MARIN MUNICIPAL WATER DISTRICT

URBAN WATER MANAGEMENT PLAN

2015 UPDATE

JUNE 2016

PREPARED BY:

RMC water and environment

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List of Acronyms

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AF	Acre-feet
AFY	Acre-feet per year
AMR	Automatic meter reading
BMP	Best management practices
BTTP	Bon Tempe Treatment Plant
CASGEM	California Statewide Groundwater Elevation Monitoring
CCF	Hundred cubic feet
CII	Commercial, Industrial, Institutional
CMSA	Central Marin Sanitation Agency
CUWCC	California Urban Water Conservation Council
district	Marin Municipal Water District
DMM	Demand management measure
DOF	Department of Finance
DSS	Decision Support System
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utilities District
EDU	Equivalent dwelling units
EIR	Environmental Impact Report
ET	Evapotranspiration
ETWU	Estimated total water use
FFIP	Fire Flow Improvement Plan
FFMP	Fire Flow Master Plan
GIS	Geographic information system
gpm	Gallons per minute
GPCD	Gallons per capita per day
HET	High-efficiency toilet
IRWM	Integrated Regional Water Management
LGVSD	Las Gallinas Valley Sanitation District
MAWA	Maximum applied water allowance
MG	Million gallons
mgd	Million gallons per day
mg/L	Million gallons per liter

MHI	Median household income
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
NMWD	North Marin Water District
SAP	Systems Application Programing
SASM	Sewerage Agency of Southern Marin
SCWA	Sonoma County Water Agency
SFEP	San Francisco Estuary Partnership
SGTP	San Geronimo Treatment Plant
SSA	Subregional study areas
ULFTs	Ultra-low flow toilets
UWMP	Urban Water Management Plan
VOMWD	Valley of the Moon Water District
WRCC	Western Regional Climate Information Center
WWTP	Wastewater treatment plant

1.0 Introduction and Executive Summary

Water planning is an essential function of water suppliers, but is particularly critical as California faces ongoing drought and expected long-term changes in climate. Prior to the adoption of the Urban Water Management Planning Act in 1983, there were no specific requirements for water agencies to conduct long-term planning. While many agencies had conducted planning efforts prior to the Act, there were a number who did not and were thus left vulnerable to supply disruptions resulting from drought or catastrophic events.

The Marin Municipal Water District (MMWD or district) understands that water is a limited resource and that a long-term reliable supply of water is essential to protect the local and state economy. As a charter signatory to the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding (MOU) for Urban Water Conservation, the district is committed to reducing the per capita demand of its water customers. It also recognizes that, while conservation and efficient use of water is a statewide concern, planning for this use is best done at a local level. As described in this Urban Water Management Plan (UWMP or Plan), the district has developed local surface water supplies, and implemented both water conservation programs and a recycled water program to maximize the use of local resources and increase water supply reliability.

1.1 Plan Preparation

The Urban Water Management Planning Act requires that urban water suppliers providing water for municipal purposes to more than 3,000 customers, or supplying more than 3,000 acre-feet (AF) of water annually, prepare and adopt an Urban Water Management Plan. These Plans must report, describe, and evaluate water deliveries and uses, water supply sources, efficient water uses, and demand management measures. Marin Municipal Water District, as an urban water supplier, has updated its Plan to remain in compliance with the California Water Code and the Urban Water Management Planning Act. All units presented in the district's Plan are in acre-feet per year (AFY), and all data is represented in calendar year, with the exception of water losses, which are presented on a fiscal year basis.[1]

As part of preparing the UWMP, the district notified the cities within its service area that the district would be updating the Plan. Additionally, the district noticed and held a public hearing to present the Plan and provide a forum for collecting comments. To further provide opportunity for comment, the district formally held a month-long public comment period and

[1] MMWD financial information is parsed on a fiscal year, not calendar year, basis. Because water loss calculations require integration of financial data, water losses were unable to be calculated on a calendar year basis. As such, water losses are presented on a fiscal year basis. The district's fiscal year begins on July 1 and ends on June 30.

posted a draft of the Plan on the district's website and provided copies at 13 local libraries. More information on plan preparation can be found in **Chapter 2.0 Plan Preparation**.

1.2 District Overview

The district serves roughly 190,000 customers within approximately 147 square miles along the eastern corridor of Marin County from the Golden Gate Bridge northward. MMWD serves ten incorporated cities and towns, including San Rafael, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Corte Madera, Tiburon, Belvedere and Sausalito. The service area has a relatively low growth rate of less than one percent per year; 2040 projected population is projected to be just over 210,000. The district's climate is characterized by warm, dry summers and cool, wet winters. Annual average precipitation is 30 inches, with over 50 inches in the Mount Tamalpais watershed, the origin of the majority of the district's water supply. Average temperature ranges from a low of 40 degrees in the winter to a high of 80 degrees in the summer. However, due to a number of microclimates within the service area, the region is subject to wide variations in annual precipitation and experiences varying temperatures. More information on the district is included in **Chapter 3.0 System Description**.

1.3 District Supplies and Water Use

The majority of the district's water supply comes from a network of seven local, rain-fed reservoirs. Total reservoir storage operated by the district is 25.9 billion gallons (79,566 AFY), but the district estimates that operational yield of the reservoirs is about 20,000 AFY. This supply is supplemented with water imported from the Russian River and purchased from the Sonoma County Water Agency (SCWA). The district has contracted with SCWA for this source of water since 1975; this contract allows the district to take deliveries of up to 14,300 AFY. Projections are consistent with SCWA's UWMP. To treat this supply, the district operates three water treatment plants, including the Bon Tempe Treatment Plant, the San Geronimo Treatment Plant, and the Ignacio treatment facility. There are five wastewater treatment plants within the area that collectively treat roughly 17,000 AFY. Of this amount, just over 2,000 AFY is recycled for non-potable purposes such as landscape irrigation. MMWD's recycled water system consists of nearly 25 miles of pipeline and delivers about 520 AFY through 342 service connections. The district produces its own recycled water by treating secondary effluent provided to the district by the Las Gallinas Valley Sanitary District. More information on the district's supply can be found in **Chapter 6.0 System Supplies**.

Water within the district's service area is largely used for single- and multi-family residential homes, which make up 75 percent of the district's total demand. Commercial, institutional, and landscape comprise the remaining 25 percent of total demand. Current demand for potable and raw water is 22,610 AFY, which is expected to increase to roughly 25,860 AFY by 2040. Water loss, is included in this demand and is defined as the difference between water produced and water sold to customers. In California, unaccounted-for urban water generally

ranges from 6 to 15 percent. In fiscal year (FY) 2014-15, the district's system losses, which include real and apparent losses, were calculated to be 1,500 AF, roughly 7 percent of the total demand. More detailed information on the district's water use is documented in **Chapter 4.0 System Water Use.**

1.4 SB X7-7 Reporting

The Water Conservation Bill of 2009 (SBX7-7), passed in November 2007, was designed to reduce statewide per capita urban water use by 20 percent by the year 2020. SB X7-7 requires urban water suppliers to report in their UWMPs base daily per capita water use, an urban water use target, an interim urban water use target, and compliance daily per capita water use.

Base daily per capita water use is calculated by dividing per capita water use by population. The district's five-year base daily per capita water use, which runs from 2003 through 2007, is 147 gallons per capita per day (GPCD). The district's 10-year base daily per capita water use, which is from 1995 through 2004, is 149 GPCD. Based on these benchmarks, the district's 2020 water use target is 124 GPCD (using Method 3) and its interim (2015) target is 137 GPCD. The district is currently meeting both its interim and 2020 water use targets, as the daily per capita water use in 2015 was 110 GPCD, well below both targets. Through continued implementation of demand management measures and other conservation activities, the district expects that it will continue to meet its water use target in the year 2020. A more detailed discussion of SB X7-7 baselines and targets, including the district's involvement in a Regional Alliance, is provided in **Chapter 5.0 Baselines and Targets.**

1.5 Demand Management Measures

The district's programs for demand management through water conservation began in 1971, and a study in 1999 found that the per capita water use had been reduced by an estimated 25 percent during the period from 1970 to 1998. The district's *2007 Water Conservation Master Plan* illustrates its on-going dedication to a future in which water waste is reduced, the environment is protected, and water rates are based on the efficient use of available water resources. The district's recycled water program and water conservation efforts are discussed in more detail in **Chapter 6.0 System Supplies** and **Chapter 9.0 Demand Management Measures**, respectively.

1.6 Supply Reliability and Contingency Planning

There are a number of factors that could negatively impact the reliability of the district's supply, including limits on the amount available, water quality, climatic conditions, or a combination of these. To adequately plan for a potential future reduction in supply, the district compared historical supply to projected future demands to identify potential

shortages. This analysis helps determine the potential shortage that could occur should a given historical year type repeat. Results indicate that the district has adequate supply to meet future demand through 2040 in all year types (see **Table 7-4**, **Table 7-5**, and

Table 7-6). The *2040 Water Resources Plan*, when finalized in 2017, will provide further analysis of the district's reliability risks and will identify projects to improve future water supply resiliency. Detailed information on supply reliability is included in **Chapter 7.0 Water Supply Reliability Assessment.**

To address potential shortages, the district developed a rationing plan which is outlined in Title 13 of the district's code. Based on the level of total reservoir storage, a 10 percent voluntary rationing occurs when total reservoir storage is less than 50,000 AF on April 1st and a 25 percent mandatory rationing occurs when storage is less than 40,000 AF on April 1st. A water shortage emergency and a mandatory 50 percent reduction is declared when total reservoir storage on December 1st is projected to be near or less than 30,000 AF. To support these rationing levels, the district has developed a number of prohibitions including rationing on landscape irrigation and limits of water features and swimming pools. The district is currently developing a *2040 Water Resources Plan*, which will further identify supply options to increase resiliency during times of shortage. More information on the district's current water contingency planning can be found in **Chapter 8.0 Water Shortage Contingency Planning**.

1.7 Plan Adoption, Submittal, and Implementation

The district will submit its 2015 Urban Water Management Plan to the California Department of Water Resources by July 1, 2016 via the approved upload tools. The district will submit a CD copy of the Plan to the California State Library and the cities to which it provides water no later than 30 days after the Plan is adopted by the district's Board of Directors. A copy of the Plan will also be available on the district's website, at the district's offices, and at local libraries. The Plan will be implemented to meet the district's 2020 urban water use target of 124 GPCD by continued implementation of the district's water conservation program and focused demand management measures. More detailed information can be found in **Chapter 10.0 Plan Adoption, Submittal, and Implementation**.

1.8 Plan Organization

The district's 2015 Urban Water Management Plan is organized into the chapters as listed below.

Chapter 2: Plan Preparation

Chapter 3: System Description

Chapter 4: System Water Use

Chapter 5: SB X7-7 Baselines and Targets

Chapter 6: System Supplies

Chapter 7: Water Supply Reliability Assessment

Chapter 8: Water Shortage Contingency Planning

Chapter 9: Demand Management Measures

Chapter 10: Plan Adoption, Submittal, and Implementation

2.0 Plan Preparation

2.1 Basis for Preparing a Plan

The Urban Water Management Planning Act was created by Assembly Bill (AB) 797, which was signed into law in September 1983. Since that time, the Act has been amended by AB 2661 (July 1990), AB 1869 (October 1991), and AB 11X (October 1991). Since the 2010 Urban Water Management Plans (UWMPs) were submitted, AB 2067, Senate Bill (SB) 1420, and SB 1036 were passed, which further amended reporting requirements associated with the Urban Water Management Planning Act.

The Urban Water Management Planning Act requires that urban water suppliers (i.e., municipal water suppliers providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 AF of water annually) prepare and adopt UWMPs that report, describe, and evaluate water deliveries and uses, water supply sources, efficient water uses, and demand management measures. These plans are required to be prepared every five years and are due following years ending in 0 and 5. The Urban Water Management Planning Act also directs water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies are available to meet existing and future demands. Urban water suppliers are required to assess current demands and supplies over a 20-year planning horizon and consider various drought scenarios. Water shortage contingency planning and drought response actions are also to be included in a UWMP.

In November 2009, the Water Conservation Bill of 2009 (SBX7-7) was passed. This bill includes elements of the 20x2020 Water Conservation Plan which was designed to reduce the statewide per capita urban water use by 20 percent by the year 2020. The Water Conservation Bill of 2009 requires urban water suppliers to report in their UWMPs base daily per capita water use (baseline), an urban water use target, an interim urban water use target, and compliance daily per capita water use. This will enable water agencies and the California Department of Water Resources (DWR), to track progress towards decreasing daily per capita urban water use throughout the state. Beginning in 2016, retail water suppliers are required to comply with the conservation requirements in SBX 7-7 in order to be eligible for State water grants and loans.

The Marin Municipal Water District (MMWD or district) is an urban retail water supplier that owns and operates a public water system, as defined in the California Water Code. **Table 2-1** below provides information on the district's public water system.

Table 2-1: Retail Public Water System (DWR Table 2-1)

Public Water System Number	Public Water System Name	Number of Municipal Connections 2015	Volume of Water Supplied 2015 (AFY)
2110003	Marin Municipal Water District	61,800	23,726
	TOTAL	**61,800**	**23,726**

The district has prepared this UWMP based on the 2015 UWMP Guidebook to remain in compliance with the Urban Water Management Planning Act and the California Water Code, and to meet the following planning objectives:

- Ensure the efficient use of available water supplies;
- Determine existing baseline water consumption;
- Establish water use targets;
- Describe and evaluate historical and projected water use;
- Evaluate current and projected water supply reliability;
- Describe and evaluate demand management measures; and
- Provide a water shortage contingency plan.

In an effort to verify that the district has met all the requirements for urban water management planning as outlined in the California Water Code, a checklist is provided in Appendix A. This checklist indicates the page number that corresponds to each Water Code requirement related to urban water management planning.

2.2 Regional Planning

Regional planning can deliver mutually beneficial solutions to all agencies involved by potentially reducing costs for an individual agency, assessing water resources at the appropriate geographic scale, or allowing for solutions that cross jurisdictional boundaries. Recognizing these benefits, MMWD has opted to participate in regional planning by participating in and including Regional Alliance SB X7-7 targets. A Regional Alliance is a group of water suppliers agreeing among themselves to plan, comply, and report as a region on the requirements of SB X7-7.

2.3 Individual or Regional Planning and Compliance

The district has opted to develop this UWMP as an individual agency, as shown in **Table 2-2**. As such, the Plan covers the district's service area and addresses all the relevant requirements of the California Water Code.

Table 2-2: Plan Identification (DWR 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	North Marin-Sonoma Alliance
☐	Regional Urban Water Management Plan (RUWMP)		
NOTES:			

As stated in Section 2.2, the district has opted to be a part of a Regional Alliance and include the Regional Alliance SB X7-7 targets in this 2015 UWMP. A Regional Alliance allows water suppliers to work toward cooperatively developing programs and meeting regional water conservation targets without necessarily submitting a Regional Plan. The district has joined a regional alliance with the Water Contractors, which include the cities of Santa Rosa, Rohnert Park, Sonoma, Cotati, Petaluma, Town of Windsor, North Marin Water District (NMWD) and Valley of the Moon District (VOMWD), to comply with the daily per capita water use targets on a regional basis. The district's compliance with an Interim 2015 Water Use Target will be assessed based upon how the district performs relative to its individual target or how the Regional Alliance as a whole performs relative to the Regional Alliance target. If the district meets either of these targets, the district will be deemed in compliance with SB X7-7.

2.4 Fiscal Year or Calendar Year and Units of Measure

As indicated in **Table 2-3**, with the exception of water losses, all data reported in this UWMP is on a calendar year basis and all water volume units are presented in acre-feet (AF). [2] Because the UWMP is structured in calendar year, water use and planning data for the entire calendar year of 2015 is used.

Table 2-3: Agency Identification (DWR Table 2-3)

Types of Agency	
☐	Agency is a wholesaler
☑	Agency 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	Acre Feet (AF)
NOTES: (1) Water losses are presented on a fiscal year basis, beginning on July 1 and ending on June 30.	

2.5 Coordination and Outreach

The district has actively encouraged community participation in its water planning efforts over the years. With the initiation of urban water management plans, public meetings were held for each of the 1985, 1990, 1995, 2000, 2005, and 2010 plans. In 1991, the district entered into an integrated water management planning process that encourages and incorporates public input as a part of the district's development of both water supply and demand management efforts.

The district has encouraged public participation in the development of this 2015 UWMP and provided opportunities for public review and comment. Notices of public hearings were placed in the local newspaper and posted at the district office and local libraries. A copy of the notice is provided in Appendix B. The public notice stated that the UWMP was being

[2] MMWD financial information is parsed on a fiscal year, not calendar year, basis. Because the water loss reporting procedure requires integration of financial data, water losses were unable to be calculated on a calendar year basis. As such, water losses are presented on a fiscal year basis. The district's fiscal year begins on July 1 and ends on June 30.

updated and that the public was encouraged to provide oral and written comments on the UWMP.

On April 19, 2016 and on May 17, 2016, the district held public hearings that included presentations related to the 2015 UWMP. During the first public meeting, the district heard and discussed any comments from the public. This hearing provided an opportunity for the district's customers/residents and employees in the area to learn about the water supply situation and plans for providing a reliable, safe, high-quality water supply for the future. During the second public hearing, the district discussed responses to comments received on the UWMP. The Final UWMP was approved at a subsequent Board meeting.

California Water Code Section 10621(b) stipulates that a water supplier must notify any city or county within which the supplier provides water that it is reviewing and considering changes to the UWMP. This notification must occur at least 60 days before the public hearing. MMWD held the first public hearing for the UWMP on April 19th and again on May 17th, and notifications were sent out on January 29, 2016, well in advance of the 60-day requirement. A copy of this notice is provided in Appendix C.

Per section 10631 of the California Water Code, the district must provide its wholesaler, the Sonoma County Water Agency (SCWA), with water use projections for SCWA supply for 20 years in five-year increments (see **Table 6-1**). The district provided these water use projections to SCWA in November 2015 (**Table 2-4**).

Table 2-4: Water Supplier Exchange Information (DWR Table 2-4)

The retail supplier has informed the following wholesale supplier(s) of projected water use in accordance with CWC 10631.
Wholesale Water Supplier Name
Sonoma County Water Agency
NOTES:

In addition to Sonoma County Water Agency, the other agencies and organizations contacted or involved in the preparation, discussion, and/or coordination of this UWMP are listed in **Table 2-5**.

Table 2-5: Coordination and Notification for Plan Preparation

Organization/Agency Name	
City of Belvedere	North Marin Water District
City of Larkspur	Town of Corte Madera
City of Mill Valley	Town of Fairfax
City of Novato	Town of Ross
City of San Rafael	Town of San Anselmo
City of Sausalito	Town of Tiburon
County of Marin	General Public

3.0 System Description

This section provides a description of the district's water system, including a description of the climate, population, and demographics. This section also provides descriptions of the distribution system.

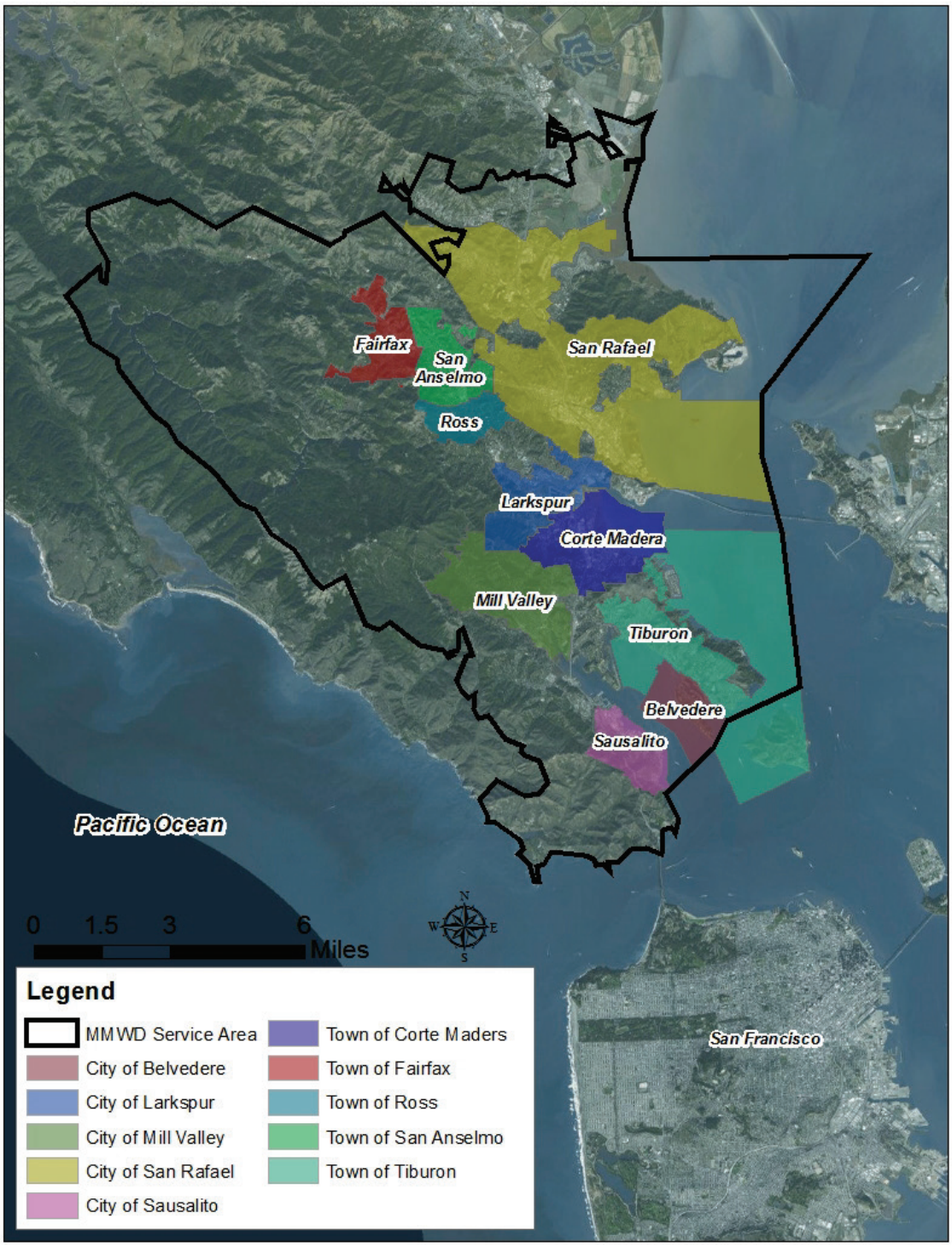
3.1 General Description

The district serves the populous eastern corridor of Marin County from the Golden Gate Bridge northward up to, but not including, Novato. The district is bounded by the San Francisco Bay on the east, and stretches through the San Geronimo Valley in the west. The incorporated cities and towns of San Rafael, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Corte Madera, Tiburon, Belvedere and Sausalito are within the district's service area.

Prior to the organization of the Marin Municipal Water District, water service in the area was provided by several unrelated private water companies. The principal water companies operating in the County were the Marin Water and Power Company and the North Coast Water Company. In 1911, a group of public-spirited citizens organized the Southern Marin Water District Association to place the water supply of the County on a public ownership basis. As a result of the efforts and work of this organization, a petition bearing 1,863 validated signatures was presented to the County Board of Supervisors in January 1912, paving the way for an election for the incorporation of the Marin Municipal Water District. The district received its Charter from the Secretary of State on April 25, 1912. The Municipal Water District Act was created for the district, the pioneer municipal district in California.

The district covers approximately 147 square miles and serves a population of approximately 190,000 customers through about 61,800 active service connections. Five of the seven district reservoirs (Alpine, Bon Tempe, Kent, Lagunitas, and Phoenix Lake) are located on the north slope of Mt. Tamalpais. The remaining two district reservoirs (Nicasio and Soulajule) are outside the district's service area in western Marin County. The district's service area is shown in **Figure 3-1**. Pipelines range from 3/4-inch pipes connecting customers' water meters to the district's mains, to the 42-inch transmission mains that carry source water to the treatment plants. The pipes are made of various materials depending on when and where they were installed.

Figure 3-1: Marin Municipal Water District Service Area



As described in **Table 3-1**, the district's potable water distribution system includes approximately 886 miles of water mains, 94 pump stations, and 127 treated water storage tanks with a total storage capacity of 81.9 million gallons (MG). The district treats water at its three treatment plants, the Bon Tempe Treatment Plant (BTTP) near Ross, the San Geronimo Treatment Plant (SGTP) in Woodacre, and the Ignacio treatment facility. Together, these facilities have a combined design capacity of 71 million gallons per day (mgd). Observed high flows have reached 58 mgd; however, the average daily maximum flow is approximately 25 mgd. In 2015, the total production of the three plants averaged 20.4 mgd. The district's service area boundaries, location of water treatment plants, and potable water distribution system are illustrated in **Figure 3-2**.

Table 3-1: Summary of Potable Water Facilities

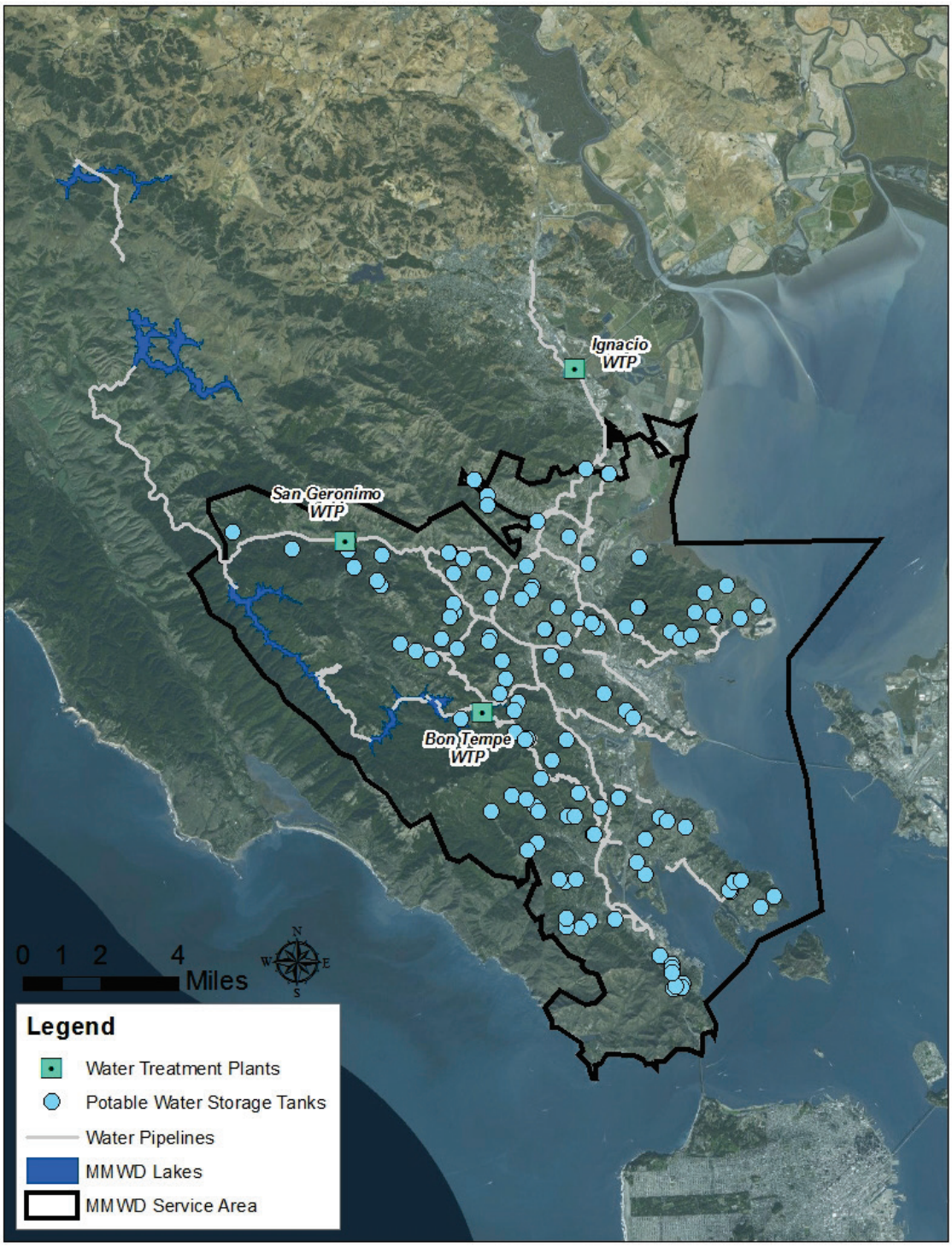
Facility	Value
Miles of pipeline	886
Number of storage tanks	127
Total tank storage capacity	81.9 MG
Number of pump stations	94
Number of potable water treatment plants	3
Maximum daily treatment plant capacity (designed)	71 mgd
Maximum daily treatment plant capacity (observed)	58 mgd
Average daily treatment plant production	20 mgd

In addition to the district's potable water system, the district also owns and operates a recycled water system, which is described in detail in Section 6.5, and briefly summarized below in **Table 3-2**.

Table 3-2: Summary of Recycled Water Facilities

Facility	Value
Miles of pipeline	27
Number of storage tanks	3
Total tank storage capacity	1.9 MG
Number of pump stations	4
Number of recycled water treatment plants	1
Maximum daily treatment plant capacity	2 mgd

Figure 3-2: Distribution System



3.2 Climate

The district has a Mediterranean coastal climate. Summers are mild and dry, and winters are cool and wet, with an annual average of 30 inches of precipitation in the service area and over 50 inches of rainfall in the Mt. Tamalpais watershed. The region is subject to wide variations in annual precipitation and contains a multitude of microclimates. Summer fog helps reduce summer irrigation requirements. **Table 3-3** below indicates the monthly average evapotranspiration (ETo), precipitation, and maximum and minimum temperature for the service area.

Table 3-3: Monthly Average Climate Data Summary*

Month	Standard Monthly Average ETo (inches)	Average Total Rainfall (inches)	Average Temperature (degrees Fahrenheit)	
			Max	Min
January	1.52	10.45	55.6	38.6
February	2.01	8.36	60.5	41.0
March	3.33	6.36	64.5	42.0
April	4.51	2.81	69.3	43.8
May	5.62	1.31	74.1	46.5
June	6.09	0.36	79.8	49.5
July	6.13	0.05	83.4	50.2
August	5.50	0.08	82.7	50.1
September	4.38	0.46	81.4	49.6
October	3.10	2.46	74.8	47.0
November	1.77	5.82	64.2	42.8
December	1.24	8.89	56.3	39.1

NOTES: ETo data is from California Irrigation Management Information System (CIMIS). The data is from a station in Point San Pedro (157) and has a period of record from 2002 through 2011; rainfall and temperature data is from Western Regional Climate Information Center (WRCC). The data is from a station in Kentfield, CA (044500) and has a period of record from 1902 through 2015.

3.2.1 Climate Change

Water managers throughout California are beginning to see the effects of a changing climate and recognize the risks associated with these changes. A portion of the district's service area is located along the coast of the San Francisco Bay, which, with a changing climate, could see rising sea levels. Over the last 30 years, mean sea level around the San Francisco Bay area has been observed to change between 0 and 3 millimeters per year (NOAA 2013). There are a number of sensitive habitats, as well as man-made structures, located along this coastline that could be affected by a rise in sea level. The Corte Madera Marsh State Marine Park and Bothin Marsh Preserve, as well as several other marsh lands, are located near the coastline. The towns of Tiburon, Sausalito, and San Rafael have marinas that rely on the protection of breakwaters, and developed areas in San Rafael rely on a levee structure for protection from storm surges. There are also a number of ferries that run from San Francisco to Marin County which bring tourists and economic interests to the region.

As the climate changes, less frequent, more intense storms are expected. These storms have an increased potential to cause flooding, both in areas with historical flooding and in new areas. While the district is not located within a 200-year floodplain, it does rely on a network of reservoirs to capture runoff from the local watersheds. A change in precipitation patterns will necessitate water management strategies that are able to capture and store the precipitation from these storms while managing flood risk. With less frequent, more intense storms, there will also be extended dry periods. The watersheds that MMWD relies on for water supply are heavily wooded. Under climate change, soils and wooded areas are expected to become increasingly dry, which creates additional fuel load for wildfires.

The district's service area provides rich habitat for a healthy ecosystem, which could be affected by a changing climate. Marin County is home to 17 endangered, threatened, or rare fauna species, including the California Tiger Salamander, Western snowy plover, and Longfin smelt. There are also 20 endangered, threatened, or rare flora in Marin County, including the Tiburon paintbrush, Two-fork clover, and Sonoma spineflower. As the climate changes, climate variability could lead to changes in habitat distribution for these species, furthering endangering them. The San Francisco Bay is a key estuary for California that relies on freshwater draining from the Sacramento and San Joaquin rivers. Changes in snowmelt and rain/snow patterns in the Sierra Nevada Mountains would alter the flows in both of these rivers, ultimately affecting the seasonal freshwater flow patterns for the Bay.

3.3 Service Area Population and Demographics

Marin County was typically characterized as a summer vacation area in the early 1900s. With the completion of the Golden Gate Bridge in 1936, the County began to develop into a bedroom community supporting the business and industry of San Francisco and the East Bay area.

Growth in Marin, mainly residential in nature, boomed during the period following World War II up to the early years of the 1970s. Growth during the last two decades has averaged less than one percent per year, and the County Planning Department indicates that only four percent of lands within the County remain available for new development. The population within the district remained level during the 1970's and 1980's. During that same period, the number of water service connections increased by 21 percent, from 46,000 to 58,000, with the majority being residential services, and the number of people per household declined from 3.1 to 2.5. Annual population increases in the 1990s and early 2000s were less than one percent per year. The district's service area is generally considered to be built-out and very low population growth is expected within the area.

Table 3-4 shows the 2015 service area population, as well as the estimated population in five-year increments from 2020 through 2040. The 2015 population estimate is based on data from the Department of Finance (DOF); estimates for the remaining years are based on projections for the district's service area prepared by the Association of Bay Area Governments (ABAG).

The ABAG figures project a continued slow growth rate of about 0.46 percent per year for the 25-year period. The methodology used in developing the district's service area population from the ABAG projections is included in Appendix D.

Table 3-4: Population - Current and Projection (DWR Table 3-1)

	2015	2020	2025	2030	2035	2040	Data Source[2]
Service Area Population[1]	189,000	191,300	195,500	199,800	205,000	210,400	ABAG
NOTES: 1) Service area population is defined as the population served by the distribution system. 2) The population is based on Association of Bay Area Governments (ABAG) 2013 Projections, which use Census data.							

4.0 System Water Use

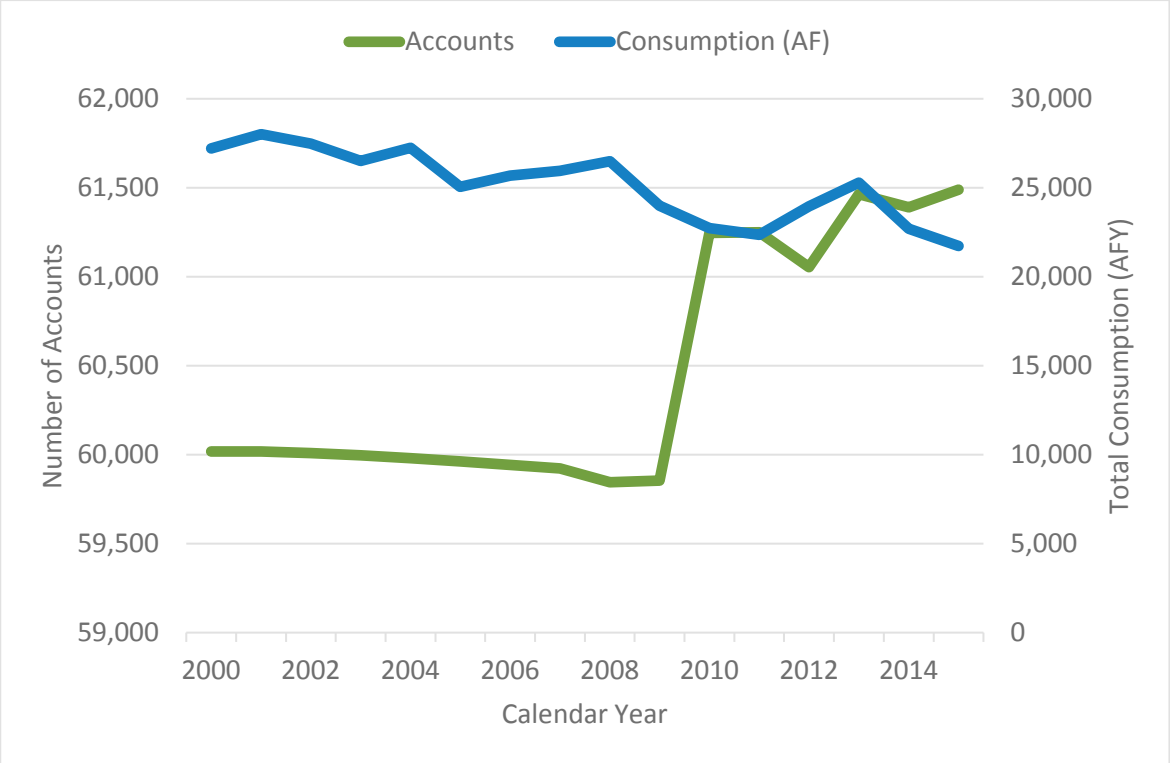
The district's past, current and projected water demands are presented in this section. Current water demand is provided by water use sector and projected to 2040 in five-year increments. Current system losses are also provided and projected to 2040. Note that the district is not a wholesaler and does not sell water to any other agencies.

4.1 Water Uses by Sector

This section quantifies past water use, as well as current and projected future water demands by water use sectors (i.e., single-family residential, multi-family residential, commercial, etc.).

Despite growth, districtwide water use has steadily decreased, as illustrated in **Figure 4-1** below.

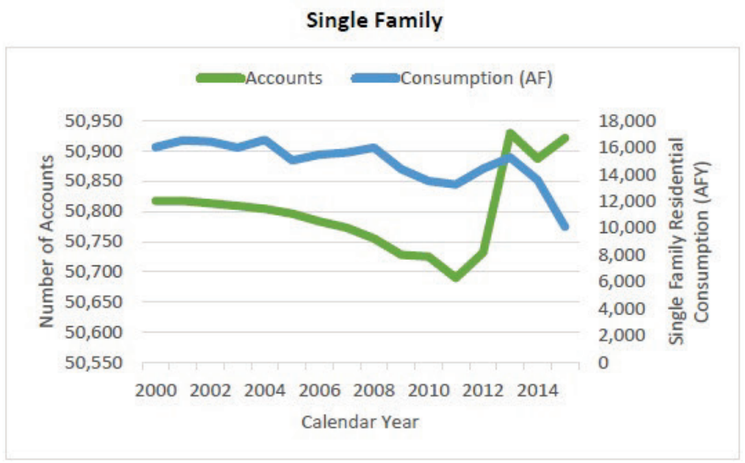
Figure 4-1: Historical Water Use and Service Connections

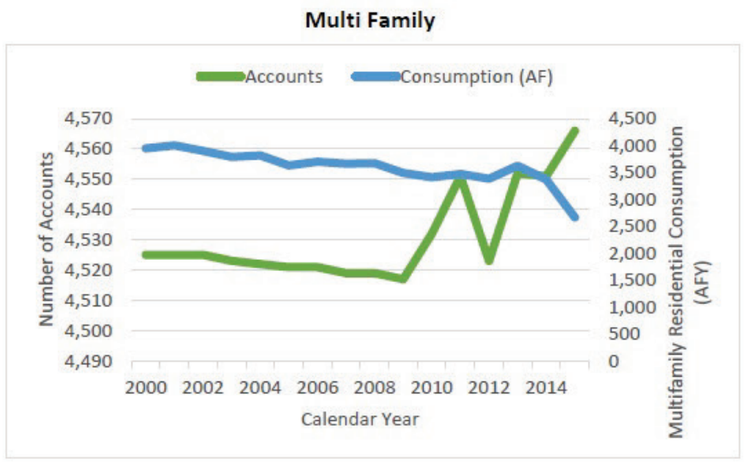


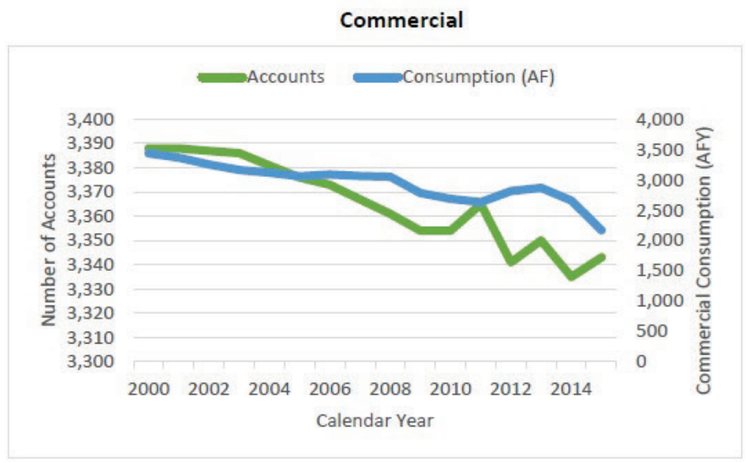
NOTES: In 2010, the district began tracking "other accounts" which include fireline connections. The apparent increase in the number of accounts is a result of this improved tracking implemented in 2010.

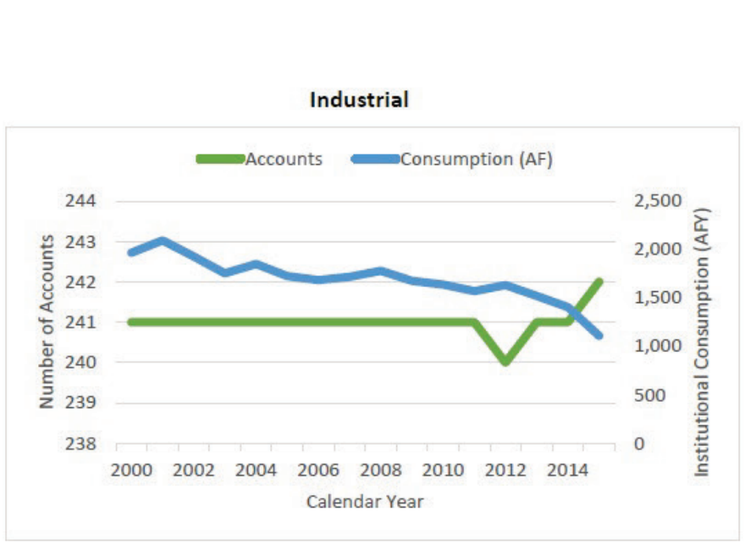
Figure 4-2 below compares historical water use and number of connections by customer sector.

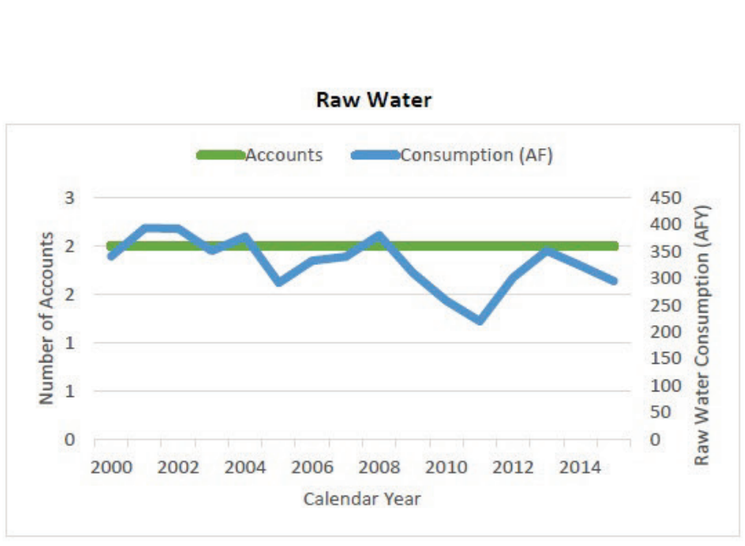
Figure 4-2: Historical Water Use and Number of Connections per Customer Sector

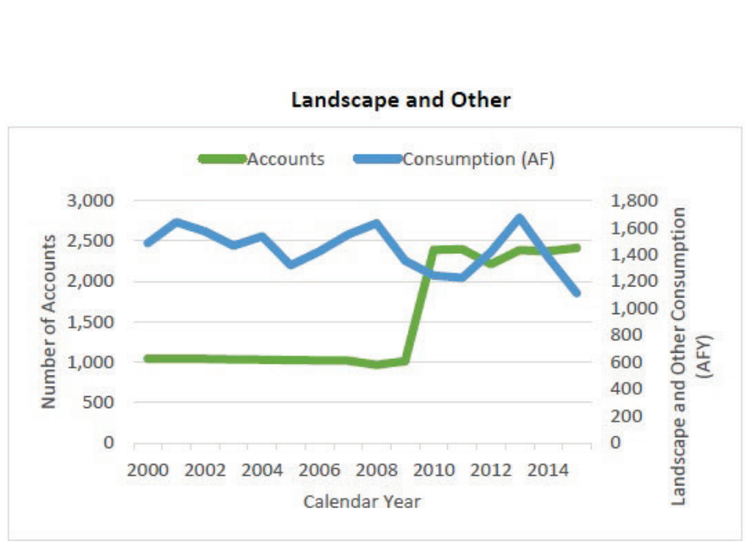












NOTES: In 2010, the district began tracking “other accounts” which include fireline connections. The apparent increase in the number of accounts in the Landscape and Other graph is a result of this improved tracking implemented in 2010.

Table 4-1 below provides a summary of 2015 actual water demands, which were collected using billing data. Note that this table does not include demand for recycled water. Total demand with recycled water is in **Table 4-3**.

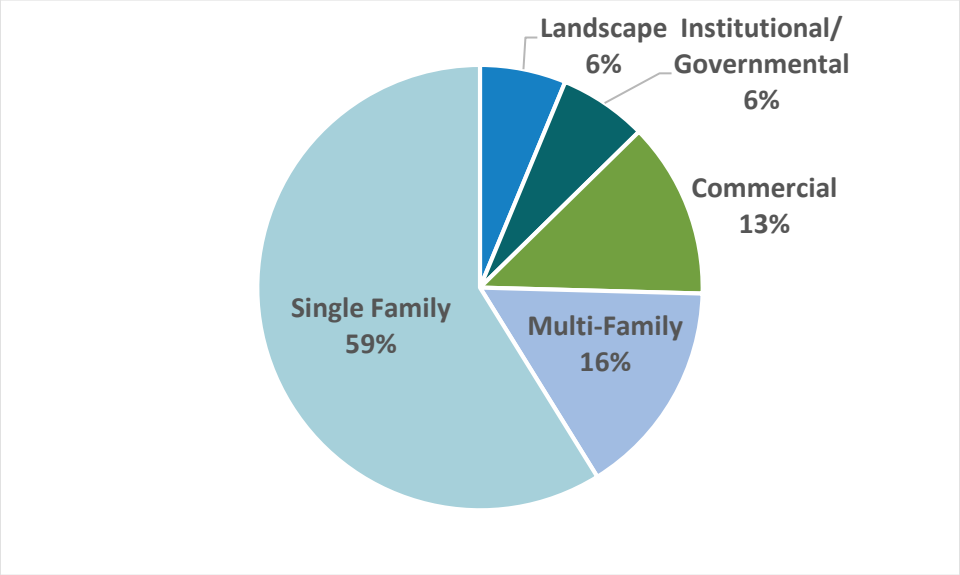
Environmental release requirements are included under the wetlands and wildlife habitat use type and include requirements associated with Kent and Soulajule lakes. The district releases water from the Kent and Soulajule lakes to meet environmental flow requirements that benefit silver salmon and steelhead populations in Walker Creek and Lagunitas Creek. The district made an agreement with the California Department of Fish and Game in 1976, with an amendment in 1985, to release a volume of water from Soulajule reservoir that maintains a constant streamflow in Walker Creek of 20 cfs during the winter and spring months. The amount of water released is decreased in the summer and fall months and when the reservoir level is low. The district releases water from Kent reservoir in accordance with the 1995 SWRCB Order 95-17 to maintain the streamflow in Lagunitas Creek of 20 to 25 cfs during winter months in wet years, with decreased flows during the summer and during dry years. Increased upstream migration flows are released from Kent for four three-day periods between November and February to provide for the upstream migration of anadromous fish.

Table 4-1: Demand for Potable and Raw Water - Actual (AFY) (DWR Table 4-1)

Use Type	2015 Actual		
	Additional Description (as needed)	Level of Treatment When Delivered	Volume (AFY)
Single Family	-	Drinking water	12,314
Multi-Family	-	Drinking water	3,277
Commercial	-	Drinking water	2,633
Industrial	-	N/A	0
Institutional / Governmental	-	Drinking water	1,315
Landscape	-	Drinking water	1,251
Groundwater recharge	-	N/A	0
Saline water intrusion barrier	-	N/A	0
Agricultural irrigation	-	N/A	0
Wetlands or wildlife habitat	Environmental releases from Kent and Soulajule Lakes	Raw water	15,726
Sales/Transfers/ Exchanges to other agencies	-	N/A	0
Losses	-	Drinking water	1,500
Other	Fireline and hydrant meter water.	Drinking water	26
Other	Water sold to San Geronimo Golf Course and the Meadow Club.	Raw water	304
		Total	**38,346**
NOTES: (1) Errors attributed to rounding; (2) Environmental releases include both reservoir spill and water released to satisfy environmental release requirements. In 2015, 6,145 AF was released from Soulajule and 9,581 AF was released from Kent; (3) Losses reported are from FY 14-15 and represent real and apparent losses.			

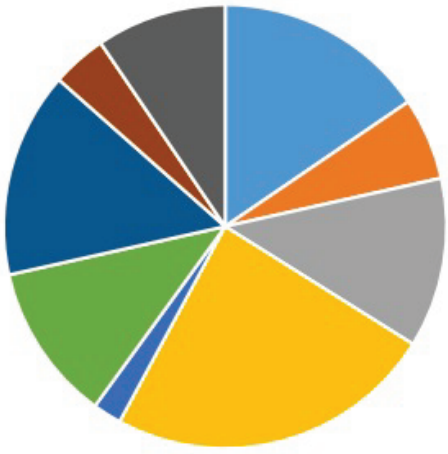
The distribution of water use among the customer sectors is illustrated in **Figure 4-3**. Most service connections are single-family residential, which represented about 60 percent of the district's total 2015 demand.

Figure 4-3: 2015 Distribution of Water Use by Sector



Roughly 70% of single-family residential water use is indoors. **Figure 4-4** below shows the breakdown of an average district single-family residential household's indoor water use.

Figure 4-4: Average Single-Family Residential Household Indoor Water Use



Element of Indoor Use	Average 2015 Single Family Indoor Water Use (gal/day/account)	Percent of Use
Toilets	27	16%
Lavatory Faucets	11	6%
Non-Lavatory/Kitchen Faucets	22	12%
Showers	43	24%
Dishwashers	4	2%
Clothes Washers	20	12%
Internal Leakage	27	15%
Baths	7	4%
Other	17	10%
Total	**177**	**100%**

Water demand projections were developed through 2040 using the district's Demand Side Management Least Cost Planning Decision Support System (DSS) model. The demand analysis process included forecasting future water demand by customer category based upon forecasted increases in population and employment, combined with the effects of natural fixture replacement and the implementation of more efficient plumbing codes in the future. Natural replacement with more efficient fixtures due to the implementation of plumbing codes generates "passive conservation" savings (see Section 4.3). Passive savings are noted in **Table 4-6**. To forecast future demands, the model begins with an assumed base year. The base demand used for the district's analysis was the average demand observed in the years 2008 through 2013. Demand in the years 2014 and 2015 was unusually low in response to the ongoing drought and State-mandated water use reductions.

While projections account for passive savings, the district has taken a more conservative approach to demand projections by not accounting for conservation savings associated with future active measures. However, savings associated with all past active conservation efforts are embedded into the demand projections. This approach, while conservative, safeguards against potential future shortages by planning for the highest level of demand; any potential shortages at this level of demand could be mitigated by active conservation. Active conservation would thus increase resiliency for district customers by stretching available supply.

In October 2015, the Board of Directors' Resiliency Committee met to review the demand analysis described above. As a result of that meeting and a number of public comments, the district ran a second scenario that used 2015 demand as the base year, instead of an average demand from 2008 through 2013. This second model run shows a scenario in which demands do not rebound after the drought, but rather remain low. Under the second scenario, 2020 demands are projected to be 22,011 AF and are projected to be 21,820 AF in 2040. The full analysis using 2015 as the baseline is provided in Appendix E as an alternative analysis of demand forecasts under continued drought-level conservation efforts with little to no rebounding effect following the drought.

It is important to be conservative in estimating potential future shortfalls in water supply planning efforts such that the District can be confident in its ability to meet state-mandated water use reductions in addition to planning for sufficient supply to meet future demands. Omitting 2014 and 2015 from the base year demands provides a more conservative estimate of future demand, appropriate for this planning effort. As such, for the purposes of implementing robust water supply planning, the demands presented in the following tables utilize the demands projected from the base demand developed using 2008 through 2013 demands. It should be noted that when this UWMP is updated in 2020, demands will be re-projected based on actual demands observed between 2015 and 2020. These updated demands are expected to more accurately reflect actual post-drought conditions than either scenario presented herein.

Table 4-2 below provides water use projections from 2020 through 2040 in five-year increments. As with **Table 4-1**, this table does not include demand for recycled water. Total demand with recycled water is shown in **Table 4-3**.

Table 4-2: Demand for Potable and Raw Water - Projected (AFY) (DWR Table 4-2)

Use Type	Additional Description (as needed)	Projected Water Use (AFY)				
		2020	2025	2030	2035	2040
Single Family	-	14,291	14,240	14,174	14,263	14,425
Multi-Family	-	3,432	3,324	3,234	3,199	3,194
Commercial	-	2,799	2,761	2,741	2,740	2,750
Industrial	-	0	0	0	0	0
Institutional / Governmental	-	1,635	1,670	1,707	1,752	1,798
Landscape	-	1,492	1,514	1,540	1,572	1,606
Groundwater recharge	-	0	0	0	0	0
Saline water intrusion barrier	-	0	0	0	0	0
Agricultural irrigation	-	0	0	0	0	0
Wetland or wildlife habitat	Environmental releases from Kent and Soulajule Lakes	15,726	15,726	15,726	15,726	15,726
Sales/ Transfers/ Exchanges to other agencies	-	0	0	0	0	0
Losses[2]	-	1,705	1,695	1,688	1,698	1,716
Other	Includes fireline and hydrant meter water.	33	34	35	36	37
Other	Includes raw water sold to San Geronimo Golf Course and the Meadow Club.	307	313	320	329	337
	Total	**41,420**	**41,277**	**41,165**	**41,315**	**41,589**

NOTES: (1) Errors attributed to rounding; (2) Losses were calculated by determining losses as a percent of a total of the demand for FY 14-15 (less wetland and wildlife habitat demand) and applying that percentage to the projected demand. Losses represent real and apparent losses. (3) These demands reflect only passive conservation. The district intends to implement active conservation, with savings shown in Table 4-7. With active conservation, 2040 demand is projected to be lower than presented herein (2015 demand with active conservation was 38,346 AFY; projected 2040 demand with active conservation is 39,897 AFY, as shown in Appendix E).

The district did not engage in any transfers, exchanges, or surface water augmentation; thus, the district has no demands associated with these activities. Additionally, while the district does make environmental streamflow releases from some of its local lakes, for the purposes of this section, there are no demands associated with wetland or wildlife habitat.

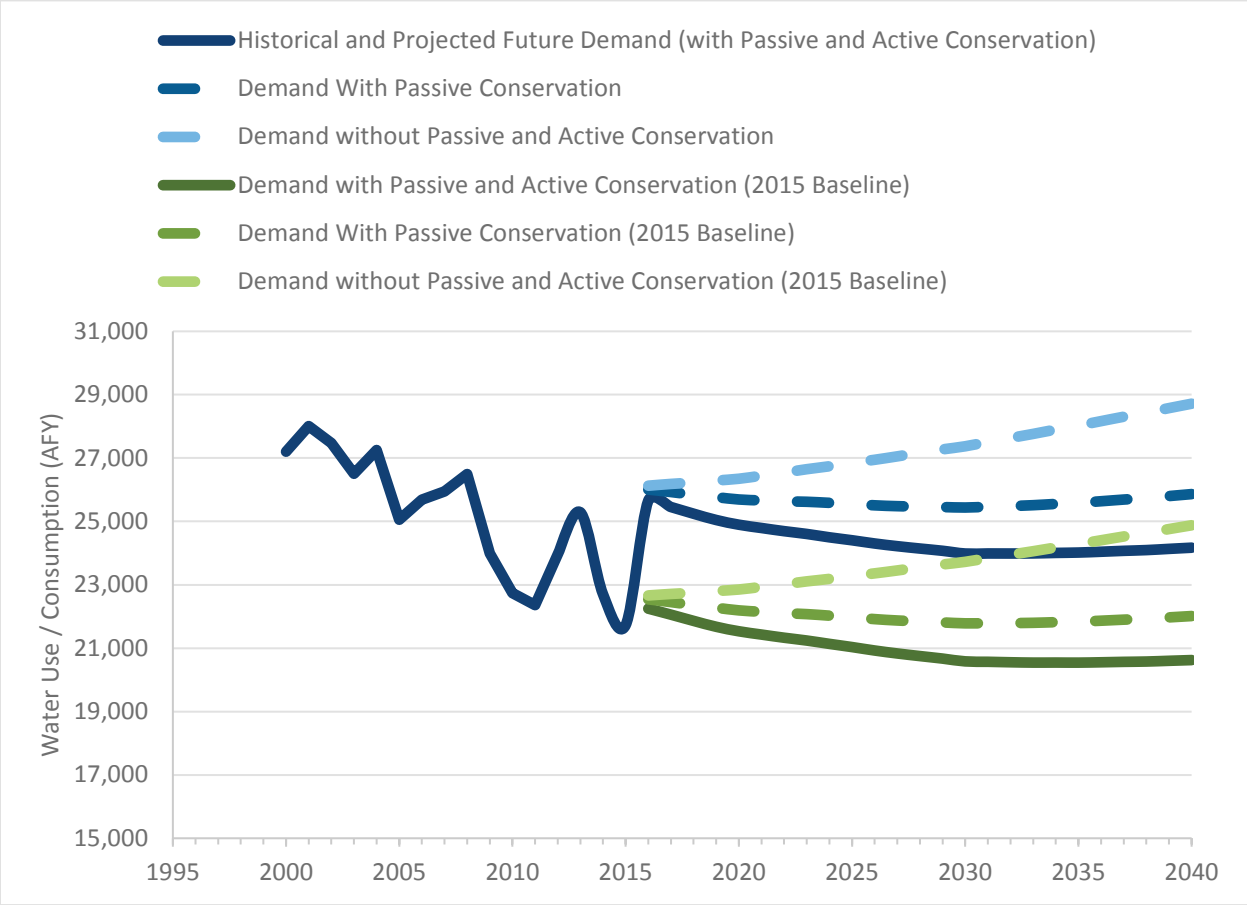
The district's total water demands, including recycled water, are summarized in **Table 4-3.**

Table 4-3: Total Water Demands (AFY) (DWR Table 4-3)

	2015	2020	2025	2030	2035	2040
Potable and Raw Water (AFY)	38,346	41,420	41,277	41,165	41,315	41,589
Recycled Water Demand (AFY)	520	520	520	520	520	520
Total (AFY)	**38,866**	**41,940**	**41,797**	**41,685**	**41,835**	**42,109**
NOTES: (1) Losses were calculated by determining the percent of losses as a total of the demand for FY 14-15 and applying that percentage to the projected demand. Losses represent real and apparent losses. (2) Projected demands reflect only passive conservation. The district intends to implement active conservation, with savings shown in Table 4-7. Total demand in 2015 with active conservation was 38,346 AFY. With active conservation, 2040 total demand is projected to be lower than presented herein (projected 2040 demand with active conservation and recycled water is 40,417 AFY, as shown in Appendix E).						

As mentioned in the section above, District will implement conservation savings that are anticipated to reduce the projected demand presented in **Table 4-3**. **Figure 4-5** below shows projected demand with passive and active savings, with passive only savings, and without passive and active savings for the projected demands used in the UWMP and the alternate demand projections (assuming a 2015 baseline). Additionally, historical demands are also provided. Note that historical demands include savings associated with both passive and active conservation.

Figure 4-5: Historical and Projected Demand



NOTES: The above figure does not include 15,726 AFY of demand associated with wetland or wildlife habitat.

4.2 Distribution System Water Losses

This section quantifies distribution system water losses for the most recent 12-month period for which data are available. Distribution system water losses include water physically lost from the water distribution system and the supplier's storage facilities, up to the point of customer consumption. For July 2014 through June 2015, the district's losses, including real and apparent losses, totaled 1,500 AF, as shown in **Table 4-4**. The full water loss reporting analysis is included in Appendix F.

Table 4-4: Water Loss Summary Most Recent 12 Month Period Available (as calculated in DWR Appendix L worksheet) (DWR Table 4-4)

Reporting Period Start Date (Month/Year)	Volume of Water Loss
July 2014	1,500 AF
NOTES: the volume of water lost represents both real and apparent losses for FY 14-15.	

4.3 Future Water Savings and Water Use for Lower Income Households

As indicated in **Table 4-5** below, water use for lower income households and savings associated with passive conservation are included in the water use projections noted in **Table 4-2** and **Table 4-3**. Further discussion of these two components are included the sections below.

Table 4-5: Inclusion in Water Use Projections (DWR Table 4-5)

Component	Included?
Are Future Water Savings Included in Projections?	Y
If "Yes" to above, state the section or page number where citations of the codes, ordinances, etc. utilized in demand projections are found.	Location in UWMP - Section 4.3
Are Lower Income Residential Demands Included in Projections?	Y

4.3.2 Future Water Savings

As noted in **Table 4-5**, passive savings are included in the water use projections in **Table 4-2** and **Table 4-3**. Passive savings are provided below in **Table 4-6**. Savings from codes and ordinances, or passive savings, were estimated through 2040 by using the Demand Side Management Least Cost Planning Decision Support System (DSS Model). Passive conservation refers to water savings resulting from actions and activities that do not depend on direct financial assistance or educational programs from the district. These savings result primarily from (1) the natural replacement of existing plumbing fixtures with water-efficient models required under current plumbing code standards, and (2) the installation of water-efficient fixtures and equipment in new buildings and retrofits as required under CALGreen Building Code Standards. The DSS Model evaluated water savings associated with the National Plumbing Code, CALGreen, the California Energy Commission, AB 715, and AB 407 to project passive conservation savings.

Table 4-6: Projected Passive Water Conservation Savings (AFY)

	2020	2025	2030	2035	2040
Passive Savings (AFY)	654	1,296	1,933	2,439	2,853
NOTES: Passive savings are included in the overall water use projections provided in Table 4-1 and Table 4-2.					

In addition to passive savings, the district also expects to achieve savings associated with implementation of its conservation program. Active savings, or savings resulting from the district's conservation program, are listed below in **Table 4-7**. For planning purposes, active savings are not accounted for in the demand projections noted in **Table 4-2** and **Table 4-3.** Given that active savings can fluctuate, the district is opting to plan for future demands with passive savings only; thus, any level of conservation program implementation will result in reduced future demands. More information on the district's conservation program and planned activities can be found in **Chapter 9.0 Demand Management Measures**.

Table 4-7: Projected Active Water Conservation Savings (AFY)

	2020	2025	2030	2035	2040
Active savings (AFY)	796	1,147	1,452	1,570	1,691

4.3.3 Water Use for Lower Income Households

State legislation (SB 1087 and Government Code §65589.7) effective January 1, 2006 requires local water agencies and sewer districts to grant priority to service connections for projects that help meet the community's fair housing need. For the purposes of assessing fair housing needs, a lower-income household is defined as a household with an income that is less than 80 percent of the statewide median household income (MHI), adjusted for family size. Based on the *Final Regional Housing Need Plan for the San Francisco Bay: 2014-2022* (ABAG, July 2013), the number of new, lower-income homes to be constructed between 2014 and 2022 in MMWD's service area is about 985 housing units. There are no data available for the division of these units between single-family and multi-family low-income housing units; though, based on the demographics of the district's service area, it is assumed that most low-income housing units are multi-family units.

The 985 new lower-income housing units to be constructed between 2014 and 2022 represent about 43 percent of the anticipated total new construction over the same period. This percentage was applied to the total number of new housing developments anticipated to be constructed between 2020 and 2040 to estimate the number of lower-income households. From there, the number of future lower-income housing units was estimated.

The district's current residential per unit water demand is approximately 0.33 AFY. This was determined by taking the average water use for the years 2008 through 2013 and dividing it by the average number of residential connections for the years 2008 through 2013. The estimated residential per unit water demand was applied to the projected number of future lower-income households to estimate the water demands of lower income households. **Table 4-8** below provides a summary of lower-income water demands. These water use projections are included in the overall water use projections provided in **Table 4-1** and **Table 4-2.**

Table 4-8: Lower-Income Projected Water Demands (AFY)

	2020	2025	2030	2035	2040
Number of New Lower-Income Households	523	514	540	519	538
Lower-Income Water Demands (AFY)	172	169	178	171	177
NOTES: Lower-income water demands are included in the overall water use projections provided in Table 4-1 and Table 4-2.					

4.4 Climate Change (Optional)

Increasing air temperatures due to climate change will result in increased evaporation leading to drier soils, increased plant evapotranspiration (ETo), and a longer growing season. All of these factors generally increase water demand. While the district is not located in a strongly agricultural region, nor does it have major industries that require cooling/process water, the district does have reservoir release requirements that must be met in order to satisfy stream flow and temperature requirements. Meeting these may become more difficult in the future with highly variable precipitation, increased average temperatures, and potentially longer dry periods. The district has been successful reducing demands with conservation measures, including water waste prohibitions in Title 13 of the district code. However, as demand hardens in the future, and because the district is heavily dependent on precipitation-driven supplies, the region may become more vulnerable to shortages.

Seasonal water use, comprised primarily by outdoor water use, is expected to increase as average temperatures increase and droughts become more frequent. MMWD's total water use varies seasonally and monthly. In the last 5 years, monthly water use has ranged from roughly 1,000 AF to over 3,500 AF. Average dry season (April-October) monthly water use is approximately 2,300 AF and average wet season (November-March) monthly water use is approximately 1,500 AF. When removing recycled water use, fireline water, hydrant meter water, and raw water, monthly water use has ranged from 1,000 AF to 3,200 AF.

5.0 Baselines and Targets

This section includes a baseline water use calculation and defines specific water use targets to meet the 2020 goal of 20 percent water use reduction. All suppliers are required to submit the SB X7-7 Verification Form, which is included as Appendix G.

After examining sample of data from the Department of Finance (DOF), DWR determined that significant discrepancies exist between DOF-projected populations for 2010 (based on 2000 Census data) and actual population for 2010, as compiled by the US Census. Therefore, DWR is requiring retailers who did not use 2010 Census data for their baseline population calculations in the 2010 UWMP to recalculate their baseline population in the 2015 UWMP. In the 2010 UWMP, the district used an average of three numbers, including Subregional study areas (SSA) 2005 projections, SSA 2007 projections, and projections from the Association of Bay Area Governments (ABAG's) Projections 2009 report. Because each of the projections were produced prior to 2010, none of the three sources used data from the 2010 Census data. To comply with the guidance in the 2015 Guidebook, the district is recalculating its baseline population and baseline daily per capita water use.

All tables within this section, as well as throughout the UWMP, are in acre-feet per year, as indicated in **Table 5-1** below.

Table 5-1: Units of Measure Used in the UWMP
(SB X7-7 Table 0)

Units
Acre-feet per year (AFY)

5.1 Baselines and Targets

The following sections describe the methods used to calculate the baseline water use and targets:

- **Baseline daily per capita water use**: The amount of water used within the district's distribution system area on a per capita basis.

- **Urban water use target**: The amount of water planned to be delivered in 2020 to each resident within the district's distribution system area, taking into account water conservation practices that are currently in place or which will be implemented.

- **Interim urban water use target**: The planned daily per capita water use in 2015, a value halfway between the baseline daily per capita water use and the urban water use target.

5.1.1 Base Period Ranges

Two baseline periods must be evaluated to calculate the base daily per capita water use:

- **10- to 15-Year Base Period:** This is a 10-year or 15-year continuous period used to calculate baseline per capita water use. If recycled water makes up less than 10 percent of 2008 water deliveries, a continuous 10-year period is used. If recycled water makes up 10 percent or more of 2008 water deliveries, a continuous 10- to 15-year period is used.

- **5-Year Base Period:** This is a continuous five-year period used to determine whether the 2020 per capita water use target meets the legislation's minimum water use reduction requirements of at least a 5 percent reduction per capita water use.

The base period is used to calculate a base daily per capita water use, which is the baseline for computation of required future reductions. The district's 2008 water and recycled water deliveries are shown in **Table 5-2**. Recycled water made up about 2.1 percent of total water deliveries. Therefore, a 10-year base period is required to calculate baseline per capita water use. The baseline period of 1995 through 2004 was used. **Table 5-2** also shows the five-year base period used to calculate the minimum water use reduction requirement.

Table 5-2: Baseline Period Ranges (SB X7-7 Table 1)

Base	Parameter	Value	Units
10- Year Base Period	2008 total water deliveries	30,264	AF
	2008 total volume of delivered recycled water	648	AF
	2008 recycled water as a percent of total deliveries	2.1%	percent
	Number of years in base period[1]	10	years
	Year beginning base period range	1995	
	Year ending base period range	2004	
5-Year Base Period	Number of years in base period	5	years
	Year beginning base period range	2003	
	Year ending base period range	2007	
NOTES: The 2008 recycled water as a percent of total deliveries is less than 10 percent. Therefore, the first base period is a continuous 10-year period.			

5.2 Service Area Population

MMWD's service area correlates with several city boundaries within Marin County[3]. As a result, historical population for those cities was taken directly from DOF. MMWD also serves a portion of unincorporated Marin County. To determine the percentage of the population of unincorporated Marin County served by MMWD, a GIS analysis was performed for the years 2000 and 2010 (the most recent years for which census data is available). More information on this analysis is presented in Appendix H. Thus, two methods were used to determine the historical populations, as noted in **Table 5-3** below.

[3] The cities of Belvedere, Corte Madera, Fairfax, Larkspur, Mill Valley, Ross, San Anselmo, San Rafael, Sausalito, and Tiburon fall entirely within MMWD's service area.

Table 5-3: Method for Population Estimates (SB X7-7 Table 2)

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

Table 5-4 below presents the total population within MMWD's service area for each year from 1995 through 2015. These population numbers were used to update the SB X7-7 baselines and targets and were incorporated into the Retail Demand Model, developed by Maddaus Water Management, Inc., to project future demand.

Table 5-4: MMWD Service Area Historical Population

Year	MMWD Service Area Population	Source
1995	172,700	DOF[1]
1996	174,300	DOF
1997	176,400	DOF
1998	178,000	DOF
1999	179,300	DOF
2000	181,300	2000 US Census
2001	181,400	DOF
2002	181,300	DOF
2003	181,400	DOF
2004	180,600	DOF
2005	179,700	DOF
2006	179,800	DOF
2007	180,100	DOF
2008	181,200	DOF
2009	182,300	DOF
2010	183,700	2010 US Census
2011	184,300	DOF
2012	185,000	DOF
2013	185,800	DOF
2014	187,500	DOF
2015	189,000	DOF
NOTES: 1) Department of Finance; 2) Numbers have been rounded to nearest hundred		

Table 5-5 below indicates the population for each year within the 10-year and five-year baselines, as well as the 2015 compliance year.

Table 5-5: Service Area Population (SB X7-7 Table 3)

Year		Population*	Notes
10 Year Baseline Population			
Year 1	1995	172,700	
Year 2	1996	174,300	
Year 3	1997	176,400	
Year 4	1998	178,000	
Year 5	1999	179,300	
Year 6	2000	181,300	
Year 7	2001	181,400	
Year 8	2002	181,300	
Year 9	2003	181,400	
Year 10	2004	180,600	
5 Year Baseline Population			
Year 1	2003	181,400	
Year 2	2004	180,600	
Year 3	2005	179,700	
Year 4	2006	179,800	
Year 5	2007	180,100	
2015 Compliance Year Population			
2015		189,000	
* Depending on the method used, the "Population" column is filled from either DOF data, DWR population tool, or manually if using "Other."			
NOTES: 1) Department of Finance; 2) Numbers have been rounded to nearest hundred			

5.3 Gross Water Use

Gross water use is defined as the total volume of water entering the distribution system. Gross water use excludes recycled water, water placed into long-term storage, water conveyed for use by another supplier, water delivered for agricultural use, and process water. To determine gross water use, the district first identified the total volume of water entering the distribution system.

Table 5-6 presents the total volume of water entering the distribution system by source, including the district's local lakes and imported water from the Sonoma County Water Agency, for each of the years included in the 10-year baseline and five-year baseline. The selected baselines allow the district maximum flexibility in meeting their 2015 interim water use target and 2020 water use goal.

Table 5-6: Volume Entering the Distribution System(s) (AFY) (SB X7-7 Table 4A)

Baseline Year		Agency's Own Sources				Purchased or Imported Water Sources				Total Water into Distribution System (AFY)
		Name of Source	Volume Entering Distribution System (AFY)	Meter Error Adjustment* Optional	Corrected Volume from Own Sources (AFY)	Name of Source	Volume Entering Distribution System (AFY)	Meter Error Adjustment	Corrected Volume from Own Sources (AFY)	
10 to 15 Year Baseline – Water into Distribution System(s)										
Year 1	1995	Local lakes	22,945	0	22,945	SCWA	4,650	0	4,650	27,595
Year 2	1996	Local lakes	22,261	0	22,261	SCWA	6,066	0	6,066	28,327
Year 3	1997	Local lakes	22,685	0	22,685	SCWA	7,176	0	7,176	29,861
Year 4	1998	Local lakes	20,793	0	20,793	SCWA	7,307	0	7,307	28,100
Year 5	1999	Local lakes	21,830	0	21,830	SCWA	7,885	0	7,885	29,715
Year 6	2000	Local lakes	22,462	0	22,462	SCWA	8,330	0	8,330	30,792
Year 7	2001	Local lakes	23,591	0	23,591	SCWA	8,203	0	8,203	31,794
Year 8	2002	Local lakes	23,009	0	23,009	SCWA	8,361	0	8,361	31,370
Year 9	2003	Local lakes	22,403	0	22,403	SCWA	8,060	0	8,060	30,463
Year 10	2004	Local lakes	23,041	0	23,041	SCWA	8,034	0	8,034	31,075
5 Year Baseline – Water into Distribution System(s)										
Year 1	2003	Local lakes	22,403	0	22,403	SCWA	8,060	0	8,060	30,463
Year 2	2004	Local lakes	23,041	0	23,041	SCWA	8,034	0	8,034	31,075
Year 3	2005	Local lakes	21,837	0	21,837	SCWA	7,153	0	7,153	28,990
Year 4	2006	Local lakes	22,113	0	22,113	SCWA	7,159	0	7,159	29,272
Year 5	2007	Local lakes	21,220	0	21,220	SCWA	8,117	0	8,117	29,337
2015 Compliance Year – Water into Distribution System										
2015		Local lakes	18,071	0	18,071	SCWA	5,135	0	5,135	23,206
* Meter Error Adjustment – See guidance in Methodology 1, Step 3 of Methodologies Document										

Table 5-7 below shows annual gross water use for each of the years within the 10-year and five-year baselines. The district delivers recycled water to customers within a separate system and has no large storage infrastructure after water is treated. Additionally, the district does not export water, deliver agricultural water, nor deliver process water. Therefore, the district has no deductions from the volume of water into the distribution system and this volume is equal to the annual gross water use, as shown below.

Table 5-7: Annual Gross Water Use (AFY) (SB X7-7 Table 4)

Baseline Year		Volume Into Distribution System (AFY)	Deductions					Annual Gross Water Use (AFY)
			Exported Water	Change in Dist. System Storage (+/-)	Indirect Recycled Water	Water Delivered for Agricultural Use	Process Water	
10 to 15 Year Baseline - Gross Water Use								
Year 1	1995	27,595	0	0	0	0	0	27,595
Year 2	1996	28,327	0	0	0	0	0	28,327
Year 3	1997	29,861	0	0	0	0	0	29,861
Year 4	1998	28,100	0	0	0	0	0	28,100
Year 5	1999	29,715	0	0	0	0	0	29,715
Year 6	2000	30,792	0	0	0	0	0	30,792
Year 7	2001	31,794	0	0	0	0	0	31,794
Year 8	2002	31,370	0	0	0	0	0	31,370
Year 9	2003	30,463	0	0	0	0	0	30,463
Year 10	2004	31,075	0	0	0	0	0	31,075
10 - 15 year baseline average gross water use								**29,909**
5 Year Baseline - Gross Water Use								
Year 1	2003	30,463	0	0	0	0	0	30,463
Year 2	2004	31,075	0	0	0	0	0	31,075
Year 3	2005	28,990	0	0	0	0	0	28,990
Year 4	2006	29,272	0	0	0	0	0	29,272
Year 5	2007	29,337	0	0	0	0	0	29,337
5 year baseline average gross water use								**29,827**
2015 Compliance Year - Gross Water Use								
2015		23,206	0	0	0	0	0	23,206

* NOTE that the units of measure must remain consistent throughout the UWMP, as reported in Table 2-3.

5.4 Baseline Daily Per Capita Water Use

The daily per capita water use was calculated for each year in the base period by dividing the gross water use by the distribution system population. The daily per capita water use for the 10-year baseline and the five-year baseline is shown in **Table 5-8**. The base daily per capita water use is calculated as the average daily per capita water use over the respective baseline period.

Table 5-8: Gallons per Capita per Day (GPCD) (SB X7-7 Table 5)

Baseline Year		Service Area Population	Annual Gross Water Use (AFY)	Annual Daily Per Capita Water Use (GPCD)
10 Year Baseline GPCD				
Year 1	1995	172,700	27,595	143
Year 2	1996	174,300	28,327	145
Year 3	1997	176,400	29,861	151
Year 4	1998	178,000	28,100	141
Year 5	1999	179,300	29,715	148
Year 6	2000	181,300	30,792	152
Year 7	2001	181,400	31,794	156
Year 8	2002	181,300	31,370	154
Year 9	2003	181,400	30,463	150
Year 10	2004	180,600	31,075	154
			10-Year Average Baseline GPCD	**149**
Baseline Year		**Service Area Population**	**Annual Gross Water Use (AFY)**	**Annual Daily Per Capita Water Use (GPCD)**
5-Year Baseline GPCD				
Year 1	2003	181,400	30,463	150
Year 2	2004	180,600	31,075	154
Year 3	2005	179,700	28,990	144
Year 4	2006	179,800	29,272	145
Year 5	2007	180,100	29,337	145
			5-Year Average Baseline GPCD	**148**
2015 Compliance Year GPCD				
2015		189,000	23,206	110

The following table, **Table 5-9**, includes the 10-year baseline GPCD, the five-year baseline GPCD, and the GPCD during the 2015 compliance year.

Table 5-9: Gallons per Capita per Day (SB X7-7 Table 6)

Baseline Period	GPCD
10-Year Baseline GPCD	149
5-Year Baseline GPCD	148
2015 Compliance Year GPCD	110

5.5 Water Use Targets

An urban water use target for the year 2020 and an interim water use target for the year 2015 must be set using one of four methods:

- **Method 1:** Eighty percent of the water supplier's baseline 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 CII uses.
- **Method 3:** Ninety-five percent of the applicable state hydrologic region target as stated in the State's April 30, 2009, draft 20x2020 Water Conservation Plan.
- **Method 4:** An alternative approach developed by the DWR that takes into consideration water loss, conservation program saturation, and a number of other factors.

Method 3 was used to determine the district's water use targets, as noted in **Table 5-10**.

Table 5-10: 2020 Target Method (SB X7-7 Table 7)

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

The district's service area is entirely within Hydrologic Region 2 - San Francisco Bay Area. The 2020 urban water use target for this region is 131 GPCD. Ninety-five percent of this target, 124 GPCD, represents the 2020 target for the district (as shown in **Table 5-11** below).

Table 5-11: Target Method 3 (SB X7-7 Table 7-E)

Agency May Select More Than One as Applicable	Hydrologic Region	Percentage of Service Area in This Hydrological Region	"2020 Plan" Regional Targets (GPCD)	Method 3 Regional Targets (95%) (GPCD)
☐	North Coast	0%	137	130
☐	North Lahontan	0%	173	164
☐	Sacramento River	0%	176	167
☑	San Francisco Bay	100%	131	124
☐	San Joaquin River	0%	174	165
☐	Central Coast	0%	123	117
☐	Tulare Lake	0%	188	179
☐	South Lahontan	0%	170	162
☐	South Coast	0%	149	142
☐	Colorado River	0%	211	200
			Target	**124**

The maximum allowable GPCD target in 2020, based on 95 percent of the five-year baseline (146.98), was determined to be 139.63 GPCD. The target based on Method 3 (124 GPCD) is less than the 139.62 GPCD maximum; therefore, no further adjustment to the 2020 target is required. See **Table 5-12** below.

Table 5-12: Confirm Maximum Reduction for 2020 Target (GPCD) (SB X7-7 Table 7-F)

5-Year Baseline GPCD	Maximum 2020 Target* GPCD	Calculated 2020 Target (GPCD)	Confirmed 2020 Target (GPCD)
148	140	124	124
* Maximum 2020 Target is 95% of the 5-Year Baseline GPCD			

The interim water use target for year 2015 was calculated as the mid-point between the 10-year baseline of 149 GPCD and the 2020 target of 124 GPCD. A summary of the water use targets is provided in **Table 5-13**.

Table 5-13: 2015 Interim Target GPCD (SB X7-7 Table 8)

Confirmed 2020 Target	10-Year Baseline GPCD	2015 Interim Target GPCD
124	149	137

5.6 2015 Compliance

With a 2015 GPCD of 110 GPCD, the district is in compliance with its 137 GPCD 2015 Interim Target. No adjustments were required, nor made (see **Table 5-14**).

Table 5-14: 2015 Compliance (SB X7-7 Table 9)

Actual 2015 GPCD	2015 Interim Target GPCD	Optional Adjustments			In Compliance? Y/N
		Extraordinary Events	Weather Normalization	Economic Adjustment	
110	137	0	0	0	YES

5.7 Regional Alliance

In addition to meeting the daily per capita water use targets on an individual basis, the Water Conservation Bill of 2009 also allows urban water retail suppliers to plan, comply and report on the 2015 and 2020 water use targets on a regional basis. As defined in DWR's

Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use, the district is eligible to participate in a regional alliance with other retail water supply agencies (the Water Contractors) since they all receive wholesale water from a common wholesale water supplier, Sonoma County Water Agency (SCWA).

The district has joined a regional alliance with the Water Contractors, which include the cities of Santa Rosa, Rohnert Park, Sonoma, Cotati, Petaluma, Town of Windsor, NMWD and VOMWD to comply with the daily per capita water use targets on a regional basis.

The alliance has selected Target Method 1, as previously described, to determine the regional alliance target. **Table 5-15** provides the individual and regional alliance water use targets for both 2015 and 2020.

Table 5-15: Regional Alliance Population, Water Use, and Regional Target

Regional Alliance Member	2015			2020		
	Current Population	Water Contractor Individual GPCD Target	Product of Population and GPCD Target [(1)x(2)]	Current Population	Water Contractor Individual GPCD Target	Product of Population and GPCD Target [(1)x(2)]
	(1)	(2)	(3)	(1)	(2)	(3)
City of Cotati	7,288	93	679,016	7,288	130	947,440
MMWD	189,000	110	20,715,583	189,000	124	23,436,000
North Marin Water District	61,381	156	9,575,436	61,381	139	8,531,959
City of Petaluma	61,798	159	9,825,882	61,798	141	8,713,518
City of Rohnert Park	41,675	90	3,765,473	41,675	119	4,959,325
City of Santa Rosa	173,071	136	23,537,656	173,071	126	21,806,946
City of Sonoma	11,147	202	2,251,694	11,147	180	2,006,460
Valley of the Moon	23,478	133	3,122,574	23,478	124	2,911,272
Town of Windsor	27,486	143	3,930,498	27,486	130	3,573,180
TOTAL	596,342		77,403,812	596,324		76,886,100
Regional GPCD Target [Total of (3) / Total of (1)]					**129**	

Members of the regional alliance project that the regional alliance will be in compliance with its 2015 and 2020 water use targets as shown in **Table 5-16**, which provides the projected 2015 and 2020 compliance daily per capita water use for the regional alliance.

Table 5-16: Regional Alliance Daily per Capita Water Use (GPCD)

	2015	2020
Regional Per Capita Water Use Target	143	129
Total Projected Per Capita Water Use	100	117

A copy of the letter to DWR regarding the formation of the regional alliance, as well as the letter agreement forming the regional alliance and the district's Board Resolution approving the letter agreement are included in Appendix I.

6.0 System Supplies

This section describes existing and future sources of water available to the district. It includes a description of each water source, source limitations, water quality, and future opportunities for additional supply development. The district's water supplies presently come from a combination of local surface water supplies, imported water from SCWA, and recycled water. Each water supply is described further in the following sections.

6.1 Purchased Water

Since 1975, the district has contracted with the SCWA for a supplemental supply of water, primarily from Lake Sonoma via the Russian River. The district's present contract with SCWA is based on two antecedent documents: the *1975 Off-Peak Water Supply Agreement* (Off-Peak Agreement) and its amendments, and the *1991 Agreement for the Sale of Water between SCWA and the district*. In 1996, these two contracts were combined into a single new agreement, the *Supplemental Water Supply Agreement* (Agreement).

In its original form, the Off-Peak Agreement allowed the district to take delivery, in the months of October through April, of up to 4,300 AF of water surplus to the needs of all other SCWA customers. The contract was amended twice before its inclusion in the Supplemental Water Supply Agreement of 1996. The first amendment changed the basis of delivery of this water from "surplus" to "firm", meaning that the district's water deliveries would be as reliable as that provided to SCWA's contractors. The second amendment allowed deliveries up to 360 AF per month from May to September.

The 1991 Agreement for Water Supply allowed the district to take deliveries of up to 10,000 AF of water per year beyond the amount included in the Off-Peak Agreement. These water deliveries were classified as "as available." This meant that the contracted water supply was secondary to water provided to SCWA's contractors and to water provided under the Off-Peak Agreement, but would be provided unless certain predefined conditions existed.

The Supplemental Water Supply Agreement combined the two prior agreements such that the district can now take deliveries of up to 14,300 AFY from SCWA. All of these deliveries are also now classified as "firm" water. In addition to the annual delivery limit, the Agreement also places seasonal limitations on water delivery rates to the district[4]. Deliveries are limited to 23.1 mgd from December to March and 12.8 mgd from May to September. In April and November, deliveries cannot exceed 20.1 mgd, and in October, deliveries are limited to 17.1 mgd.

The Supplemental Water Supply Agreement expired on June 30, 2014, but a Temporary Extension of the Supplemental Water Supply Agreement extended the Off-Peak Agreement

[4] While seasonal limitation on water delivery exist, these flow volumes are not possible with the current, shared delivery infrastructure. For example, during the summer the majority of the pipeline's capacity is utilized by North Marin Water District.

and Water Sale Agreement until June 30, 2015. A formal Agreement renewal was subsequently approved and became effective July 1, 2015. This renewed Agreement, dated June 16, 2015, will remain in force through June 30, 2025, and includes a renewal provision that will extend the Agreement through June 30, 2040.

In addition to contractual delivery limits, Russian River water deliveries to the district are subject to available pipeline capacity in facilities owned by SCWA and NMWD. Russian River water is diverted by SCWA at a series of sub-surface Ranney collectors near Wohler Bridge in Sonoma County. Water destined for the district flows through SCWA pipelines to Petaluma. From Petaluma, the water flows southward in NMWD's aqueduct for eight miles to the northern end of the district's pipeline facilities in Novato. The Interconnection Agreement from 2014 describes the district's rights to use the excess capacity in NMWD's facilities. The Interconnection Agreement runs contiguous with the SCWA Restructured Agreement for Water Supply, which will expire on June 30, 2040 and has renewal options.

The district's water use projections for imported water from SCWA are shown in **Table 6-1**. These demands have been coordinated with the demands listed in SCWA's 2015 UWMP.

Table 6-1: Wholesale Supplies - Existing and Planned Sources of Water (AFY)

Wholesale Sources[1,2]	Contracted Volume	2015	2020	2025	2030	2035	2040
Sonoma County Water Agency (AFY)	14,300	7,000	8,460	9,920	10,000	10,000	10,000
NOTES: (1) The Sonoma County Water Agency is a wholesale water provider to retail customers in Sonoma and Marin County. The "contractors" consist of the North Marin Water District, City of Petaluma, City of Rohnert Park, City of Santa Rosa, City of Sonoma, Valley of the Moon Water District, Town of Windsor, and City of Cotati.							

Water imported from SCWA is naturally filtered in the deep sand and gravel below the river bed and requires no further clarification. This water enters the district's system at the Ignacio Water Quality and Pumping Station, where water quality is monitored continually and adjusted as needed.

6.2 Groundwater

There are three groundwater basins identified in DWR's Bulletin 118 that are at least partially within the district's service area. These three basins include Ross Valley, San Rafael Valley, and part of the Novato Basin. All three basins are categorized by the California Statewide Groundwater Elevation Monitoring (CASGEM) program as very low priority basins.

Groundwater use within the district's service area is limited to small, domestic use through private groundwater pumping wells. The district has studied the potential for municipal groundwater use since the 1970's. Several studies since that time have determined that the potential for municipal groundwater use within the boundaries of the district's service area is very limited due to limited production capabilities, water quality constraints, and potential water rights issues (Parker Groundwater, 2015). As a result of these studies, groundwater is not currently or planned to be used as a municipal water supply source by the district, though private groundwater wells are used in the district's service area (see **Table 6-2**). There is municipal groundwater use in other parts of the north Bay Area; for instance, SCWA recently completed a Groundwater Management Plan that evaluates groundwater resources within Sonoma County.

Table 6-2: Groundwater Volume Pumped (AFY) (DWR Table 6-1)

☑	Supplier does not pump groundwater. The supplier will not complete the table below.					
Groundwater Type	**Location or Basin Name**	**2011**	**2012**	**2013**	**2014**	**2015**
Alluvial Basin		0	0	0	0	0
Fractured Rock		0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**

The district has explored potential groundwater recharge opportunities, including the potential for indirect potable reuse. Recently, the district completed joint studies with Sewerage Agency of Southern Marin (SASM) and Central Marin Sanitation Agency (CMSA) to explore the potential of using highly-treated recycled water to recharge the groundwater basin. These studies are further discussed in Section 6.5.5.

6.3 Surface Water

The district's primary water supply is local surface water. Until 1976, all of the district's water supply was obtained solely from rainfall collected from the Mt. Tamalpais watershed, including approximately 28 square miles of district-owned lands, and 36 square miles not owned by the district. Six reservoirs in the watershed had a storage capacity of 17.3 billion gallons. Through a bond issue authorized during the drought of the 1970s, a seventh reservoir was completed in 1980, Soulajule Reservoir, which added 3.4 billion gallons to the total storage. The district's Kent Lake facility was expanded in 1982 by raising Peters Dam 45 feet, increasing the storage capacity from 5.4 billion gallons to 10.6 billion gallons. Presently, total reservoir storage operated by the district is 25.9 billion gallons (79,566 AF).

In managing its surface water supply, the district defines the operational yield of its water supply system as the volume of water that can be provided to its customers in most years without depleting its reservoir storage to the point where stored water would be insufficient to meet a reduced water demand during a repeat of the most severe historical drought period (1976 through 1978). The district's operational yield is based on 81 years of estimated monthly hydrologic data, from 1928 through 2009. Using this hydrologic data and assuming that existing operational and regulatory constraints remain in effect and that Russian River water deliveries are 8,500 AFY, a computer model was developed and used to determine how much water the district could prudently provide while enforcing mandatory water rationing at an average level of 25 percent across customer sectors once during the period of record.

Prior to 2006, the "system yield" was estimated to be 29,300 AFY (including local and SCWA supplies), which was predicated on the district receiving relief from instream flow requirements included in its Lagunitas Creek water rights beyond the dry year allowances included in those rights. However, the salmonids that occupy the stream below the district's reservoirs have been classified as endangered species by both State and Federal regulatory agencies. Under these conditions, and contrary to past assumptions, it is unlikely that the district will receive dry year instream flow relief beyond the 15 percent reduction allowed under SWRCB Order WR 95-17. Taking this into account, the district now estimates the "operational yield" of its water sources to be about 28,500 AFY.

For the purpose of the 2015 UWMP, the district will use 28,500 AFY as the operational yield, with an assumed 20,000 AFY from the reservoirs and 8,500 AFY from SCWA. However, the district is currently updating this analysis as part of the *2040 Water Resources Plan* and will conduct a safe yield analysis under current reservoir conditions over the historic period of record. The results of the analysis will be available when the *2040 Water Resources Plan* is finalized in late 2017.

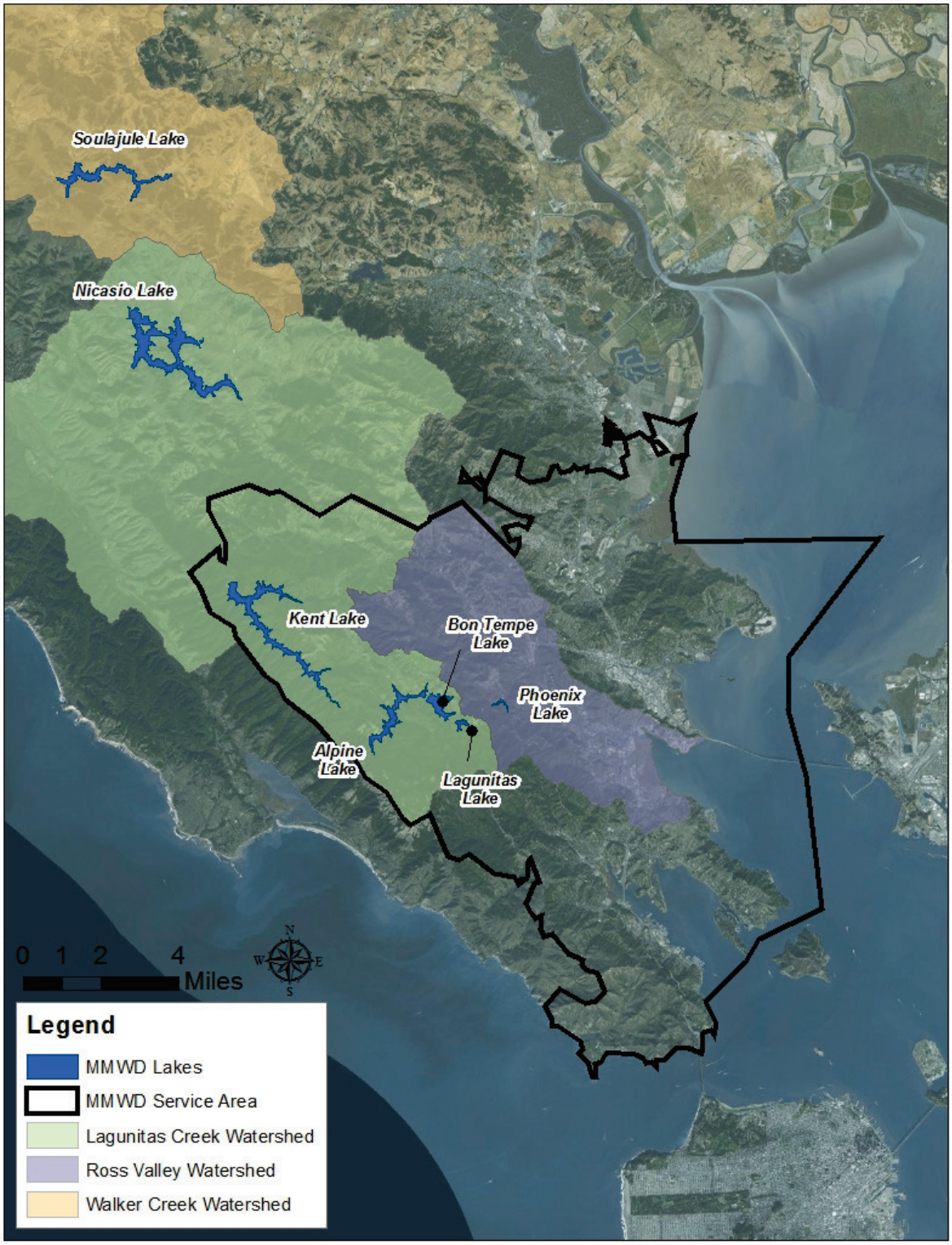
A chronology of the district's water rights and development of its reservoir system is provided in **Table 6-3**. A map of the reservoir system and the watersheds is shown in **Figure 6-1.**

Table 6-3: District Surface Water Reservoir System (AF)

Reservoir Name	Year Constructed	Storage Capacity (AF)	Water Rights
Lake Lagunitas	1873	350	Pre-1914
Phoenix Lake	1905	411	Pre-1914
Bon Tempe Reservoir	1948	4,017	Appropriative Permit No. 05633
Alpine Lake	1918 1924 1941	3,069 4,600 8,891	Pre-1914 Appropriative Permit No. 05633
Kent Lake	1953 1982	16,050 32,895	Appropriative Permit No. 05633, 09390, 18546
Nicasio Reservoir	1960	29,000[1]	Appropriative Permit No. 12800
Soulajule Reservoir	1980	10,572	Appropriative License 12807 and Permit No. 16892
Total Existing Reservoir Storage		**79,566**	

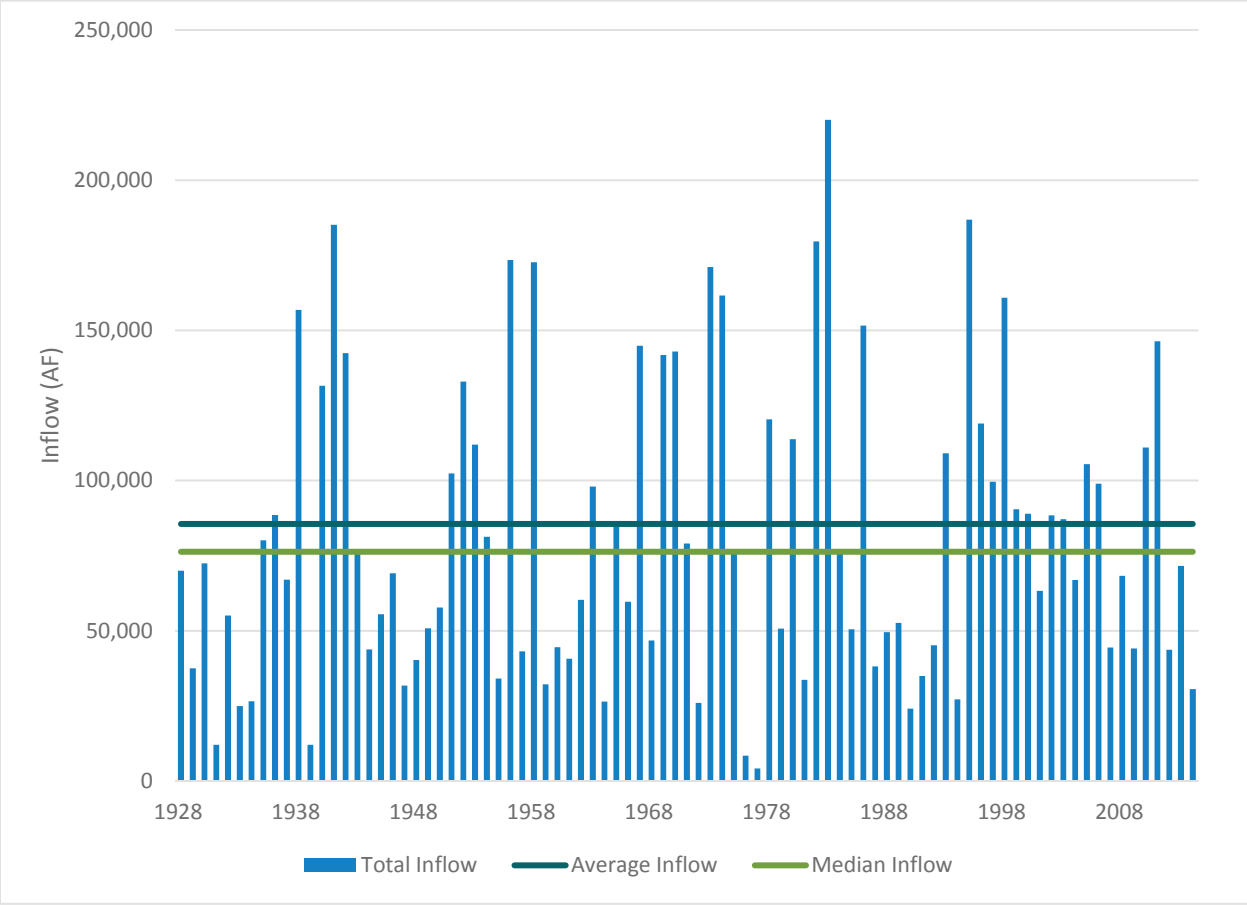
NOTES: (1) Under the water right for storage, 6,570 AF of water from Nicasio Creek can be transferred from Nicasio Reservoir to Kent Lake to fill Kent Lake; this is in addition to any inflows from Lagunitas Creek into Kent Lake. This would free up capacity in Nicasio Reservoir for additional storage up to the total of 29,000 AF (22,430 AF stored in Nicasio Reservoir plus 6,750 transferred and stored in Kent Lake). However, new infrastructure would be required to transfer this supply since it cannot be conveyed via Lagunitas Creek.

Figure 6-1: Surface Water Reservoirs



Annual inflow data for the district's reservoir system for the period from 1928 to 2014 is shown in **Figure 6-2**. The annual runoff into the district's reservoirs varies greatly from a maximum of 220,000 AF in 1983 to a minimum of only 4,100 AF in 1977. The average and median annual runoff are 84,800 AF and 72,300 AF, respectively.

Figure 6-2: Annual Reservoir Inflow (AFY)



Surface water from the Mt. Tamalpais watershed is aerated seasonally in the reservoirs to maintain adequate dissolved oxygen concentration. From the reservoirs, the water is conveyed to either the Bon Tempe Treatment Plant (BTTP) near Ross or the San Geronimo Treatment Plant (SGTP) in Woodacre. Suspended matter is removed in clarifiers, microscopic particles are removed in deep-bed, multi-media filters, and bacteria and pathogens are inactivated by disinfectants. The water is then treated to control corrosion. The district has been fluoridating its water since 1973 as required by a voter approved ballot measure in 1972.

6.4 Stormwater

Stormwater is water that runs off rooftops, streets, and sidewalks. While the district encourages the use of small-scale rainwater capture systems for non-potable purposes such as irrigation, stormwater is not considered a supply source for the district.

6.5 Wastewater and Recycled Water

6.5.1 Recycled Water Coordination

The majority of recycled water used within the district's service area is distributed by the district. The Sewage Agency of Southern Marin (SASM) produces approximately 30 AFY of tertiary-treated recycled water that is used to irrigate playing fields situated adjacent to the SASM treatment plant. SASM treats and distributes this water. The majority of recycled water production occurs at the district's facility co-located at the Las Gallinas Valley Sanitary District (LGVSD). The wastewater originates from within the LGVSD service area, which is also within MMWD's service area. The collected wastewater is treated to secondary level at LGVSD's wastewater treatment plant and then receives further treatment at the district's Las Gallinas Valley Water Recycling Facility before being distributed to customers.

In 2014, the LGVSD began supplying approximately 150 AFY of tertiary-treated recycled water produced at the newly constructed LGVSD recycled water membrane plant to North Marin Water District. It is anticipated that MMWD will partner with LGVSD to expand recycled water production at this facility to replace the district's aging recycled water treatment plant. This transition is expected to be completed by calendar year end 2018 or sooner.

The district has a close working relationship with the LGVSD, and prior to the recycled water season (April-October), the district provides a written estimate of the quantity of recycled water that will be needed for the season. The LGVSD attempts to provide the district with enough fresh effluent, which is of a higher water quality than stored pond water, to meet its projected demand.

6.5.2 Wastewater Collection, Treatment, and Disposal

Within the district's service area there are sixteen wastewater collection entities. Of the sixteen wastewater collection entities, eleven are wastewater collection entities and five have treatment facilities.

Three of the five treatment entities utilize secondary effluent for landscape irrigation at their wastewater treatment plant. The Richardson Bay Sanitary District irrigates an adjacent park with secondary effluent. This water does not meet current recycled water regulations, but the existing practice has been "grandfathered." SASM has a small tertiary treatment facility and irrigates an adjacent park; however, saltwater intrusion limits this operation to low tide cycles only.

Table 6-4 summarizes the sixteen wastewater collection and treatment entities within the district's service area. Development within Marin County is limited due to space constraints; therefore, wastewater projections are estimated to remain steady over the planning horizon.

☐	There is no wastewater collection system. The supplier will not complete the table below.
	Percentage of 2015 service area covered by wastewater collection system (optional)
	Percentage of 2015 service area population covered by wastewater collection system (optional)

Wastewater Collections			Recipient of Collected Wastewater			
Name of Wastewater Collection Agency	**Was Volume Measured or Estimated?**	**Volume of Wastewater Collected from the UWMP Service Area in 2015 (AFY)**	**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? (*opt*)**
Almonte Sanitary District	Estimated[1]	147	SASM	SASM Plant	Y	N
Alto Sanitary District	Estimated[1]	105	SASM	SASM Plant	Y	N
Central Marin Sanitation Agency (CMSA)	Metered	0	CMSA	CMSA Plant	Y	N
City of Sausalito	Estimated	613	SMCSD	SMCSD Plant	Y	N
Homestead Valley Sanitary District	Estimated[1]	196	SASM	SASM Plant	Y	N
Las Gallinas Valley Sanitary District (LGVSD)	Metered	2,372	LGVSD	LGVSD Plant	Y	N

☐	There is no wastewater collection system. The supplier will not complete the table below.
	Percentage of 2015 service area covered by wastewater collection system (optional)
	Percentage of 2015 service area population covered by wastewater collection system (optional)

Wastewater Collections			Recipient of Collected Wastewater			
Name of Wastewater Collection Agency	**Was Volume Measured or Estimated?**	**Volume of Wastewater Collected from the UWMP Service Area in 2015 (AFY)**	**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? (*opt*)**
National Park Service	Metered	71	SMCSD	SMCSD Plant	Y	N
Richardson Bay Sanitary District	Estimated[1]	918	SASM	SASM Plant	Y	N
San Quentin State Prison	Metered	372	CMSA	CMSA Plant	Y	N
San Rafael Sanitation District	Metered	3,875	CMSA	CMSA Plant	Y	N
Sanitary District No. 1 (Ross Valley)	Metered	4,802	CMSA	CMSA Plant	Y	N
Sanitary District No. 2 (Corte Madera)	Metered	1,122	CMSA	CMSA Plant	Y	N
Sanitary District No. 5 (Tiburon)	Metered	504	Sanitary District No. 5 (Tiburon)	Main Plant, Paradise Cove Facility	Y	N

☐	There is no wastewater collection system. The supplier will not complete the table below.
	Percentage of 2015 service area covered by wastewater collection system (optional)
	Percentage of 2015 service area population covered by wastewater collection system (optional)

Wastewater Collections			Recipient of Collected Wastewater			
Name of Wastewater Collection Agency	**Was Volume Measured or Estimated?**	**Volume of Wastewater Collected from the UWMP Service Area in 2015 (AFY)**	**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? (*opt*)**
Sausalito-Marin City Sanitary District (SMCSD)	Metered	224	SMCSD	SMCSD Plant	Y	N
Sewerage Agency of Southern Marin (SASM)	Estimated[1]	1,337	SASM	SASM Plant, Reclamation Facility	Y	N
Tamalpais Community Services District	Estimated	339	SASM; SMCSD	SASM Plant, SMCSD Plant	Y	N
Total Wastewater Collected from Service Area in 2015 (AFY)		**16,997**				

[1] Flows are estimated based on the proportionate amount of equivalent dwelling units (EDU's) for each agency. SASM treated a total of 2,734 mgd in 2015; the percent of proportionate EDU's for each agency was applied to this total to estimate the total volume each agency collected.

Table 6-5 provides a summary of the volumes of treated effluent discharged and recycled within the district's service area in 2015.

6.5.3 Recycled Water System

The district started water recycling during the drought of 1976-77 when a pilot plant was commissioned for drought relief. The pilot plant demonstrated that recycled water was available when other sources were not. Increased concern about limited potable supplies led to a joint effort with the LGVSD to build a permanent facility. In 1981, a 1.0 mgd direct filtration plant was completed and served 60 AFY to nearby McInnis Park and to highway landscaping. Plans for further expansion were set back when the state water reclamation regulations (Title 22) were made more stringent. The water quality that the plant was capable of producing was no longer adequate for irrigating parks, playgrounds, and greenbelts.

In 1989, the district upgraded the recycled water facility from direct filtration to full conventional treatment and increased capacity to 2.0 mgd. With improved water quality, the district was able to expand its recycled water market. From 1990 through 1994, the distribution system was enlarged using district funds plus a $5 million low-interest loan from the State Revolving Fund. Today, the district's recycled water system, shown in **Figure 6-3**, contains 24.5 miles of pipeline, 1.7 MG of storage, 4 pump stations, and serves about 520 AF of recycled water per year through 342 service connections.

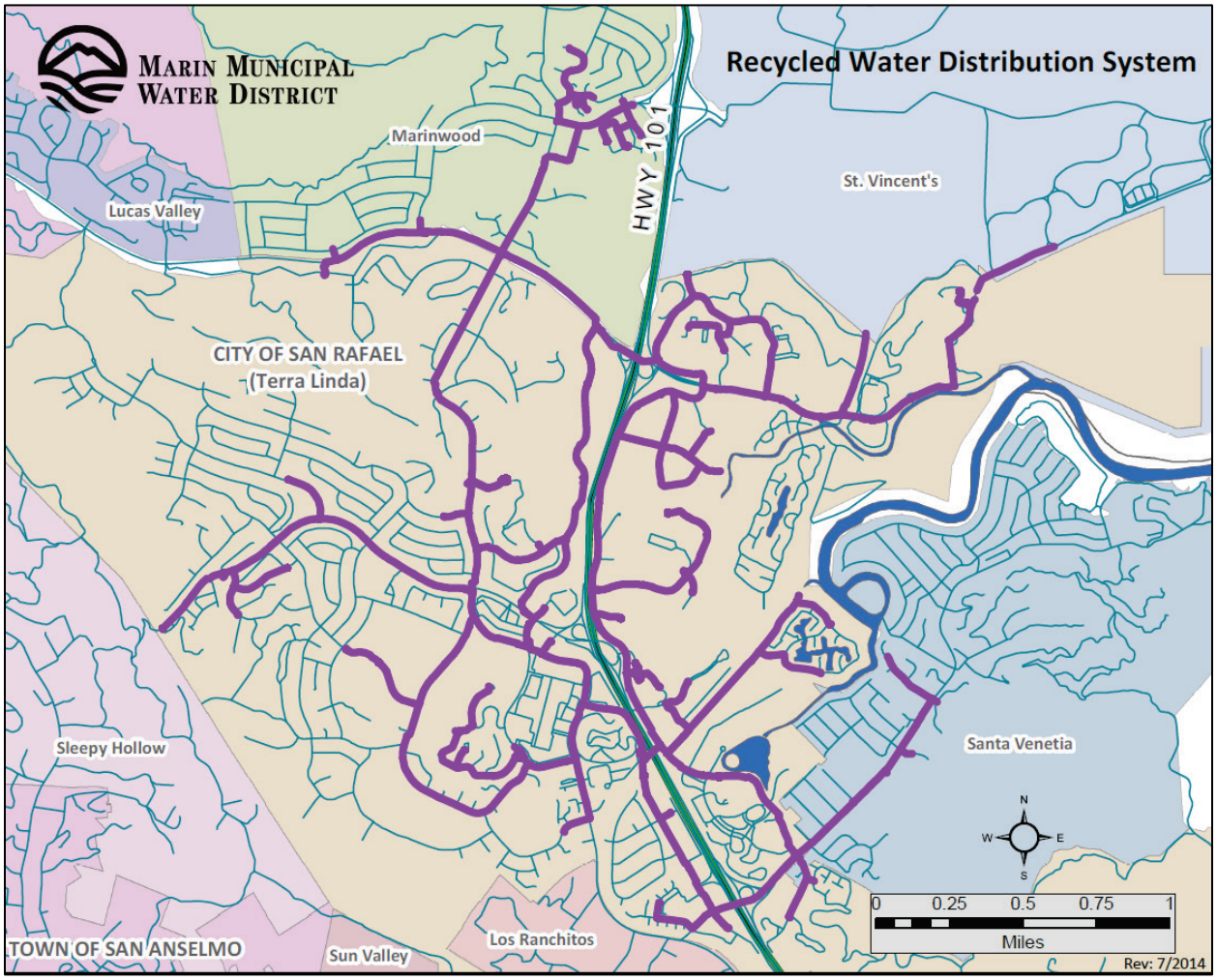
Table 6-5: Wastewater Treatment and Discharge within Service Area in 2015 (AFY) (DWR Table 6-3)

☐	No wastewater is treated or disposed of within the UWMP service area. The supplier will not complete the table below.

Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID No. (optional)	Method of Disposal	Does this Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level	2015 Volumes (AFY)			
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area
Central Marin Sanitation Agency Plant	San Francisco Bay	Shallow estuary draining roughly 40% of California's water	2 215116001	Bay or estuary outfall	N	Secondary[1]	10,171	6,290	0	0
Central Marin Sanitation Agency Plant	San Francisco Bay	Shallow estuary draining roughly 40% of California's water	2 215116001	Bay or estuary outfall	N	Disinfected Secondary - 23	0	0	0	1,178
Las Gallinas Valley Sanitary Agency Plant	Miller Creek	7.6 mile long stream draining into San Pablo Bay east of Marinwood	2 215012001	River or creek outfall	N	Secondary[1]	2,372	1,151	0	0
Las Gallinas Valley Sanitary Agency Plant	Miller Creek	7.6 mile long stream draining into San Pablo Bay east of Marinwood	2 215012001	River or creek outfall	N	Tertiary	0	0	520	241
Paradise Cove Facility Sanitary District #5 (Tiburon)	San Francisco Bay	Shallow estuary draining roughly 40% of California's water	2 215021002	Bay or estuary outfall	N	Secondary[1]	16	16	0	0
Main Plant Sanitary District #5 (Tiburon)	San Francisco Bay	Shallow estuary draining roughly 40% of California's water	2 215021001	Bay or estuary outfall	N	Secondary[1]	488	488	0	0
Sausalito Marin City Sanitary District Plant	San Francisco Bay	Shallow estuary draining roughly 40% of California's water	2 215023001	Bay or estuary outfall	N	Secondary[1]	1,218	1,218	0	0
Sewerage Agency of Southern Marin Plant	Raccoon Straits	A part of the San Francisco Bay located between Angel Island and Tiburon Peninsula	2 215015001	River or creek outfall	N	Secondary[1]	2,734	2,554	0	0
Sewerage Agency of Southern Marin Plant	Raccoon Straits	A part of the San Francisco Bay located between Angela Island and Tiburon Peninsula	2 215015001	River or creek outfall	N	Tertiary	0	0	0	31
						Total:	16,999	11,717	520	1,450

NOTES: 1) The water quality designation in the WDR for each of these treatment plants indicate disinfected secondary treatment.

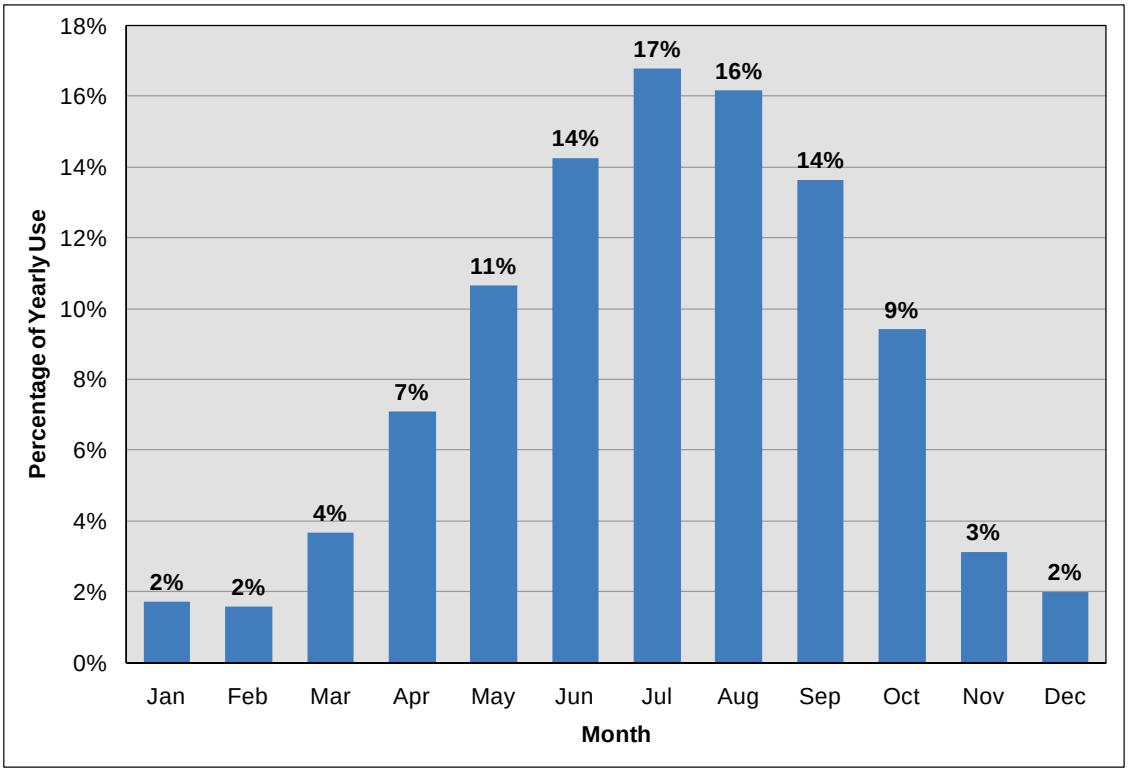
Figure 6-3: Recycled Water Distribution System



Over the past 25 years, the district has consistently strived to expand the use of recycled water, number of sites served, and the total amount of recycled water put to use. The recycled water distribution system currently serves 342 customers. The system is located in the northern part of the district's service area from the Marin County Civic Center through Marinwood. All customers on the system are served recycled water from the district's Las Gallinas Recycling Plant, operated in conjunction with the Las Gallinas Valley Sanitary District. At this time, almost all of the potential recycled water customers along the 24 miles of existing pipeline have already been converted from potable to recycled water.

As shown in **Figure 6-4**, unlike many areas of Southern California, Marin County experiences a relatively wet rainy season which decreases the demand season for landscape irrigation to about 7 months of the year (April through October). The district's Las Gallinas Recycling Plant is not typically operated during the winter months when water demand is low except during severe drought conditions. During the winter months, and other periods when the recycled water demand is low the recycled water customers are supplied with potable water. For the period 2000 through 2015, the recycled system demand averaged approximately 695 AFY. However, the actual recycled water supplied to the recycled system averaged 565 AFY, or about 81 percent of the total demand. Recycled water deliveries in 2015 were 520 AFY; this is assumed to remain constant in future years.

Figure 6-4: Average Recycled Water Use by Month



6.5.4 Recycled Water Beneficial Uses

This section outlines the current and future beneficial uses of recycled water within the district's service area. This section also compares recycled water demands projected in the 2010 UWMP to actual observed recycled water demand.

6.5.4.1 Current and Planned Uses of Recycled Water

Although irrigation remains the primary use (95 percent) for recycled water in the district's service area, there are virtually no large-scale irrigation accounts and no major

industrial water users in the area. Therefore, the district has turned to alternative uses of recycled water to optimize the efficiency of the system, including the following.

- **Flushing Toilets with Recycled Water** – As a result of efforts launched in 1991, there are now 26 buildings in the district's service area that use recycled water to flush toilets and urinals. This includes the 330-bed Marin County Jail, which was the first indoor use of recycled water in a penal institution. All new buildings in the recycled water service area are now required to be constructed with dual plumbing to use recycled water indoors as well as for landscape irrigation. In September 2011, the district began providing recycled water to 33 San Pedro, the first residential condominium complex in California to be dual plumbed to use recycled water for toilet flushing.

- **Car Washes with Recycled Water** – In 1995, the district was the first in California to use recycled water in a car wash. Building on that success, two new car washes were constructed to use recycled water. All new car washes in the recycled water service area are now required to use recycled water.

- **HVAC Cooling Towers with Recycled Water** –The district successfully pioneered the first use of recycled water in a HVAC cooling tower in 1995. Since then, a second building has had the HVAC system converted to recycled water.

- **Commercial Laundries with Recycled Water** –In 1998, the district was the first water district in California to convert a commercial laundry to use tertiary-treated recycled water.

Table 6-6 below indicates the existing and future recycled water uses on which the district can rely.

Table 6-6: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area (AFY) (DWR 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 Agency Producing (Treating) the Recycled Water	Marin Municipal Water District
Name of Agency Operating the Recycled Water Distribution System	Marin Municipal Water District
Supplemental Water Added in 2015	0 AFY
Source of 2015 Supplemental Water	N/A

Beneficial Use Type	General Description of 2015 Uses	Level of Treatment	2015	2020	2025	2030	2035	2040
Agricultural Irrigation	--	--	0	0	0	0	0	0
Landscape Irrigation (exc golf courses)	Parks, schools, medians, cemeteries, residential	Tertiary	307	307	307	307	307	307
Golf Course Irrigation	McInnis Park Golf Center	Tertiary	61	61	61	61	61	61
Commercial Use	Building landscape, car wash	Tertiary	113	113	113	113	113	113
Industrial Use	Cooling tower, other industrial	Tertiary	23	23	23	23	23	23
Geothermal and Other Energy Production	--		0	0	0	0	0	0
Seawater Intrusion Barrier	--		0	0	0	0	0	0
Recreational Impoundment	--		0	0	0	0	0	0
Wetlands or Wildlife Habitat	--		0	0	0	0	0	0
Groundwater Recharge (IPR)	--		0	0	0	0	0	0

Table 6-6: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area (AFY) (DWR 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 Agency Producing (Treating) the Recycled Water			Marin Municipal Water District					
Name of Agency Operating the Recycled Water Distribution System			Marin Municipal Water District					
Supplemental Water Added in 2015			0 AFY					
Source of 2015 Supplemental Water			N/A					
Beneficial Use Type	**General Description of 2015 Uses**	**Level of Treatment**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Surface Water Augmentation (IPR)	--		0	0	0	0	0	0
Direct Potable Reuse	--		0	0	0	0	0	0
Other	Toilet/urinal flushing in commercial and residential settings		16	16	16	16	16	16
		Total	**520**	**520**	**520**	**520**	**520**	**520**
NOTES:								

6.5.4.2 Planned Versus Actual Use of Recycled Water

The district's 2010 UWMP projected demand for recycled water in 2015 to be 649 AF, and projected recycled water production in 2015 to be 534 AF. Actual recycled water use in 2015 was 520 AF, which is 129 AF less than the total demand projected in the 2010 UWMP, but is only 13 AFY less than the projected recycled water supply in the 2010 UWMP. This difference is the result of water efficiency training provided to local landscape maintenance firms, the district's conservation program, and reduced water use in response to the drought. **Table 6-7** provides a comparison of the 2010 UWMP projection for 2015 demand to actual 2015 use.

Table 6-7: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual (AFY) (DWR Table 6-5)

☐	Recycled water was not used in 2010 nor projected for use in 2015. The supplier will not complete the table below.

Use Type		2010 Projection for 2015 (AFY)	2015 Actual Use (AFY)
Agricultural Irrigation		0	0
Landscape Irrigation (exc golf courses)		391	307
Golf Course Irrigation		70	61
Commercial Irrigation		144	113
Industrial Use		27	23
Geothermal and other energy production		0	0
Seawater Intrusion Barrier		0	0
Recreational Impoundment		0	0
Wetlands or Wildlife Habitat		0	0
Groundwater Recharge (IPR)		0	0
Surface Water Augmentation (IPR)		0	0
Direct Potable Reuse		0	0
Other	Toilet/urinal flushing in commercial and residential settings	17	16
	TOTAL	**649[1]**	**520**

NOTES: (1)2010 UWMP projections reflect projected demand for recycled water in 2015; however, the 2010 UWMP projected actual 2015 recycled water production to be 534 AF.

6.5.5 Actions to Encourage and Optimize Future Recycled Water Use

The district uses a variety of incentives to encourage recycled water use. One of the more positive marketing aspects of recycled water is reliability. The droughts of 1976-77 and 1987-92 necessitated severe rationing with resultant damage to customers' landscape plantings. With recycled water used for landscaping during droughts, customers' investments in landscaping are protected.

Several district policies also encourage the use of recycled water. The rates for recycled water were originally established at half of the Tier 1 potable rate and, based on the rate structure changes that will be in effect May 2016, are at 69 percent of the Tier 1 potable rate. The district also requires use of recycled water, where it is available, as a condition of potable water service. For existing potable water customers, the conversion to recycled water is provided without a charge or fee from the district. Board Policy No. 2, included in Appendix J, contains the district policy on recycled water.

Table 6-8 provides a summary of estimated recycled water use that could be realized by implementing these methods to encourage recycled water use.

Table 6-8: Methods to Expand Recycled Water Use (DWR Table 6-6)

Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Supply (AFY)
Financial Incentives	Recycled water rates are 69 percent of the single-family tier 1 potable water rate	Currently in place	0
Conditional Service	The district requires use of recycled water, where available, as a condition of potable water service	Currently in place	0
Studies related to water supply	The district will be preparing a *2040 Water Resources Plan* (to be completed in 2017) that will evaluate the potential for expanded recycled water use in their service area	2017-2020	Unknown. Result pending completion of *2040 Water Resources Plan*
		TOTAL	**Unknown**
NOTES: Projected results are estimates.			

In 1990, the district prepared a preliminary design report for a second recycling plant to be located at the CMSA wastewater treatment plant. The study identified approximately 900 AF of potential use in east San Rafael, on the San Quentin Peninsula, and the lower Ross Valley. The sewage collection system for CMSA has extensive and widespread saltwater intrusion that has increased dramatically since the initial planning for this project. The preliminary salt water intrusion mitigation study, performed as part of this project, found that eight of the 17 raw sewage pumping stations had chloride concentrations over 1,000 mg/L, limiting potential use for irrigation purposes.

Since 2010, MMWD has participated in two joint feasibility studies. The first, completed in October 2014 in partnership with SASM, assessed the feasibility of developing a new recycled water system within SASM's service area to offset potable water use and promote recycled water use for irrigation, cooling tower use, and/or wetlands enhancement (Carollo 2014). The second, completed in partnership with CMSA, assessed the feasibility of constructing a new recycled water system to offset existing potable supplies. While both studies developed alternatives, neither yielded a preferred project due to high project costs (Carollo 2015a).

The district has thoroughly explored ways to expand water recycling. However, with few large users of non-potable water (such as golf courses and heavy industry) within the district's service area, the district's remaining water recycling options are more expensive and less feasible than continuing to use potable infrastructure. As more customers improve irrigation efficiency, reduce turf areas, switch to native and drought-tolerant landscapes, and convert parks and athletic fields to artificial turf, there are fewer opportunities and lower demand for recycled water. For example, the total water entitlement of all recycled water customers connected to the recycled water system is 956 AF. However, typical annual demand has dropped to approximately 606 AFY. This reduction in demand for recycled water appears to be a result of the water efficiency and conservation program, especially the water efficiency training provided to local landscape maintenance firms who service both the potable and recycled water irrigation customers.

Another obstacle to increased water recycling in the district's service area is severe saltwater intrusion into the sewer collection systems of most of the local sanitation agencies, including that of the community's largest wastewater agency, CMSA. Rehabilitation of the sewer collection system was explored, but intrusion is so widespread that the cost to repair the sewers is much more than the cost of the water recycling project. Reducing salt in wastewater using membrane processes has also been explored, but the high cost and increased concentration of contaminants remaining in the wastewater discharge render that alternative infeasible from both a cost and regulatory perspective.

Satellite recycling plants, which can intercept sewage above the zones of saltwater intrusion and process the sewage to tertiary recycled water, appeared to be a promising avenue for enlarging the district's recycled water program. In 2001, the district conducted a study, partially funded through a grant from the DWR, to investigate the viability and

cost of incorporating satellite water recycling plants into the district's distribution system. However, while the study concluded that this approach was technically feasible, it would cost over $3,000 per AF, making it prohibitively expensive. Recent feasibility studies have also considered satellite treatment plants and the costs are far greater than $3,000/ AF.

The district continues to investigate the potential for expansion of recycled water, which, along with conservation, is a high priority in the district's vision of sustainable water resource management. As part of its *2040 Water Resources Plan*, the district will evaluate recycled water and potable reuse opportunities.

6.6 Desalinated Water Opportunities

In August of 2010, the district adopted Ordinance 420, which states that the district shall not approve construction, or financing for construction, of a desalination facility unless such construction is approved by a majority of district voters voting in an election held within the district's service area for that purpose. While the district has in the past explored desalination as a potential supply option, the district does not intend to pursue desalination to augment water supplies at this time.

6.7 Exchanges or Transfers

The district's service area is entirely within Marin County. Marin County is a peninsula surrounded on three sides by water. The physical barriers imposed by these water bodies severely limit the water transfer opportunities available to the district.

However, during the drought of the 1970s, the district made use of water transfers to augment its supplies. Emergency pipeline connections were made to SCWA, north of the district, and to the East Bay Municipal Utility District (EBMUD) water system to the east. Water was delivered to the district from the State Water Project through the EBMUD system and from the Russian River via the SCWA and North Marin Water District water systems.

The temporary connection with EBMUD was installed in the emergency pull-out lane of the Richmond-San Rafael Bridge. It was removed from the bridge in the early 1980s when traffic increased making the pipeline a safety hazard. However, the connection to the NMWD and SCWA was improved into a permanent connection and contracts allowing delivery of water during non-emergency periods have been implemented as described in Section 6.1. Today, about 25 percent of the district's water supply is delivered via this connection.

MMWD anticipates assessing, as one of many resiliency options, the feasibility of transfers with EBMUD and other local water suppliers as part of its *2040 Water Resources Plan*, scheduled for release in 2017, and as part of its involvement in the Bay Area Regional Reliability Drought Contingency Plan.

6.8 Future Water Projects

The district's commitment to water conservation and implementation of its Water Conservation Master Plan, as well as its commitment to complying with the Water Conservation Bill of 2009, are projected to maintain the water demand at a level that can be supplied from existing water sources for the planning horizon of this UWMP. As a result, no future potable water supply projects are necessary at this time to increase the amount of available potable water supply, as shown in **Table 6-9** below. However, the district is currently preparing a *2040 Water Resources Plan* which will identify potential projects to increase supply resiliency for district customers.

Table 6-9: Expected Future Water Supply Projects or Programs (DWR 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. LOCATION OF THE NARRATIVE _____.

Name of Future Projects or Programs	Joint Project with other agencies?	Description (if needed)	Planned Implementation Year	Planned for Use in Year Type	Expected Increase in Water Supply to Agency (AFY)

6.9 Summary of Existing and Planned Sources of water

Table 6-10 below summarizes, by source, the total amount of actual water supplied in 2015, as well as the total right or safe yield associated with each of the district's supply.

Table 6-10: Water Supplies – Actual (AFY) (DWR Table 6-8)

Water Supply	Detail	2015		
		Actual Volume (AFY)	Water Quality	Total Right or Safe Yield (AFY)
Purchased or Imported Water	Sonoma County Water Agency	5,135	Drinking water	14,300
Supply from Storage		0	--	--
Groundwater		0	--	--
Surface Water		17,767	Drinking water	20,000
Surface Water	Environmental releases from Kent and Soulajule Lakes	15,726	Raw water	
Recycled Water	Marin Municipal Water District	520	Recycled water	520
Desalinated Water		0	--	--
Stormwater Use		0	--	--
Transfers		0	--	--
Exchanges		0	--	--
Other	Water sold to San Geronimo Golf Course and the Meadow Club	304	Raw water	343
	Total	**39,452**		**35,163**

NOTES: (1) Surface water is included twice, one representing potable water use by district customers and the other representing environmental releases from Kent and Soulajule Lakes; (2) Totals reflect actual production, including real and apparent losses for calendar year 2015.

Table 6-11 below summarizes, by source, the total amount of projected supply from 2020 through 2040 in five-year increments. Also included is the total right or safe yield associated with each of the district's supply. Note that the numbers represent the total amount of supply available to the district, whereas **Table 6-10** shows only the supply that was used to meet demand, regardless of how much was available.

Table 6-11: Water Supplies – Projected (AFY) (DWR Table 6-9)

	Detail	2020		2025		2030		2035		2040	
		Reasonably Available Volume (AFY)	Total Right or Safe Yield (AFY)	Reasonably Available Volume (AFY)	Total Right or Safe Yield (AFY)	Reasonably Available Volume (AFY)	Total Right or Safe Yield (AFY)	Reasonably Available Volume (AFY)	Total Right or Safe Yield (AFY)	Reasonably Available Volume (AFY)	Total Right or Safe Yield (AFY)
Purchased or Imported Water	Sonoma County Water Agency	8,460	14,300	9,920	14,300	10,000	14,300	10,000	14,300	10,000	14,300
Supply from Storage		0	--	0	--	0	--	0	--	0	--
Groundwater		0	--	0	--	0	--	0	--	0	--
Surface Water		141,970	20,000	141,970	20,000	141,970	20,000	141,970	20,000	141,970	20,000
Recycled Water		520	520	520	520	520	520	520	520	520	520
Desalinated Water		0	--	0	--	0	--	0	--	0	--
Stormwater Use		0	--	0	--	0	--	0	--	0	--
Transfers		0	--	0	--	0	--	0	--	0	--
Exchanges		0	--	0	--	0	--	0	--	0	--
Other	Raw water to golf courses	304	343	304	343	304	343	304	343	304	343
	Total	**151,254**	**35,163**	**152,714**	**35,163**	**152,794**	**35,163**	**152,794**	**35,163**	**152,794**	**35,163**
NOTES: (1) Recycled water right or safe yield columns reflect the maximum capacity for treatment of disinfected recycled water for unrestricted reuse.											

6.10 Climate Change Impacts to Supply

Coping with inter-annual variability has always been a challenge for long-term water supply planning in the Bay Area, and climate change may intensify variability in coming decades. With potential additional changes imposed by climate change, there will be a heightened need to evaluate and respond to increased water supply variability.

The district's water supply does not come from snowmelt nor from coastal aquifers, but rather from local runoff and the Russian River, a rainfall-driven river. This precipitation is stored in local reservoirs and released during the drier summer months. The district is currently very storage-limited; existing storage capacity represents only about two years of demand. There are no remaining economically-feasible sites for new surface water storage facilities and no underlying groundwater basin or alluvial aquifers of any significance as a supply.

Historically, MMWD has been able to meet demands with rationing and conservation but has had to increase purchased water from SCWA during prior periods of extreme drought. Given that the district is storage-limited, it can and has experienced changes in storage very quickly. From December 2012 to January 2014, MMWD experienced a period of very low precipitation, and its reservoirs reached significantly low storage conditions that nearly triggered significant mandatory reductions. Water supply circumstances then changed in early February 2014 when the district received 15 inches of rain, more than the total rain during the prior 400 days combined.

Sea level rise could also negatively impact the district's service area. There are a number of developed low lying areas within the district's service area that could become inundated with sea level rise. Other areas may see an increase in the regularity of flood events. This could result in reduced overall water use in the service area, or shifts in the location of uses, as customers are either forced or opt to move elsewhere.

As climate change advances, there is also a potential for increased ecological vulnerability to currently identified invasive species as well as to new invasive species. According to Cal WeedMapper, Marin County has over 150 invasive flora species, including water hyacinth (*elchhornia crassipes*), European beachgrass (*ammophilia arenaria*), and red brome (*bromus madritensus* ssp. *rubens*). There are also 19 invasive flora species that, while not yet in Marin County, have been identified within 50 miles of the County. These include spotted knapweed (*centaurea maculosa*), alligator weed (*alternanthera philoxeroides*), and the South American spongeplant (*limnobium laevigatum*). There are also 11 invasive fauna species within Marin County, including the Asian estuarine mudsnail (*batillaria attramentaria*), the amethyst gem clam (*gemma gemma*), and the American oyster drill (*urosalpinx cinerea*). Invasive species could impact the district's water supply by negatively affecting water quality and infrastructure systems.

Climate change is expected to affect the district's supply as follows:

- Total precipitation is not projected to change significantly, although there may be less precipitation in the spring.
- Timing of runoff is expected to shift to earlier in the year, affecting reservoir storage, especially in the spring and summer months.
- Variability in annual precipitation is expected to continue, with vulnerability to droughts and dry periods.
- More intense storms anticipated that may affect surface water runoff and storage and stored water quality.
- Sea level rise could inundate some of the developed low lying areas and increase flooding regularity in other areas.

Climate Ready North Bay, a coalition of conservation leaders, land managers, decision-makers, and scientists, are currently working on a customized climate vulnerability assessment for the Marin County study area. This assessment, when complete, will provide climate change-related data products for Marin County. The district, using these data products, will build and run a dynamic systems model to analyze the district's resiliency under climate change scenarios. The results of this analysis will be included in the district's *2040 Water Resources Plan*, which will be finalized in 2017.

7.0 Water Supply Reliability Assessment

7.1 Constraints on Water Sources

Many factors could result in constraints of the district's water supply, including limits on the amount available, water quality, climatic conditions, or a combination of these. **Table 7-1** lists the district's sources of water supply and the potential factors that could impact the district's supply.

Table 7-1: Factors Resulting in Inconsistency of Supply

Factors	Sonoma County Water Agency (Imported Water)	District Produced Surface Water	Recycled Water
Limitation Quantification	Quantity limited by contractual limits and available pipeline capacity. When pipeline capacity impacts deliveries, the district/SCWA will have to construct new conveyance facilities to supplement capacity.	Climatic variation could result in limited storage carryover.	None
Legal	Supplies could potentially be reduced subject to unanticipated regulatory requirements.	None	None
Environmental	Fish habitat protection could result in summertime diversion curtailments on the Russian River. Future supply increases may not be consistent due to delays in construction, approval of water rights applications, or environmental documentation.	Future increases in instream flow requirements could decrease supply.	None
Water Quality	None	None	Salt-water intrusion in low-lying areas of sewer collection system could impact recycled water quality.
Climatic	Drought could reduce available surface water supply.	Drought could reduce available surface water supply.	None

Water imported from SCWA is subject to reductions during dry years. As described in the SCWA 2010 UWMP, when the Lake Sonoma water volume is less than 100,000 AF before July 15, a 30 percent reduction of diversions is required, as dictated by State Water Resources Control Board's Water Rights Decision 1610. However, SCWA will work with its retail water customers to conjunctively manage Russian River and groundwater supplies to promote sustainability of these resources. SCWA is also developing plans to enhance groundwater recharge of stormwater in the Sonoma Valley, Petaluma Valley, and Santa Rosa Plain watersheds. These strategies will increase the reliability of groundwater as a supply for SCWA's other customers, providing an increased reliability of surface water for MMWD. However, in addition to the reliability impacts associated with drought, the imported supply is also limited by both contractual delivery limits and infrastructure capacity, as previously described in **Chapter 6.0 System Supplies**.

Similar to the imported supply, the district's local surface water supply could also be impacted by future droughts and/or climate change. The reliability of the local surface water, as well as recycled water quality concerns are described later in this chapter.

The district is fortunate to have water of exceptionally high quality and has never exceeded a water quality regulatory limit or received a regulatory violation. Five of the seven local surface water reservoirs are located in a district-owned and protected watershed that substantially reduces the potential for contamination. The two reservoirs outside the protected watershed are located in rural areas with low population densities that are maintained by strict zoning requirements. In addition, the district has established Watershed Protection Agreements with landowners in these watersheds. Accordingly, the excellent water quality that the district has historically enjoyed is expected to continue into the future. There have been no instances when water quality issues have limited water supply or affected reliability.

As described in **Chapter 6.0 System Supplies**, the district has developed an extensive recycled water program in the Las Gallinas area. The district has jointly investigated the feasibility of building water recycling systems in other areas as well, none of which were found to be economically feasible. An additional constraint to water recycling is saltwater intrusion into low-lying areas of the sewer collection systems that renders the water too salty to use for landscape irrigation, the primary market for recycled water in the district's service area. The district's existing recycled water system would also vulnerable to salt water intrusion in the event of a severe earthquake. Most of the low-lying areas subject to saltwater intrusion are have soil conditions that would experience differential settlement in an earthquake and allow further saltwater inflow into the sewage collection system.

A summary of the current and projected water supply impacts due to water quality is provided in **Table 7-2**.

Table 7-2: Water Quality - Current and Projected Water Supply Impacts (AFY)

Water Source	Description of Condition	2020	2025	2030	2035	2040
Sonoma County Water Agency (wholesale supplier)	No issues	0	0	0	0	0
District Produced Surface Water	No issues	0	0	0	0	0
Recycled Water	Vulnerable to salt water intrusion	0	0	0	0	0

7.2 Reliability by Year Type

The district's drought planning considers aggregated water supplies from all sources during single-dry and multiple-dry years as defined below:

- **Average Year:** Defined as the year that most closely represents the average water supply available to the district.
- **Single-Dry Year:** Defined as the year that represents the lowest water supply available to the district.
- **Multiple-Dry Year:** Defined as the period that represents the lowest water supply available to the district for a consecutive 3-year period.

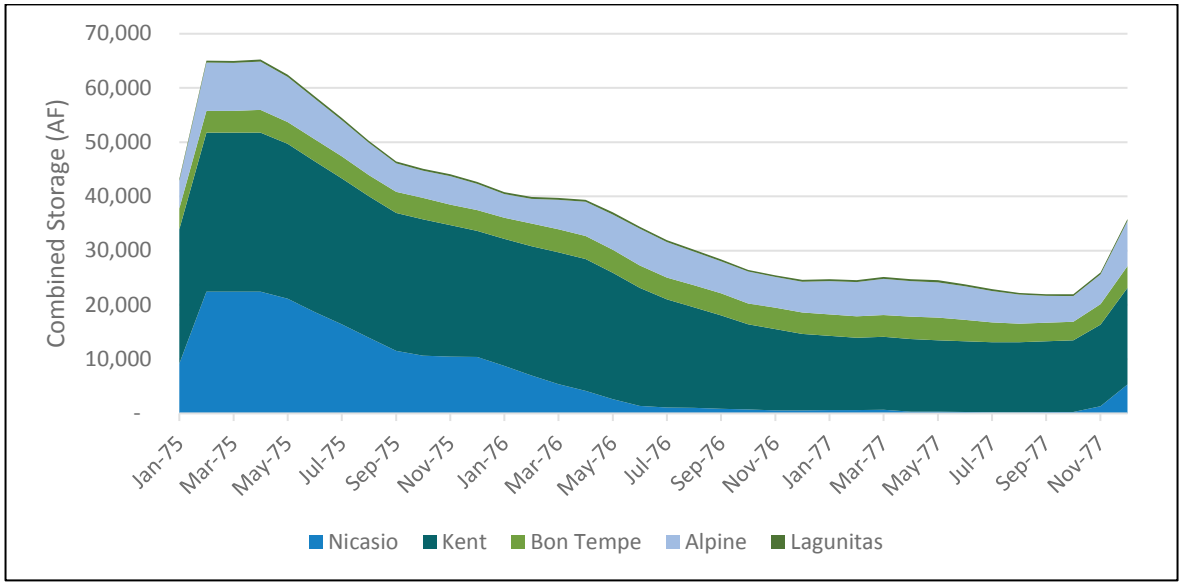
Table 7-3 below indicates the estimated total potable water supply in each year type. The average year was determined by taking the average supply available to the district over the period of record. The year 2004 was determined to have been most representative of the average supply available (141,970 AFY). The year 1977 was determined to have had the lowest supply available to the district (11,296 AFY) and is thus used as the basis for the single dry year type. The period from 1975 through 1977 had the lowest supply available for a consecutive 3-year period (143,646 AFY total) and is thus used as the basis for the multiple dry year type. The dry years were compared to normal water years, shown as a percentage of normal water year supply. The district's combined reservoir storage for the multiple dry year period is shown in **Figure 7-1**.

Table 7-3: Bases of Water Year Data (DWR 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 (AFY)	% of Average Supply
Average Year	2004	141,970	100%
Single-Dry Year	1977	11,296	8%
Multiple-Dry Years 1st Year	1975	100,737	71%
Multiple-Dry Years 2nd Year	1976	31,613	22%
Multiple-Dry Years 3rd Year	1977	11,296	8%

NOTES: Supplies shown here reflect historic conditions. Storage improvements implemented in response to the 1977 drought, including construction of Soulajule Reservoir and raising Kent Reservoir dam, resulted in an increase in carryover storage and ability to capture inflow under a repeat of 1975-1977 hydrologic conditions. In addition, the district has negotiated additional firm yield from SCWA compared to in 1975-1977. For the purpose of the following tables, the estimated increased supply available from the raised dam at Kent Reservoir and the additional available SCWA supply result in the following assumptions related to available supply: Single-Dry Year: 59,922 AF; Multiple Dry Year 1: 122,887 AF; Multiple Dry Year 2: 75,780 AF; Multiple Dry Year 3: 59,922 AF. While not included in the tables for the dry year scenarios, the anticipated increase in supply resiliency provided by Soulajule Lake is assumed to be at least 10,000 AFY.

Figure 7-1: Combined Storage for District Reservoirs – Multiple Dry Period (1975-1977)



NOTE: The totals for Kent reflect the increased storage available from raising the dam at Kent Lake. Soulajule was not constructed until 1980. While not included in the figure above, the additional supply reliability provided by Soulajule Lake is estimated to be at least 10,000 AFY.

Supplies shown here reflect historic conditions. Storage improvements implemented in response to the 1977 drought, including construction of Soulajule Reservoir and raising Kent Reservoir dam, resulted in an increase in carryover storage and the ability to capture inflow under a repeat of 1975-1977 hydrologic conditions. In addition, the district has negotiated additional firm yield from SCWA compared to in 1975-1977. For the purpose of the following tables, the estimated increased supply available from the raised dam at Kent Reservoir and the additional available SCWA supply result in the following updated assumptions related to available supply under a repeat of 1975-1977 hydrologic conditions:

- Single-Dry Year: 59,922 AF
- Multiple Dry Year 1: 122,887 AF
- Multiple Dry Year 2: 75,780 AF
- Multiple Dry Year 3: 59,922 AF

While additional supply reliability related to the construction of Soulajule Lake is not included in the above assumptions, Soulajule Lake is estimated to provide the district with an additional 10,000 AFY of supply reliability.

7.3 Supply and Demand Assessment

Table 7-4, **Table 7-5**, and **Table 7-6** compare projected water supplies and demands under normal, single dry, and multiple dry water years, respectively. Dry year supplies in the following tables reflect the supplies that were available during the respective year type as noted in **Table 7-3**. As noted above, supply available has been updated to account for storage improvements and increased firm yield from SCWA in place now as compared to the 1975-1977 period.

Table 7-4: Normal Year Supply and Demand Comparison (AFY) (DWR Table 7-2)

	2020	2025	2030	2035	2040
Supply Totals (from DWR table 6-9)	151,254	152,714	152,794	152,794	152,794
Demand Totals (from DWR table 4-3)	40,235	41,797	41,685	41,835	42,109
Difference	111,019	110,917	111,109	110,959	110,685
NOTES: (1) These demands reflect only passive conservation. The district intends to implement active conservation, with savings shown in Table 4-7. With active conservation, 2040 demand is projected to be lower than presented herein (projected 2040 demand with active conservation and recycled water is 40,417 AFY, as shown in Appendix E). (2) Recycled water is included in the supply and demand presented.					

Table 7-5: Single Dry Year Supply and Demand Comparison (AFY) (DWR Table 7-3)

	2020	2025	2030	2035	2040
Local Supplies	*55,142*	*55,142*	*55,142*	*55,142*	*55,142*
SCWA Supplies	*5,300*	*5,300*	*5,300*	*5,300*	*5,300*
Supply Totals	60,442	60,442	60,442	60,442	60,442
Demand Totals	41,940	41,797	41,685	41,835	42,109
Difference	18,502	18,645	18,757	18,607	18,333
NOTES: (1) Estimated supplies available reflect additional storage resulting from raising Kent Reservoir in 1982 and renegotiating SCWA agreements. (2) Demands reflect passive conservation only. The district intends to implement active conservation, with savings shown in Table 4-7. With active conservation, 2040 starting demand is projected to be lower than presented herein (projected 2040 demand with active conservation and recycled water is 40,417 AFY, as shown in Appendix E). (3) Any errors are attributed to rounding. (4) Recycled water is included in the supply and demand presented.					

Table 7-6: Multiple Dry Years Supply and Demand Comparison (AFY) (DWR Table 7-4)

		2020	2025	2030	2035	2040
First Year	Supply Totals	123,407	123,407	123,407	123,407	123,407
	Demand Totals	41,940	41,797	41,685	41,835	42,109
	Difference	81,467	81,610	81,722	81,572	81,298
Second Year	Supply Totals	76,300	76,300	76,300	76,300	76,300
	Demand Totals	41,940	41,797	41,685	41,835	42,109
	Difference	34,360	34,503	34,615	34,465	34,191
Third Year	Supply Totals	60,442	60,442	60,442	60,442	60,442
	Demand Totals	41,940	41,797	41,685	41,835	42,109
	Difference	18,502	18,645	18,757	18,607	18,333

NOTES: (1) Estimated supplies available reflect additional storage resulting from raising Kent Reservoir in 1982 and renegotiating SCWA agreements. (2) Demands reflect passive conservation only. The district intends to implement active conservation, with savings shown in Table 4-7. With active conservation, 2040 starting demand is projected to be lower than presented herein (projected 2040 demand with active conservation and recycled water is 40,417 AFY, as shown in Appendix E). (3) Any errors are attributed to rounding. (4) Recycled water is included in the supply and demand presented.

Based on this comparison, the district will have sufficient supplies to meet the demands during normal and dry water years. This is attributed to the measures already implemented by the district to increase storage and SCWA supply, as well as the district's aggressive conservation measures and the district's Dry Year Water Use Reduction Program. As part of the *2040 Water Resources Plan*, the district will identify and evaluate additional supply options, as well as provide a recommended supply portfolio. It is anticipated that the district will implement some of the options within the recommended portfolio in order to increase future supplies available to the district.

7.4 Regional Supply Reliability

The district's water supply is dominated by relatively small reservoirs capturing runoff from local watersheds, and the current safe yield represents only about two years of demand. The district supplements this local supply with water from the Sonoma County Water Agency. To improve resiliency, the district is undergoing a *2040 Water Resources Plan* that will identify

ways in which the district can increase the current safe yield and maximize its local sources of supply. The study will determine the risk of future water shortages, identify various regional partnerships, and study the feasibility of a number of local projects with the potential to increase resiliency. The *2040 Water Resources Plan* is expected to be released in fall 2017 and is further discussed in **Section 6.8 Future Water Projects**.

8.0 Water Shortage Contingency Planning

The UWMP Act requires that each water supplier provide a Water Shortage Contingency Plan that outlines how the supplier will prepare for and respond to water shortages. This section includes guidance for describing the staged response to a water shortage that occurs over a period of time (such as a drought), as well as catastrophic supply interruptions.

8.1 Past Drought and Emergency Conservation Information

The local region experienced a brief, but deep drought in the period from 1975 through 1977. This drought was the most severe experienced by the district and, as such, became the district's drought of record. A more prolonged drought punctuated with brief periods of rainfall occurred from 1987 through 1992.

During the 1970s drought, the district explored the feasibility of groundwater use and found that groundwater was both very limited and also impacted by the drought. The district increased its efforts to distribute low-flow showerheads, toilet tank displacement bottles and water conservation literature, and constructed pipelines (both temporary and permanent) across the Richmond-San Rafael Bridge and to Sonoma County to import water. Ultimately, the district relied heavily on the ability of its consumers to make radical reductions in the amount of water they consumed. During the final stage of the 1976-77 drought, consumers reduced their water use by approximately 63 percent when the district went into a mandatory water use reduction program.

Following the 1970s drought, the district continued to add water conservation programs, added more surface water storage, and developed its recycled water program. By 1987, the water demand had returned to pre-drought levels. However, with improved supplies and the ability to import water from the SCWA, the district was able to reduce the requested mandatory water use reductions during the late 1980s and early 1990s drought. The water use reductions that were requested and achieved during this drought depressed water use for years after the drought had ended. Water use did not return to 1980 levels until the year 2001. Subsequently, increased water conservation efforts stabilized water use until the financial recession that began in 2008 reduced water demand to about the same low levels experienced during the early 1990s drought.

More recent drought conditions have indicated a need for additional system storage in an effort to accommodate more climate variability. For instance, on December 31, 2012, MMWD's reservoirs were full (79,566 AF) and fiscal year to-date rainfall was 33 inches, compared to average rainfall of 19 inches. The following calendar year (2013), MMWD received 10.68 inches of rainfall, far below the previous record low of 19 inches set in 1929. By January 16, 2014, storage levels had dropped to 43,600 AF, roughly 18,700 AF below normal for that date. A high pressure system, referred to as the Ridiculously Resilient Ridge, had settled in the Pacific Ocean and was preventing storm events from reaching the Bay Area and much of California. With no rainfall in the forecast, reservoir storage levels were on course to

be below 50,000 AF on April 1, which would have prompted implementation of MMWD's Dry Year Water Use Reduction Program.

Over the course of 14 months, MMWD's water supply circumstances had changed dramatically, going from full reservoirs to conditions nearly requiring mandatory reductions. Water supply circumstances changed again in early February 2014 when the district received 15 inches of rain, more than had been received during the prior 400 days. Storage levels were above 50,000 AF on April 1, negating the need for mandatory use reductions. However, because storage levels remained below normal, the district continued its campaign of urging customers to further improve water use efficiency.

Recent variability in rainfall patterns emphasizes the need to investigate, evaluate, and develop water supply resiliency. In response to this need, the district is also developing a *2040 Water Resources Plan*, expected in 2017.

8.2 Stages of Action

The district developed its current rationing plan (Title 13 sections 13.020.30-13.02.040) in 1999, with updates in 2011, 2014, and 2015. With the ongoing implementation of conservation programs and the effects of demand hardening, a voluntary rationing program at the 10 percent level was established to preserve water in the early stages of a potential dry period. Mandatory rationing levels set at 25 percent and 50 percent were also established to conserve water in extended dry periods.

Table 8-1 shows the three stages of water shortage currently used by the district, including a 10 percent voluntary rationing, a 25 percent mandatory rationing, and a 50 percent mandatory rationing (water shortage emergency). The water rationing stages are linked to the amount of water in the district's reservoirs as shown in **Table 8-1**. The 10 percent voluntary rationing stage is triggered when total reservoir storage is less than 50,000 AF on April 1st. The 25 percent mandatory rationing stage is triggered when total reservoir storage is less than 40,000 AF on April 1st. The 50 percent mandatory rationing stage is triggered when total reservoir storage on December 1st is projected to be in the vicinity of, or less than, 30,000 AF.

Table 8-1: Stages of WSCP (DWR Table 8-1)

Stage	Complete One or Both	
	Percent Supply Reduction	Water Supply Condition
Alert Stage (Voluntary Rationing)	10%	Total reservoir storage is less than 50,000 acre-feet on April 1
Mandatory Rationing	25%	Total reservoir storage is less than 40,000 acre-feet on April 1
Water Shortage Emergency	50%	Total reservoir storage on December 1 is projected to be in the vicinity of, or less than, 30,000 acre-feet

8.3 Prohibitions on End Users

The district has a number of prohibitions that it implements during periods of rationing. Additionally, the district implements on-going prohibitions to reduce baseline water waste. **Table 8-2** below highlights these prohibitions.

Table 8-2: Restrictions and Prohibitions on End Users (DWR Table 8-2)

Stage	Restrictions and Prohibitions to End Users	Additional Explanation or Reference (optional)	Penalty, Charge, or Other Enforcement? Y/N
Landscape Irrigation			
On-going	Restrict or prohibit runoff from landscape irrigation	Irrigation shall not be conducted in a manner or to an extent that allows water to run off or overspray the areas being watered. Every consumer is required to have his/her water distribution lines and facilities under control at all times to avoid water waste.	Y
Mandatory Rationing Stages	Limit landscape irrigation to specific times	No irrigation between the hours of 9 AM and 7 PM	Y
Mandatory Rationing Stages	Other landscape restriction or prohibition	No irrigation of new turf areas	Y
Commercial Industrial Institutional (CII)			
On-going	Lodging establishment must offer opt out of linen service	Must provide patrons the option of not having towels and linen laundered daily	Y
Mandatory Rationing Stages	Restaurants may only serve water upon request	Prohibit restaurants from serving water to patrons, except on request	Y
Water Features and Swimming Pools			
On-going	Require covers for pools and spas	Pool covers are required for all new outdoor swimming pools	Y
On-going	Restrict water use for decorative water features, such as fountains	Prohibit non-recycling decorative water fountains	Y

Table 8-2: Restrictions and Prohibitions on End Users (DWR Table 8-2)

Stage	Restrictions and Prohibitions to End Users	Additional Explanation or Reference (optional)	Penalty, Charge, or Other Enforcement? Y/N
Mandatory Rationing Stages	Other water feature or swimming pool restriction	Prohibit use of potable water for refilling or as make-up water for decorative fountains or pools	Y
Other			
On-going	Prohibit use of potable water for washing hard surfaces	Prohibit washing sidewalks, walkways, driveways, parking lots, and all other hard-surfaced areas by direct hosing, except to properly dispose of flammable or other dangerous liquids or substances or to prevent or eliminate materials dangerous to public health and safety	Y
On-going	Customers must repair leaks, breaks, and malfunctions in a timely manner	Prohibit escape of water through breaks or leaks within the consumer's plumbing or private distribution system for any substantial period of time within which such break or leak should reasonably have been discovered and corrected. It shall be presumed that a period of forty-eight hours after the consumer discovers such a leak or break, or receives notice from the district of such leak or break, whichever occurs first, is a reasonable time within which to correct such leak or break	Y
Mandatory Rationing Stage	Require automatic shut-off hoses	Prohibit washing of cars, boats, airplanes with hose without a shut-off nozzle	Y
On-going	Other	New connections may not install single-pass cooling systems for air conditioning or other cooling system applications unless required for health or safety reasons	Y

Table 8-2: Restrictions and Prohibitions on End Users (DWR Table 8-2)

Stage	Restrictions and Prohibitions to End Users	Additional Explanation or Reference (optional)	Penalty, Charge, or Other Enforcement? Y/N
On-going	Other	New connections may not install non-recirculating systems for conveyer carwash applications.	Y
On-going	Other	Prohibit installation of reverse-osmosis water purifying systems not equipped with an automatic shutoff unit.	Y
Mandatory Rationing Stages	Other	Every consumer shall eliminate water wastage and non-essential use of potable water from the district in an effort to aid the district in achieving a twenty-five percent reduction in the amount of water used by all consumers in the last year in which no restrictions in water use were required.	Y

In addition to the above prohibitions on end users, the district has also developed an Allocation Plan for mandatory rationing levels from 20 percent to 50 percent. This allocation plan includes differing use reductions by user category as shown in **Table 8-3**. The basic philosophy in developing these required use reductions is to generally weigh the uses involved in the various consumer classes and then to set reductions to ensure that basic health and sanitation needs are met. Therefore, discretionary water uses, such as using potable water for irrigation, are expected to be reduced to a greater extent than seen to-date. While the district's set mandatory rationing stages are 25 percent and 50 percent, as outlined in **Table 8-1**, the additional rationing levels (20 percent, 30 percent, and 40 percent) are provided for further information in the event that external factors mandated some other level of rationing.

Table 8-3: Allocation Plan - Proposed Cutbacks at Different Rationing Levels

Billing Codes	20% Rationing	25% Rationing	30% Rationing	40% Rationing	50% Rationing
Billing Code 1-5 (Residential)	25%	32%	32%	46%	55%
Billing Code 6 (Institutional)	20%	25%	30%	40%	50%
Billing Code 7 (Business)	15%	20%	25%	35%	45%
Billing Code 8 (Irrigation)	45%	50%	60%	75%	90%

8.3.1 Landscape Irrigation

During mandatory rationing, the district prohibits irrigation between the hours of 9 AM and 7 PM, as well as irrigation of any new turf areas. At all times, the district mandates that irrigation shall not be conducted in a manner or to an extent that allows water to run off or overspray the areas being watered. This means that every consumer is required to have his/her water distribution lines and facilities under control at all times to avoid water waste. If customers are found to be in violation of any of these restrictions, the district may impose penalties or other enforcement actions.

8.3.2 Commercial, Industrial, Institutional (CII)

At all times, hotels, motels, and other commercial lodging establishments must provide patrons the option of not having towels and linens laundered daily. A notice of this option must be prominently displayed in each bathroom. During mandatory rationing periods, restaurants may only serve water to patrons upon request. If customers are found to be in violation of this restriction, the district may impose penalties or other enforcement actions.

8.3.3 Water Features and Swimming Pools

The district prohibits the use of non-recycling decorative water fountains at all times, even during periods of no or voluntary rationing. Additionally, all new outdoor swimming pools must be equipped with a cover. During mandatory rationing periods, using potable water as refill or make-up water for decorative fountains or decorative pools is prohibited. If customers are found to be in violation of these restrictions, the district may impose penalties or other enforcement actions.

8.3.4 Defining Water Features

In its water conservation ordinance, the district defines water features as "… a design element where open water performs an aesthetic or recreational function. Water features

include ponds, lakes, waterfalls, fountains, artificial streams, spas and swimming pools (where water is artificially supplied). The surface area of water features is included in the high water use hydrozone of the landscape area." For the purposes of this Water Shortage Contingency Plan, there are two classes of water features. The first is categorized as decorative water features and includes decorative fountains and decorative pools. The second is categorized as recreational water features and includes both in-ground and aboveground structures such as swimming pools. According to Health and Safety Code Section 115921, pools or swimming pools are considered any structure intended for swimming or recreational bathing that contains water over 18 inches deep. This includes in-ground or aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas, and non-portable wading pools. Due to the limited number of recreational water features within its service area, the district does not currently have any restrictions on recreational water features. All restrictions related to water features are intended for decorative water features only.

8.3.5 Other

There are several additional water use restrictions that the district always has in place. For instance, the district permanently prohibits washing sidewalks, walkways, driveways, parking lots, and all other hard-surfaced areas by direct hosing, except to properly dispose of flammable or other dangerous liquids or substances or to prevent or eliminate materials dangerous to public health and safety. Also, the district permanently prohibits the escape of water through breaks or leaks within the consumer's plumbing or private distribution system for any substantial period of time within which such break or leak should reasonably have been discovered and corrected. The district assumes that a period of 48 hours after the consumer discovers a leak or break, or receives notice from the district of a leak or break, is a reasonable time within which to correct the leak or break. The district also prohibits new connections from installing reverse-osmosis water purifying systems that do not have an automatic shutoff unit. In addition, no new connections may install single-pass cooling systems for air conditioning or other cooling system applications unless required for health or safety reasons. Finally, non-recirculating systems for conveyer carwash applications are prohibited for new connections.

During periods of mandatory rationing, the restrictions expand to prohibit customers from washing cars, boats, and airplanes with a hose not equipped with a shut-off nozzle. In addition, every consumer is required to eliminate water wastage and non-essential use of potable water from the district in an effort to aid the district in achieving a twenty-five percent reduction in the amount of water used by all consumers in the last year in which no restrictions in water use were required. If customers are found to be in violation of any of these restrictions, including those that are permanently in place, the district may impose penalties or other enforcement actions.

8.3.6 Variances to Dry Period Regulations

The district does allow for certain variances to the water shortage stage requirements previously discussed. All variance requests must be submitted in writing to the district and include the account name, service number, and service address.

8.3.6.1 Residential Customers

Variance requests will be considered for the following:

- Medical hardship - Requires letter from physician supporting applicant's request.
- For business use in home - Requires copy of business license.

8.3.6.2 Commercial, Institutional, and Other Uses

Requests will be considered when the customer can show that severe financial handicap will occur without additional water. The written request should include a statement addressing the following:

- What has been done to reduce consumption,
- Why is the customer unable to further reduce consumption, and
- How much water the customer needs.

In granting variances, water saving retrofits or modifications may be required if deemed practical by district personnel. For example, a licensed home day care center may be required to retrofit 1.6 gallon ultra-low flow toilets (ULFTs) and flow restricting faucet aerators before being granted a variance allotment.

Variances will not be granted for:

- Home businesses without a business license,
- Temporary residents (less than 6 months),
- Pets or livestock (except cattle and horses),
- Gardening or landscaping needs,
- Parks or athletic fields, or
- Normal expansion of a business or institution.

8.4 Penalties, Charges, and Other Enforcement of Prohibitions

Any customer violating the regulations and restrictions on water use set forth above in **Table 8-2** shall receive a written warning for the first such violation. Upon a second violation, the customer shall receive a written warning and the district may require a flow restrictor to be installed in the service. If a flow restrictor is placed, the cost of installation and removal shall be paid by the violator. Any willful violation occurring subsequent to the issuance of the second written warning shall constitute a misdemeanor and may be referred to the Marin County District Attorney's office for prosecution. The district may also disconnect the water service. If water service is disconnected, it shall be restored only upon payment of the turn-on charge fixed by the district's Board of Directors.

Per the district's Water Conservation Ordinance (Title 13), penalties for failure to comply with any provisions of Section 13.02.021 are as follows:

- First Violation: The district will issue a written warning and delivery a copy of Title 13 by mail, hand, facsimile or email.
- Second Violation: A second violation within the preceding twelve (12) calendar months is punishable by a fine not to exceed one hundred dollars ($100).
- Third Violation: A third violation within the preceding twelve (12) calendar months is punishable by a fine not to exceed two hundred and fifty dollars ($250).
- Fourth and Subsequent Violations: A fourth and any subsequent violation is punishable by a fine not to exceed five hundred dollars ($500).

Each day that a violation of Title 13 occurs is considered a separate offense. In addition to financial penalties, penalties may include installation of flow restrictors and shut-off of service.

8.5 Consumption Reduction Methods

Consumption reduction methods are actions that are taken by the district to reduce water consumption, while prohibitions on end uses, addressed in Section 8.2, are actions that restrict end uses that are the responsibility of the end users. In addition to the actions described in Section 8.2, the district also engages in consumption reduction actions to support the varying rationing stages. These actions include aggressive public information campaigns, water saving retrofit incentives, and technical support such as water audits and leak detection surveys. These actions are highlighted in **Table 8-4**, below.

Table 8-4: Stages of WSCP - Consumption Reduction Methods (DWR Table 8-3)

Stage	Consumption Reduction Methods by Water Supplier	Additional Explanation or Reference (optional)
On-going	Extend Public Information Campaign	
On-going	Offer Water Use Surveys	
On-going	Provide Rebates on Plumbing Fixtures and Devices	
On-going	Provide Rebates for Landscape Irrigation Efficiency	
On-going	Provide Rebates for Turf Rebates	

8.6 Determining Reductions

The district uses database tools that have been integrated into the district's Systems Application Programming (SAP) system and SCADA archive system to track and report on changes in water consumption. These tools can be used to determine actual water reductions once the district issues a water alert.

8.7 Revenue and Expenditure Impacts

The district recognizes that rationing will have an adverse effect on revenues and available reserves and that operational costs often rise in time of drought because of the level of customer service activities required and increased water management costs. The following sections discuss the district's rate structure and reserve funds to safeguard against these revenue and expenditure impacts.

8.7.1 Drought Rate Structures, Surcharges

The district's water rate structure includes both a Fixed Bi-Monthly Service Charge and a Commodity Charge. The Service Charge is a flat bi-monthly charge based on the size of the meter serving a property and generally recovers the district's costs of billing, customer service, meter replacement and repair, meter reading, and a portion of general administrative overhead. The Commodity Charge is a variable per-unit charge measured in hundred cubic feet (CCF), or per 748 gallons, and is designed to recover the costs of water supply, treatment and distribution, and watershed maintenance. The district's rates for the Commodity Charge consist of three or four billing tiers that impose higher rates per unit of water as the level of consumption increases.

Predetermined storage levels, as previously described, will trigger set water use reduction goals. This reduction in water use will likely result in decreased revenues. However,

district ordinances specify that a voluntary water conservation program of 10 percent will automatically result in a temporary increase of water rates by 10 percent, and a mandatory rationing program of 25 percent will result in a temporary increase of water rates by 25 percent.

In the drought of the 1987-1992, the district established a five-tier rate structure to encourage conservation. While this rate structure no longer exists, if necessary, a similar rate structure may be considered in future rationing periods.

In June 2014, the district began an update to their Cost of Service Analysis (included in Appendix K). Based on this analysis, the Board of Directors voted to increase the fixed Service Charge and add a new Watershed Management Fee in December 2015. Combined, these two changes increase the district's revenue from fixed charges from 17 percent to 28 percent of total water rate revenue. Additionally, the Board approved adjustments to the tier rates of the Commodity Charge for all customer classes and approved changes in the tier allotments for multi-family and duplex customer classes. The Board also approved an increase of 4% of all water service rates, fees, and charges effective May 1, 2016. Recycled water rates also increased and are based on the customers' water budget or, if one is not in place, of 1986-87 consumption.

8.7.2 Use of Financial Reserves

In 2012, the district created the Rate Stabilization Fund as part of the issuance of revenue bonds. This fund allows the district to set aside surplus to be used to meet the district's annual debt service in any future year or for any other lawful purpose. Such a set-aside needs to happen within 180 days of the financial year end. In December 2014, the district's Board of Directors voted to set aside $4.9 million from operating surplus from the 2013/14 fiscal year to boost the Rate Stabilization Fund. This increased the balance of the Rate Stabilization Fund to $7.3 million, which is equal to one year of debt service. As a result of the drought, the Finance Committee authorized the withdrawal of $1.4 million from the Rate Stabilization Fund in October 2015, decreasing the balance to $5.9 million.

8.7.3 Other Measures

Other measures that the district would implement to safeguard against revenue impacts associated with rationing include implementing staff furloughs, suspending replacement of personnel upon retirement, and moving charges from operations to capital projects.

8.8 Resolution or Ordinance

Agencies are required to submit a draft or approved/adopted water shortage contingency resolution or ordinance in the UWMP. Title 13 of the district's Code, *Water Service Conditions and Water Conservation Measures*, fulfills this requirement and is included in Appendix L.

8.9 Catastrophic Supply Interruption

In 1999, the district updated its emergency response plan in preparation for the advent of the year 2000 and the various possible energy shortage scenarios suggested by the Y2K event. A subsequent update of the emergency response plan occurred in 2004; another update is currently underway and is expected to be complete in spring of 2016. As a result of these plans, the district has emergency response generators that can power a variety of small- to medium-sized pump stations throughout the service area. To accept the power from the emergency generators, the district has retrofitted most of its pump stations. The remaining stations can be bypassed to allow gas engine driven pumping or have emergency generators onsite.

In addition, the district has installed large fixed generators and fuel supply systems at the Bon Tempe Water Treatment Plant and the Ignacio Water Quality Station. These facilities will allow the district to provide full winter use period water deliveries (about half of summer use demand) to its customers for a month or more in the absence of outside (PG&E) power supplies.

The district is in a seismically active area and a major earthquake could result in a catastrophic supply interruption. The district developed a seismic strengthening program for its treatment and transmission system in 1995. The seismic strengthening is also linked to providing water for fire suppression needs following a significant seismic event and was folded into the district's Fire Flow Master Plan (FFMP). The FFMP was implemented over a 15-year period and extended as Fire Flow Improvement Program (FFIP) in May 2012 for an additional 19 years. The *2040 Water Resources Plan* will assess impacts and options to improve resiliency in the event of a catastrophic supply interruption resulting from a major earthquake.

During a declared shortage, the district will issue notifications to its customers to conserve water. If the length of service interruption is to be for an extended period of time, the district will determine if the situation is localized or widespread and develop a specific plan to provide water for health and safety during the situation.

During extended periods of water shortage, the district has worked with other water suppliers to provide modest amounts of water to ultimately reduce the overall level of cutbacks in water use required of the district's customers. Even with the additional supplies, the district requested a 57 percent use reduction by its customers during the drought of the 1970s.

8.10 Minimum Supply for the Next Three Years

The minimum water supply available during each of the next three years (2016 - 2018) is provided in **Table 8-5**. Potable water supplies (imported water and surface water) are based on the years from 1975 through 1977, which represent the driest 3-year historic sequence (based on locally-produced water). Recycled water is not subject to cutbacks due to drought and thereby has 100 percent reliability. Therefore, recycled water was not included in this table.

Table 8-5: Minimum Supply Next Three Years (AFY) (DWR Table 8-4)

	2016	2017	2018
Available Water Supply	122,887	75,780	59,922
NOTES: (1) Recycled water is not included in this table.			

9.0 Demand Management Measures

Demand management measures (DMMs) are specific actions a water supplier takes to support its water conservation efforts. AB 2067 streamlined the DMM reporting in UWMPs from the 14 specific measures required in the 2010 UWMPs to seven more general measures for the 2015 UWMPs. The following sections provide a comprehensive description of the district's water conservation programs, including programs currently being implemented and planned programs.

9.1 MMWDs Demand Management Measures

The district's programs for demand management through water conservation began in 1971 when water conservation literature from the American Water Works Association was inserted into water bills. By the mid-1970s, the district's programs had expanded to include retrofits of water-using fixtures and have continued to expand over the last 40 years.

When the district was embarking on its Integrated Water Resources Management Program in 1991, a review of water demands found that an estimated 11 percent reduction in water use had occurred during the period from 1970 to 1987 after taking into account the additional services installed during the period. A similar review took place in 1999 and found that the demand had been reduced by an estimated 25 percent during the period from 1970 to 1998.

In June 2007, the district adopted its *2007 Water Conservation Master Plan*. By reference, the Conservation Master Plan is incorporated herein, and included in Appendix M.

More recently, in late 2010, the district joined with SCWA and the Water Contractors to form the Sonoma Marin Saving Water Partnership (Partnership). The Partnership allows the district, SCWA, and the Water Contractors to maximize cost-effective water conservation by identifying projects and programs that can be implemented regionally. The regional partnership commits each signatory to remain in good standing with the CUWCC, to be on track with implementing the BMPs, and to budget and spend $15 million over 10 years for implementing water conservation programs. Since the Partnership was formed, a regional water conservation educational campaign was launched and regional conservation programs are being promoted.

The following sections describe the district's efforts in implementing each of the DMMs as listed in California Water Code Section 10631 (f).

9.1.1 Water Waste Prevention Ordinances

Title 13 of the district's Code, Water Service Conditions and Water Conservation Measures, includes a section on water waste prohibitions. This section explicitly states that the waste of water is to be prohibited. The section prohibits nonessential uses, places restrictions on reverse-osmosis units, and includes prohibitions on new connections. Title 13 of the district's Code is included in Appendix L.

9.1.2 Metering

The district is fully metered and has required, since Ordinance 20 was signed in 1928, that all new connections be metered. The district requires separate landscape meters for qualified customers and has policies about the use of installed meters. For instance, Section 13.02.065 of the district's Code states that "…use of any district water not metered is prohibited." Additionally, Section 13.020.070 states that "it is unlawful […] to remove, replace, alter, or damage any water meter or components thereof." If a violator is found, the district may impose penalties as outlined in the ordinance.

The district continues to replace meters as they age. The continued objective of the meter replacement program is to achieve a 20-year life cycle for all meters. Tests performed indicate that meters older than 20 years run, on average, 4.5 percent slower than new meters. By replacing the oldest meters in the system on an ongoing basis, the meter change program improves overall meter accuracy and retains revenue that would otherwise be lost by an inaccurate meter.

9.1.3 Conservation Pricing

The district's pricing structure is based on the cost of service and includes both a fixed service charge and a per-unit charge, reflecting both fixed costs and costs based on the amount of water used. The per-unit charge includes the cost of water supply, treatment and distribution, and watershed maintenance. To determine the per unit charge, the district uses a system of three or four billing tiers, depending on the customer class. The per-unit charge is designed to proportionally allocate a greater share of the costs of service to those whose higher water usage generates additional costs to MMWD. It incidentally promotes efficient water useage and conservation through pricing signals that the more customers use, the more they will pay. The rate structure reflects MMWD's various sources of supply, coupled with specific consumption patterns that directly impact MMWD's costs.

In June 2014, the district began an update to their Cost of Service Analysis (Carollo 2015b). Based on this analysis, included as Appendix K, the Board of Directors voted to modify the rate structure effective January 1, 2016 and increase all water service rates, fees, and charges by 4% effective May 1, 2016. These decisions are included in Appendix N.

As part of the rate structure changes, the district increased the fixed Service Charge and added a new Watershed Management Fee in December 2015. Combined, these two changes increase the district's revenue from fixed charges from 17 percent to 28 percent of total water rate revenue. Additionally, the Board approved adjustments to the tier rates of the Commodity Charge for all customer classes and approved changes in the tier allotments for multi-family and duplex customer classes. The Board also approved an increase of 4% of all water service rates, fees, and charges effective May 1, 2016. The Board also approved an increase in recycled water rates. Recycled water rates are based on the customers' water budget or, if one is not in place, of 1986-87 consumption.

For residential customers, the district uses four tiers, with separate allotments for summer months and winter months. In the winter and summer months, a majority of the single-family residential demands occur in Tiers 1 and 2. A discernible peaking pattern is shown, in which the volume of water consumed increases significantly in the summer. Tiers 3 and 4 capture these increased peak demands and provide a structure for recovering infrastructure and supply costs required to meet these peak demands (Carollo 2015b).

For non-residential customers, the district uses a more site-specific method for determining tier breakpoints. Each non-residential customer has a water entitlement and a water budget. The water entitlement is the maximum amount of water the district is committed to supply any individual customer on an annual basis. The district has unique methods for determining the water entitlement for accounts that were in service prior to 1991, for new accounts, and for new dedicated irrigation accounts. The water budget is the district's determination of the actual consumption requirement of the customer.

9.1.4 Public Education and Outreach

MMWD offers a number of rebates to its customers for water-saving fixtures, pool covers, hot water recirculating systems, and rain barrels. For toilets, the district offers customers up to $150 for each EPA WaterSense labeled toilet and up to $150 for an Energy Star Most Efficient clothes washer. MMWD also offers $150 rebate for EPA WaterSense labeled urinals or qualifying no-water urinals. For residential customers, the district offers $50 rebates for each of the following products: pool covers, hot water recirculating systems, organic mulch, laundry-to-landscape system components, and rain barrels. For commercial and multi-family irrigation customers that install qualifying irrigation equipment, MMWD offers up to $1,500 per irrigation meter.

The district also offers free water audits to residential and non-residential customers. During these water use surveys, a district representative evaluates the existing water-using fixtures, landscape irrigation system, and water use patterns to identify water savings opportunities. After the visit, the customer receives a written report of the existing water use patterns and a list of recommendations to increase efficiency. For large irrigation systems, the district offers a specialized large landscape water use survey.

For all schools located within the district's service area, MMWD offers several free programs, including watershed field trips, classroom presentations, and various materials intended to guide curriculum for various ages. All school programs are designed to support education standards while fostering water conservation and environmental stewardship. The district also has a list of resources with links, where appropriate, on their website that customers can access. For residential customers, the district has a Do-It-Yourself home water survey that customers can print and work through the activities.

9.1.5 Programs to Assess and Manage Distribution System Real Loss

While the district has not had an individual dedicated solely to leak detection since 2002, it does have a Leak Detection Team that has implemented a program to assess and manage system real loss. Leak detection and survey is handled by the Valve Technicians on an incident-by-incident basis. The Valve Technicians are first responders to all mainline leaks, mainline shut downs for the crews and contractors, consumer calls, and meter turn-on/offs. The process of leak detection involves pinpointing a specific leak location. This process assists staff in completing repairs with a minimal amount of excavation. Leak surveying is accomplished by canvassing the entire water distribution system. Using sonic leak detection equipment, technicians are able to locate leaks that may be hidden from view, because they are not yet surfacing. The leaks typically found during a survey include district leaks—mainline and service line—and consumer leaks.

9.1.6 Water Conservation Program Coordination and Staffing Support

The district has 10 full-time staff members within the Water Conservation Department dedicated to implementing and overseeing the conservation program. The primary responsibilities of the Department include designing, developing, and implementing conservation programs for all MMWD customers. The Department also provides support to customers, including completing water use surveys and reports, answering any questions about conservation programs, and providing printed materials related to the district's conservation programs. The Conservation Department and its activities are funded by the general fund, which is supported by revenue from water sales.

9.1.7 Other Demand Management Measures

9.1.7.1 Landscape Plan Review Services

Water conservation staff provide landscape plan review services for all municipal jurisdictions in MMWD's service area at no cost. Title 13 of the district's Code includes a section on water efficient landscaping that requires projects needing a building or landscape permit, plan check or design review. The plan review process consists of reviewing construction documents to verify compliance with efficiency standards, calculating a maximum applied water allowance (MAWA) and estimating total water use (ETWU), conducting a site inspection, and issuing a final letter of approval.

9.2 Implementation over the Past Five Years

9.2.1 Water Waste Prevention Ordinances

During the last five years, Title 13 of the district's Code has been amended three times to account for changing conditions, including the drought. Ordinance 421, approved January 5, 2011, added, amended, and repealed certain sections of Title 13 related to water budgets, landscape irrigation, and enforcement. Ordinance 427, approved September 19, 2014, amends section 13.02.020 by adding sections 13.02.020 (1)(F) and (G) and section

13.02.020 (4). Ordinance 428, approved April 7, 2015 amends section 13.02.020 by adding sections (1)(H) and (1)(I).

9.2.2 Metering

The district continues to require that all existing and new connections be metered. On January 1, 2011, the district expanded requirements for separate landscape water service meters. This includes separate meters for all new landscapes and a private meter for all rehabilitated landscapes over 1,000 square feet, except for single-family and two-unit residential landscapes. For single-family and two-unit residential landscapes, a private submeter is required for all points of connection where the irrigated landscape is greater than or equal to 2,500 square feet.

9.2.3 Conservation Pricing

Over the last five years, the district has maintained a tiered pricing structure. Residential water bills were calculated using the same tier breakpoints for all sites within a category, including single-family residential sites, duplex sites, and multi-family residential sites. For instance, from December through May, all residential customers would pay a certain amount per CCF for Tier 1 water. However, single-family customers would pay this amount for each hundred cubic feet up to 21 CCF, while all duplex residential customers would pay that amount for each CCF up to 24 CCF and all multi-family residential customers would pay that amount for each CCF up to 12 CCF.

The billing structure for non-residential accounts is tied to the meter's water budget. For billing purposes, the water budget is divided into six bi-monthly allocations referred to as baselines which directly impact how much water is available to the site at the lowest water rate during each billing period. When the meter is read, the water use is compared to the baseline for that billing period and the tier breakdowns are calculated. For instance, the customer is charged at the Tier 1 rate for the first 85 percent of the baseline. For any water from 86 percent to 150 percent of the baseline, the customer is charged at the Tier 2 rate and for any use 150 percent and over the baseline, the customer is charged the Tier 3 rate.

The new rate structure, as described in **Section 9.1.3 Conservation Pricing**, will go into effect by mid-2016.

9.2.4 Public Education and Outreach

In total, during the period of 2011-2015, the conservation department completed a total of 5,245 site surveys, provided program activities for 33,622 K-12 students, interacted with 24,922 customers at public outreach events, issued 2,244 high efficiency clothes washer, 5,070 high efficiency toilet, and 1,410 landscape rebates, completed 92 landscape plan approvals, conducted 1,107 water waste investigations, and responded to 28,634 customer phone and email inquiries.

As reported in the 2011 CUWCC report, the district published 10 newsletter articles on conservation, sent 61 email messages, and produced 14 flyers and/or brochures. The district also provided conservation-related updates on their website, including information about school programs offered, how to read meters, and a weekly watering schedule. The district distributed home water survey kits to over 2,000 students from the seventh grade through the twelfth grade, offered 55 classroom presentations reaching over 1,200 students, and offered 20 large group assembly presentations reaching over 5,000 students. MMWD also held one teacher training workshop and either funded or staffed 23 field trips for over 900 students.

In 2012, the district published 9 newsletter articles on conservation, sent 61 email messages, and produced 16 flyers and/or brochures. The district also launched a landscape water conservation media campaign, which included the "Iggy the Irrigation Controller" mascot, which reminded customers to conserve irrigation water. The district distributed home water survey kits to over 1,500 students from the seventh grade through the twelfth grade, offered 64 classroom presentations reaching over 750 students, and offered 18 large group assembly presentations reaching over 6,500 students. MMWD also held a Mt. Tamalpais Watershed Centennial Coloring Contest where 300 students participated and either funded or staffed 36 field trips for over 1,400 students.

In 2013, the district organized 44 field trips and large group assemblies reaching nearly 8,000 students. In addition, the district offered 52 classroom presentations reaching over 1,500 students. The district also provided 133 residential high-efficiency clothes-washer rebates, 218 high efficiency toilet rebates, and 34 low-flow showerhead devices. Additionally, the district conducted over 1,320 surveys, including 47 surveys for the commercial, institutional, and industrial sector.

In 2014, the district organized 39 field trips and large group assemblies reaching nearly 8,000 students. In addition, the district offered 25 classroom presentation reaching nearly 800 students. The district also provided 674 residential high-efficiency clothes-washer rebates, 1,370 high efficiency toilet rebates, and 70 low-flow showerhead devices. Additionally, the district conducted over 1,387 surveys, including 41 surveys for the commercial, institutional, and industrial sector.

In 2015, the district organized 38 field trips and large group assemblies reaching about 6,500 students. In addition, the district offered 21 classroom presentations reaching over 500 students. The district also provided 615 residential high-efficiency clothes-washer rebates, 1,535 high efficiency toilet rebates, and 41 low-flow showerhead devices. Additionally, the district conducted over 767 surveys, including 32 surveys for the commercial, institutional, and industrial sector.

9.2.5 Programs to Assess and Manage Distribution System Real Loss

Over the last five years, the district has maintained its program for assessing and managing distribution system real loss as described in Section 9.1.5. From 2008 through April 2015, the Leak Detection Team surveyed 1,535 miles of pipeline. As a result, they detected 1,080 customer service leaks, 1,050 district service leaks, 95 leaks on hydrants, and 311 leaks on water mains. In addition, the district has an ongoing program (as part of its Capital Improvement Program) to replace aging distribution pipeline; on average, the district replaced 8 miles of pipeline per year over the last five years. Including fireflow improvements, the district replaced approximately 13 miles per year over the last 5 years. Combined, these efforts have resulted in the district saving roughly 2.2 million gallons of water. The district estimates unaccountable water loss in 2010 at 10.8 percent; in 2015, loss was 7.2 percent.

9.2.6 Water Conservation Program Coordination and Staffing Support

Over the last five years, the district has maintained 10 full-time staff members within the Water Conservation Department dedicated to implementing and overseeing the conservation program. The Department has designed, developed, and implemented conservation programs, including educational outreach, rebates, and for all MMWD customers. The Department also provides support to customers, including completing water use surveys and reports, answering any questions about conservation programs, and providing printed materials related to the district's conservation programs. The Conservation Department and its activities are funded by the general fund, which is supported by revenue from water sales.

9.2.7 Other Demand Management Measures

9.2.7.1 Landscape Plan Review Services

Over the last five years, conservation staff have provided complimentary review of construction documents to verify compliance with efficiency standards, calculate the MAWA and ETWU, conduct a site inspection, and issue a final letter of approval. On December 15, 2015 the district's Board adopted Ordinance 430 that revised conservation requirements for new and rehabilitated landscape projects, effectively decreasing the amount of water budgeted for all landscape areas in the future.

9.3 Planned Implementation to Achieve Water Use Targets

The district will continue implementing the DMMs discussed in this chapter to achieve its 2020 water use goal. Repairing leaks and actively managing water loss are the most cost-effective ways to reach water use targets. However, all DMMs work synergistically to reduce water use. The planned implementation of the DMMs is described in the sections below.

9.3.1 Water Waste Prevention Ordinances

The district will continue to add, amend, and repeal Title 13, particularly Section 13.02.020, "water waste prohibitions," to adapt to changing conditions within its service area. The district anticipates that this DMM will continue to play an important role in helping the district meet its 2020 GPCD goal.

9.3.2 Metering

The district has been awarded $975,000 in grant funding to implement a water conservation project utilizing automatic meter reading (AMR) technology and irrigation equipment rebates at 800 irrigation accounts. This is one of ten implementation projects in a $32 million Bay Area Proposition 84 Drought Round Integrated Regional Water Management (IRWM) grant. The Association of Bay Area Governments/San Francisco Estuary Partnership (ABAG/SFEP) will manage the grant and serve as official grantee for the award.

With AMR, water meters can be read by truck-mounted sensors by driving down the street, allowing a cost-effective means to collect readings on a weekly, rather than bi-monthly, basis. With weekly meter readings available via a web portal, customers and staff can be more proactive in finding and responding to leaks, and monitoring water budgets to reduce overwatering. In addition to new AMR equipment, this project will provide customers with rebates up to $1,500 per irrigation meter for high-efficiency irrigation equipment, scientific water budgets, and accurate GIS maps of the landscape areas served by each meter to generate an estimated aggregate reduction in water use of 400 AF/year at these sites.

9.3.3 Conservation Pricing

The district is committed to maintaining a pricing structure that is tied to the cost of service. On December 8, 2015, the district's Board of Directors updated the pricing structure to increase rates by 4 percent beginning May 1, 2016. More information on this new structure is provided in **Section 9.1.3 Conservation Pricing**.

9.3.4 Public Education and Outreach

The district will continue its current public education and outreach program, which will consist of providing fixture rebates, offering free water audits, offering free programs to local schools, and providing information on the district's website.

9.3.5 Programs to Assess and Manage Distribution System Real Loss

The district will continue its current program through 2020. While losses could increase slightly from 2015 to 2020 if demands increase, the district's assessment and management of losses will be a large component in meeting the district's 2020 goal of 124 GPCD.

9.3.6 Water Conservation Program Coordination and Staffing Support

The district will continue its current conservation program structure and staffing support by maintaining 10 full-time positions dedicated to overseeing the district's conservation program.

9.3.7 Other Demand Management Measures

9.3.7.1 Landscape Plan Review Services

Moving forward, the district will continue to provide complimentary landscape review services for all municipal jurisdictions within MMWD's service area. This includes reviewing construction documents to verify compliance with efficiency standards, calculating a MAWA and ETWU, conducting a site inspection, and issuing a final letter of approval.

9.4 California Urban Water Conservation Council

MMWD is an original signatory to the CUWCC's MOU. Each year, the district submits annual reports required by Section 6.2 of the MOU. The district's 2013-2014 Annual Report to the CUWCC, as well as documentation that the district has met the MOU coverage requirements, is provided in Appendix O.

10.0 Plan Adoption, Submittal, and Implementation

10.1 Inclusion of all 2015 Data

The district conducts their reporting for UWMP preparation on a calendar year basis. As such, this 2015 UWMP includes water use and planning data for the entire 2015 calendar year.

10.2 Notice of Public Hearing

10.2.1 Notice to Cities and Counties

California Water Code Section 10621(b) stipulates that a water supplier must notify any city or county within which the supplier provides water that it is reviewing and considering changes to the UWMP. This notification must occur at least 60 days before the public hearing. MMWD held the public hearing for the UWMP on April 19, 2016. Notifications were sent out on January 29, 2016, well in advance of the 60 day requirement. A copy of this notice is provided in Appendix C.

Section 10641 of the California Water Code states that a water supplier must notice the time and place of the hearing to any city or county that the supplier provides water. It is recommended that the notice be addressed to the City Manager or County Administrator and that it include the UWMP review schedule and contact information of the Plan preparer. Notifications were sent out on April 1, 2016. A copy of this notice is provided in Appendix B.

Table 10-1 below indicates the cities and counties that received notices.

Table 10-1: Notification to Cities and Counties (DWR Table 10-1)

City Name	60 Day Notice (CWC 1021(b))	Notice of Public Hearing (CWC 10642)
City of Belvedere	☑	☑
Town of Corte Madera	☑	☑
Town of Fairfax	☑	☑
City of Larkspur	☑	☑
City of Mill Valley	☑	☑
City of Novato	☑	☑
Sonoma County Water Agency	☑	☑
North Marin Water District	☑	☑
Town of Tiburon	☑	☑
City of Sausalito	☑	☑
City of San Rafael	☑	☑
Town of San Anselmo	☑	☑
Town of Ross	☑	☑
County Name	**60 Day Notice (CWC 1021(b))**	**Notice of Public Hearing (CWC 10642)**
Marin County	☑	☑

10.2.2 Notice to the Public

Government Code 6066 requires that the water supplier notify the public of the public hearing in a local newspaper once a week for two consecutive weeks. The notice must include the time and place of the hearing, as well as the location where the draft UWMP is available for public review. The district noticed the public on April 5 and April 11, 2016 in the Marin Independent Journal. A copy of these notices is provided in Appendix B.

10.3 Public Hearing and Adoption

California Water Code 10642 states that prior to adopting the 2015 UWMP, the water supplier must hold a public hearing. The purpose of the public hearing is to allow public input on the Plan, consider economic impacts of the UWMP, and adopt a method for determining the water

supplier's water use target. The district held a public meeting on April 19, 2016. A copy of the agenda is provided in Appendix P.

The district also held a month-long public comment period from April 4, 2016 through May 2, 2016. Comments received were addressed by the district in a response to comments matrix, which is included in Appendix Q. A second public hearing was held on May 17, 2016 to review the comments and how they were addressed in the final Plan.

10.3.1 Adoption

The updated Plan was adopted by the district's Board of Directors at the June 7, 2016 meeting. A copy of the resolution is provided in Appendix R.

10.4 Plan Submittal

The district will submit the 2015 UWMP to the California Department of Water Resources (DWR) by July 1, 2016 via the approved website. No later than 30 days after the Plan is adopted by the district's Board of Directors, the district will submit a CD copy of the adopted 2015 UWMP to the California State Library and submit a copy to any city or county to whom the district provides water.

10.5 Public Availability

California Water Code 10645 requires that water suppliers, no later than 30 days after filing a copy with DWR, must make the approved Plan available for public review during normal business hours. The district will provide a copy of the approved 2015 UWMP to the XXXX library, leave a copy at the front lobby of the district, and post the plan on the district's website.

10.6 Plan Implementation

This UWMP will be implemented to meet the 2020 urban water use targets. Daily per capita urban water use will be decreased throughout the service area by implementing the district's water conservation program, as defined in the district's *2007 Water Conservation Master Plan*. The program includes the hiring of additional conservation staff, funding rebate programs at higher levels, improvements to the Customer Assistance Program, and additional funding for the new School Education Program. Significant improvements will also be made in public outreach and marketing, conservation database and website development, contractor education, research, and regional development projects.

10.7 Amending an Adopted UWMP

Should the district amend any portion of the approved 2015 UWMP, the district will follow each of the steps for notification, public hearing, adoption, and submittal that are required for an updated Plan. However, the 60-day notification to cities and counties to whom the district

supplies water will not be sent again; the notification sent with the original plan addresses the requirement.

11.0 References

ABAG, July 2013. Regional Housing Need Plan for the San Francisco Bay Area: 2014-2022. July 2013. <http://planbayarea.org/pdf/final_supplemental_reports/Final_Bay_Area_2014-2022_RHNA_Plan.pdf>

Carollo. 2014. Sewerage Agency of Southern Marin/Marin Municipal Water District Recycled Water Feasibility Study. October 2014.

Carollo. 2015a. Recycled Water Feasibility Study: Central Marin Sanitation Agency and Marin Municipal Water District. September 2015.

Carollo. 2015b. Cost of Service Study. December 2015. <http://www.marinwater.org/DocumentCenter/View/3591>

Maddaus Water Management. 2016. 2015 Urban Water Management Plan Water Demand Analysis and Water Conservation Measures Update. May 2016.

National Oceanic and Atmospheric Administration (NOAA). 2013. Regional Mean Sea Level Trends. Accessed 27 October 2015. <http://tidesandcurrents.noaa.gov/sltrends/slrmap.htm>.

Parker Groundwater Hydrologic Consulting. 2015. Conduct Peer Review of Existing Marin County Groundwater Studies and Advise MMWD on Proceeding Actions. September 2015.

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