Efficiency			✓		✓	✓	
Urban Water Use Efficiency			✓		✓	✓	
Improve Operational Efficiency and Transfers							
Conveyance-Regional/Local	✓	✓	✓	✓		✓	
System Reoperation	✓	✓	✓	✓			✓
Water Transfers			✓	✓			
Increase Water Supply							
Conjunctive Management and Groundwater Storage		✓	✓	✓		✓	
Municipal Recycled Water			✓	✓			
Surface Storage - CALFED	✓	✓	✓	✓		✓	✓
Surface Storage-Regional/Local	✓	✓	✓	✓		✓	✓
Improve Water Quality							
Drinking Water Treatment and Distribution			✓	✓		✓	
Groundwater Remediation/Aquifer Remediation			✓	✓		✓	
Matching Water Quality to Use			✓	✓		✓	
Pollution Prevention	✓		✓			✓	
Salt and Salinity Management	✓		✓	✓		✓	
Urban Stormwater Runoff Management	✓	✓				✓	

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Water Quality Protection	Hydropower
Improve Flood Management							
Flood Management	✓	✓				✓	✓
Practice Resource Stewardship							
Agricultural Lands Stewardship	✓	✓			✓	✓	
Ecosystem Restoration	✓	✓	✓			✓	
Forest Management	✓	✓	✓			✓	
Land Use Planning and Management	✓	✓				✓	
Recharge Area Protection		✓	✓	✓		✓	
Sediment Management	✓	✓	✓			✓	✓
Watershed Management	✓	✓	✓	✓		✓	✓
People and Water							
Economic Incentives	✓	✓	✓	✓	✓	✓	✓
Outreach and Engagement	✓	✓	✓	✓	✓	✓	✓
Water and Culture	✓				✓	✓	
Water-Dependent Recreation	✓	✓	✓			✓	
Other Strategies							
Crop Idling for Water Transfers			✓	✓	✓		
Irrigated Land Retirement			✓		✓		
Rainfed Agriculture					✓		

Source: Adapted from the Climate Change Handbook for Regional Water Planning (CDM, 2011).

16.5.3 "No Regret" Strategies

In addition to RMS, the Region also identified "No Regret" adaptation strategies that address climate change impacts. "No Regret" strategies are practices that make sense for the current water management context and conditions while also providing benefits in the context of future projected conditions caused by climate change. As a result, the Region either is already implementing or planning to implement its "No Regret" strategies.

Table 16-6 summarizes which RMS deemed appropriate for the Region overlap with "No Regrets" strategies for the Region.

Table 16-6: No Regret Strategies in the Merced Region

Resource Management Strategies	No Regrets Strategy
Reduce Water Demand	
Agricultural Water Use Efficiency	✓
Urban Water Use Efficiency	✓
Improve Operational Efficiency and Transfers	
Conveyance-Regional/Local	
System Reoperation	
Water Transfers	✓
Increase Water Supply	
Conjunctive Management and Groundwater Storage	✓
Recycled Municipal Water	✓
Surface Storage – CALFED	
Surface Storage – Regional/Local	
Improve Water Quality	
Drinking Water Treatment and Distribution	✓
Groundwater Remediation/Aquifer Remediation	✓
Matching Quality to Use	✓
Pollution Prevention	✓
Salt and Salinity Management	
Urban Runoff Management	✓
Improve Flood Management	
Flood Risk Management	✓
Practice Resource Stewardship	
Agricultural Lands Stewardship	✓
Ecosystem Restoration	✓

Resource Management Strategies	No Regrets Strategy
Forest Management	
Land Use Planning and Management	✓
Recharge Area Protection	✓
Sediment Management	✓
Watershed Management	✓
People and Water	
Economic Incentives	✓
Outreach and Engagement	✓
Water and Culture	
Water-Dependent Recreation	
Other Strategies	
Crop Idling for Water Transfers	
Irrigated Land Retirement	
Rainfed Agriculture	✓

16.5.4 GHG Reduction Strategies

Table 16-7 (adapted from the California Water Plan Update 2009) identifies GHG reduction opportunities associated with each RMS deemed appropriate for the Region. Many of these RMS reduce energy consumption, especially the energy embedded in water, which ultimately reduces GHG emissions. Reducing GHG emissions will help the Region contribute to climate change mitigation. Additionally, Merced County recently partnered with The Nature Conservancy on a Land Management and Multi-Benefit Assessment project. This project developed a tool for County land use planning to assess the climate and GHG reduction benefits achieved through a variety of land use, land management and conservation activities. This tool can be used in the future to estimate benefits related to a range of RMS.

Table 16-7: RMS and GHG Reduction Opportunities

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Reduce Water Demand	Agricultural Water Use Efficiency Urban Water Use Efficiency	Reducing water demands will reduce groundwater pumping demands, which result in GHG emissions.

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
Improve Operational Efficiency and Transfers	Conveyance – Regional/local System Reoperation Water Transfers	Improving operational efficiencies can improve the overall efficiency of the Region's water systems, thereby reducing cumulative energy demands and GHG emissions.
Increase Water Supply	Conjunctive Management & Groundwater Municipal Recycled Water Surface Storage - CALFED Surface Storage – Regional/Local	Localize water use, and efficiently reuse water to reduce groundwater pumping requirements and associated GHG emissions.
Improve Water Quality	Drinking Water Treatment and Distribution Groundwater Remediation/Aquifer Remediation Matching Water Quality to Use Pollution Prevention Salt and Salinity Management Urban Stormwater Runoff Management	Stabilize water cycles by conserving water systems to their natural state.
Improve Flood Management	Flood Management	Controlling flooding in a holistic watershed-based nature will potentially reduce the need for construction of intensive flood control systems. This will reduce energy and associated GHG emissions that would be required for construction.
Practice Resources Stewardship	Agricultural Lands Stewardship Ecosystem Restoration Forest Management Land Use Planning and Management Recharge Area Protection Sediment Management Watershed Management	Provide opportunities for carbon sequestration, reforestation, and reduce climate change impacts by restoring/maintaining land surfaces.
People and Water	Economic Incentives (Loans, Grants and Water Pricing)	Establishing economic incentives and educating the public on the impacts of GHG emissions can encourage

Management Objectives	Resource Management Strategy	GHG Reduction Opportunities
	Outreach and Engagement Water and Culture Water-Dependent Recreation	reduction in water use and an associated reduction in energy use.
Other	Crop Idling for Water Transfers Irrigated Land Retirement Rainfed Agriculture	Reduce energy requirements and GHG emissions from decreased groundwater pumping demands.

Source: Adapted from the California Water Plan Update 2009 (DWR, 2009).

16.5.5 Plan for Further Data Gathering

Identifying and implementing appropriate adaptation strategies requires having the data necessary to (1) understand the magnitude of climate change impacts and associated vulnerabilities and (2) plan for strategy implementation in a timely manner. To aid in this understanding, the Merced Region has developed a data gathering and analysis approach to collecting and assimilating data related to the prioritized climate change vulnerabilities.

As an umbrella document, the Merced IRWM Plan is intended to coalesce and build upon available planning information and studies, not supersede them. Currently, significant data collection efforts are underway at the state, national, and international levels by agencies including DWR, CARB, the USEPA, and the IPCC among others. In order to ensure that the Merced Plan is responsive to projected climate change impacts and prioritized vulnerabilities, it will be critical to assimilate the data and information being collected through these avenues into future Plan updates. Further, a variety of project-specific data and information will be collected as part of the project performance and monitoring program. These data could contribute additional information on climate change information on the regional level that could be used to augment information developed at the state and national levels.

In conjunction with future Merced IRWM Plan updates, the available body of climate change information, data, and literature will be evaluated and incorporated into the vulnerability analysis and throughout the Plan, as appropriate. In addition, the data collection tables completed in support of the Plan-level and project-level monitoring will be revised, as appropriate, to include additional climate change parameters. Further, the data management system (DMS) being developed for the Merced GSP (Opti DMS) may be used to track data that supports analysis of climate change impacts. This DMS could be augmented to allow for the visualization of data held in local databases, such as WISKI, Envision Connect, and Microsoft Excel spreadsheets, and can be expanded and augmented to allow for local control of data, continued use of legacy data systems, and data dissemination and use. Future planning efforts will determine precisely how the Opti DMS may be utilized to support the gathering and analysis of climate change data.

At a minimum the following data collection and analysis actions will be implemented as part of future plan updates to ensure that the plan adequately addresses prioritized climate change vulnerabilities:

- Review statewide available data at the following sites:
  - DWR IRWM Climate Change Document Clearinghouse – http://www.water.ca.gov/climatechange/docs/IRWM-ClimateChangeClearinghouse.pdf

  - DWR's Climate Change Website – https://water.ca.gov/Programs/All-Programs/Climate-Change-Program
  - Climate Change Handbook – http://slowatershedproject.org/reports/slo-county/US-EPA-Climate-Change-Handbook-for-Regional-Water-Planning.pdf
  - State of California Climate Change Portal – http://www.climatechange.ca.gov
  - CARB website – http://www.arb.ca.gov/cc/cc.htm
  - The California CAT website – http://climatechange.ca.gov/climate_action_team/index.html
  - CEQA Greenhouse Gas Analysis Guidance for DWR Grantees – http://www.water.ca.gov/climatechange/docs/Guidance%20For%20Grantees-%20Calculating%20GHGs%20for%20CEQA2011.pdf
  - Association of Environmental Professionals. 2007. Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents. https://www.counties.org/sites/main/files/file-attachments/aep_global_climate_change_june_29_final1.pdf
  - California Climate Action Registry. (2009). General Reporting Protocol Version 3.1. https://sfenvironment.org/sites/default/files/fliers/files/ccar_grp_3-1_january2009_sfe-web.pdf
  - California Climate Adaptation Planning Guide – http://resources.ca.gov/climate/safeguarding/local-action
  - Center for Biological Diversity. 2007. The California Environmental Quality Act on the Front Lines of California's Fight Against Global Warming. http://www.biologicaldiversity.org/publications/papers/CBD-CEQA-white-paper.pdf

- Review national and international data at the following sites:
  - U.S. EPA. 2009. Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2007. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2007
  - World Resources Institute and World Business Council for Sustainable Development. N.d. The Greenhouse Gas Protocol for Project Accounting. http://www.wri.org/publication/greenhouse-gas-protocol-0

- Update plan performance monitoring and project-specific monitoring data collection tables to include climate change parameters as appropriate.

APPENDIX F
SB X7-7 COMPLIANCE FORM

SB X7-7 Table 0: Units of Measure Used in 2020 UWMP* *(select one from the drop down list)*
Million Gallons
**The unit of measure must be consistent throughout the UWMP, as reported in Submittal Table 2-3.*
NOTES:

SB X7-7 Table 2: Method for 2020 Population Estimate	
Method Used to Determine 2020 Population (may check more than one)	
☑	**1. Department of Finance** (DOF) or **American Community Survey** (ACS)
☐	**2. Persons-per-Connection Method**
☐	**3. DWR Population Tool**
☐	**4. Other** DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: 2020 Service Area Population	
2020 Compliance Year Population	
2020	15,448
NOTES:	

SB X7-7 Table 4: 2020 Gross Water Use							
		2020 Deductions					
Compliance Year 2020	**2020 Volume Into Distribution System** *This column will remain blank until SB X7-7 Table 4-A is completed.*	**Exported Water ***	**Change in Dist. System Storage*** (+/-)	**Indirect Recycled Water** *This column will remain blank until SB X7-7 Table 4-B is completed.*	**Water Delivered for Agricultural Use***	**Process Water** *This column will remain blank until SB X7-7 Table 4-D is completed.*	**2020 Gross Water Use**
	2,779	-	-	-	-	1,854	**926**
*** Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.							
NOTES:							

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	City of Livingston
This water source is *(check one)* **:**	
☑	The supplier's own water source
☐	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional (+/-)*	Corrected Volume Entering Distribution System
	2,779	-	2,779

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.*

[2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES

SB X7-7 Table 4-B: 2020 Indirect Recycled Water Use Deduction *(For use only by agencies that are deducting indirect recycled water)*

2020 Compliance Year	2020 Surface Reservoir Augmentation					2020 Groundwater Recharge			Total Deductible Volume of Indirect Recycled Water Entering the Distribution System
	Volume Discharged from Reservoir for Distribution System Delivery[1]	Percent Recycled Water	Recycled Water Delivered to Treatment Plant	Transmission/ Treatment Loss[1]	Recycled Volume Entering Distribution System from Surface Reservoir Augmentation	Recycled Water Pumped by Utility[1,2]	Transmission/ Treatment Losses[1]	Recycled Volume Entering Distribution System from Groundwater Recharge	
			-		-			-	-

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.*

[2] *Suppliers will provide supplemental sheets to document the calculation for their input into "Recycled Water Pumped by Utility". The volume reported in this cell must be less than total groundwater pumped - See Methodology 1, Step 8, section 2.c.*

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C: 2020 Process Water Deduction Eligibility **(For use only by agencies that are deducting process water) Choose Only One**	
☑	**Criteria 1**- Industrial water use is equal to or greater than 12% of gross water use. Complete SB X7-7 Table 4-C.1
☐	**Criteria 2** - Industrial water use is equal to or greater than 15 GPCD. Complete SB X7-7 Table 4-C.2
☐	**Criteria 3** - Non-industrial use is equal to or less than 120 GPCD. Complete SB X7-7 Table 4-C.3
☐	**Criteria 4** - Disadvantaged Community. Complete SB x7-7 Table 4-C.4
NOTES:	

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.1: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 1)*

Criteria 1
Industrial water use is equal to or greater than 12% of gross water use

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction	2020 Industrial Water Use	Percent Industrial Water	**Eligible for Exclusion Y/N**
	2,779	1,854	67%	YES

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.2: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 2)*

Criteria 2
Industrial water use is equal to or greater than 15 GPCD

2020 Compliance Year	2020 Industrial Water Use	2020 Population	2020 Industrial GPCD	**Eligible for Exclusion Y/N**
	1,854	15,448	329	YES

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.3: 2020 Process Water Deduction Eligibility *(For use only*
by agencies that are deducting process water using Criteria 3)

Criteria 3
Non-industrial use is equal to or less than 120 GPCD

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction *Fm SB X7-7 Table 4*	2020 Industrial Water Use	2020 Non-industrial Water Use	2020 Population *Fm SB X7-7 Table 3*	Non-Industrial GPCD	**Eligible for Exclusion Y/N**
	2,779	1,854	925	15,448	164	NO

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.4: 2020 Process Water Deduction Eligibility ***(For** use only by agencies that are deducting process water using Criteria 4)*

Criteria 4

Disadvantaged Community. A "Disadvantaged Community" (DAC) is a community with a median household income less than 80 percent of the statewide average.

SELECT ONE

"Disadvantaged Community" status was determined using one of the methods listed below:

1. IRWM DAC Mapping tool https://gis.water.ca.gov/app/dacs/

☐	If using the IRWM DAC Mapping Tool, include a screen shot from the tool showing that the service area is considered a DAC.

2. 2020 Median Income

	California Median Household Income*		Service Area Median Household Income	Percentage of Statewide Average	**Eligible for Exclusion? Y/N**
☑	**2020**	**$75,235**	54,886	73%	YES

*California median household income 2015 -2019 as reported in US Census Bureau QuickFacts.

NOTES

Data from these tables will not be entered into WUEdata. Instead, the entire tables will be uploaded to WUEdata as a separate upload in Excel format.

This table(s) is only for Suppliers that deduct process water from their 2020 gross water use.

SB X7-7 Table 4-D: 2020 Process Water Deduction - Volume *Complete a separate table for each industrial customer with a process water exclusion*

Name of Industrial Customer	*Foster Frams*				
Compliance Year 2020	Industrial Customer's Total Water Use *	Total Volume Provided by Supplier*	% of Water Provided by Supplier	Customer's Total Process Water Use*	Volume of Process Water Eligible for Exclusion for this Customer
	1,833	1,833	100%	1,833	1,833

* **Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES:

SB X7-7 Table 4-D: 2020 Process Water Deduction - Volume *Complete a separate table for each industrial customer with a process water exclusion*

Name of Industrial Customer	*Emerald Textiles*				
Compliance Year 2020	Industrial Customer's Total Water Use *	Total Volume Provided by Supplier*	% of Water Provided by Supplier	Customer's Total Process Water Use*	Volume of Process Water Eligible for Exclusion for this Customer
	21	21	100%	21	21

* **Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES:

SB X7-7 Table 5: 2020 Gallons Per Capita Per Day (GPCD)		
2020 Gross Water *Fm SB X7-7 Table 4*	**2020 Population** *Fm SB X7-7 Table 3*	**2020 GPCD**
926	15,448	**164**
NOTES:		

SB X7-7 Table 9: 2020 Compliance							
Actual 2020 GPCD[1]	Optional Adjustments to 2020 GPCD Enter "0" if Adjustment Not Used Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]	TOTAL Adjustments[1]	Adjusted 2020 GPCD [1] *(Adjusted if applicable)*	2020 Confirmed Target GPCD [1, 2]	**Did Supplier Achieve Targeted Reduction for 2020?**
164		-		-	164	165	**YES**

[1] *All values are reported in GPCD*

[2] ***2020 Confirmed Target GPCD*** *is taken from the Supplier's SB X7-7 Verification Form Table SB X7-7, 7-F.*

APPENDIX G
GROUNDWATER SUBBASIN BULLETIN 118

San Joaquin Valley Groundwater Basin
Merced Subbasin

- Groundwater Subbasin Number: 5-22.04
- County: Merced
- Surface Area: 491,000 acres (767 square miles)

Basin Boundaries and Hydrology

The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The northern portion of the San Joaquin Valley drains toward the Delta by the San Joaquin River and its tributaries, the Fresno, Merced, Tuolumne, and Stanislaus Rivers. The southern portion of the valley is internally drained by the Kings, Kaweah, Tule, and Kern Rivers that flow into the Tulare drainage basin including the beds of the former Tulare, Buena Vista, and Kern Lakes.

The Merced subbasin includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rock of the Sierra Nevada foothills on the east. The subbasin boundary on the south stretches westerly along the Madera-Merced County line (Chowchilla River) and then between the boundary of the Le Grand-Athlone Water District and the Chowchilla Water District. The boundary continues west along the northern boundaries of Chowchilla Water District and El Nido Irrigation District. The southern boundary then follows the western boundary of El Nido I.D. south to the northern boundary of the Sierra Water District, which is followed westerly to the San Joaquin River. Average annual precipitation is 11 to 13 inches, increasing eastward.

Hydrogeologic Information

The San Joaquin Valley represents the southern portion of the Great Central Valley of California. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide. It is filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively. Continental deposits shed from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough. This depositional axis is below to slightly west of the series of rivers, lakes, sloughs, and marshes, which mark the current and historic axis of surface drainage in the San Joaquin Valley.

Water Bearing Formations

Geologic units in the Merced Subbasin consist of consolidated rocks and unconsolidated deposits. The consolidated rocks include the Ione Formation, the Valley Springs Formation, and the Mehrten Formation. In the eastern part of the area, the consolidated rocks generally yield small quantities of water to wells except for the Mehrten Formation, which is an important aquifer.

The unconsolidated deposits were laid down during the Pliocene to present. From oldest to youngest, these deposits include continental deposits, lacustrine and marsh deposits, older alluvium, younger alluvium, and flood-basin deposits. The continental deposits and older alluvium are the main water-yielding units in the unconsolidated deposits. The lacustrine and marsh deposits (which include the Corcoran, or "E-" Clay), and the flood-basin deposits yield little water to wells, and the younger alluvium in most places probably yields only moderate quantities of water to wells (Page 1973.)

There are three ground water bodies in the area: an unconfined water body, a confined water body, and the water body in consolidated rocks. The unconfined water body occurs in the unconsolidated deposits above and east of the Corcoran Clay, which underlies the western half of the subbasin at depths ranging between about 50 and 200 feet (DWR 1981), except in the western and southern parts of the area where clay lenses occur and semi-confined conditions exist. The confined water body occurs in the unconsolidated deposits below the Corcoran Clay and extends downward to the base of fresh water. The water body in consolidated rocks occurs under both unconfined and confined conditions.

The estimated average specific yield of this subbasin is 9.0 percent (based on DWR, San Joaquin District internal data and that of Davis 1959).

Restrictive Structures

Groundwater flow is primarily to the southwest, following the regional dip of basement rock and sedimentary units. DWR (2000) data show two groundwater depressions south and southeast of the city of Merced during 1999.

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 30 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 15 feet. The ten-year period from 1978 to 1988 saw stabilization and a rebound of about 10 feet. 1988 through 1995 again showed steep declines, bottoming out in 1996 with water levels rising from 1996 to 2000. Water level declines have been more severe in the eastern portion of the subbasin

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 9.0 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 21,100,000 af to a depth of 300 feet and 47,600,000 af to the base of fresh groundwater. These same calculations give an estimate of 15,700,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of

stored groundwater in this subbasin as of 1961 is 37,000,000 af to a depth of $\leq$ 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data.

Natural recharge into the subbasin is estimated to be 47,000 af. Values for artificial recharge and subsurface inflow are not determined. There is approximately 243,000 af of applied water recharge into the subbasin. Annual urban and agricultural extractions are 54,000 af and 492,000 af, respectively. Other extractions equal approximately 9,000 af. Subsurface inflow values are not determined.

Groundwater Quality

Characterization. The groundwater in this subbasin is characterized by calcium-magnesium bicarbonate at the basin interior, sodium bicarbonate to the west, and calcium-sodium bicarbonate to the south. Small areas of sodium chloride and calcium-sodium chloride waters exist at the southwest corner of the basin (Page 1973). TDS values range from 100 to 3,600 mg/L, with a typical range of 200 to 400 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in 46 wells ranging from 150 to 424 mg/L, with an average value of 231 mg/L. For 10 wells, EC values range from 260 to 410 μmhos/cm, with an average value of 291 μmhos/cm.

Impairments. There are localized areas of high hardness, iron, nitrate, and chloride in this subbasin.

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	65	0
Radiological	58	1
Nitrates	64	2
Pesticides	62	8
VOCs and SVOCs	59	1
Inorganics – Secondary	65	8

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water

quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: 100 – 4,450	Average: 1,500 – 1,900
	Total depths (ft)	
Domestic		
Municipal/Irrigation	Range: 100 - 800	

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR (incl. Cooperators)	Groundwater levels	378 Semi-annually
Department of Health Services (including Cooperators)	Title 22 water quality	142 Varies

Basin Management

Groundwater management:	None
Water agencies	
Public	Merced I.D., Merquin County Water District, Turner Island Water District, Le Grand-Athlone W.D., Plainsburg I.D., Stevinson W.D.
Private	Not Determined

References Cited

California Department of Water Resources (DWR), San Joaquin District. Unpublished Land and Water Use Data.

_____. Well completion report files.

_____. 1995. Internal computer spreadsheet for 1990 normal computation of net water demand used in preparation of DWR Bulletin 160-93.

_____. 1981. *Depth to Top of Corcoran Clay.* 1:253,440 scale map.

_____. 2000. *Spring 1999, Lines of Equal Elevation of Water in Wells, Unconfined Aquifer*. 1:253,440 scale map sheet.

Davis, GH, Green, JH, Olmstead, SH, and Brown, DW. 1959a. *Ground Water Conditions and Storage Capacity in the San Joaquin Valley, California*; US Geological Survey Water Supply Paper No. 1469, 287p.

Page, RW, and Balding, GO. 1973. Geology and Quality of Water in the Modesto-Merced Area, San Joaquin Valley, California, with a Brief Section of Hydrology. USGS Water-Resources Investigations 6-73, 85p.

Williamson, Alex K, Prudic, David E, and Swain, Lindsay A. 1989. *Groundwater flow in the Central Valley, California.* US Geological Survey Professional Paper 1401-D. 127 p.

Additional References

Balding, GO, and Page, RW. 1971. *Data for Wells in the Modesto-Merced Area San Joaquin Valley, California.* U.S. Geological Survey Open-File Report.

California Department of Water Resources. 1980. Bulletin 118-80. *Ground Water Subbasins in California.*

_____. 1994. Bulletin 160-93. *California Water Plan Update, Vol. 1.*

Davis, SN and Hall, FR. 1959b. *Water Quality of Eastern Stanislaus and North Merced Counties, California*; Stanford Univ. Pubs., Geol. Sci., v. 6, no. 1. 112 p.

Errata

Changes made to the basin description will be noted here.

APPENDIX H
ENERGY INTENSITY TABLES

Urban Water Supplier: *City of Livingston*

Water Delivery Product (If delivering more than one type of product use Table O-1C)

Retail Potable Deliveries

Table O-1B: Recommended Energy Reporting - Total Utility Approach

Enter Start Date for Reporting Period	1/1/2020	**Urban Water Supplier Operational Control**		
End Date	12/30/2020			
☐ Is upstream embedded in the values reported?		**Sum of All Water Management Processes**	**Non-Consequential Hydropower**	
Water Volume Units Used	*MG*	Total Utility	Hydropower	1452331
Volume of Water Entering Process (volume unit)		*2779.00*	*0*	*2779*
Energy Consumed (kWh)		*4848012*	*0*	*4848012*
Energy Intensity (kWh/volume)		*1744.5*	*0.0*	*1744.5*

Quantity of Self-Generated Renewable Energy

0 kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

Metered Data

Data Quality Narrative:

Data was provided by the City of Livingston Public Works Department. The 2,779 MG is the total amount of groundwater produced by the City's eight active goundwater wells during 2020. A total of 4,848,012 kWh was used to extract groundwater from the underlining groundwater basin at each of the eight active groundwater wells and pump the water into the distribution system.

Narrative:

In the water system, energy is consumed to pump water from the underlining groundwater basin at each of the eight active groundwater wells and pump the water into the distribution system. The City does not produce any form of renewable engery for the water system and all engery consumped is produced by PG&E.

City of Livingston

City of Livingston

Table O-2: Recommended Energy Reporting - Wastewater & Recycled Water					
Enter Start Date for Reporting Period	1/1/2020	**Urban Water Supplier Operational Control**			
End Date	12/30/2020	**Water Management Process**			
☐ Is upstream embedded in the values reported?		Collection / Conveyance	Treatment	Discharge / Distribution	Total
Volume of Water Units Used	MG				
Volume of Wastewater Entering Process (volume units selected above)		*0*	*457*	*0*	*457*
Wastewater Energy Consumed (kWh)			*1452331*	*0*	*1452331*
2779		*0.0*	*3178.0*	*0.0*	*3178.0*
4848012		*0*	*0*	*0*	*0*
Recycled Water Energy Consumed (kWh)		*0*	*0*	*0*	*0*
Recycled Water Energy Intensity (kWh/volume)		*0.0*	*0.0*	*0.0*	*0.0*

Quantity of Self-Generated Renewable Energy related to recycled water and wastewater operations

0 kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

Metered Data

Data Quality Narrative:

Data is provided by the City from wastewater flow meters and electric meters. Energy consumption in the "Treatment" process includes includes conveyance, treament, and discharge.

Narrative:

Wastewater management processes consuming energy include pumps, treatment, and discharge. The total wastewater volume is listed under the "Treatment" process. Recycled water energy consumption is not readily available. The City does not produce any form of renewable engery for the wastewater system and all engery consumped is produced by PG&E.

APPENDIX I
WATER CONSERVATION RESOLUTIONS
(RESOLUTION NO. 2015-23 & 2016-55)

RESOLUTION NO. 2015-__

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LIVINGSTON RESCINDING RESOLUTION 2015-____ REGARDING MANDATORY WATER USE RESTRICTIONS AND ADOPTING WATER USE RESTRICTIONS CONTAINED IN THE WATER SHORTAGE CONTINGENCY PLAN CONTAINED IN THE 2015 URBAN WATER MANAGEMENT PLAN.

WHEREAS, On January 17, 2014, Governor Edmund G. Brown Jr. issued Proclamation No. 1-17-2014 declaring a State of Emergency to exist in California due to severe drought conditions and calling on Californians to reduce their water usage by 20 percent; and

WHEREAS, On April 25, 2014, the Governor issued an Executive Order to strengthen the state's ability to manage water and directed the State Water Resources Control Board (SWRCB) under its authority in California Water Code Section 1058.5 to adopt emergency regulations as it deems necessary to address water shortage conditions; and

WHEREAS, On July 15, 2014, the State Water Resources Control Board adopted California Code of Regulations, Title 23, Sections 863, 864, and 865, emergency regulations finding a drought emergency in California and imposing water conservation measures on individuals and water suppliers.

WHEREAS, Section 864 applies to all Californians and prohibits certain activities in promotion of water conservation, many of which are already required by the City of Livingston; and

WHEREAS, Section 865 requires mandatory outdoor irrigation restrictions and reporting by water suppliers, including urban water suppliers like the City of Livingston; and

WHEREAS, On July 28, 2014, the State Office of Administrative Law approved the SWRCB's proposed regulation and it became law; and

WHEREAS, On April 1, 2015, Governor Edmund G. Brown Jr. issued an Executive Order requiring mandatory water conservation measures to achieve a statewide reduction in potable water use of 25 percent; and

WHEREAS, the City has promoted conservation and on February 21, 2014 adopted Resolution 2014-1 imposing outside watering restrictions; and

WHEREAS, the City has achieved an 18 percent reduction in average per capita water use from 2013 to 2014; and

WHEREAS, the City relies solely on groundwater for its potable water supply; and

WHEREAS, groundwater levels have been declining significantly and are impacting the reliability of some of the City's water supply wells; and

WHEREAS, water conservation can reduce the City's Maximum Day Demand and increase the reliability of its water supply.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Livingston hereby resolves as follows:

1. Upon adoption of the 2015 Urban Water Management Plan, Resolution 2015-_____ is rescinded and replaced with the Water Shortage Contingency Plan in Chapter 8 of said UWMP.
2. The City Council of the City of Livingston hereby maintains the declaration of a local drought emergency and recognizes that needs to adopt mandatory water conservation measures so that the water supply can be conserved for the greater public benefit; and
3. This emergency condition shall be presumed to continue unchanged unless and until a contrary finding is made by the City Council by resolution.
4. The following MANDATORY water conservation measures are hereby adopted, in compliance with the State Water Resources Control Board's July 15, 2014 emergency drought regulations (collectively, the "Outdoor Water Use Restrictions"):
    a. Outdoor irrigation of ornamental landscapes or turf with potable water shall be limited to two days per week in accordance with the following schedule:
        i. Addresses ending in an even number shall only water on Tuesdays and Saturdays.
        ii. Addresses ending in an odd number shall only water on Thursdays, and Sundays.
        iii. No outdoor irrigation on Mondays, Wednesdays and Fridays.
    b. No outdoor irrigation of ornamental landscapes or turf with potable water is permitted between the hours of 9am and 8pm, except for drip irrigation, soaker hoses and hand watering;
    c. No outdoor irrigation is permitted within 48 hours of a storm event;
    d. No excessive water flow or runoff onto pavement, sidewalks, gutters or ditched from watering or irrigating landscapes or vegetation of any kind;
    e. No car washing is allowed on Mondays, Wednesdays and Fridays except for commercial car washes equipped with a recirculating system. Car washing (except commercial car washes) shall be done by using a hand-held bucket or a hand-held hose equipped with a positive self-closing water shut-off nozzle.
    f. The application of potable water to driveways and sidewalks is prohibited, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency; and
    g. The use of potable water in a fountain or other decorative water feature is prohibited, except where the water is part of a recirculating system.
    h. Property owners must fix leaks, breaks or malfunctions when they find them, or within 72 hours of receiving a notice from the City;
5. The City Council of the City of Livingston authorizes the City Manager to direct staff to further promote water conservation by:
    a. Providing notice of the new regulations in English and Spanish in bill inserts, and City's webpage.
    b. Training staff on the new regulations.

c. Providing information to customers regarding opportunities to save water.
d. Conducting water loss audits and make leak detection and repair a top priority for the duration of the drought.
e. Preparing and submitting to the SWRCB the monitoring reports described in California Code of Regulations, Title 23, Section 865(d).

6. Per CCR Title 23, Section 864, the taking of any action prohibited in this resolution, in addition to any other applicable civil or criminal penalties, is an infraction, punishable by a fine of up to five hundred dollars ($500.00) for each day in which the violation occurs. Consistent with Section 864, violators will be assessed fines, after an initial warning, in accordance to the following schedule:
    a. Warning for the first violation
    b. $100 for the second violation
    c. $200 for the third violation
    d. $500 for the fourth violation and any other violation within a 12-month period.
7. Council also authorizes the City Manager to direct staff to monitor compliance and to enforce in the event the desired response is not being achieved.
8. Council's adoption of the proposed Outdoor Water Use Restrictions is categorically exempt from CEQA under CEQA Guidelines 15307 (Actions by Regulatory Agencies for Protection of Natural Resources).

Passed and adopted this ____day of May, 2015, by the following vote:

AYES:
NOES:
ABSENT:

_____
Rodrigo Espinoza, Mayor
of the City of Livingston

ATTEST:

I, hereby certify that the foregoing resolution was regularly introduced, passed and adopted at a Regular Meeting of the City Council of the City of Livingston this ___ day of May, 2015.

_____
Antonio Silva, City Clerk
of the City of Livingston

RESOLUTION NO. 2016-55

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LIVINGSTON ADOPTING A WATER SHORTAGE CONTINGENCY PLAN AND RESCINDING RESOLUTION 2015-23.

WHEREAS, the Urban Water Management Planning Act ("Act") requires every urban water agency supplying more than 3,000 acre-feet of water annually or serving 3,000 or more connections to prepare and adopt an Urban Water Management Plan (UWMP); and

WHEREAS, the Act requires that the 2015 UWMP include a water shortage contingency plan (WSCP) that describes mandatory water use restrictions to prepare for and respond to water shortages; and

WHEREAS, the WSCP is included in the City's 2015 UMWP as Chapter 8; and

WHEREAS, on May 5, 2015, the City of Livingston City Council adopted Resolution 2015-23 declaring a local drought emergency and adopting mandatory water conservation measures so that the water supply can be conserved for the greater public benefit; and

WHEREAS, the mandatory water use restrictions in Resolution 2015-23 are redundant with those in the WSCP.

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Livingston hereby resolves as follows:

1. Resolution 2015-23 is rescinded and replaced with the WSCP contained in Chapter 8 of the 2015 UWMP

Passed and adopted this 4th day of October, 2016, by the following vote:

AYES: Mayor Pro-Tem Samra and Council Members Sicairos and Soria
NOES: None
ABSENT: Mayor Espinoza and Council Member McCabe

Gurpal Samra, Mayor Pro-Tem
of the City of Livingston

ATTEST:

I, hereby certify that the foregoing resolution was regularly introduced, passed and adopted at a Regular Meeting of the City Council of the City of Livingston this 4th day of October, 2016.

Betty Cota, Deputy City Clerk
of the City of Livingston

APPENDIX J
RATE STRUCTURE

ORDINANCE NO. ___

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LIVINGSTON ESTABLISHING NEW RATES FOR WATER SERVICE, EFFECTIVE NOVEMBER 4, 2021

WHEREAS, the City of Livingston (the "City") provides water services to its residents; and

WHEREAS, the City charges customers of this utility a charge to fund the on-going operation and maintenance of the water services; and

WHEREAS, Chapter 9-5 entitled "Water Service Regulations" of the Livingston Municipal Code provides for the establishment and operation of a water system and the imposition and collection of certain fees and charges from recipients of water services; and

WHEREAS, water services provided by the City include, but are not limited to, collecting, pumping, treating, storing, and distributing water obtained from City wells; and

WHEREAS, Section 9-5-27 of the Livingston Municipal Code provides for the setting of water charges, fee, and assessments by resolution or ordinance; and

WHEREAS, Chapter 9-5 of the Livingston Municipal Code addresses various aspects of the City water service and requirements governing its use, including applications for service, deposits, meter installation and use, charges, meter readings, billing, discontinuance of service, and unpaid accounts, including provisions in Section 9-5-27, paragraph (D) of the Livingston Municipal Code establishing that all unpaid accounts for water delivered at any premises "shall constitute a lien against the same and shall be subject to collection all as provided by the Revenue Bond Law of 1941;" and

WHEREAS, the City of Livingston determined to undertake a rate study to analyze the revenue requirements and the rate structure that should be adopted to proportionately allocate the costs of providing water service to its water customers. The rate study was prepared by Hansford Economic Consulting Inc., and has been on file at Livingston City Hall since the notices to property owners and customers were sent out on April 30, 2021; and

WHEREAS, charges for local agency water service have been held to be "property related fees or charges" subject to the requirements of Article XIIID of the California Constitution, also known as Proposition 218, pursuant to the holding in *Bighorn-Desert View Water Agency v. Verjil* (2006) 39 C4th 205; and

WHEREAS, Section 6 of Article XIIID of the California Constitution provides that imposing or increasing any property related fee or charge requires identifying the parcels on which the fee or charge will be imposed, and providing notice by mail of the proposed fee or charge to the record owner of each identified parcel indicating the amount of the fee or charge to be imposed on each parcel, the basis on which the amount of the proposed fee or charge was calculated, the reason for the fee or charge, and the date, time and location of a public hearing on the proposed fee or charge; and

WHEREAS, Section 53756 of the California Government Code provides that agencies providing water and sewer service may adopt a schedule of fees or charges authorizing automatic adjustments that pass through increases in wholesale charges for water, sewage treatment, or wastewater treatment or inflation adjustments, subject to requirements specified in that section; and

WHEREAS, Section 6 of Article XIIID of the California Constitution further provides that hearings on proposed property-related fees or charges must be conducted at least forty-five (45) days after mailed notice to the owners of each identified parcel on which the fee or charge is proposed to be imposed, and that at the hearing, the local agency must consider all protests against the proposed fee or charge, and that if written protests against the proposed fee or charge are presented by a majority of owners of the identified parcels, the agency shall not impose the fee or charge; and

WHEREAS, the City Council directed that notice of a hearing ("Hearing") thereon be given to the property owners and tenants in the City, with such notice to include, among other matters, the information required to be included pursuant to California Constitution Article XIII D section 6; and

WHEREAS, such notice has been mailed to those persons, at least forty-five (45) days before the Hearing; and

WHEREAS, the Revenue Bond Law of 1941, codified in section 54300 and following of the California Government Code, includes provisions that provide for the enforcement and collection of amounts due for utility services, subject to notice requirements that apply when delinquent charges are made a lien on the property that received the services; and

WHEREAS, Section 54354.5 of the California Government Code prescribes that adoption of local agency resolutions or ordinances revising charges for utility services subject to the imposition of liens under the Revenue Bond Law and follow the notice and a hearing in accordance with that section, including publication of notice of the time and place of a hearing on the proposed resolution or ordinance specifying that any interested person, including all persons owning property in the jurisdiction of the local agency, may appear and be heard on any matter relating to the proposed ordinance or the proposed rates or charges; and

WHEREAS, the notice required under Government Code section 54354.5 must be published at least once each week for two (2) weeks prior to the hearing in a newspaper published within the local agency jurisdiction, with the first publication occurring at least fifteen (15) days prior to the hearing; and

WHEREAS, such notice has been published once each week for two (2) weeks, in accordance with Government Code section 54354.5, in the Merced Sun-Star on May 30, 2021 and June 6, 2021, as evidenced by Proofs of Publication on file with the City Clerk, prior to the public hearing held for this Ordinance; and

WHEREAS, City staff has worked closely with a Stakeholders' Committee, a Committee formed by the City Council, made up of two (2) Council Members and members of the community, to analyze the City's water service needs and draft rate studies; and

WHEREAS, the City held several workshops to inform the public of the proposed water service rates; and

WHEREAS, the City held workshops regarding the utility rate study in English, Spanish, and Punjabi. The workshops were held in the City Council Chambers as follows: May 25, 2021, June 3, 2021 and June 7, 2021; and

WHEREAS, the Hearing was held June 15, 2021; and

WHEREAS, at the Hearing, the City Council heard and considered all oral testimony, written materials, and written protests concerning the establishment and imposition of the proposed rate increases to the Water Service Rates; and

WHEREAS, upon close of the Hearing, the City did not receive written protests against the establishment and imposition of the proposed rate increases to the Water Service Rates from a majority of the affected property owners and tenants directly liable for the payment of the Water Service Rates; and

WHEREAS, the City Council continued the item to the September 21, 2021 Council meeting for further discussion; and

WHEREAS, the proposed water service rates are not discriminatory or excessive, are sufficient under Government Code section 54515, comply with the provisions or covenants of any outstanding revenue bonds of the City payable from the revenues of the water enterprise, comply with the provisions of Title 5, Division 2, Part 1, Chapter 6 of the Government Code, and are in compliance with all other applicable law; and

WHEREAS, the revenues derived from the proposed Water Service Rates will not exceed the funds required to provide the water services and shall be used exclusively for the water service system; and

WHEREAS, the amount of the proposed water service rates will not exceed the proportional cost of the service attributable to each parcel upon which they are proposed for imposition; and

WHEREAS, the proposed water service rates will not be imposed on a parcel unless the water services are actually used by, or immediately available to, the owner of the parcel; and

WHEREAS, this Ordinance shall supersede all other previous resolutions and/or ordinances that may conflict with, or be contrary to, this Ordinance respecting the Water Service Rates described more particularly herein.

THE CITY COUNCIL OF THE CITY OF LIVINGSTON DOES ORDAIN AS FOLLOWS:

SECTION 1. RECITALS

The foregoing recitals are true and correct and made a part of this Ordinance.

SECTION 2. WATER SERVICE RATES ADJUSTMENT

The City Council of the City of Livingston does hereby approve the Water Service Rates set forth in the attached **Exhibit A**. The City Council hereby authorizes and directs the City Manager to implement and take all actions necessary to effectuate the rates for the Service Fees set forth herein effective on November 4, 2021.

SECTION 3. DELINQUENT CHARGES CONSTITUTE A LIEN

Delinquent charges and penalties when recorded in accordance with the provisions of the Revenue Bond Law shall constitute a lien upon the real property served.

SECTION 4. CEQA

The City Council hereby finds that the levy of the proposed water service rates as supported by a water rate study prepared by Hansford Economic Consulting Inc. (which is incorporated herein by reference), is exempt from CEQA review under Public Resources Code section 21080(b)(8) and CEQA Guidelines section 15273 because the proposed water service rates are necessary and reasonable to fund the administration, operation, maintenance, and improvements of the City's water system, are necessary to maintain service within the City's existing service area, and will not result in expansion of the system. The City Council further finds that the action entails the creation of a government funding mechanism which is exempt from CEQA as not being a "project" pursuant to CEQA guidelines section 15378. The City Council authorizes the City Clerk to file a notice of exemption with the County Clerk to that effect.

SECTION 5. GENERAL AUTHORIZATION

The City Manager is hereby authorized and directed, for and in the name of and on behalf of the City, to execute and deliver any and all documents, to do any and all things and take any and all actions that may be necessary or advisable, in their discretion, in order to effect the purposes of this Ordinance. All actions heretofore taken by officers, employees, and agents of the City that are in conformity with the purposes and intent of this resolution are hereby approved, confirmed, and ratified.

SECTION 6. SEVERABILITY

If any provision of this Ordinance or the application thereof to any person or circumstance, is held invalid, the remainder of the Ordinance, including the application of such part or provision to other persons or circumstances shall not be affected thereby and shall continue in full force and effect. To this end, provisions of this Ordinance are severable. The City Council hereby declares that it would have passed each section, subsection, subdivision, paragraph, sentence, clause, or phrase hereof irrespective of the fact that any one or more sections, subsections, subdivisions, paragraphs, sentences, clauses, or phrases be held unconstitutional, invalid, or unenforceable.

SECTION 7. SUPERSESSION/REPEAL

Ordinance No. 614 adopted June 3, 2014, and any and all other resolutions or ordinances and parts thereof in conflict with the provisions of this Ordinance are superseded and repealed, effective on the effective date of this Ordinance. However, violations, rights accrued, liabilities accrued, or appeals taken, prior to the effective date of this Ordinance, under any chapter, ordinance, or part of an ordinance, or resolution or part of a resolution, shall be deemed to remain in full force for the purpose of sustaining any proper suit, action, or other proceedings, with respect to any such violation, right, liability or appeal.

SECTION 8. EFFECTIVE DATE

This Ordinance shall become effective thirty (30) days after its final passage and adoption. The increased Water Service Rates, as attached hereto as **Exhibit A**, shall become effective on November 4, 2021.

Introduced: June 15, 2021
Passed and Adopted:

_____
Juan Aguilar, Jr., Mayor
of the City of Livingston

ATTEST:

State of California)
County of Merced)
City of Livingston)

I, hereby certify that the foregoing Ordinance was duly introduced at a Regular Meeting of the City Council of the City of Livingston on the 15th day of June, 2021, and was passed and adopted at a Regular Meeting of the City Council of the City of Livingston this ____ day of ____, 2021, by the following vote:

AYES:
NOES:
ABSENT:
ABSTAIN:

_____
Leticia Vasquez-Zurita, City Clerk
of the City of Livingston

3795211.1

EXHIBIT A

Total calculated rates include the fixed monthly service charges, meter replacement fees, and consumption charges. The calculated water rate schedule is provided in **Table 10** below.

Table 10
Calculated New Water Rates Schedule

Charges	Current	Aug-21	Jul-22	Jul-23	Jul-24	Jul-25
Base Charge						
1" and smaller	$25.13	$28.64	$29.79	$30.98	$32.22	$33.52
1.5"	$50.27	$57.29	$59.58	$61.96	$64.45	$67.04
2"	$80.43	$91.66	$95.32	$99.14	$103.11	$107.26
3"	$175.94	$200.51	$208.52	$216.86	$225.56	$234.63
4"	$301.61	$343.73	$357.46	$371.76	$386.68	$402.23
6"	$628.35	$716.10	$744.70	$774.51	$805.58	$837.98
8"	$1,206.43	$1,374.92	$1,429.82	$1,487.05	$1,546.72	$1,608.91
10"	$1,910.18	$2,176.95	$2,263.88	$2,354.50	$2,448.97	$2,547.45
Meter Fee						
1" and smaller	$3.05	$3.30	$3.39	$3.47	$3.56	$3.65
1.5"	$11.11	$7.79	$7.99	$8.18	$8.39	$8.60
2"	$12.13	$14.88	$15.25	$15.63	$16.02	$16.42
3"	$25.74	$18.56	$19.03	$19.50	$19.99	$20.49
4"	$40.61	$43.94	$45.04	$46.17	$47.32	$48.51
6"	$56.33	$75.94	$77.83	$79.78	$81.77	$83.82
8"	$89.50	$123.82	$126.91	$130.09	$133.34	$136.67
10"	$204.51	$159.79	$163.78	$167.88	$172.07	$176.38
Service Charge Monthly Water Allowance						
Attached Residential (per Unit)	10,000	gallons				
Detached Residential (per Unit)	25,000	gallons				
Non-Residential (per Meter)	35,000	gallons				
Consumption Charge per 1,000 gallons of water in excess of allowance each month						
All Customers	$1.57	$1.64	$1.72	$1.80	$1.89	$1.98
Construction Water	$1.17	$1.88	$1.97	$2.06	$2.15	$2.25

Source: City of Livingston and 2021 HEC rate study. sched

* Water rate schedules 1.5x outside City limits.

In compliance with California SB-7, which requires all new multi-family residential development to be individually metered or sub-metered, any newly constructed units will pay the same base rate per unit as all current detached residential units unless the owner of the building(s) sub-meters each unit and performs its own internal water billing of each unit.

APPENDIX K
NOTICE OF PUBLIC HEARING (NOT INCLUDED IN DRAFT UWMP)

APPENDIX L

PUBLICATION OF NOTICE OF PUBLIC HEARING (NOT INCLUDED IN DRAFT UWMP)

APPENDIX M

2020 UWMP AND WSCP ADOPTION RESOLUTION (NOT INCLUDED IN DRAFT UWMP)

APPENDIX N
2020 UWMP CHECKLIST

2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
Chapter 1	10615	A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities.	Introduction and Overview	Chapter 1, pg. 8-12
Chapter 1	10630.5	Each plan shall include a simple description of the supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information. Additionally, a supplier may also choose to include a simple description at the beginning of each chapter.	Summary	Lay Description, pg. 1-7
Section 2.2	10620(b)	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Plan Preparation	Section 2.2
Section 2.6	10620(d)(2)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Plan Preparation	Section 2.5
Section 2.6.2	10642	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Plan Preparation	Section 2.5
Section 2.6, Section 6.1	10631(h)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) - if any - with water use projections from that source.	System Supplies	Sections 2.5.1 & 6.4
Section 2.6	10631(h)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	System Supplies	Not Applicable
Section 3.1	10631(a)	Describe the water supplier service area.	System Description	Chapter 3, pg. 17-22
Section 3.3	10631(a)	Describe the climate of the service area of the supplier.	System Description	Section 3.4
Section 3.4	10631(a)	Provide population projections for 2025, 2030, 2035, 2040 and optionally 2045.	System Description	Section 3.5.1, Table 3-2
Section 3.4.2	10631(a)	Describe other social, economic, and demographic factors affecting the supplier's water management planning.	System Description	Section 3.5.2
Sections 3.4 and 5.4	10631(a)	Indicate the current population of the service area.	System Description and Baselines and Targets	Section 3.5.1
Section 3.5	10631(a)	Describe the land uses within the service area.	System Description	Section 3.6
Section 4.2	10631(d)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Section 4.3
Section 4.2.4	10631(d)(3)(C)	Retail suppliers shall provide data to show the distribution loss standards were met.	System Water Use	Section 4.3.3
Section 4.2.6	10631(d)(4)(A)	In projected water use, include estimates of water savings from adopted codes, plans and other policies or laws.	System Water Use	Section 4.3.6
Section 4.2.6	10631(d)(4)(B)	Provide citations of codes, standards, ordinances, or plans used to make water use projections.	System Water Use	Section 4.3.6
Section 4.3.2.4	10631(d)(3)(A)	Report the distribution system water loss for each of the 5 years preceding the plan update.	System Water Use	Section 4.3.3
Section 4.4	10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	System Water Use	Section 4.4
Section 4.5	10635(b)	Demands under climate change considerations must be included as part of the drought risk assessment.	System Water Use	Section 4.5
Chapter 5	10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	Baselines and Targets	Section 5.6
Chapter 5	10608.24(a)	Retail suppliers shall meet their water use target by December 31, 2020.	Baselines and Targets	Section 5.7
Section 5.1	10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	Baselines and Targets	Not Applicable
Section 5.2	10608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	Baselines and Targets	Section 5.7.1
Section 5.5	10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use of the 5 year baseline. This does not apply if the suppliers base GPCD is at or below 100.	Baselines and Targets	Section 5.7
Section 5.5 and Appendix E	10608.4	Retail suppliers shall report on their compliance in meeting their water use targets. The data shall be reported using a standardized form in the SBX7-7 2020 Compliance Form.	Baselines and Targets	Section 5.7.2
Sections 6.1 and 6.2	10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought.	System Supplies	Sections 6.2, 6.4 & 7.2

2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
Sections 6.1	10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought, *including changes in supply due to climate change.*	System Supplies	Section 6.11
Section 6.1	10631(b)(2)	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	System Supplies	Not Applicable
Section 6.1.1	10631(b)(3)	Describe measures taken to acquire and develop planned sources of water.	System Supplies	Section 6.9
Section 6.2.8	10631(b)	Identify and quantify the existing and planned sources of water available for 2020, 2025, 2030, 2035, 2040 and optionally 2045.	System Supplies	Section 6.10
Section 6.2	10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Section 6.3
Section 6.2.2	10631(b)(4)(A)	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System Supplies	Section 6.3.3
Section 6.2.2	10631(b)(4)(B)	Describe the groundwater basin.	System Supplies	Section 6.3.1
Section 6.2.2	10631(b)(4)(B)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	System Supplies	Section 6.3.4
Section 6.2.2.1	10631(b)(4)(B)	For unadjudicated basins, indicate whether or not the department has identified the basin as a high or medium priority. Describe efforts by the supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	System Supplies	Section 6.3.1 & 6.3.4
Section 6.2.2.4	10631(b)(4)(C)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	System Supplies	Section 6.3.5
Section 6.2.2	10631(b)(4)(D)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System Supplies	Section 6.3.5
Section 6.2.7	10631(c)	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	System Supplies	Section 6.2
Section 6.2.5	10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System Supplies (Recycled Water)	Section 6.6
Section 6.2.5	10633(c)	Describe the recycled water currently being used in the supplier's service area.	System Supplies (Recycled Water)	Section 6.6
Section 6.2.5	10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System Supplies (Recycled Water)	Section 6.6.4
Section 6.2.5	10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	System Supplies (Recycled Water)	Section 6.6.4
Section 6.2.5	10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System Supplies (Recycled Water)	Section 6.6.5
Section 6.2.5	10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	System Supplies (Recycled Water)	Section 6.6
Section 6.2.6	10631(g)	Describe desalinated water project opportunities for long-term supply.	System Supplies	Section 6.7
Section 6.2.5	10633(a)	Describe the wastewater collection and treatment systems in the supplier’s service area with quantified amount of collection and treatment and the disposal methods.	System Supplies (Recycled Water)	Section 6.6
Section 6.2.8, Section 6.3.7	10631(f)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and for a period of drought lasting 5 consecutive water years.	System Supplies	Section 6.9
Section 6.4 and Appendix O	10631.2(a)	The UWMP must include energy information, as stated in the code, that a supplier can readily obtain.	System Suppliers, Energy Intensity	Section 6.12
Section 7.2	10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Water Supply Reliability Assessment	Section 7.2
Section 7.2.4	10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water Supply Reliability Assessment	Section 7.2.4
Section 7.3	10635(a)	Service Reliability Assessment: Assess the water supply reliability during normal, dry, and a drought lasting five consecutive water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Water Supply Reliability Assessment	Section 7.2
Section 7.3	10635(b)	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Water Supply Reliability Assessment	Section 7.3

2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
Section 7.3	10635(b)(1)	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts 5 consecutive years.	Water Supply Reliability Assessment	Section 7.3
Section 7.3	10635(b)(2)	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Water Supply Reliability Assessment	Section 7.3
Section 7.3	10635(b)(3)	Include a comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.	Water Supply Reliability Assessment	Section 7.3
Section 7.3	10635(b)(4)	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.	Water Supply Reliability Assessment	Section 7.3
Chapter 8	10632(a)	Provide a water shortage contingency plan (WSCP) with specified elements below.	Water Shortage Contingency Planning	Chapter 7 pg. 56-65
Chapter 8	10632(a)(1)	Provide the analysis of water supply reliability (from Chapter 7 of Guidebook) in the WSCP	Water Shortage Contingency Planning	Section 8.2
Section 8.10	10632(a)(10)	Describe reevaluation and improvement procedures for monitoring and evaluation the water shortage contingency plan to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Water Shortage Contingency Planning	Section 8.10
Section 8.2	10632(a)(2)(A)	Provide the written decision-making process and other methods that the supplier will use each year to determine its water reliability.	Water Shortage Contingency Planning	Section 8.3
Section 8.2	10632(a)(2)(B)	Provide data and methodology to evaluate the supplier's water reliability for the current year and one dry year pursuant to factors in the code.	Water Shortage Contingency Planning	Section 8.3
Section 8.3	10632(a)(3)(A)	Define six standard water shortage levels of 10, 20, 30, 40, 50 percent shortage and greater than 50 percent shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Water Shortage Contingency Planning	Section 8.4
Section 8.3	10632(a)(3)(B)	Suppliers with an existing water shortage contingency plan that uses different water shortage levels must cross reference their categories with the six standard categories.	Water Shortage Contingency Planning	Section 8.4, Table 8-1
Section 8.4	10632(a)(4)(A)	Suppliers with water shortage contingency plans that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Water Shortage Contingency Planning	Section 8.4, Table 8-1
Section 8.4	10632(a)(4)(B)	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Water Shortage Contingency Planning	Section 8.5
Section 8.4	10632(a)(4)(C)	Specify locally appropriate operational changes.	Water Shortage Contingency Planning	Section 8.5
Section 8.4	10632(a)(4)(D)	Specify additional mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions are appropriate to local conditions.	Water Shortage Contingency Planning	Section 8.5
Section 8.4	10632(a)(4)(E)	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Water Shortage Contingency Planning	Section 8.5
Section 8.4.6	10632.5	The plan shall include a seismic risk assessment and mitigation plan.	Water Shortage Contingency Plan	Section 8.5.6
Section 8.5	10632(a)(5)(A)	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Water Shortage Contingency Planning	Section 8.6
Section 8.5 and 8.6	10632(a)(5)(B) 10632(a)(5)(C)	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Water Shortage Contingency Planning	Section 8.6
Section 8.6	10632(a)(6)	Retail supplier must describe how it will ensure compliance with and enforce provisions of the WSCP.	Water Shortage Contingency Planning	Section 8.7
Section 8.7	10632(a)(7)(A)	Describe the legal authority that empowers the supplier to enforce shortage response actions.	Water Shortage Contingency Planning	Section 8.8
Section 8.7	10632(a)(7)(B)	Provide a statement that the supplier will declare a water shortage emergency Water Code Chapter 3.	Water Shortage Contingency Planning	Section 8.8
Section 8.7	10632(a)(7)(C)	Provide a statement that the supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Water Shortage Contingency Planning	Section 8.8
Section 8.8	10632(a)(8)(A)	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Section 8.9

2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
Section 8.8	10632(a)(8)(B)	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Section 8.9
Section 8.8	10632(a)(8)(C)	Retail suppliers must describe the cost of compliance with Water Code Chapter 3.3: Excessive Residential Water Use During Drought	Water Shortage Contingency Planning	Section 8.9
Section 8.9	10632(a)(9)	Retail suppliers must describe the monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance.	Water Shortage Contingency Planning	Section 8.10
Section 8.11	10632(b)	Analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	Water Shortage Contingency Planning	Section 8.12
Sections 8.12 and 10.4	10635(c)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 30 days after the submission of the plan to DWR.	Plan Adoption, Submittal, and Implementation	Section 10.4
Section 8.12	10632(c)	Make available the Water Shortage Contingency Plan to customers and any city or county where it provides water within 30 after adopted the plan.	Water Shortage Contingency Planning	Section 10.4
Sections 9.1 and 9.3	10631(e)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Demand Management Measures	Section 9.2
Sections 9.2 and 9.3	10631(e)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Demand Management Measures	Section 9.3
Chapter 10	10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets (recommended to discuss compliance).	Plan Adoption, Submittal, and Implementation	Chapter 10 pg. 94-98
Section 10.2.1	10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. Reported in Table 10-1.	Plan Adoption, Submittal, and Implementation	Section 10.2.1
Section 10.4	10621(f)	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.	Plan Adoption, Submittal, and Implementation	Section 10.4
Sections 10.2.2, 10.3, and 10.5	10642	Provide supporting documentation that the urban water supplier made the plan and contingency plan available for public inspection, published notice of the public hearing, and held a public hearing about the plan and contingency plan.	Plan Adoption, Submittal, and Implementation	Sections 10.2 - 10.4, Appendices K & L
Section 10.2.2	10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Plan Adoption, Submittal, and Implementation	Section 10.2.1
Section 10.3.2	10642	Provide supporting documentation that the plan and contingency plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Appendix M
Section 10.4	10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Plan Adoption, Submittal, and Implementation	Section 10.4
Section 10.4	10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Plan Adoption, Submittal, and Implementation	Section 10.4
Sections 10.4.1 and 10.4.2	10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Plan Adoption, Submittal, and Implementation	Section 10.4
Section 10.5	10645(a)	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.5
Section 10.5	10645(b)	Provide supporting documentation that, not later than 30 days after filing a copy of its water shortage contingency plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.5
Section 10.6	10621(c)	If supplier is regulated by the Public Utilities Commission, include its plan and contingency plan as part of its general rate case filings.	Plan Adoption, Submittal, and Implementation	Section 10.6
Section 10.7.2	10644(b)	If revised, submit a copy of the water shortage contingency plan to DWR within 30 days of adoption.	Plan Adoption, Submittal, and Implementation	Section 10.7.2