GARDEN GROVE

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2015

URBAN WATER MANAGEMENT PLAN

FINAL DRAFT

MAY 2016

2015 URBAN WATER MANAGEMENT PLAN

City of Garden Grove

FINAL DRAFT

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ACRONYMS AND ABBREVIATIONS

20x2020	20% water use reduction in GPCD by year 2020
Act	Urban Water Management Planning Act
AF	Acre-Feet
AFY	Acre-Feet per Year
AMI	Advanced Metering Infrastructure
AWWA	American Water Works Association
Biops	Biological Opinions
BPP	Basin Production Percentage
CDR	Center for Demographic Research
CFS	Cubic Feet per Second
CII	Commercial/Industrial/Institutional
City	City of Garden Grove
CRA	Colorado River Aqueduct
CUP	Conjunctive Use Program
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
Delta	Sacramento-San Joaquin River Delta
DMM	Demand Management Measure
DOF	Department of Finance
DVL	Diamond Valley Lake
DWR	Department of Water Resources
EOC	Emergency Operation Center
FY	Fiscal Year
GAP	Green Acres Project
GCM	General Circulation Model
GPCD	Gallons per Capita per Day
GPM	Gallons per Minute
GWRS	Groundwater Replenishment System
HECW	High Efficiency Clothes Washers
HET	High Efficiency Toilet
IRP	Integrated Water Resource Plan
IWA	International Water Association
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
Metropolitan	Metropolitan Water District of Southern California
MF	Microfiltration
MG	Million Gallon
MGD	Million Gallons per Day
MHI	Median Household Income

MOU	Memorandum of Understanding
MTBE	Methyl Tertiary Butyl Ether
MWDOC	Municipal Water District of Orange County
NDMA	N-nitrosodimethylamine
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
PPCP	Pharmaceuticals and Personal Care Product
RHNA	Regional Housing Needs Assessment
SBx7-7	Senate Bill 7 as part of the Seventh Extraordinary Session
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
Study	Colorado River Basin Water Supply and Demand Study
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
UV	Ultraviolet
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WBIC	Weather Based Irrigation Controller
WEROC	Water Emergency Response Organization of Orange County
WF-21	Water Factory 21
WOCWB	West Orange County Water Board
WSAP	Water Supply Allocation Plan
WSDM	Water Surplus and Drought Management

1 INTRODUCTION

1.1 Urban Water Management Plan Requirements

Water Code Sections 10610 through 10656 of the Urban Water Management Planning Act (Act) require every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet (AF) of water annually to prepare, adopt, and file an Urban Water Management Plan (UWMP) with the California Department of Water Resources (DWR) every five years in the years ending in zero and five. The 2015 UWMP updates are due to DWR by July 1, 2016.

This UWMP provides DWR with a detailed summary of present and future water resources and demands within the City of Garden Grove's (City) service area and assesses the City's water resource needs. Specifically, the UWMP provides water supply planning for a 25-year planning period in five-year increments and identifies water supplies needed to meet existing and future demands. The demand analysis must identify supply reliability under three hydrologic conditions: a normal year, a single-dry year, and multiple-dry years. The City's 2015 UWMP updates the 2010 UWMP in compliance with the requirements of the Act as amended in 2009, and includes a discussion of:

- Water Service Area and Facilities
- Water Sources and Supplies
- Water Use by Customer Type
- Demand Management Measures
- Water Supply Reliability
- Planned Water Supply Projects and Programs
- Water Shortage Contingency Plan
- Recycled Water Use

Since the original Act's passage in 1983, several amendments have been added. The most recent changes affecting the 2015 UWMP include Senate Bill 7 as part of the Seventh Extraordinary Session (SBx7-7) and SB 1087. SBx7-7, or the Water Conservation Act of 2009, is part of the Delta Action Plan that stemmed from the Governor's goal to achieve a 20 percent statewide reduction in urban per capita water use by 2020 (20x2020). Reduction in water use is an important part of this plan that aims to sustainably manage the Bay Delta and reduce conflicts between environmental conservation and water supply; it is detailed in Section 3.2.2. SBx7-7 requires each urban retail water supplier to develop urban water use targets to achieve the 20x2020 goal and the interim ten percent goal by 2015. Each urban retail water supplier must include in its 2015 UWMPs the following information from its target-setting process:

- Baseline daily per capita water use
- 2020 urban water use target
- 2015 interim water use target compliance

- Compliance method being used along with calculation method and support data
- An implementation plan to meet the targets

The other recent amendment, made to the UWMP on September 19, 2014, is set forth by SB 1420, Distribution System Water Losses. SB 1420 requires water purveyors to quantify distribution system losses for the most recent 12-month period available. The water loss quantification is based on the water system balance methodology developed by the American Water Works Association (AWWA).

The sections in this UWMP correspond to the outline of the Act, specifically Article 2, Contents of Plans, Sections 10631, 10632, and 10633. The sequence used for the required information, however, differs slightly in order to present information in a manner reflecting the unique characteristics of the City's water utility. The UWMP Checklist has been completed, which identifies the location of Act requirements in this Plan and is included in Appendix A. This is an individual UWMP for a retail agency, as shown in Tables 1-1 and 1-2. Table 1-2 also indicates the units that will be used throughout this document.

Table 1-1: Plan Identification

Plan Identification			
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	Orange County 20x2020 Regional Alliance
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

Table 1-2: Plan Identification

Agency Identification	
Type of Agency (select one or both)	
☐	Agency is a wholesaler
☑	Agency is a retailer
Fiscal or Calendar Year (select one)	
☐	UWMP Tables Are in Calendar Years
☑	UWMP Tables Are in Fiscal Years
If Using Fiscal Years Provide Month and Date that the Fiscal Year Begins (mm/dd)	
7/1	
Units of Measure Used in UWMP (select from Drop down)	
Unit	AF
NOTES:	

1.2 Agency Overview

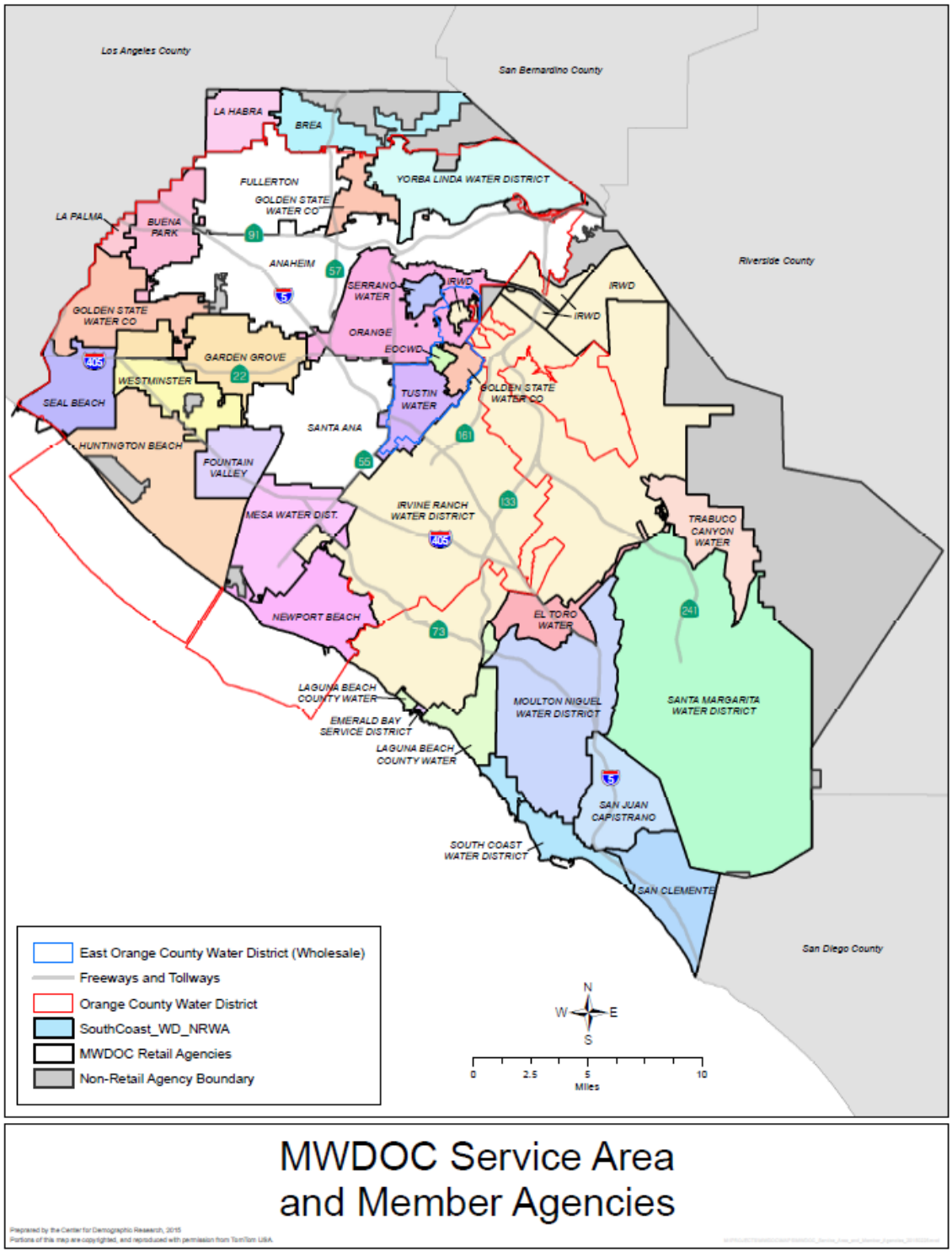
The City is governed by a non-partisan five-member City Council elected at large to serve staggered four-year terms. The Mayor and the Mayor Pro Tempore are elected by the Council from among its members to serve two-year terms. The City Council appoints a City Manager who, as the City's Chief Administrative Officer, is responsible for all City Departments, including the City's Water Utility. The City Council also appoints various members of commissions, committees, and citizen advisory groups. The current City Council members include:

- Bao Bguyen – Mayor
- Steve Jones – Mayor Pro Tempore
- Christopher Phan – Councilmember
- Phat Bui – Councilmember
- Kris Beard – Councilmember

In 1958, the City established a Municipal Water Department, which is now recognized as the Water Services Division of the Public Works Department. The Water Services Division is the principal water retailer within the City boundaries and also provides water service for two small neighborhoods outside the City. The Water Services Division is responsible for operating and maintaining wells, reservoirs, imported water connections, distribution pipelines, fire hydrants, water meters and related infrastructure, and for meter reading, billing and accounting services. The Water Services Division also conducts

comprehensive water quality testing and monitoring programs and develops long range operational and engineering plans designed to prepare for future needs and contingencies.

The City receives its water from two main sources, local well water from the Lower Santa Ana River Groundwater basin, which is managed by the Orange County Water District (OCWD), and imported water from the Municipal Water District of Orange County (MWDOC). MWDOC is Orange County's wholesale supplier and is a member agency of the Metropolitan Water District of Southern California (Metropolitan).



MWDOC Service Area and Member Agencies

Figure 1-1: Regional Location of Urban Water Supplier

1.3 Service Area and Facilities

1.3.1 City of Garden Grove Service Area

The City is located in north central Orange County. The City is located south of Anaheim and north of Santa Ana, and is about 25 miles south of Los Angeles and 9 miles inland from the Pacific Ocean. The City has an area of 17.8 square miles and is generally flat, with elevations ranging from a low of about 25 feet above sea level in the southwest to 130 feet in the northeast. The City is predominately residential, although it also has five industrial parks, 19 retail centers, and nine large hotels and one conference center. The City is located along the Garden Grove Freeway (SR 22) which provides excellent access to I-5 and the Orange County Freeway (SR 57) to the east and I-405, I-605 and I-710 to the west.

The City supplies customers throughout the City's 17.8 square mile area. The City also serves water to one neighborhood that is not within the incorporated boundaries of the City. The neighborhood is in the vicinity northwest of Chapman Avenue and Dale Street and the other in the area of Lampson Avenue and Beach Street. Figure 1-2 shows the City limits and water service area.

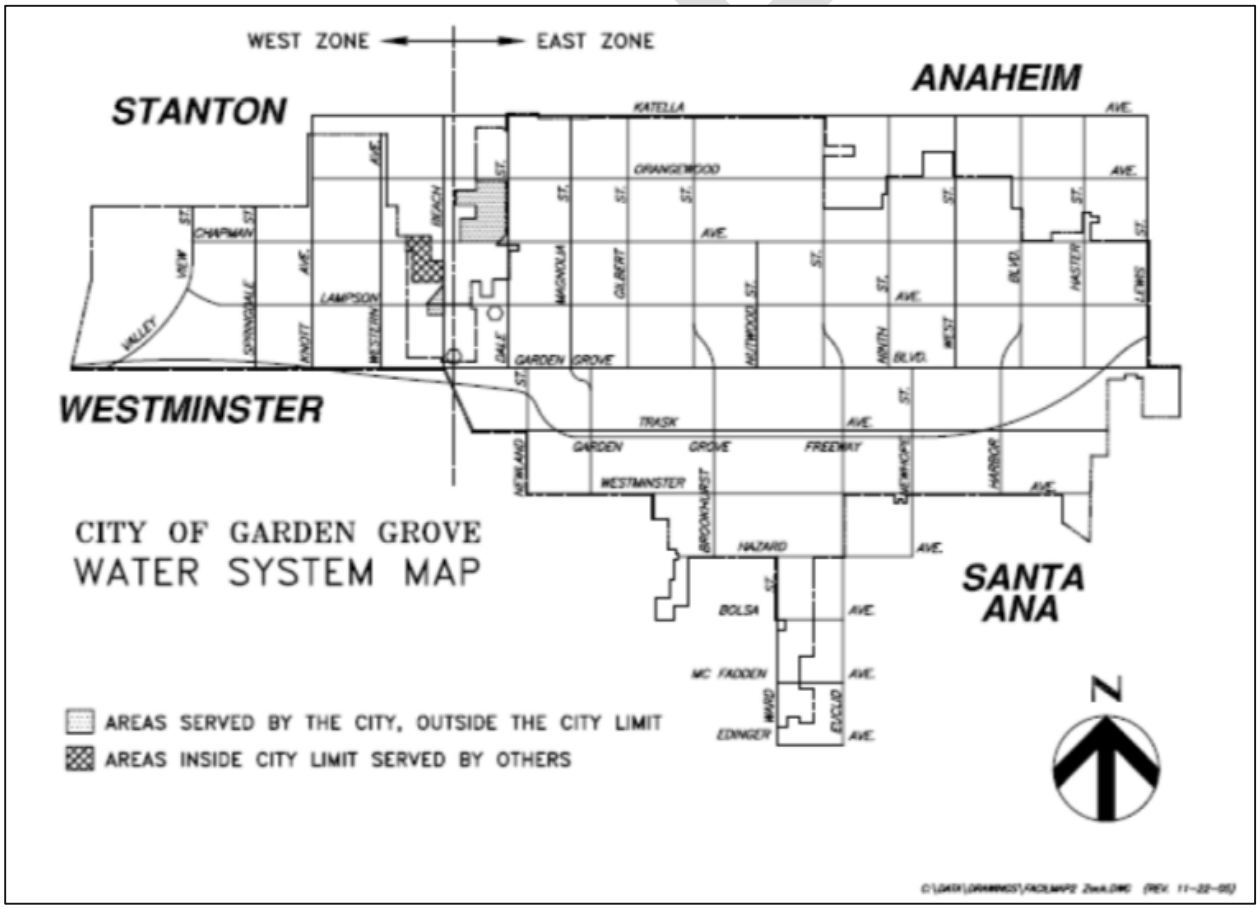


Figure 1-2: City of Garden Grove's Service Area

1.3.2 City of Garden Grove Water Facilities

Groundwater is pumped from 11 active wells located throughout the City. MWDOC wholesales imported water to the City from Metropolitan through four imported water connections. Metropolitan treats water supplied to the City at the Diemer Filtration Plant in northern Orange County. The City's water distribution system is connected to Metropolitan transmission mains at four locations along the northern and eastern sides of the City.

The City also operates eight storage and distribution reservoirs at five sites with a combined capacity of 53 million gallons (MG). The storage volume is the equivalent of more than two days average use and is more than adequate for peaking demands and firefighting needs. The storage system is supported with 17 booster pumps located at the reservoir sites. The booster pumps have a total capacity of 46,600 gallons per minute (gpm), which is more than enough to keep the system pressurized under peak flow conditions. The City also maintains nine emergency interconnections with neighboring water systems.

The City's distribution system pressures are managed to ensure that water pressure is within acceptable ranges for both domestic use and fire flow demands. Peak demands can be met with combinations of increased pressure rates and water from storage tanks.

The system connections and water volume supplied are summarized in Table 1-3, and the wholesalers informed of this water use as required are displayed in Table 1-4.

Table 1-3: Public Water Systems

Retail Only: Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2015	Volume of Water Supplied 2015
CA3010062	City of Garden Grove	33,647	24,049
	TOTAL	33,647	24,049
NOTES:			

Table 1-4: Water Supplier Information Exchange

Retail: Water Supplier Information Exchange
The retail supplier has informed the following wholesale supplier(s) of projected water use in accordance with CWC 10631.
MWDOC
NOTES:

2 DEMANDS

2.1 Overview

Since the last UWMP update, southern California's urban water demand has been largely shaped by the efforts to comply with the SBx7-7. This law requires all California retail urban water suppliers serving more than 3,000 acre-feet per year (AFY) or 3,000 service connections to achieve a 20 percent water demand reduction (from a historical baseline) by 2020. The City has been actively engaged in efforts to reduce water use in its service area to meet the 2015 interim 10 percent reduction and the 2020 final water use target. Meeting this target is critical to ensure the City's eligibility to receive future state water grants and loans.

In April 2015 Governor Brown issued an Emergency Drought Mandate as a result of one of the most severe droughts in California's history, requiring a collective reduction in statewide urban water use of 25 percent by February 2016, with each agency in the state given a specific reduction target by DWR. In response to the Governor's mandate, the City is carrying out more aggressive conservation efforts. It is also implementing higher (more restrictive) stages of its water conservation ordinance in order to achieve its demand reduction target of 20 percent set for the City itself and the Regional Alliance of all participating MWDOC utility agencies (discussed later in Section 2.5).

In addition to local water conservation ordinances, the City has engaged in activities that range from being a signatory member of the California Urban Water Conservation Council's (CUWCC) Best Management Practices (BMP) Memorandum of Understanding since 2000 to ongoing water audit and leak detection programs. The City has also partnered with MWDOC on educational programs, indoor retrofits and training.

These efforts have been part of statewide water conservation ordinances that require watering landscape watering, serving water in restaurants and bars, and reducing the amount of laundry cleaned by hotels. Further discussion on the City's water conservation ordinance is covered in Section 5 Water Supplies Contingency Plan.

This section analyzes the City's current water demands by customer type, factors that influence those demands, and projections of future water demands for the next 25 years. In addition, to satisfy SBx7-7 requirements, this section provides details of the City's SBx7-7 compliance method selection, baseline water use calculation, and 2015 and 2020 water use targets.

2.2 Factors Affecting Demand

Water demands within the City's service area are dependent on many factors such as local climate conditions and the evolving hydrology of the region, demographics, land use characteristics, and economics. In addition to local factors, southern California's imported water sources are also experiencing drought conditions that impact availability of current and future water supplies.

2.2.1 Climate Characteristics

The City is located within the South Coast Air Basin (SCAB) that encompasses all of Orange County, and the urban areas of Los Angeles, San Bernardino, and Riverside counties. The SCAB climate is characterized by southern California's "Mediterranean" climate: a semi-arid environment with mild winters, warm summers and moderate rainfall.

Local rainfall has limited impacts on reducing demand for the City. Water that infiltrates into the soil may enter groundwater supplies depending on the local geography. However, due to the large extent of impervious cover in southern California, rainfall runoff quickly flows to a system of concrete storm drains and channels that lead directly to the ocean. OCWD is one agency that has successfully captured stormwater along the Santa Ana River and in recharge basins for years and used it as an additional source of supply for groundwater recharge.

Metropolitan's water supplies come from the State Water Project (SWP) and the Colorado River Aqueduct (CRA), influenced by climate conditions in northern California and the Colorado River Basin, respectively. Both regions have been suffering from multi-year drought conditions with record low precipitation which directly impact water supplies to southern California.

2.2.2 Demographics

The City has a 2015 population of 176,649 according to the California State University at Fullerton's Center of Demographics Research (CDR). The City is almost completely built-out, and its population is projected to increase only 2.4 percent by 2040, representing an average growth rate of 0.09 percent per year.

Current and projected growth has decreased slightly since the 2010 UWMP; housing is becoming denser and new residential units are multi-storied within the service area. In the 2010 UWMP, the Brookhurst Triangle Project was slated for development of a residential community on 13.9 acres. That project schedule has changed and was approved in March 2015 by the Garden Grove Planning Commission. The development would create 674-residental units and could begin as early as May 2016. Table 2-1 shows the population projections in five-year increments out to 2040 within the City's service area.

Table 2-1: Population – Current and Projected

Retail: Population - Current and Projected						
Population Served	2015	2020	2025	2030	2035	2040
	176,649	178,729	179,440	180,428	181,002	180,825
NOTES: Center for Demographic Research, California State University, Fullerton 2015						

2.2.3 Land Use

The City's service area can best be described as a predominately single and multi-family residential community located in central Orange County. There are pockets of commercials and tourist catering use within the service area.

2.3 Water Use by Customer Type

An agency's water consumption can be projected by understanding the type of use and customer type creating the demand. Developing local water use profiles helps to identify quantity of water used, and by whom within the agency's service area. A comprehensive profile of the agency's service area enables the impacts of water conservation efforts to be assessed and to project the future benefit of water conservation programs.

The following sections of this UWMP provide an overview of the City's water consumption by customer account type as follows:

- Single-family Residential
- Multi-family Residential
- Commercial
- Institutional/ Government

Other water uses including sales to other agencies and non-revenue water are also discussed in this section.

2.3.1 Overview

There are 33,647 current customer active and inactive service connections in the City's water distribution system with all existing connections metered. Approximately 68.5 percent of the City's water demand is residential; commercial, industrial, institutional and governmental accounts for the remaining 31.5 percent of the total demand.

Table 2-2 contains a summary of the City's total water demand in fiscal year (FY) 2014-15 for potable water.

Table 2-2: Demands for Potable and Raw Water - Actual (AF)

Retail: Demands for Potable and Raw Water - Actual		
Use Type	2015 Actual	
	Level of Treatment When Delivered	Volume
Single Family	Drinking Water	11,838
Multi-Family	Drinking Water	4,625
Institutional/Governmental	Drinking Water	1,677
Commercial	Drinking Water	3,280
Industrial	Drinking Water	1,051
Landscape	Drinking Water	838
Other	Drinking Water	3
Losses	Drinking Water	737
	TOTAL	24,049
NOTES: Data retrieved from MWDOC Customer Class Usage Data and FY 2014-2015 Retail Tracking.		

2.3.2 Non-Residential

Non-residential use includes commercial, industrial, institutional and governmental water demands. Institutional/governmental water use accounts for 7 percent of total water demands, commercial accounts for 13.6 percent, industrial accounts for 4.4 percent and dedicated landscape accounts for 3.5 percent of total demand. The City has a mix of commercial uses (markets, restaurants, etc.), public entities (schools, fire stations and government offices), office complexes, light industrial and warehouses.

2.3.3 Sales to Other Agencies

The City does not sell water to other agencies although it does maintain emergency interconnections with neighboring systems.

2.3.4 Non-Revenue Water

Non-revenue water is defined by the International Water Association (IWA) as the difference between distribution systems input volume (i.e. production) and billed authorized consumption. Non-revenue water consists of three components: unbilled authorized consumption (e.g. hydrant flushing, firefighting, and blow-off water from well start-ups), real losses (e.g. leakage in mains and service lines, and storage tank overflows), and apparent losses (unauthorized consumption, customer metering inaccuracies and systematic data handling errors).

A water loss audit was conducted per AWWA methodology for the City to understand the relationship between water loss, operating costs and revenue losses. This audit was developed by the IWA Water Loss Task Force as a universal methodology that could be applied to any water distribution system. This audit meets the requirements of SB 1420 that was signed into law in September 2014. Understanding

and controlling water loss from a distribution system is an effective way for the City to achieve regulatory standards and manage their existing resources.

2.3.4.1 AWWA Water Audit Methodology

There are five data categories that are part of the AWWA Water Audit: 1) Water Supplied 2) Authorized Consumption 3) Water Losses 4) System Data and 5) Cost Data. Data was compiled from questionnaires, invoices, meter test results, and discussion with the City. Each data value has a corresponding validation score that evaluates the City's internal processes associated with that data entry. The scoring scale is 1-10 with 10 representing best practice.

The Water Supplied section represents the volume of water the City delivered from its own sources, purchased imported water, or water that was either exported or sold to another agency. Validation scores for each supply source correspond to meter accuracy and how often the meters are calibrated. If the calibration results of supply meters were provided, a weighted average of errors was calculated for master meter adjustment. This adjustment factor was applied to reported supply volumes for meters that were found to register either over or under the true volume. Validity scores for meter adjustment are based on how often the meter is read and what method is used.

The Authorized Consumption section breaks down consumption of the volume of Water Supplied. Billed metered water is billed and delivered to customers and makes up the majority of an agency's consumption. Billed unmetered water is water that is delivered to a customer for a set fee but the actual quantity of water is not metered. Customer accounts for this type of use are typically determined by utility policy. Unbilled metered water is the volume used and recorded, but the customer is not charged. This volume is typically used for City facilities per City policy. Unbilled unmetered water is authorized use that is neither billed nor metered which typically includes activities such as firefighting, flushing of water mains and sewers, street cleaning, and fire flow testing. The AWWA Water Audit recommends using the default value of 1.25 percent to represent this use, as calculating an accurate volume is often tedious due to the many different components involved and it represents a small portion of the City's overall use. For each consumption type listed above the associated validation score reflects utility policy for customer accounts, frequency of meter testing and replacement, computer-based billing and transition to electronic metering systems.

Water Losses are defined as the difference between the volume of water supplied and the volume of authorized consumption. Water losses are further broken down into apparent and real losses. Apparent losses include unauthorized consumption, customer meter inaccuracies and systematic data handling errors. Default percentages were provided for the Audit by AWWA for unauthorized consumption and systematic data handling error as this data is not often available. The corresponding default validation score assigned is 5 out of 10. A discrete validation score was included for customer meter inaccuracies to represent quality of meter testing records, testing procedures for meter accuracy, meter replacement cycles, and inclusion of new meter technology.

System Data includes information about the City's physical distribution system and customer accounts. The information included is: length of mains, number of active and inactive service connections, location of customer meters in relation to the property line, and the average operating pressure of the system. The number of service connections is automatically divided by the length of mains to find the service connection density of the system. The calculated service connection density determines which

performance indicators best represent a water system's real loss performance. The validity scores in this section relate to the water system's policies and procedures for calculating and documenting the required system data, quality of records kept, integration with an electronic database including GIS and SCADA, and how often this data is verified.

The final section is Cost Data and contains three important financial values related to system operation, customer cost and water production. The total annual cost of operating the water system, customer retail unit cost and the variable production cost per AF are included. The customer retail unit value is applied to the apparent losses to determine lost revenue, while the variable production cost is typically applied to real losses. In water systems with scarce water supplies, a case can be made for real losses to be valued at the retail rate, as this volume of water could be sold to additional customers if it were not lost.] Validity scores for these items consider how often audits of the financial data and supporting documents are compiled and if third-party accounting professionals are part of the process.

Calculations based on the entered and sufficiently valid data produce a series of results that help the City quantify the volume and financial impacts of water loss and facilitate comparison of the City's water loss performance with that of other water systems who have also performed water loss audits using the AWWA methodology. The City's Data Validity Score was 72 out of 100, with a total water loss volume of 2,362.758 AFY. The Non-Revenue Water volume represents 10.6 percent of the total water supplied by the City. The value of non-revenue water is calculated to be $2,209,296 per year.

The Infrastructure Leakage Index (ILI) is a performance indicator developed from the ratio of Current Annual Real Losses (CARL) to the Unavoidable Annual Real Losses (UARL). CARL was developed as part of the workbook and explained as real losses above. UARL is developed on a per system basis with an equation based on empirical data, developed by IWA that factors in the length of mains (including fire hydrant laterals), number of service connections, average distance of customer service connection piping between the curb stop and the customer meter and the total length of customer service piping, all multiplied by average system pressure. The City received an ILI score of 2.19 which taken at face value is a very high score and indicates that real losses are well managed. This value suggests that the City's real loss volume is beneath the technically achievable minimum, which is possible but unlikely. This requires further field investigation of leakage if leakage detection and control practices are not extensively implemented and/or, given the Data Validity Score for some components in the Audit, further investigation/confirmation of entries such as water supplied/accuracy of supply meters, accuracy of customer meters, systematic data handling errors, and applicability of the default percentages applied in the audit.

Real losses make up a significant portion of the City's total water loss at 72 percent; as most of this was developed from default percentages provided by the AWWA Water Audit. Based on this information, the City can improve water loss by taking a closer look at apparent losses and developing a strategy to better quantify this data in the future. The overall Water Audit score can also be improved by meeting the standards AWWA has developed for each data point through clear City procedures and reliable data.

The result of the AWWA Water Audit completed for the City as required by the 2015 UWMP is summarized in Table 2-4. The water loss summary was calculated over a one-year period from available data and the methodology explained above.

Table 2-3: Water Loss Audit Summary (AF)

Retail: 12 Month Water Loss Audit Reporting	
Reporting Period Start Date (mm/yyyy)	Volume of Water Loss
07/2014	2,363
NOTES:	

2.4 Demand Projections

Demand projections were developed by MWDOC for each agency within their service area based on available data as well as land use, population and economic growth. Three trajectories were developed representing three levels of conservation: 1) continued with existing levels of conservation (lowest conservation), 2) addition of future passive measures and active measures (baseline conservation), and 3) aggressive turf removal program - 20 percent removal by 2040 (aggressive conservation). The baseline demand projection was selected for the 2015 UWMP. The baseline scenario assumes the implementation of future passive measures affecting new developments, including the Model Water Efficient Landscape, plumbing code efficiencies for toilets, and expected plumbing code for high-efficiency clothes washers. It also assumes the implementation of future active measures, assuming the implementation of Metropolitan incentive programs at historical annual levels seen in Orange County.

2.4.1 Demand Projection Methodology

The water demand projections were an outcome of the Orange County (OC) Reliability Study led by MWDOC where demand projections were divided into three regions within Orange County: Brea/La Habra, Orange County Groundwater Basin, and South County. The demand projections were obtained based on multiplying a unit water use factor and a demographic factor for three water use sectors, including single-family and multi-family residential (in gallons per day per household), and non-residential (in gallons per day per employee). The unit water use factors were based on a survey of Orange County water agencies (FY 2013-14) and represent a normal weather, normal economy, and non-drought condition. The demographic factors are future demographic projections, including the number of housing units for single and multi-family residential areas and total employment (number of employees) for the non-residential sector, as provided by CDR.

The OC Reliability Study accounted for drought impacts on 2016 demands by applying the assumption that water demands will bounce back to 85 percent of 2014 levels i.e. pre-drought levels by 2020 and 90 percent by 2025 without future conservation, and continue at 90 percent of unit water use through 2040. The unit water use factor multiplied by a demographic factor yields demand projections without new conservation. To account for new conservation, projected savings from new passive and active conservation were subtracted from these demands.

2.4.2 Agency Refinement

Demand projections were developed by MWDOC for the City as part of the OC Reliability Study. The future demand projections were reviewed and accepted by the City as a basis for the 2015 UWMP.

2.4.3 25 Year Projections

A key component of the 2015 UWMP is to provide insight into the City's future water demand outlook. The City's current water demand is 24,049 AFY, met through locally pumped groundwater and purchased imported water from MWDOC. Table 2-4 is a projection of the City's water demand for the next 25 years.

Table 2-4: Demands for Potable and Raw Water - Projected (AF)

Retail: Demands for Potable and Raw Water - Projected					
Use Type	Projected Water Use *Report To the Extent that Records are Available*				
	2020	2025	2030	2035	2040
Single Family	11,852	12,723	12,810	12,807	12,825
Multi-Family	4,631	4,971	5,005	5,003	5,011
Institutional/Governmental	1,679	1,802	1,815	1,814	1,817
Commercial	3,284	3,525	3,549	3,548	3,554
Industrial	1,052	1,130	1,137	1,137	1,139
Landscape	839	901	907	907	908
Other	3	3	3	3	3
Losses	738	792	798	797	798
TOTAL	24,078	25,847	26,024	26,017	26,055
NOTES: Data retrieved from MWDOC Customer Class Usage Data and Retail Water Agency Projections.					

The above demand values were provided by MWDOC and reviewed by the City as part of the UWMP effort. As the regional wholesale supplier for much of Orange County, MWDOC works in collaboration with each of its retail agencies as well as Metropolitan, its wholesaler, to develop demand projections for imported water. The City will aim to decrease its reliance on imported water by pursuing a variety of water conservation strategies, per capita water use is developed in Section 2.5 below.

Table 2-5: Inclusion in Water Use Projections

Retail Only: Inclusion in Water Use Projections	
Are Future Water Savings Included in Projections?	Yes
If "Yes" to above, state the section or page number, in the cell to the right, where citations of the codes, ordinances, etc… utilized in demand projections are found.	Section 4.1
Are Lower Income Residential Demands Included In Projections?	Yes
NOTES:	

The demand data presented in this section accounts for passive savings in the future. Passive savings are water savings as a result of codes, standards, ordinances and public outreach on water conservation

and higher efficiency fixtures. Passive savings are anticipated to continue for the next 25 years and will result in continued water saving and reduced consumption levels.

2.4.4 Total Water Demand Projections

Based on the information provided above, the total demand for potable water is listed below in Table 2-6. The City has no plans to provide recycled water in its service area.

Table 2-6: Total Water Demands (AF)

Retail: Total Water Demands						
	2015	2020	2025	2030	2035	2040
Potable and Raw Water	24,049	24,078	25,847	26,024	26,017	26,055
Recycled Water Demand	0	0	0	0	0	0
TOTAL WATER DEMAND	24,049	24,078	25,847	26,024	26,017	26,055
NOTES:						

2.4.5 Water Use for Lower Income Households

Since 2010, the UWMP Act has required retail water suppliers to include water use projections for single-family and multi-family residential housing for lower income and affordable households. This will assist the City in complying with the requirement under Government Code Section 65589.7 granting priority for providing water service to lower income households. A lower income household is defined as a household earning below 80 percent of the median household income (MHI).

DWR recommends retail suppliers rely on the housing elements of city or county general plans to quantify planned lower income housing with the City's service area (DWR, 2015 UWMP Guidebook, February 2016). The Regional Housing Needs Assessment (RHNA) assists jurisdictions in updating general plan's housing elements section. The RHNA identifies housing needs and assesses households by income level for the City through 2010 decennial Census and 2005-2009 American Community Survey data. The fifth cycle of the RHNA covers the planning period of October 2013 to October 2021. The Southern California Association of Governments (SCAG) adopted the RHNA Allocation Plan for this cycle on October 4, 2012 requiring housing elements updates by October 15, 2013. The California Department of Housing and Community Development reviewed the housing elements data submitted by jurisdictions in the SCAG region and concluded the data meets statutory requirements for the assessment of current housing needs.

The housing elements from the RHNA includes low income housing broken down into three categories: extremely low (less than 30 percent MHI), very low (31 percent - 50 percent MHI), and lower income (51 percent - 80 percent MHI). The report gives the household distribution for all households of various income levels in the City which can be seen in Table 2-7. Altogether the City has 48.75 percent low income housing (SCAG, RHNA, November 2013).

Table 2-7: Household Distribution Based on Median Household Income

Number of Households by Income	
Extremely Low Income	7,220
Very Low Income	6,327
Lower Income	8,468
Moderate Income	9,337
Above Moderate Income	13,805
Total Households	45,157

Table 2-8 provides a breakdown of the projected water needs for low income single family and multifamily units. The projected water demands shown here represent 48.75 percent of the projected water demand for the single-family and multifamily categories provided in Table 2-4 above. For example, the total low income single family residential demand is projected to be 5,778 AFY in 2020 and 6,252 AFY in 2040.

Table 2-8: Projected Water Demands for Housing Needed for Low Income Households (AF)

Low Income Water Use					
Water Use Sector	Fiscal Year Ending				
	2020	2025	2030	2035	2040
Total Residential Demand	16,483	17,694	17,815	17,810	17,836
SF Residential Demand-Low Income Households	5,778	6,203	6,245	6,243	6,252
MF Residential Demand-Low Income Households	2,257	2,423	2,440	2,439	2,443
Total Low Income Households Demand	8,035	8,626	8,685	8,682	8,695

2.5 SBx7-7 Requirements

The Water Conservation Act of 2009, also known as Senate Bill (SB) x7-7, signed into law on February 3, 2010, requires the State of California to reduce urban water use by 20 percent by the year 2020. The City must determine baseline water use during their baseline period and water use targets for the years 2015 and 2020 to meet the state's water reduction goal. The City may choose to comply with SBx7-7 individually or as a region in collaboration with other retail water suppliers. Under the regional compliance option, the City is still required to report its individual water use targets. The City is required to be in compliance with SBx7-7 either individually or as part of the alliance, or demonstrate they have a plan or have secured funding to be in compliance, in order to be eligible for water related state grants and loans on and after July 16, 2016.

For the 2015 UWMP, the City must demonstrate compliance with its 2015 water use target to indicate whether or not they are on track to meeting the 2020 water use target. The City also revised their baseline per capita water use calculations using 2010 U.S. Census data. Changes in the baseline calculations also result in updated per capita water use targets.

DWR also requires the submittal of SBx7-7 Verification Forms, a set of standardized tables to demonstrate compliance with the Water Conservation Act in this 2015 UWMP. This form is included as Appendix B.

2.5.1 Baseline Water Use

The baseline water use is the City's gross water use divided by its service area population, reported in gallons per capita per day (GPCD). Gross water use is a measure of water that enters the distribution system of the supplier over a 12-month period with certain allowable exclusions. These exclusions are:

- Recycled water delivered within the service area
- Indirect recycled water
- Water placed in long term storage
- Water conveyed to another urban supplier
- Water delivered for agricultural use
- Process water

Water suppliers within the OCWD Groundwater Basin, including the City, have the option of choosing to deduct recycled water used for indirect potable reuse from their gross water use to account for the recharge of recycled water into the basin by OCWD, historically through Water Factory 21, and now by the Groundwater Replenishment System (GWRS).

Water suppliers must report baseline water use for two baseline periods, the 10- to 15-year baseline (baseline GPCD) and the five-year baseline (target confirmation) as described below.

2.5.1.1 Ten to 15-Year Baseline Period (Baseline GPCD)

The first step to calculating the City's water use targets is to determine its base daily per capita water use (baseline water use). The baseline water use is calculated as a continuous (rolling) 10-year average during a period, which ends no earlier than December 31, 2004 and no later than December 31, 2010. Water suppliers whose recycled water made up 10 percent or more of their 2008 retail water delivery can use up to a 15-year average for the calculation. Recycled water use was less than 10 percent of the City's retail delivery in 2008; therefore, a 10-year baseline period is used.

The City's baseline water use is 163 GPCD, obtained from the 10-year period July 1, 1996 to June 30, 2005.

2.5.1.2 Five-Year Baseline Period (Target Confirmation)

Water suppliers are required to calculate water use, in GPCD, for a five-year baseline period. This number is used to confirm that the selected 2020 target meets the minimum water use reduction requirements. Regardless of the compliance option adopted by the City, it will need to meet a minimum water use target of 5 percent reduction from the five-year baseline water use. This five-year baseline water use is calculated as a continuous five-year average during a period, which ends no earlier than

December 31, 2007 and no later than December 31, 2010. The City's five-year baseline water use is 156 GPCD, obtained from the five-year period July 1, 2003 to June 30, 2008.

2.5.1.3 Service Area Population

The City's service area boundaries correspond with the boundaries for a city or census designated place. This allows the City to use service area population estimates prepared by the Department of Finance (DOF). The CDR, California State University, Fullerton, is the entity which compiles population data for Orange County based on DOF data. The calculation of the City's baseline water use and water use targets in the 2010 UWMP was based on the 2000 U.S. Census population numbers obtained from CDR. The baseline water use and water use targets in this 2015 UWMP have been revised based on the 2010 U.S. Census population obtained from CDR in 2012.

2.5.2 SBx7-7 Water Use Targets

In the 2015 UWMP, the City may update its 2020 water use target by selecting a different target method than what was used in 2010. The target methods and determination of the 2015 and 2020 targets are described below.

2.5.2.1 SBx7-7 Target Methods

DWR has established four target calculation methods for urban retail water suppliers to choose from. The City is required to adopt one of the four options to comply with SBx7-7 requirements. The four options include:

- *Option 1* requires a simple 20 percent reduction from the baseline by 2020 and 10 percent by 2015.
- *Option 2* employs a budget-based approach by requiring an agency to achieve a performance standard based on three metrics
    - Residential indoor water use of 55 GPCD
    - Landscape water use commensurate with the Model Landscape Ordinance
    - 10 percent reduction in baseline commercial/industrial/institutional (CII) water use
- *Option 3* is to achieve 95 percent of the applicable state hydrologic region target as set forth in the State's 20x2020 Water Conservation Plan.
- *Option 4* requires the subtraction of Total Savings from the baseline GPCD:
    - Total savings includes indoor residential savings, meter savings, CII savings, and landscape and water loss savings.

With MWDOC's assistance in the calculation of the City's base daily per capita use and water use targets, the City selected to comply with Option 3 consistent with the option selected in 2010.

2.5.2.2 2015 and 2020 Targets

Under Compliance Option 3, to achieve 95 percent of the South Coast Hydrologic Region target as set forth in the State's 20x2020 Water Conservation Plan, the City's 2015 target is 153 GPCD and the 2020 target is 142 GPCD as summarized in Table 2-9. The 2015 target is the midway value between the 10-year baseline and the confirmed 2020 target. In addition, the confirmed 2020 target needs to meet a minimum of 5 percent reduction from the five-year baseline water use.

Table 2-9: Baselines and Targets Summary

Baselines and Targets Summary *Retail Agency*					
Baseline Period	Start Year	End Year	Average Baseline GPCD*	2015 Interim Target *	Confirmed 2020 Target*
10-15 year	*1996*	*2005*	*163*	*153*	*142*
5 Year	*2004*	*2008*	*156*		
*All values are in Gallons per Capita per Day (GPCD)					
NOTES:					

Table 2-10 compares the City's 2015 water use target to its actual 2015 consumption. Based on this comparison, the City is in compliance with its 2015 interim target and has already met the 2020 water use target.

Table 2-10: 2015 Compliance

2015 Compliance *Retail Agency*			
Actual 2015 GPCD	2015 Interim Target GPCD	2015 GPCD *(Adjusted if applicable)*	Did Supplier Achieve Targeted Reduction for 2015? Y/N
102	153	102	Yes
All values are in Gallons per Capita per Day (GPCD)			
NOTES:			

2.5.3 Regional Alliance

A retail supplier may choose to meet the SBx7-7 targets on its own or it may form a regional alliance with other retail suppliers to meet the water use target as a region. Within a Regional Alliance, each retail water supplier will have an additional opportunity to achieve compliance under both an individual target and a regional target.

- If the Regional Alliance meets its water use target on a regional basis, all agencies in the alliance are deemed compliant.
- If the Regional Alliance fails to meet its water use target, each individual supplier will have an opportunity to meet their water use targets individually.

The City is a member of the Orange County 20x2020 Regional Alliance formed by MWDOC, its wholesaler. This regional alliance consists of 29 retail agencies in Orange County as described in MWDOC's 2015 UWMP. MWDOC provides assistance in the calculation of each retail agency's baseline water use and water use targets.

In 2015, the regional baseline and targets were revised to account for any revisions made by the retail agencies to their individual 2015 and 2020 targets. The regional water use target is the weighted average of the individual retail agencies' targets (by population). The Orange County 20x2020 Regional Alliance weighted 2015 target is 175.9 GPCD and 2020 target is 156.4 GPCD. The actual 2015 water use in the region is 129 GPCD, i.e. the region has already met its 2020 GPCD goal.

3 WATER SOURCES AND SUPPLY RELIABILITY

3.1 Overview

The City relies on a combination of imported water and local groundwater to meet its water needs. The City works together with three primary agencies, Metropolitan, MWDOC, and OCWD to ensure a safe and reliable water supply that will continue to serve the community in periods of drought and shortage. The sources of imported water supplies include the CRA and the SWP provided by Metropolitan and delivered through MWDOC.

The City's main source of water supply is groundwater from the Lower Santa Ana River Groundwater Basin, also known as the Orange County Groundwater Basin. Currently, the City relies on approximately 70 percent groundwater and 30 percent imported and the water supply mix is projected to remain roughly the same by 2040. The City's projected water supply portfolio is shown on Figure 3-1.

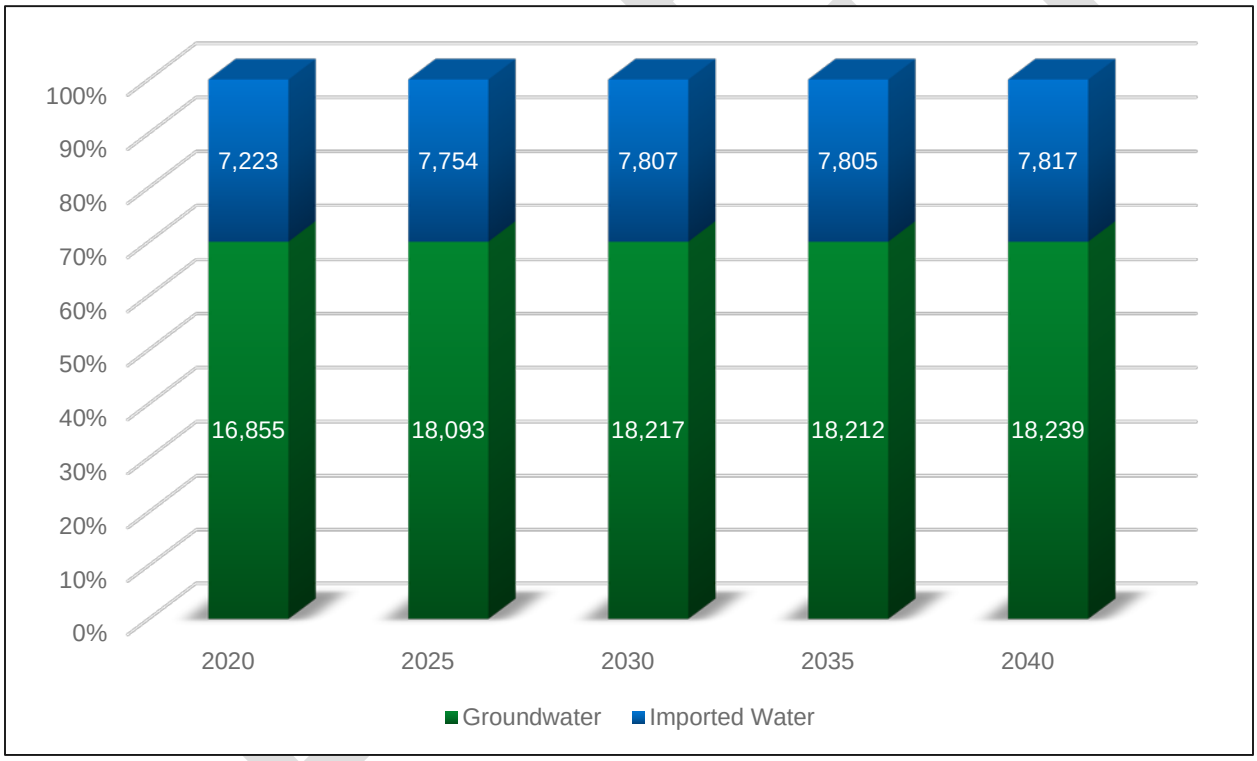


Figure 3-1: Water Supply Sources in the City (AF)

The following sections provide a detailed discussion of the City's water sources as well as the future water supply portfolio for the next 25 years. Additionally, the City's projected supply and demand under various hydrological conditions are compared to determine the City's supply reliability for the 25 year planning horizon.

3.2 Imported Water

The City supplements its local groundwater with imported water purchased from Metropolitan through MWDOC. The City currently relies on 6,640 AFY of imported water purchased wholesale from Metropolitan. Metropolitan's principal sources of water are the Colorado River via the CRA and the Lake Oroville watershed in Northern California through the SWP. The raw water obtained from these sources is, for Orange County, treated at the Robert B. Diemer Filtration Plant located north of Yorba Linda. Typically, the Diemer Filtration Plant receives a blend of Colorado River water from Lake Mathews through the Metropolitan Lower Feeder and SWP water through the Yorba Linda Feeder. The City currently maintains four connections to the Metropolitan system along the Orange County Feeder with a total available capacity of 66 cubic feet per second (cfs).

The West Orange County Water Board (WOCWB), a Joint Powers Agency, manages surface water deliveries from Metropolitan to five (5) of its member agencies. These member agencies are the cities of Garden Grove, Fountain Valley (no voting rights), Huntington Beach, Westminster, and Seal Beach. WOCWB oversees the maintenance of two (2) feeder pipelines that connect to the treated surface water supply. These pipelines have a capacity of 21 cfs and 45 cfs. Each of the member agencies has contributed to the capital cost for the capacity of the feeder pipelines and directly pays MWDOC for the use of water.

3.2.1 Colorado River Supplies

The Colorado River was Metropolitan's original source of water after Metropolitan's establishment in 1928. The CRA, which is owned and operated by Metropolitan, transports water from the Colorado River to its terminus at Lake Mathews in Riverside County. The actual amount of water per year that may be conveyed through the CRA to Metropolitan's member agencies is subject to the availability of Colorado River water for delivery.

The CRA includes supplies from the implementation of the Quantification Settlement Agreement and related agreements to transfer water from agricultural agencies to urban uses. The 2003 Quantification Settlement Agreement enabled California to implement major Colorado River water conservation and transfer programs, stabilizing water supplies for 75 years and reducing the state's demand on the river to its 4.4 MAF entitlement. Colorado River transactions are potentially available to supply additional water up to the CRA capacity of 1.25 million acre-feet (MAF) on an as-needed basis. Water from the Colorado River or its tributaries is available to users in California, Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming, as well as to Mexico. California is apportioned the use of 4.4 MAF of water from the Colorado River each year plus one-half of any surplus that may be available for use collectively in Arizona, California, and Nevada. In addition, California has historically been allowed to use Colorado River water apportioned to but not used by Arizona or Nevada. Metropolitan has a basic entitlement of 550,000 AFY of Colorado River water, plus surplus water up to an additional 662,000 AFY when the following conditions exists (Metropolitan, 2015 Draft UWMP, March 2016):

- Water unused by the California holders of priorities 1 through 3
- Water saved by the Palo Verde land management, crop rotation, and water supply program
- When the U.S. Secretary of the Interior makes available either one or both:

- Surplus water is available
- Colorado River water is apportioned to but unused by Arizona and/or Nevada

Unfortunately, Metropolitan has not received surplus water for a number of years. The Colorado River supply faces current and future imbalances between water supply and demand in the Colorado River Basin due to long term drought conditions. Over the past 16 years (2000-2015), there have only been three years when the Colorado River flow has been above average (Metropolitan, 2015 Draft UWMP, March 2016). The long-term imbalance in future supply and demand is projected to be approximately 3.2 MAF by the year 2060.

Approximately 40 million people rely on the Colorado River and its tributaries for water with 5.5 million acres of land using Colorado River water for irrigation. Climate change will affect future supply and demand as increasing temperatures may increase evapotranspiration from vegetation along with an increase in water loss due to evaporation in reservoirs, therefore reducing the available amount of supply from the Colorado River and exacerbating imbalances between increasing demands from rapid growth and decreasing supplies.

Four water supply scenarios were developed around these uncertainties, each representing possible water supply conditions. These four scenarios are as follow:

- **Observed Resampled:** future hydrologic trends and variability are similar to the past approximately 100 years.
- **Paleo Resampled:** future hydrologic trends and variability are represented by reconstructions of streamflow for a much longer period in the past (approximately 1,250 years) that show expanded variability.
- **Paleo Conditioned:** future hydrologic trends and variability are represented by a blend of the wet-dry states of the longer paleo-reconstructed period.
- **Downscaled General Circulation Model (GCM) Projected:** future climate will continue to warm, with regional precipitation and temperature trends represented through an ensemble of future downscaled GCM projections.

The Colorado River Basin Water Supply and Demand Study (Study) assessed the historical water supply in the Colorado River Basin through two historical streamflow data sets, from the year 1906 through 2007 and the paleo-reconstructed record from 762 through 2005. The following are findings from the study:

- Increased temperatures in both the Upper and Lower Colorado River Basins since the 1970s has been observed.
- Loss of springtime snowpack was observed with consistent results across the lower elevation northern latitudes of the western United States. The large loss of snow at lower elevations strongly suggest the cause is due to shifts in temperature.
- The deficit between the two year running average flow and the long-term mean annual flow that started in the year 2000 is more severe than any other deficit in the observed period, at nine years and 28 MAF deficit.

- There are deficits of greater severity from the longer paleo record compared to the period from 1906 through 2005. One deficit amounted to 35 MAF through a span of 16 years.
- A summary of the trends from the observed period suggest declining stream flows, increases in variability, and seasonal shifts in streamflow that may be related to shifts in temperature.

Findings concerning the future projected supply were obtained from the Downscaled GCM Projected scenario as the other methods did not consider the impacts of a changing climate beyond what has occurred historically. These findings include:

- Increased temperatures are projected across the Colorado River Basin with larger changes in the Upper Basin than in the Lower Basin. Annual Basin-wide average temperature is projected to increase by 1.3 degrees Celsius over the period through 2040.
- Projected seasonal trends toward drying are significant in certain regions. A general trend towards drying is present in the Colorado River Basin, although increases in precipitation are projected for some higher elevation and hydrologically productive regions. Consistent and expansive drying conditions are projected for the spring and summer months throughout the Colorado River Basin, although some areas in the Lower Basin are projected to experience slight increases in precipitation, which is thought to be attributed to monsoonal influence in the region. Upper Basin precipitation is projected to increase in the fall and winter, and Lower Basin precipitation is projected to decrease.
- Snowpack is projected to decrease due to precipitation falling as rain rather than snow and warmer temperatures melting the snowpack earlier. Areas where precipitation does not change or increase is projected to have decreased snowpack in the fall and early winter. Substantial decreases in spring snowpack are projected to be widespread due to earlier melt or sublimation of snowpack.
- Runoff (both direct and base flow) is spatially diverse, but is generally projected to decrease, except in the northern Rockies. Runoff is projected to increase significantly in the higher elevation Upper Basin during winter but is projected to decrease during spring and summer.

The following future actions must be taken to implement solutions and help resolve the imbalance between water supply and demand in areas that use Colorado River water (U.S. Department of the Interior Bureau of Reclamation, Colorado River Basin Water Supply and Demand Study, December 2012):

- Resolution of significant uncertainties related to water conservation, reuse, water banking, and weather modification concepts.
- Costs, permitting issues, and energy availability issues relating to large-capacity augmentation projects need to be identified and investigated.
- Opportunities to advance and improve the resolution of future climate projections should be pursued.
- Consideration should be given to projects, policies, and programs that provide a wide-range of benefits to water users and healthy rivers for all users.

3.2.2 State Water Project Supplies

The SWP consists of a series of pump stations, reservoirs, aqueducts, tunnels, and power plants operated by DWR and is an integral part of the effort to ensure that business and industry, urban and suburban residents, and farmers throughout much of California have sufficient water. The SWP is the largest state-built, multipurpose, user-financed water project in the United States. Nearly two-thirds of residents in California receive at least part of their water from the SWP with approximately 70 percent of SWP's contracted water supply going to urban users and 30 percent to agricultural users. The primary purpose of the SWP is to divert and store water during wet periods in Northern and Central California and distribute it to areas of need in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and southern California.

The availability of water supplies from the SWP can be highly variable. A wet water year may be followed by a dry or critically dry year and fisheries issues can restrict the operations of the export pumps even when water supplies are available.

The Sacramento-San Joaquin River Delta (Delta) is key to the SWP's ability to deliver water to its agricultural and urban contractors. All but five of the 29 SWP contractors receive water deliveries below the Delta (pumped via the Harvey O. Banks or Barker Slough pumping plants). However, the Delta faces many challenges concerning its long-term sustainability such as climate change posing a threat of increased variability in floods and droughts. Sea level rise complicates efforts in managing salinity levels and preserving water quality in the Delta to ensure a suitable water supply for urban and agricultural use. Furthermore, other challenges include continued subsidence of Delta islands, many of which are below sea level, and the related threat of a catastrophic levee failure as the water pressure increases, or as a result of a major seismic event.

Ongoing regulatory restrictions, such as those imposed by federal biological opinions (Biops) on the effects of SWP and the federal Central Valley Project (CVP) operations on certain marine life, also contributes to the challenge of determining the SWP's water delivery reliability. In dry, below-normal conditions, Metropolitan has increased the supplies delivered through the California Aqueduct by developing flexible CVP/SWP storage and transfer programs. The goal of the storage/transfer programs is to develop additional dry-year supplies that can be conveyed through the available Harvey O. Banks pumping plant capacity to maximize deliveries through the California Aqueduct during dry hydrologic conditions and regulatory restrictions. In addition, the California State Water Resources Control Board (SWRCB) has set water quality objectives that must be met by the SWP including minimum Delta outflows, limits on SWP and CVP Delta exports, and maximum allowable salinity level.

Metropolitan's Board approved a Delta Action Plan in June 2007 that provides a framework for staff to pursue actions with other agencies and stakeholders to build a sustainable Delta and reduce conflicts between water supply conveyance and the environment. The Delta action plan aims to prioritize immediate short-term actions to stabilize the Delta while an ultimate solution is selected, and mid-term steps to maintain the Delta while a long-term solution is implemented. Currently, Metropolitan is working towards addressing three basin elements: Delta ecosystem restoration, water supply conveyance, and flood control protection and storage development.

"Table A" water is the maximum entitlement of SWP water for each water contracting agency. Currently, the combined maximum Table A amount is 4.17 MAFY. Of this amount, 4.13 MAFY is the maximum

Table A water available for delivery from the Delta pumps as stated in the State Water Contract. However, deliveries commonly are less than 50 percent of the Table A.

SWP contractors may receive Article 21 water on a short-term basis in addition to Table A water if requested. Article 21 of SWP contracts allows contractors to receive additional water deliveries only under specific conditions, generally during wet months of the year (December through March). Because an SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of the SWP, there are few contractors like Metropolitan that can access such supplies.

Carryover water is SWP water allocated to an SWP contractor and approved for delivery to the contractor in a given year but not used by the end of the year. The unused water is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Turnback pool water is essentially unused Table A water. Turnback pool water is able to be purchased by another contractor depending on its availability.

SWP Delta exports are the water supplies that are transferred directly to SWP contractors or to San Luis Reservoir storage south of the Delta via the Harvey O. Banks pumping plant. Estimated average annual Delta exports and SWP Table A water deliveries have generally decreased since 2005, when Delta export regulations affecting SWP pumping operations became more restrictive due to the Biops. A summary of SWP water deliveries from the years 2005 and 2013 is summarized in Table 3-1.

Table 3-1: Metropolitan Colorado River Aqueduct Program Capabilities

Year	Average Annual Delta Exports (MAF)	Average Annual Table A Deliveries (MAF)
2005	2.96	2.82
2013	2.61	2.55
Percent Change	-11.7%	-9.4%

The following factors affect the ability to estimate existing and future water delivery reliability:

- Water availability at the source: Availability depends on the amount and timing of rain and snow that fall in any given year. Generally, during a single dry year or two, surface and groundwater storage can supply most water deliveries, but multiple dry years can result in critically low water reserves.
- Water rights with priority over the SWP: Water users with prior water rights are assigned higher priority in DWR's modeling of the SWP's water delivery reliability, even ahead of SWP Table A water.
- Climate change: mean temperatures are predicted to vary more significantly than previously expected. This change in climate is anticipated to bring warmer winter storms that result in less snowfall at lower elevations, reducing total snowpack. From historical data, DWR projects that by 2050, the Sierra snowpack will be reduced from its historical average by 25 to 40 percent. Increased precipitation as rain could result in a larger number of "rain-on-snow" events, causing snow to melt earlier in the year and over fewer days than historically, affecting the availability of water for pumping by the SWP during summer.

- Regulatory restrictions on SWP Delta exports due to the Biops to protect special-status species such as delta smelt and spring- and winter-run Chinook salmon. Restrictions on SWP operations imposed by state and federal agencies contribute substantially to the challenge of accurately determining the SWP's water delivery reliability in any given year.
- Ongoing environmental and policy planning efforts: the California WaterFix involves water delivery improvements that could reduce salinity levels by diverting a greater amount of lower salinity Sacramento water to the South Delta export pumps. The EcoRestore Program aims to restore at least 30,000 acres of Delta habitat, and plans to be well on the way to meeting that goal by the year 2020.
- Delta levee failure: The levees are vulnerable to failure because most original levees were simply built with soils dredged from nearby channels and were not engineered. A breach of one or more levees and island flooding could affect Delta water quality and SWP operations for several months. When islands are flooded, DWR may need to drastically decrease or even cease SWP Delta exports to evaluate damage caused by salinity in the Delta.

The Delta Risk Management Strategy addresses the problem of Delta levee failure and evaluates alternatives to reduce the risk to the Delta. Four scenarios were developed to represent a range of possible risk reduction strategies (Department of Water Resources, The State Water Project Final Delivery Capability Report 2015, July 2015). They are:

- ***Trial Scenario 1 Improved Levees:*** This scenario looks at improving the reliability of Delta levees against flood-induced failures by providing up to 100-year flood protection. The report found that improved levees would not reduce the risk of potential water export interruptions, nor would it change the seismic risk of most levees.
- ***Trial Scenario 2 Armored Pathway:*** This scenario looks at improving the reliability of water conveyance by creating a route through the Delta that has high reliability and the ability to minimize saltwater intrusion into the south Delta. The report found that this scenario would have the joint benefit of reducing the likelihood of levee failures from flood events and earthquakes, and of significantly reducing the likelihood of export disruptions.
- ***Trial Scenario 3 Isolated Conveyance:*** This scenario looks to provide high reliability for conveyance of export water by building an isolated conveyance facility on the east side of the Delta. The effects of this scenario are similar to those for Trial Scenario 2 but with the added consequence of seismic risk of levee failure on islands that are not part of the isolated conveyance facility.
- ***Trial Scenario 4 Dual Conveyance:*** This scenario is a combination of Scenarios 2 and 3 as it looks to improve reliability and flexibility for conveyance of export water by constructing an isolated conveyance facility and through-Delta conveyance. It would mitigate the vulnerability of water exports associated with Delta levee failure and offer flexibility in water exports from the Delta and the isolated conveyance facility. However, seismic risk would not be reduced on islands not part of the export conveyance system or infrastructure pathway.

DWR has altered the SWP operations to accommodate species of fish listed under the Biops, and these changes have adversely impacted SWP deliveries. DWR's Water Allocation Analysis indicated that export

restrictions are currently reducing deliveries to Metropolitan as much as 150 TAF to 200 TAF under median hydrologic conditions.

Operational constraints likely will continue until a long-term solution to the problems in the Bay-Delta is identified and implemented. New biological opinions for listed species under the Federal ESA or by the California Department of Fish and Game's issuance of incidental take authorizations under the Federal ESA and California ESA might further adversely affect SWP and CVP operations. Additionally, new litigation, listings of additional species or new regulatory requirements could further adversely affect SWP operations in the future by requiring additional export reductions, releases of additional water from storage or other operational changes impacting water supply operations.

3.2.3 Storage

Storage is a major component of Metropolitan's dry year resource management strategy. Metropolitan's likelihood of having adequate supply capability to meet projected demands, without implementing its Water Supply Allocation Plan (WSAP), is dependent on its storage resources.

Lake Oroville is the SWP's largest storage facility, with a capacity of about 3.5 MAF. The water is released from Oroville Dam into the Feather River as needed, which converges with the Sacramento River while some of the water at Bethany Reservoir is diverted from the California Aqueduct into the South Bay Aqueduct. The primary pumping plant, the Harvey O. Banks pumping plant, pumps Delta water into the California Aqueduct, which is the longest water conveyance system in California.

3.3 Groundwater

Historically, local groundwater has been the cheapest and most reliable source of supply for the City. The City has four active wells that draw water from the Basin.

3.3.1 Basin Characteristics

The Basin underlies the northerly half of Orange County beneath broad lowlands. The Basin managed by OCWD covers an area of approximately 350 square miles, bordered by the Coyote and Chino Hills to the north, the Santa Ana Mountains to the northeast, and the Pacific Ocean to the southwest. The Basin boundary extends to the Orange County-Los Angeles Line to the northwest, where groundwater flows across the county line into the Central Groundwater Basin of Los Angeles County. The total thickness of sedimentary rocks in the Basin is over 20,000 feet, with only the upper 2,000 to 4,000 feet containing fresh water. The Pleistocene or younger aquifers comprising this Basin are over 2,000 feet deep and form a complex series of interconnected sand and gravel deposits. The Basin's full volume is approximately 66 MAF.

There are three major aquifer systems that have been subdivided by OCWD, the Shallow Aquifer System, the Principal Aquifer System, and the Deep Aquifer System. These three aquifer systems are hydraulically connected as groundwater is able to flow between each other through intervening aquitards or discontinuities in the aquitards. The Shall Aquifer system occurs from the surface to approximately 250 feet below ground surface. Most of the groundwater from this aquifer system is pumped by small water systems for industrial and agricultural use. The Principal Aquifer system occurs at depths between 200 and 1,300 feet below ground surface. Over 90 percent of groundwater production is from wells that are

screened within the Principal Aquifer system. Only a minor amount of groundwater is pumped from the Deep Aquifer system, which underlies the Principal Aquifer system and is up to 2,000 feet deep in the center of the Basin. The three major aquifer systems are shown on Figure 3-2.

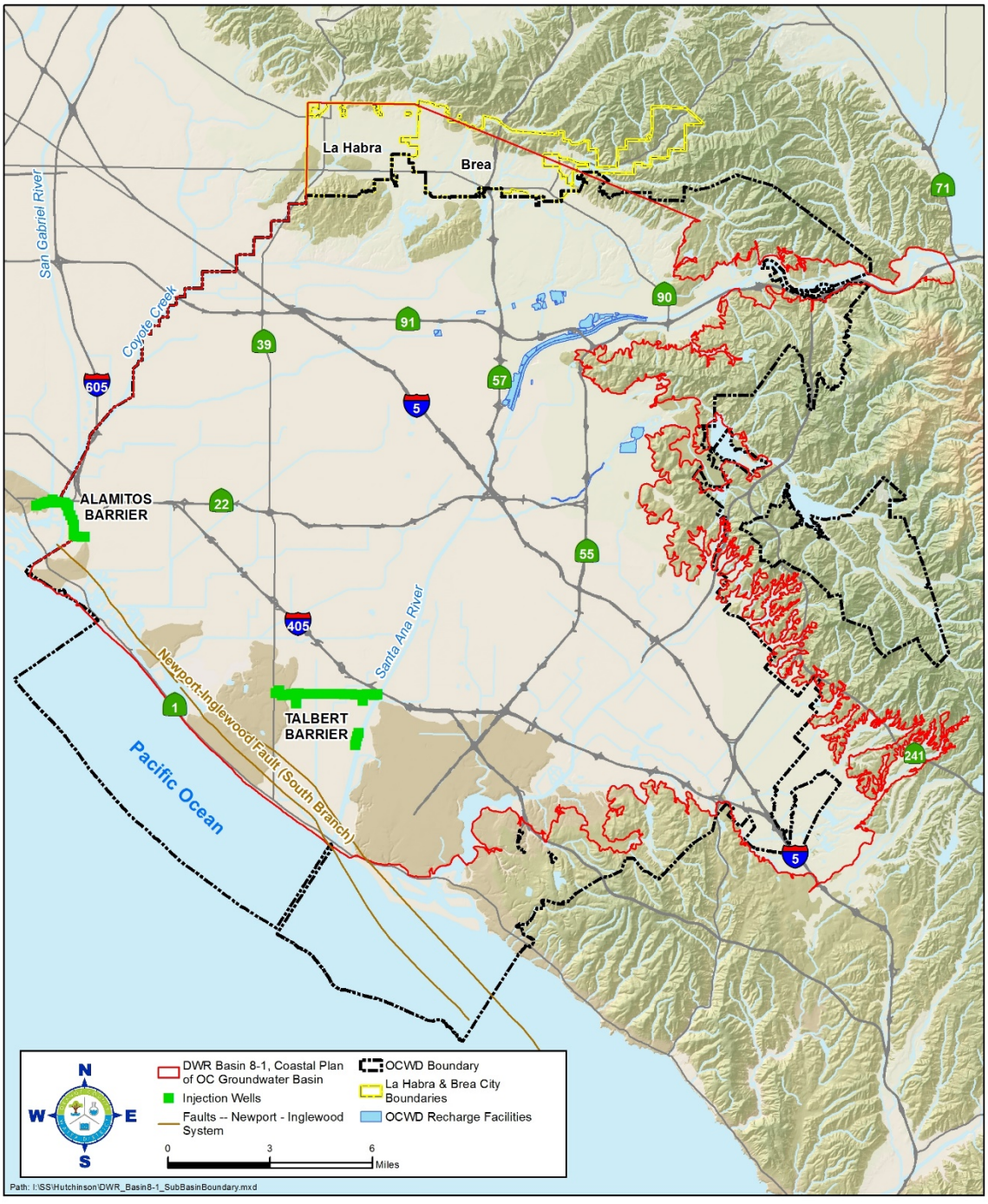


Figure 3-2: Map of the Orange County Groundwater Basin and its Major Aquifer Systems

The OCWD was formed in 1933 by a special legislative act of the California State Legislature to protect and manage the County's vast, natural, groundwater supply using the best available technology and defend its water rights to the Basin. This legislation is found in the State of California Statutes, Water – Uncodified Acts, Act 5683, as amended. The Basin is managed by OCWD under the Act, which functions as a statutorily-imposed physical solution.

Groundwater levels are managed within a safe basin operating range to protect the long-term sustainability of the Basin and to protect against land subsidence. OCWD regulates groundwater levels in the Basin by regulating the annual amount of pumping (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.3.2 Basin Production Percentage

The Basin is not adjudicated and as such, pumping from the Basin is managed through a process that uses financial incentives to encourage groundwater producers to pump a sustainable amount of water. The framework for the financial incentives is based on establishing the basin production percentage (BPP), the percentage of each Producer's total water supply that comes from groundwater pumped from the Basin. Groundwater production at or below the BPP is assessed a Replenishment Assessment (RA). While there is no legal limit as to how much an agency pumps from the Basin, there is a financial disincentive to pump above the BPP. Agencies that pump above the BPP are charged the RA plus the Basin Equity Assessment (BEA), which is calculated so that the cost of groundwater production is greater than MWDOC's full service rate. The BEA can be increased to discourage production above the BPP. The BPP is set uniformly for all Producers by OCWD on an annual basis.

The BPP is set based on groundwater conditions, availability of imported water supplies, and Basin management objectives. The supplies available for recharge must be estimated for a given year. The supplies of recharge water that are estimated are: 1) Santa Ana River stormflow, 2) Natural incidental recharge, 3) Santa Ana River baseflow, 4) GWRS supplies, and 5) other supplies such as imported water and recycled water purchased for the Alamitos Barrier. The BPP is a major factor in determining the cost of groundwater production from the Basin for that year.

In some cases, OCWD encourages treating and pumping groundwater that does not meet drinking water standards in order to protect water quality. This is achieved by using a financial incentive called the BEA Exemption. A BEA Exemption is used to clean up and contain the spread of poor quality water. OCWD uses a partial or total exemption of the BEA to compensate a qualified participating agency or Producer for the costs of treating poor quality groundwater. When OCWD authorizes a BEA exemption for a project, it is obligated to provide the replenishment water for the production above the BPP and forgoes the BEA revenue that OCWD would otherwise receive from the producer (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.3.2.1 2015 OCWD Groundwater Management Plan

OCWD was formed in 1933 by the California legislature to manage and operate the Basin in order to protect and increase the Basin's sustainable yield in a cost-effective manner. As previously mentioned, the BPP is the primary mechanism used by OCWD to manage pumping in the Basin. In 2013, OCWD's Board of Directors adopted a policy to establish a stable BPP with the intention to work toward achieving

and maintaining a 75 percent BPP by FY 2015-16. Although BPP is set at 75 percent, based on discussions with OCWD a conservative BPP of 70 percent is assumed through 2040. Principles of this policy include:

- OCWD's goal is to achieve a stable 75 percent BPP, while maintaining the same process of setting the BPP on an annual basis, with the BPP set in April of each year after a public hearing has been held and based upon the public hearing testimony, presented data, and reports provided at that time.
- OCWD would endeavor to transition to the 75 percent BPP between 2013 and 2015 as construction of the GWRS Initial Expansion Project is completed. This expansion will provide an additional 31,000 AFY of water for recharging the groundwater basin.
- OCWD must manage the Basin in a sustainable manner for future generations. The BPP will be reduced if future conditions warrant the change.
- Each project and program to achieve the 75 percent BPP goal will be reviewed individually and assessed for their economic viability.

The Basin's storage levels would be managed in accordance to the 75 percent BPP policy. It is presumed that the BPP will not decrease as long as the storage levels are between 100,000 and 300,000 AF from full capacity. If the Basin is less than 100,000 AF below full capacity, the BPP will be raised. If the Basin is over 350,000 AF below full capacity, additional supplies will be sought after to refill the Basin and the BPP will be lowered.

The Basin is managed to maintain water storage levels of not more than 500,000 AF below full condition to avoid permanent and significant negative or adverse impacts. Operating the Basin in this manner enables OCWD to encourage reduced pumping during wet years when surface water supplies are plentiful and increase pumping during dry years to provide additional local water supplies during droughts.

OCWD determines the optimum level of storage for the following year when it sets the BPP each year. Factors that affect this determination include the current storage level, regional water availability, and hydrologic conditions. When the Basin storage approaches the lower end of the operating range, immediate issues that must be addressed include seawater intrusion, increased risk of land subsidence, and potential for shallow wells to become inoperable due to lower water levels (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.3.2.2 OCWD Engineer's Report

The OCWD Engineer's Report reports on the groundwater conditions and investigates information related to water supply and Basin usage within OCWD's service area.

The overall BPP achieved in the 2013 to 2014 water year within OCWD for non-irrigation use was 75.2 percent. However, a BPP level above 75 percent may be difficult to achieve. Therefore, a BPP ranging from 65 percent to 70 percent is currently being proposed for the ensuing FY 2015-16. Analysis of the Basin's projected accumulated overdraft, the available supplies to the Basin (assuming average hydrology) and the projected pumping demands indicate that this level of pumping can be sustained for 2015-16 without harming the Basin.

A BPP of 70 percent corresponds to approximately 320,000 AF of groundwater production including 22,000 AF of groundwater production above the BPP to account for several groundwater quality enhancement projects discussed earlier.

In FY 2015-16 additional production of approximately 22,000 AF above the BPP will be undertaken by the City of Tustin, City of Garden Grove, Mesa Water District, and Irvine Ranch Water District. These agencies use the additional pumping allowance in order to accommodate groundwater quality improvement projects. As in prior years, production above the BPP from these projects would be partially or fully exempt from the BEA as a result of the benefit provided to the Basin by removing poor-quality groundwater and treating it for beneficial use (OCWD, 2013-2014 Engineer's Report, February 2015).

3.3.3 Groundwater Recharge Facilities

Recharging water into the Basin through natural and artificial means is essential to support pumping from the Basin. Active recharge of groundwater began in 1949, in response to increasing drawdown of the Basin and consequently the threat of seawater intrusion. The Basin's primary source of recharge is flow from the Santa Ana River, which is diverted into recharge basins and its main Orange County tributary, Santiago Creek. Other sources of recharge water include natural infiltration, recycled water, and imported water. Natural recharge consists of subsurface inflow from local hills and mountains, infiltration of precipitation and irrigation water, recharge in small flood control channels, and groundwater underflow to and from Los Angeles County and the ocean.

Recycled water for the Basin is from two sources. The main source of recycled water is from the GWRS and is recharged in the surface water system and the Talbert Seawater Barrier. The second source of recycled water is the Leo J. Vander Lans Treatment Facility which supplies water to the Alamitos Seawater Barrier. Injection of recycled water into these barriers is an effort by OCWD to control seawater intrusion into the Basin. Operation of the injection wells forms a hydraulic barrier to seawater intrusion.

Untreated imported water can be used to recharge the Basin through the surface water recharge system in multiple locations, such as Anaheim Lake, Santa Ana River, Irvine Lake, and San Antonio Creek. Treated imported water can be used for in-lieu recharge, as was performed extensively from 1977 to 2007 (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.3.4 Metropolitan Groundwater Replenishment Program

OCWD, MWDOC, and Metropolitan have developed a successful and efficient groundwater replenishment program to increase storage in the Basin. The Groundwater Replenishment Program allows Metropolitan to sell groundwater replenishment water to OCWD and make direct deliveries to agency distribution systems in lieu of producing water from the groundwater basin when surplus surface water is available. This program indirectly replenishes the Basin by avoiding pumping. In the in-lieu program, OCWD requests an agency to halt pumping from specified wells. The agency then takes replacement water through its import connections, which is purchased by OCWD from Metropolitan (through MWDOC). OCWD purchases the water at a reduced rate, and then bills the agency for the amount it would have had to pay for energy and the RA if it had produced the water from its wells. The deferred local production results in water being left in local storage for future use.

3.3.5 Metropolitan Conjunctive Use Program with OCWD

Since 2004, OCWD, MWDOC, and certain groundwater producers have participated in Metropolitan's Conjunctive Use Program (CUP). This program allows for the storage of Metropolitan water in the Basin. The existing Metropolitan program provides storage up to 66,000 AF of water in the Basin in exchange for Metropolitan's contribution to improvements in basin management facilities. These improvements include eight new groundwater production wells, improvements to the seawater intrusion barrier, and construction of the Diemer Bypass Pipeline. The water is accounted for via the CUP program administered by the wholesale agencies and is controlled by Metropolitan such that it can be withdrawn over a three-year time period (OCWD, 2013-2014 Engineer's Report, February 2015).

3.3.6 Groundwater Historical Extraction

The City pumps groundwater through its four wells. Pumping limitations set by the BPP and the pumping capacity of the wells are the only constraints affecting the groundwater supply to the City. A summary of the groundwater volume pumped by the City is shown in Table 3-2.

Table 3-2: Groundwater Volume Pumped (AF)

Retail: Groundwater Volume Pumped						
Groundwater Type	Location or Basin Name	2011	2012	2013	2014	2015
Alluvial Basin	Orange County Groundwater Basin	15,005	15,231	18,911	21,025	17,408
	TOTAL	15,005	15,231	18,911	21,025	17,408
NOTES:						

3.3.7 Overdraft Conditions

Annual groundwater basin overdraft, as defined in OCWD's Act, is the quantity by which production of groundwater supplies exceeds natural replenishment of groundwater supplies during a water year. This difference between extraction and replenishment can be estimated by determining the change in volume of groundwater in storage that would have occurred had supplemental water not been used for any groundwater recharge purpose, including seawater intrusion protection, advanced water reclamation, and the in-Lieu Program.

The annual analysis of basin storage change and accumulated overdraft for water year 2013-14 has been completed. Based on the three-layer methodology, an accumulated overdraft of 342,000 AF was calculated for the water year ending June 30, 2014. The accumulated overdraft for the water year ending June 30, 2013 was 242,000 AF, which was also calculated using the three-layer storage method. Therefore, an annual decrease of 100,000 AF in stored groundwater was calculated as the difference between the June 2013 and June 2014 accumulated overdrafts (OCWD, 2013-2014 Engineer's Report, February 2015).

3.4 Summary of Existing and Planned Sources of Water

The actual sources and volume of water for the year 2015 is displayed in Table 3-3.

Table 3-3: Water Supplies, Actual (AF)

Retail: Water Supplies — Actual			
Water Supply	Additional Detail on Water Supply	2015	
		Actual Volume	Water Quality
Groundwater	Orange County Groundwater Basin	17,408	Drinking Water
Purchased or Imported Water	MWDOC	6,640	Drinking Water
	Total	24,049	
NOTES:			

A summary of the current and planned sources of water for the City is shown in Table 3-4.

Table 3-4: Water Supplies, Projected (AF)

Retail: Water Supplies — Projected						
Water Supply	Additional Detail on Water Supply	Projected Water Supply *Report To the Extent Practicable*				
		2020	**2025**	**2030**	**2035**	**2040**
		Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume	Reasonably Available Volume
Groundwater	Orange County Groundwater Basin	16,855	18,093	18,217	18,212	18,239
Purchased or Imported Water	MWDOC	7,223	7,754	7,807	7,805	7,817
Total		24,078	25,847	26,024	26,017	26,055
NOTES:						

3.5 Recycled Water

The City does not own or operate any wastewater or recycled water facilities. More information concerning how the City handles it wastewater can be found in Section 6.

3.6 Supply Reliability

3.6.1 Overview

Every urban water supplier is required to assess the reliability of their water service to its customers under normal, dry, and multiple dry water years. The City depends on a combination of imported and local supplies to meet its water demands and has taken numerous steps to ensure it has adequate supplies. Development of numerous local augment the reliability of the imported water system. There are various factors that may impact reliability of supplies such as legal, environmental, water quality and climatic which are discussed below. The water supplies are projected to meet full-service demands; Metropolitan's 2015 UWMP finds that Metropolitan is able to meet, full-service demands of its member agencies starting 2020 through 2040 during normal years, single dry year, and multiple dry years.

Metropolitan's 2015 Integrated Water Resources Plan (IRP) update describes the core water resources that will be used to meet full-service demands at the retail level under all foreseeable hydrologic conditions from 2020 through 2040. The foundation of Metropolitan's resource strategy for achieving regional water supply reliability has been to develop and implement water resources programs and activities through its IRP preferred resource mix. This preferred resource mix includes conservation, local resources such as water recycling and groundwater recovery, Colorado River supplies and transfers, SWP supplies and transfers, in-region surface reservoir storage, in-region groundwater storage, out-of-region banking, treatment, conveyance and infrastructure improvements.

3.6.2 Factors Impacting Reliability

The Act requires a description of water supply reliability and vulnerability to seasonal or climatic shortage. The following are some of the factors identified by Metropolitan that may have an impact on the reliability of Metropolitan supplies.

3.6.2.1 Environment

Endangered species protection needs in the Delta have resulted in operational constraints to the SWP system, as mentioned previously in the State Water Project Supplies section.

3.6.2.2 Legal

The addition of more species under the Endangered Species Act and new regulatory requirements could impact SWP operations by requiring additional export reductions, releases of additional water from storage or other operational changes impacting water supply operations.

3.6.2.3 Water Quality

3.6.2.3.1 Imported Water

Metropolitan is responsible for providing high quality potable water throughout its service area. Over 300,000 water quality tests are performed per year on Metropolitan's water to test for regulated contaminants and additional contaminants of concern to ensure the safety of its waters. Metropolitan's supplies originate primarily from the CRA and from the SWP. A blend of these two sources, proportional to each year's availability of the source, is then delivered throughout Metropolitan's service area.

Metropolitan's primary water sources face individual water quality issues of concern. The CRA water source contains higher total dissolved solids (TDS) and the SWP contains higher levels of organic matter, lending to the formation of disinfection byproducts. To remediate the CRA's high level of salinity and the SWP's high level of organic matter, Metropolitan blends CRA and SWP supplies and has upgraded all of its treatment facilities to include ozone treatment processes. In addition, Metropolitan has been engaged in efforts to protect its Colorado River supplies from threats of uranium, perchlorate, and chromium VI while also investigating the potential water quality impact of emerging contaminants, N-nitrosodimethylamine (NDMA), and pharmaceuticals and personal care products (PPCP). While unforeseeable water quality issues could alter reliability, Metropolitan's current strategies ensure the deliverability of high quality water.

The presence of Quagga Mussels in water sources is a water quality concern. Quagga Mussels are an invasive species that was first discovered in 2007 at Lake Mead, on the Colorado River. This species of mussels form massive colonies in short periods of time, disrupting ecosystems and blocking water intakes. They are capable of causing significant disruption and damage to water distribution systems. Controlling the spread and impacts of this invasive species within the CRA requires extensive maintenance and results in reduced operational flexibility. It also resulted in Metropolitan eliminating deliveries of CRA water into Diamond Valley Lake (DVL) to keep the reservoir free from Quagga Mussels.

3.6.2.3.2 Groundwater

OCWD is responsible for managing the Basin. To maintain groundwater quality, OCWD conducts an extensive monitoring program that serves to manage the Basin's groundwater production, control groundwater contamination, and comply with all required laws and regulations. A network of nearly 700 wells provides OCWD a source for samples, which are tested for a variety of purposes. OCWD collects 600 to 1,700 samples each month to monitor Basin water quality. These samples are collected and tested according to approved federal and state procedures as well as industry-recognized quality assurance and control protocols.

Salinity is a significant water quality problem in many parts of southern California, including Orange County. Salinity is a measure of the dissolved minerals in water including both TDS and nitrates.

OCWD continuously monitors the levels of TDS in wells throughout the Basin. TDS currently has a California Secondary Maximum Contaminant Level (MCL) of 500 mg/L. The portions of the Basin with the highest levels are generally located in the Cites of Irvine, Tustin, Yorba Linda, Anaheim, and Fullerton. There is also a broad area in the central portion of the Basin where TDS ranges from 500 to 700 mg/L. Sources of TDS include the water supplies used to recharge the Basin and from onsite wastewater

treatment systems, also known as septic systems. The TDS concentration in the Basin is expected to decrease over time as the TDS concentration of GWRS water used to recharge the Basin is approximately 50 mg/L.

Nitrates are one of the most common and widespread contaminants in groundwater supplies, originating from fertilizer use, animal feedlots, wastewater disposal systems, and other sources. The MCL for nitrate in drinking water is set at 10 mg/L. OCWD regularly monitors nitrate levels in groundwater and works with producers to treat wells that have exceeded safe levels of nitrate concentrations. OCWD manages the nitrate concentration of water recharged by its facilities to reduce nitrate concentrations in groundwater. This includes the operation of the Prado Wetlands, which was designed to remove nitrogen and other pollutants from the Santa Ana River before the water is diverted to be percolated into OCWD's surface water recharge system.

Although water from the Deep Aquifer System is of very high quality, it is amber-colored and contains a sulfuric odor due to buried natural organic material. These negative aesthetic qualities require treatment before use as a source of drinking water. The total volume of the amber-colored groundwater is estimated to be approximately 1 MAF.

Other contaminants that OCWD monitors within the Basin include:

- **Methyl Tertiary Butyl Ether (MTBE) –** MTBE is an additive to gasoline that increases octane ratings but became a widespread contaminant in groundwater supplies. The greatest source of MTBE contamination comes from underground fuel tank releases. The primary MCL for MTBE in drinking water is 13 µg/L.
- **Volatile Organic Compounds (VOC) –** VOCs come from a variety of sources including industrial degreasers, paint thinners, and dry cleaning solvents. Locations of VOC contamination within the Basin include the former El Toro marine Corps Air Station, the Shall Aquifer System, and portions of the Principal Aquifer System in the Cities of Fullerton and Anaheim.
- **NDMA –** NDMA is a compound that can occur in wastewater that contains its precursors and is disinfected via chlorination and/or chloramination. It is also found in food products such as cured meat, fish, beer, milk, and tobacco smoke. The California Notification Level for NDMA is 10 ng/L and the Response Level is 300 ng/L. In the past, NDMA has been found in groundwater near the Talbert Barrier, which was traced to industrial wastewater dischargers.
- **1,4-Dioxane –** 1,4-Dioxane is a suspected human carcinogen. It is used as a solvent in various industrial processes such as the manufacture of adhesive products and membranes.
- **Perchlorate –** Perchlorate enters groundwater through application of fertilizer containing perchlorate, water imported from the Colorado River, industrial or military sites that have perchlorate, and natural occurrence. Perchlorate was not detected in 84 percent of the 219 production wells tested between the years 2010 through 2014.
- **Selenium –** Selenium is a naturally occurring micronutrient found in soils and groundwater in the Newport Bay watershed. The bio-accumulation of selenium in the food chain may result in deformities, stunted growth, reduced hatching success, and suppression of immune systems in fish and wildlife. Management of selenium is difficult as there is no off-the-shelf treatment technology available.

- **Constituents of Emerging Concern (CEC) –** CECs are either synthetic or naturally occurring substances that are not currently regulated in water supplies or wastewater discharged but can be detected using very sensitive analytical techniques. The newest group of CECs include pharmaceuticals, personal care products, and endocrine disruptors. OCWD's laboratory is one of a few in the state of California that continuously develops capabilities to analyze for new compounds (OCWD, Groundwater Management Plan 2015 Update, June 2015).

3.6.2.4 Climate Change

Changing climate patterns are expected to shift precipitation patterns and affect water supply. Unpredictable weather patterns will make water supply planning more challenging. The areas of concern for California include a reduction in Sierra Nevada Mountain snowpack, increased intensity and frequency of extreme weather events, and rising sea levels causing increased risk of Delta levee failure, seawater intrusion of coastal groundwater basins, and potential cutbacks on the SWP and CVP. The major impact in California is that without additional surface storage, the earlier and heavier runoff (rather than snowpack retaining water in storage in the mountains), will result in more water being lost to the oceans. A heavy emphases on storage is needed in the State of California.

In addition, the Colorado River Basin supplies have been inconsistent since about the year 2000, resulting in 13 of the last 16 years of the upper basin runoff being below normal. Climate models are predicting a continuation of this pattern whereby hotter and drier weather conditions will result in continuing lower runoff.

Legal, environmental, and water quality issues may have impacts on Metropolitan supplies. It is felt, however, that climatic factors would have more of an impact than legal, water quality, and environmental factors. Climatic conditions have been projected based on historical patterns but severe pattern changes are still a possibility in the future.

3.6.3 Normal-Year Reliability Comparison

The City has entitlements to receive imported water from Metropolitan through MWDOC via connection to Metropolitan's regional distribution system. Although pipeline and connection capacity rights do not guarantee the availability of water, per se, they do guarantee the ability to convey water when it is available to the Metropolitan distribution system. All imported water supplies are assumed available to the City from existing water transmission facilities. The demand and supplies listed below also include local groundwater supplies that are available to the City through OCWD by a pre-determined pumping percentage.

For the 2015 UWMP, the normal dry year was selected as the City's 2015 demand. Due to ongoing drought conditions within California and the increased implementation of mitigation measures, 2015 was determined to represent an average water demand for this UWMP.

3.6.4 Single-Dry Year Reliability Comparison

A Single-dry year is defined as a single year of no to minimal rainfall within a period that average precipitation is expected to occur. The City has documented that it is 100 percent reliable for single dry year demands from 2020 through 2040 with a demand increase of 6 percent using FY 2013-14 as the

single dry-year. This percentage was determined by MWDOC based on historical data for all of its retail agencies through the "Bump Methodology" that is explained in Appendix G.

3.6.5 Multiple-Dry Year Period Reliability Comparison

Multiple-dry years are defined as three or more years with minimal rainfall within a period of average precipitation. The City is capable of meeting all customers' demands with significant reserves held by Metropolitan, local groundwater supplies, and conservation in multiple dry years from 2020 through 2040 with a demand increase of 6 percent using FY 2011-2012 through FY 2013-14 as the driest years. MWDOC chose the highest average demand over a three year period for the multi-dry year demand increase. This value was repeated over the three year span as a conservative assumption where demand would increase significantly in a prolonged drought and would remain constant through the years. The basis of the water year is displayed in Table 3-5.

Table 3-5: Basis of Water Year Data

Retail: Basis of Water Year Data			
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	**% of Average Supply**
Average Year	2015		100%
Single-Dry Year	2014		106%
Multiple-Dry Years 1st Year	2012		106%
Multiple-Dry Years 2nd Year	2013		106%
Multiple-Dry Years 3rd Year	2014		106%
NOTES:			

3.7 Supply and Demand Assessment

A comparison between the supply and demand for projected years between 2020 and 2040 is shown in Table 3-6. As stated above, the available supply will meet projected demand due to diversified supply and conservation measures.

Table 3-6: Normal Year Supply and Demand Comparison (AF)

Retail: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	24,078	25,847	26,024	26,017	26,055
Demand totals	24,078	25,847	26,024	26,017	26,055
Difference	0	0	0	0	0
NOTES:					

A comparison between the supply and the demand in a single dry year is shown in Table 3-7. As stated above, the available supply will meet projected demand due to diversified supply and conservation measures.

Table 3-7: Single Dry Year Supply and Demand Comparison (AF)

Retail: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040
Supply totals	25,523	27,398	27,585	27,578	27,618
Demand totals	25,523	27,398	27,585	27,578	27,618
Difference	0	0	0	0	0
NOTES: Developed by MWDOC as 2015 Bump Methodology					

A comparison between the supply and the demand in multiple dry years is shown in Table 3-8.

Table 3-8: Multiple Dry Years Supply and Demand Comparison (AF)

Retail: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040
First year	Supply totals	25,523	27,398	27,585	27,578	27,618
	Demand totals	25,523	27,398	27,585	27,578	27,618
	Difference	0	0	0	0	0
Second year	Supply totals	25,523	27,398	27,585	27,578	27,618
	Demand totals	25,523	27,398	27,585	27,578	27,618
	Difference	0	0	0	0	0
Third year	Supply totals	25,523	27,398	27,585	27,578	27,618
	Demand totals	25,523	27,398	27,585	27,578	27,618
	Difference	0	0	0	0	0
NOTES: Developed by MWDOC as 2015 Bump Methodology						

4 DEMAND MANAGEMENT MEASURES

The goal of the Demand Management Measures (DMM) section is to provide a comprehensive description of the water conservation programs that a supplier has implemented, is currently implementing, and plans to implement in order to meet its urban water use reduction targets. The reporting requirements for DMM has been significantly modified and streamlined in 2014 by Assembly Bill 2067. For a retail agency such as the City the requirements changed from having 14 specific measures to six more general requirements plus an "other" category.

4.1 Water Waste Prevention Ordinances

City Council adopted the Ordinance No. 2858 in 2015 to amend and update the City's Water Conservation Program provisions in Chapter 40 of title 14 of the Garden Grove Municipal Code to facilitate the implementation of 2014 and 2015 State-mandated water conservation requirements and regulations in response to the drought conditions.

Ordinance No. 2858 established a mandatory permanent water conservation requirements and prohibition against waste that are effective at all times and is not dependent upon a water shortage for implementation as follows. The 2015 amendments are shown in italics.

- Limits on watering hours
- Limit on watering duration
- No water flow or runoff
- No washing down hard or paved surfaces
- No washing of vehicles with hose
- *No watering during or within 48 hours after measureable rainfalls*
- *Irrigation of landscapes outside of newly constructed homes and buildings must comply with regulations established by the California Building Standards Commission and the Department of Housing and Community Development*
- *Commercial lodging establishments must provide customers the option of not having towels and linen laundered daily*
- Obligation to fix leaks, breaks, or malfunctions
- Recirculating water required for water fountains and decorative water features
- No installation of single pass cooling systems
- No installation of non-recirculating systems in commercial car wash and laundry operations

In an event of a water supply shortage, the ordinance established provisions for four stages of response associated with increasingly restrictive prohibitions from Stage 1 Water Watch to Stage 4 Water Emergency (severe drought and/or major failure of any supply or distribution system). The provisions and

water conservation measures to be implemented in response to each shortage level are described in Section 5 of the UWMP. The City's water conservation ordinance is included in Appendix D.

4.2 Metering

The City meters all service connections and bills its customers bi-monthly based on water consumption.

Testing and calibration of the supply source meters, large customer meter test and repair programs, adding meters to City facilities, and residential meter change-out programs are components of the City's water loss prevention program. The City requires meters for all new connections as well as dedicated irrigation meters. Although the City does not have a formal meter calibration program, meters are calibrated on an as-needed basis. Furthermore, the City employs an Advanced Metering Infrastructure (AMI) program within its service area.

4.3 Conservation Pricing

The City has an inclining tiered-rate structure for water service rates as an incentive to encourage customers to conserve water. The rate structure includes a fixed bimonthly minimum charge and capital improvements charge determined by meter size and a commodity charge comprised of four tiers applicable to each hundred cubic feet of billed water sales. The first tier captures efficient and essential water users. The last tier is termed "excess" representing the portion that the City determined to be an excessive water usage. In FY 10/11, approximately 80% of residents remain in the first tier, which demonstrates the effectiveness of this rate structure by successfully deterring residents from excessive consumption. Other charges may include a service connection charge when adding in new customers to the water system, temporary service charges, fire protection charges and other charges related to services provided by the City.

4.4 Public Education and Outreach

The City's public education and outreach program is administered by its wholesaler, MWDOC. MWDOC has established an extensive public education and outreach program to assist its retail agencies in promoting water use efficiency awareness within their service areas. MWDOC's public education and outreach programs consist of five primary activities as described below.

In addition to the primary programs it administers, MWDOC also maintains a vibrant public website (www.mwdoc.com) as well as a social media presence on Facebook, Twitter and Instagram. MWDOC's Facebook page has more than 1,200 followers. The social media channels are used to educate the public about water-efficiency, rates and other water-related issues.

MWDOC's public education and outreach programs are described below:

School Education Programs

MWDOC school education programs reach more than 100,000 students per year. The program is broken into elementary and high school components.

- *Elementary School Program* reaches 60,000 students throughout Orange County through assemblies hosted by the Discovery Science Center. MWDOC holds a $220,000 contract with the Discovery Science Center, funded proportionally by the participating MWDOC retail agencies.
- *High School Program* is new in 2015-16 and will reach students in 20 high schools in Orange County. The program is administered by MWDOC and operated by two contractors, the OC Department of Education and the Ecology Center. Through the three-year contract, those agencies will train more than 100 county teachers on water education on topics such as, water sources, water conservation, water recycling, watersheds, and ecological solutions for the benefit of their current and future students. Teachers will learn a variety of water conservation methods, such as irrigation technology, rainwater harvesting, water recycling, and water foot printing through a tour at the Ecology Center facility. These trainings allow teachers to support student - led conservation efforts. The program will reach a minimum of 25,000 students by providing in-classroom water education and helping students plan and implement campus wide "Water Expos" that will allow peer-to-peer instruction on water issues. The $80,000 program is funded by participating agencies.

Value of Water Communication Program

MWDOC administers this program on behalf of 14 agencies. The $190,000 program involves the water agencies developing 30 full news pages that will appear weekly in the Orange County Register, the largest newspaper in the county, with a Sunday readership of 798,000. The campaign will educate OC residents and business leaders on water infrastructure issues and water efficiency measures, as well as advertise water related events and other pertinent information.

Quarterly Water Policy Dinners

The Water Policy Dinner events attract 225 to 300 water and civic leaders every quarter. The programs host speakers topical to the OC water industry, with recent addresses from Felicia Marcus of the state water board and Dr. Lucy Jones, a noted expert on earthquakes and their potential impact on infrastructure.

Annual Water Summit

The annual Water Summit brings together 300 Orange County water and civic leaders with state and national experts on water infrastructure and governance issues. The half-day event has a budget of $80,000 per year. Portions of the cost are covered by attendance and sponsorships, while MWDOC splits a portion with its event partner, OCWD.

Water Inspection Trips

Water Inspection trips take stakeholders on tours of the Colorado River Aqueduct, California Delta and other key water infrastructure sites. The public trips are required under Metropolitan's regulations. While

Metropolitan covers the cost of the trips, MWDOC has two members of the public affairs staff that work diligently on identifying OC residents and leaders to attend. MWDOC staff also attends each trip. In the past year, MWDOC participated in a dozen trips, each taking an average of 30 residents. MWDOC also works with Metropolitan on special trips to educate County Grand Jurors the key water infrastructure.

4.5 Programs to Assess and Manage Distribution System Real Loss

Senate Bill 1420 signed into law in September 2014 requires urban water suppliers that submit UWMPs to calculate annual system water losses using the water audit methodology developed by the AWWA. SB 1420 requires the water loss audit be submitted to DWR every five years as part of the urban water supplier's UWMP. Water auditing is the basis for effective water loss control. DWR's UWMP Guidebook include a water audit manual intended to help water utilities complete the AWWA Water Audit on an annual basis. A Water Loss Audit was completed for the City which identified areas for improvement and quantified total loss. Based on the data presented, the three priority areas identified were customer metering inaccuracies, billed metered, and water imported. Multiple criteria are a part of each validity score and a system wide approach will need to be implemented for the City's improvement. Quantified water loss for the FY 2014-15 was 2,363 AF which is a significant volume and presents opportunities for improvement.

The City has an ongoing leak detection, location and repair program to minimize water loss. The following measures are being implemented: testing and calibration of the supply source meters, large customer meter test and repair programs, large meter right-sizing programs, adding meters to City facilities, increases in pipe repair or replacement, residential meter change-out programs. Reported customer leaks are corrected in a timely manner. City employees frequently check for leaks while reading meters, rehabilitating streets, and in the field performing other maintenance activities.

The City does not have a formal leak detection and repair program but repairs leaks on an as-needed basis.

4.6 Water Conservation Program Coordination and Staffing Support

The City has two designated water conservation coordinators that include one full time senior administrative analyst and one part time administrative intern. These staff members' duties include the following:

- Coordinating and managing all water conservation programs and BMP implementation
- Preparing and submitting the Council's BMP implementation Report
- Conveying water conservation issues to management
- Coordinating conservation programs with operations and planning staff
- Developing an annual conservation budget to implement outreach programs
- Preparing the conservation section of the City's Urban Water Management Plan

The City funds the water conservation program through their water budget.

4.7 Other Demand Management Measures

During the past five years, FY 2010-11 to 2014-15, the City, with the assistance of MWDOC, has implemented many water use efficiency programs for its residential, CII, and landscape customers as described below. Appendix I provides quantities of rebates and installations achieved under each program since program inception. The City will continue to implement all applicable programs in the next five years.

4.7.1 Residential Programs

Water Smart Home Survey Program

The Water Smart Home Survey Program provides free home water surveys (indoor and outdoor). The Water Smart Home Survey Program uses a Site Water Use Audit program format to perform comprehensive, single-family home audits. Residents choose to have outdoor (and indoor, if desired) audits to identify opportunities for water savings throughout their properties. A customized home water audit report is provided after each site audit is completed and provides the resident with their survey results, rebate information, and an overall water score.

High Efficiency Clothes Washer Rebate Program

The High Efficiency Clothes Washer (HECW) Rebate Program provides residential customers with rebates for purchasing and installing WaterSense labeled HECWs. HECWs use 35-50 percent less water than standard washer models, with savings of approximately 9,000 gallons per year, per device. Devices must have a water factor of 4.0 or less, and a listing of qualified products can be found at ocwatersmart.com. There is a maximum of one rebate per home.

High Efficiency Toilet Rebate Program

The largest amount of water used inside a home, 30 percent, goes toward flushing the toilet. The High Efficiency Toilet (HET) Rebate Program offers incentives to residential customers for replacing their standard, water-guzzling toilets with HETs. HETs use just 1.28 gallons of water or less per flush, which is 20 percent less water than standard toilets. In addition, HETS save an average of 38 gallons of water per day while maintaining high performance standards.

4.7.2 CII Programs

Water Smart Hotel Program

Water used in hotels and other lodging businesses accounts for approximately 15 percent of the total water use in commercial and institutional facilities in the United States. The Water Smart Hotel Program provides water use surveys, customized facility reports, technical assistance, and enhanced incentives to hotels that invest in water use efficiency improvements. Rebates available include high efficiency toilets, ultralow volume urinals, air-cooled ice machines, weather-based irrigation controllers, and rotating nozzles.

Socal Water$mart Rebate Program for CII

The City through MWDOC offers financial incentives under the Socal Water$mart Rebate Program which offers rebates for various water efficient devices to CII customers, such as high efficiency toilets, ultralow volume urinals, connectionless food steamers, air-cooled ice machines, pH-cooling towers controller, and dry vacuum pumps.

4.7.3 Landscape Programs

Turf Removal Program

The Orange County Turf Removal Program offers incentives to remove non-recreational turf grass from commercial properties throughout the County. This program is a partnership between MWDOC, Metropolitan, and local retail water agency. The goals of this program are to increase water use efficiency within Orange County, reduce runoff leaving the properties, and evaluate the effectiveness of turf removal as a water-saving practice. Participants are encouraged to replace their turf grass with drought-tolerant landscaping, diverse plant palettes, and artificial turf, and they are encouraged to retrofit their irrigation systems with Smart Timers and drip irrigation (or to remove it entirely).

Water Smart Landscape Program

MWDOC's Water Smart Landscape Program is a free water management tool for homeowner associations, landscapers, and property managers. Participants in the program use the Internet to track their irrigation meter's monthly water use and compare it to a custom water budget established by the program. This enables property managers and landscapers to easily identify areas that are over/under watered and enhances their accountability to homeowner association boards.

Smart Timer Rebate Program

Smart Timers are irrigation clocks that are either weather-based irrigation controllers (WBIC) or soil moisture sensor systems. WBICs adjust automatically to reflect changes in local weather and site-specific landscape needs, such as soil type, slopes, and plant material. When WBICs are programmed properly, turf and plants receive the proper amount of water throughout the year. During the fall months, when property owners and landscape professionals often overwater, Smart Timers can save significant amounts of water.

Rotating Nozzles Rebate Program

The Rotating Nozzle Rebate Program provides incentives to residential and commercial properties for the replacement of high-precipitation rate spray nozzles with low-precipitation rate multi-stream, multi-trajectory rotating nozzles. The rebate offered through this Program aims to offset the cost of the device and installation.

Spray to Drip Rebate Program

The Spray to Drip Pilot Rebate Program offers residential and commercial customers rebates for converting planting areas irrigated by spray heads to drip irrigation. Drip irrigation systems are very water-efficient. Rather than spraying wide areas, drip systems use point emitters to deliver water to specific

locations at or near plant root zones. Water drips slowly from the emitters either onto the soil surface or below ground. As a result, less water is lost to wind and evaporation.

Socal Water$mart Rebate Program for Landscape

The City through MWDOC also offers financial incentives under the SoCal Water$mart Rebate Program for a variety of water efficient landscape devices, such as Central Computer Irrigation Controllers, large rotary nozzles, and in-stem flow regulators.

5 WATER SHORTAGE CONTINGENCY PLAN

5.1 Overview

In connection with recent water supply challenges, the State Water Resources Control Board found that California has been subject to multi-year droughts in the past, and the Southwest is becoming drier, increasing the probability of prolonged droughts in the future. Due to current and potential future water supply shortages, Governor Brown issued a drought emergency proclamation on January 2014 and signed the 2014 Executive Order that directs urban water suppliers to implement drought response plans to limit outdoor irrigation and wasteful water practices if they are not already in place. Pursuant to California Water Code Section 106, it is the declared policy of the state that domestic water use is the highest use of water and the next highest use is irrigation. This section describes the water supply shortage policies Metropolitan, MWDOC, and the City have in place to respond to events including catastrophic interruption and reduction in water supply.

5.2 Shortage Actions

5.2.1 Metropolitan Water Surplus and Drought Management Plan

Metropolitan evaluates the level of supplies available and existing levels of water in storage to determine the appropriate management stage annually. Each stage is associated with specific resource management actions to avoid extreme shortages to the extent possible and minimize adverse impacts to retail customers should an extreme shortage occur. The sequencing outlined in the Water Surplus and Drought Management (WSDM) Plan reflects anticipated responses towards Metropolitan's existing and expected resource mix.

Surplus stages occur when net annual deliveries can be made to water storage programs. Under the WSDM Plan, there are four surplus management stages that provides a framework for actions to take for surplus supplies. Deliveries in DVL and in SWP terminal reservoirs continue through each surplus stage provided there is available storage capacity. Withdrawals from DVL for regulatory purposes or to meet seasonal demands may occur in any stage.

The WSDM Plan distinguishes between shortages, severe shortages, and extreme shortages. The differences between each term is listed below.

- Shortage: Metropolitan can meet full-service demands and partially meet or fully meet interruptible demands using stored water or water transfers as necessary.
- Severe Shortage: Metropolitan can meet full-service demands only by using stored water, transfers, and possibly calling for extraordinary conservation.
- Extreme Shortage: Metropolitan must allocate available supply to full-service customers.

There are six shortage management stages to guide resource management activities. These stages are defined by shortfalls in imported supply and water balances in Metropolitan's storage programs. When Metropolitan must make net withdrawals from storage to meet demands, it is considered to be in a shortage condition. Figure 5-1 gives a summary of actions under each surplus and shortage stages when

an allocation plan is necessary to enforce mandatory cutbacks. The goal of the WSDM Plan is to avoid Stage 6, an extreme shortage.

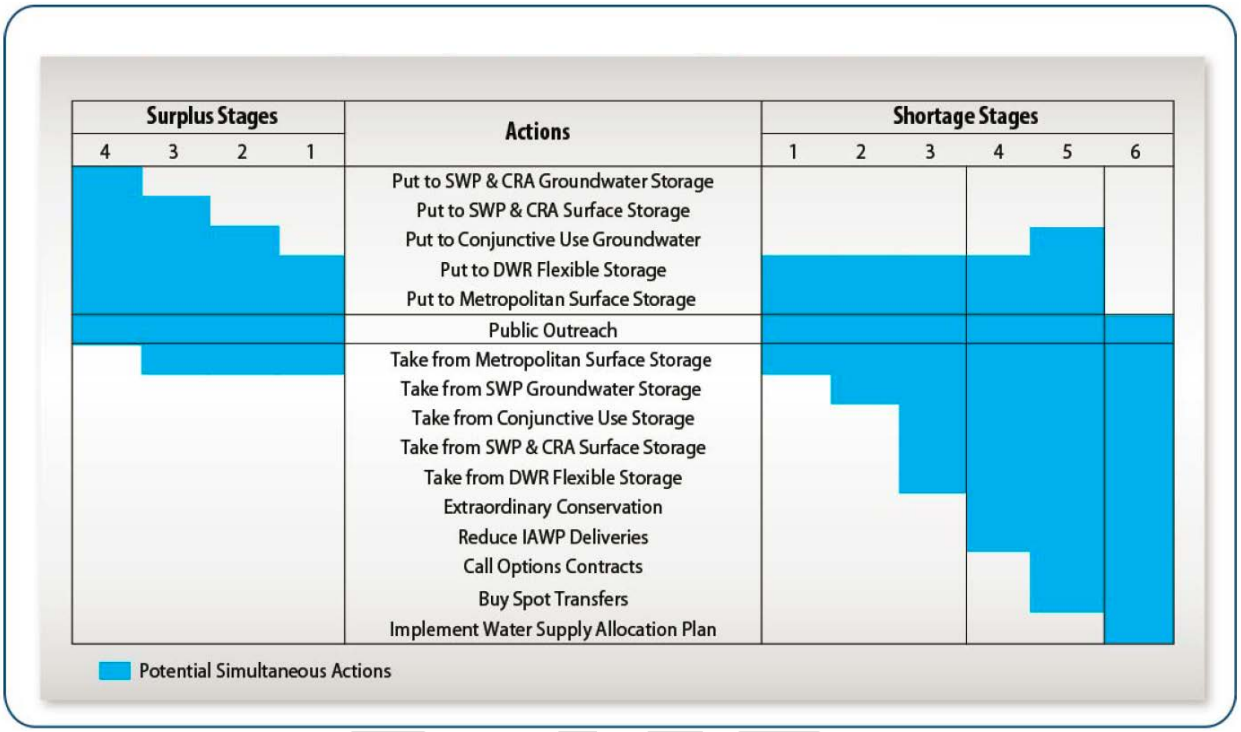


Figure 5-1: Resource Stages, Anticipated Actions, and Supply Declarations

Metropolitan's Board of Directors adopted a Water Supply Condition Framework in June 2008 in order to communicate the urgency of the region's water supply situation and the need for further water conservation practices. The framework has four conditions, each calling increasing levels of conservation. Descriptions for each of the four conditions are listed below:

- Baseline Water Use Efficiency: Ongoing conservation, outreach, and recycling programs to achieve permanent reductions in water use and build storage reserves.
- Condition 1 Water Supply Watch: Local agency voluntary dry-year conservation measures and use of regional storage reserves.
- Condition 2 Water Supply Alert: Regional call for cities, counties, member agencies, and retail water agencies to implement extraordinary conservation through drought ordinances and other measures to mitigate use of storage reserves.
- Condition 3 Water Supply Allocation: Implement Metropolitan's WSAP

As noted in Condition 3, should supplies become limited to the point where imported water demands cannot be met, Metropolitan will allocate water through the WSAP (Metropolitan, 2015 Final Draft UWMP, March 2016).

5.2.2 Metropolitan Water Supply Allocation Plan

Metropolitan's imported supplies have been impacted by a number of water supply challenges as noted earlier. In case of extreme water shortage within the Metropolitan service area is the implementation of its WSAP.

Metropolitan's Board of Directors adopted the WSAP in February 2008 to fairly distribute a limited amount of water supply and applies it through a detailed methodology to reflect a range of local conditions and needs of the region's retail water consumers.

The WSAP includes the specific formula for calculating member agency supply allocations and the key implementation elements needed for administering an allocation. Metropolitan's WSAP is the foundation for the urban water shortage contingency analysis required under Water Code Section 10632 and is part of Metropolitan's 2015 UWMP.

Metropolitan's WSAP was developed in consideration of the principles and guidelines in Metropolitan's 1999 WSDM Plan with the core objective of creating an equitable "needs-based allocation". The WSAP's formula seeks to balance the impacts of a shortage at the retail level while maintaining equity on the wholesale level for shortages of Metropolitan supplies of up to 50 percent. The formula takes into account a number of factors, such as the impact on retail customers, growth in population, changes in supply conditions, investments in local resources, demand hardening aspects of water conservation savings, recycled water, extraordinary storage and transfer actions, and groundwater and imported water needs.

The formula is calculated in three steps: 1) based period calculations, 2) allocation year calculations, and 3) supply allocation calculations. The first two steps involve standard computations, while the third step contains specific methodology developed for the WSAP.

Step 1: Base Period Calculations – The first step in calculating a member agency's water supply allocation is to estimate their water supply and demand using a historical based period with established water supply and delivery data. The base period for each of the different categories of supply and demand is calculated using data from the two most recent non-shortage FY ending 2013 and 2014.

Step 2: Allocation Year Calculations – The next step in calculating the member agency's water supply allocation is estimating water needs in the allocation year. This is done by adjusting the base period estimates of retail demand for population growth and changes in local supplies.

Step 3: Supply Allocation Calculations – The final step is calculating the water supply allocation for each member agency based on the allocation year water needs identified in Step 2.

In order to implement the WSAP, Metropolitan's Board of Directors makes a determination on the level of the regional shortage, based on specific criteria, typically in April. The criteria used by Metropolitan includes, current levels of storage, estimated water supplies conditions, and projected imported water demands. The allocations, if deemed necessary, go into effect in July of the same year and remain in effect for a 12-month period. The schedule is made at the discretion of the Board of Directors.

Although Metropolitan's 2015 UWMP forecasts that Metropolitan will be able to meet projected imported demands throughout the projected period from 2020 to 2040, uncertainty in supply conditions can result in Metropolitan needing to implement its WSAP to preserve dry-year storage and curtail demands (Metropolitan, 2015 Draft UWMP, March 2016).

5.2.3 MWDOC Water Supply Allocation Plan

To prepare for the potential allocation of imported water supplies from Metropolitan, MWDOC worked collaboratively with its 28 retail agencies to develop its own WSAP that was adopted in January 2009 and amended in 2015. The MWDOC WSAP outlines how MWDOC will determine and implement each of its retail agency's allocation during a time of shortage.

The MWDOC WSAP uses a similar method and approach, when reasonable, as that of the Metropolitan's WSAP. However, MWDOC's plan remains flexible to use an alternative approach when Metropolitan's method produces a significant unintended result for the member agencies. The MWDOC WSAP model follows five basic steps to determine a retail agency's imported supply allocation.

Step 1: Determine Baseline Information – The first step in calculating a water supply allocation is to estimate water supply and demand using a historical based period with established water supply and delivery data. The base period for each of the different categories of demand and supply is calculated using data from the last two non-shortage fiscal years ending 2013 and 2014.

Step 2: Establish Allocation Year Information – In this step, the model adjusts for each retail agency's water need in the allocation year. This is done by adjusting the base period estimates for increased retail water demand based on population growth and changes in local supplies.

Step 3: Calculate Initial Minimum Allocation Based on Metropolitan's Declared Shortage Level – This step sets the initial water supply allocation for each retail agency. After a regional shortage level is established, MWDOC will calculate the initial allocation as a percentage of adjusted Base Period Imported water needs within the model for each retail agency.

Step 4: Apply Allocation Adjustments and Credits in the Areas of Retail Impacts and Conservation– In this step, the model assigns additional water to address disparate impacts at the retail level caused by an across-the-board cut of imported supplies. It also applies a conservation credit given to those agencies that have achieved additional water savings at the retail level as a result of successful implementation of water conservation devices, programs and rate structures.

Step 5: Sum Total Allocations and Determine Retail Reliability – This is the final step in calculating a retail agency's total allocation for imported supplies. The model sums an agency's total imported allocation with all of the adjustments and credits and then calculates each agency's retail reliability compared to its Allocation Year Retail Demand.

The MWDOC WSAP includes additional measures for plan implementation, including the following:

- Appeal Process – An appeals process to provide retail agencies the opportunity to request a change to their allocation based on new or corrected information. MWDOC anticipates that under most circumstances, a retail agency's appeal will be the basis for an appeal to Metropolitan by MWDOC.
- Melded Allocation Surcharge Structure – At the end of the allocation year, MWDOC would only charge an allocation surcharge to each retail agency that exceeded their allocation if MWDOC exceeds its total allocation and is required to pay a surcharge to Metropolitan. Metropolitan enforces allocations to retail agencies through an allocation surcharge to a retail agency that exceeds its total annual allocation at the end of the 12-month allocation period. MWDOC's surcharge would be assessed according to the retail agency's prorated share (AF over usage) of MWDOC amount with

Metropolitan. Surcharge funds collected by Metropolitan will be invested in its Water Management Fund, which is used to in part to fund expenditures in dry-year conservation and local resource development.

- Tracking and Reporting Water Usage – MWDOC will provide each retail agency with water use monthly reports that will compare each retail agency's current cumulative retail usage to their allocation baseline. MWDOC will also provide quarterly reports on it cumulative retail usage versus its allocation baseline.
- Timeline and Option to Revisit the Plan – The allocation period will cover 12 consecutive months and the Regional Shortage Level will be set for the entire allocation period. MWDOC only anticipates calling for allocation when Metropolitan declares a shortage; and no later than 30 days from Metropolitan's declaration will MWDOC announce allocation to its retail agencies.

5.2.4 City of Garden Grove

City Council adopted Water Conservation Ordinance No. 2858 on June 23, 2015, which established a staged water conservation program that will encourage reduced water consumption within the City through conservation, enable effective water supply planning, assure reasonable and beneficial use of water, prevent waste of water, and maximize the efficient use of water within the City. Along with permanent water conservation requirements, the City's Water Conservation Program consists of four stages to respond to a reduction in potable water available to the City for distribution to its customers. A summary of the stages of water shortage is displayed in Table 5-1 (Garden Grove, Ordinance Number 2858, June 2015). The City does not have set percent supply reduction for each water shortage stage. The City will implement the percent supply reduction on its own discretion as it enters into a water shortage stage.

Table 5-1: Stages of Water Shortage Contingency Plan

Retail Stages of Water Shortage Contingency Plan		
Stage	Complete Both	
	Percent Supply Reduction	Water Supply Condition
1		Times of regional drought when the City assists in overall water conservation and water consumption reduction
2		Periods when the City determines water supply shortage or threatened shortage exists and a consumer demand reduction is necessary
3		Periods when there is a critical differential between supply and demand
4		Period of severe drought and/or when a major failure of any supply or distribution facility occurs in water distribution systems
NOTES: Percent supply reduction unavailable		

5.3 Three-Year Minimum Water Supply

As a matter of practice, Metropolitan does not provide annual estimates of the minimum supplies available to its member agencies. As such, Metropolitan member agencies must develop their own estimates for the purposes of meeting the requirements of the Act.

Section 135 of the Metropolitan Water District Act declares that a member agency has the right to invoke its "preferential right" to water, which grants each member agency a preferential right to purchase a percentage of Metropolitan's available supplies based on specified, cumulative financial contributions to Metropolitan. Each year, Metropolitan calculates and distributes each member agency's percentage of preferential rights. However, since Metropolitan's creation in 1927, no member agency has ever invoked these rights as a means of acquiring limited supplies from Metropolitan.

As an alternative to invoking preferential rights, Metropolitan and its member agencies accepted the terms and conditions of Metropolitan's shortage allocation plan, which allocated imported water under limited supply conditions. In fact, in FY 2015-2016, Metropolitan implemented its WSAP at a stage level 3 (seeking no greater than a 15 percent regional reduction of water use), which is the largest reduction Metropolitan has ever imposed on its member agencies. This WSAP level 3 reduction was determined when Metropolitan water supplies from the SWP was at its lowest levels ever delivered and water storage declined greater than 1 MAF in one year.

MWDOC has adopted a shortage allocation plan and accompanying allocation model that estimates firm demands on MWDOC. Assuming MWDOC would not be imposing mandatory restrictions if Metropolitan is not, the estimate of firm demands in MWDOC's latest allocation model has been used to estimate the minimum imported supplies available to each of MWDOC's retail agencies for 2015-2018. Thus, the estimate of the minimum imported supplies available to the City is 26,081 AF as shown in Table 5-2 (MWDOC, Water Shortage Allocation Model, November 2015).

Table 5-2: Minimum Supply Next Three Years (AF)

Retail: Minimum Supply Next Three Years			
	2016	2017	2018
Available Water Supply	26,081	26,081	26,081
NOTES:			

5.4 Catastrophic Supply Interruption

Given the great distances that imported supplies travel to reach Orange County, the region is vulnerable to interruptions along hundreds of miles aqueducts, pipelines and other facilities associated with delivering the supplies to the region. Additionally, the infrastructure in place to deliver supplies are susceptible to damage from earthquakes and other disasters.

5.4.1 Metropolitan

Metropolitan has comprehensive plans for stages of actions it would undertake to address a catastrophic interruption in water supplies through its WSDM Plan and WSAP. Metropolitan also developed an Emergency Storage Requirement to mitigate against potential interruption in water supplies resulting from catastrophic occurrences within the southern California region, including seismic events along the San Andreas Fault. In addition, Metropolitan is working with the state to implement a comprehensive improvement plan to address catastrophic occurrences outside of the southern California region, such as a maximum probable seismic event in the Delta that would cause levee failure and disruption of SWP deliveries. For greater detail on Metropolitan's planned responses to catastrophic interruption, please refer to Metropolitan's 2015 UWMP.

5.4.2 Water Emergency Response of Orange County

In 1983, the Orange County water community identified a need to develop a plan on how agencies would respond effectively to disasters impacting the regional water distribution system. The collective efforts of these agencies resulted in the formation of the Water Emergency Response Organization of Orange County (WEROC) to coordinate emergency response on behalf of all Orange County water and wastewater agencies, develop an emergency plan to respond to disasters, and conduct disaster training exercises for the Orange County water community. WEROC was established with the creation of an indemnification agreement between its member agencies to protect each other against civil liabilities and to facilitate the exchange of resources. WEROC is unique in its ability to provide a single point of contact for representation of all water and wastewater utilities in Orange County during a disaster. This representation is to the county, state, and federal disaster coordination agencies. Within the Orange County Operational Area, WEROC is the recognized contact for emergency response for the water community, including the City.

5.4.3 City of Garden Grove

A water shortage emergency could be the result of a catastrophic event such as result of drought, failures of transmission facilities, a regional power outage, earthquake, flooding, supply contamination from chemical spills, or other adverse conditions. The City maintains and exercises a comprehensive Emergency Management Program for such emergencies including Water Shortage Emergency Response. The Water Services Division of the Public Works Department is responsible for water operations and maintenance of the Water & Wastewater section of the City Emergency Management Plan.

The Water Services Division will operate under normal operating procedures until a situation is beyond its control. This includes implementation of any allocation plan passed through by MWDOC for Metropolitan and OCWD water shortage contingency plans.

If the situation is beyond the Water Services Division's control, the Water Emergency Operations Center (WOC) may be activated to better manage the situation. If the situation warrants, the City Emergency Operations Center (EOC) may be activated, at which time a water representative will be sent to the EOC to coordinate water emergency response with all other City department's emergency response.

In the event the EOC is activated, the City Management Policy Group will set priorities. When the EOC is activated, the WOC will take its direction from the EOC. An EOC Action Plan will be developed in the EOC that will carry out the policies dictated by the Policy Group. The WOC will use the EOC Action Plan in determining its course of action. Coordination between the WOC and the EOC will be done by the Water Services Manager in the WOC and the Operations Section Chief located in the EOC.

If the situation is beyond the Water Division's and the City's control, additional assistance will be sought through coordination with WEROC.

5.5 Prohibitions, Penalties and Consumption Reduction Methods

5.5.1 Prohibitions

The Water Conservation Ordinance No. 1586 lists water conservation requirements which shall take effect upon implementation by the City Council. These prohibitions shall promote the efficient use of water, reduce or eliminate water waste, complement the City's Water Quality regulations and urban runoff reduction efforts, and enable implementation of the City's Water Shortage Contingency Measures.

Water conservation measures become more restrictive per each progressive stage in order to address the increasing differential between the water supply and demand.

A list of restrictions and prohibitions that are applicable to each stage is displayed in Table 5-3.

Table 5-3: Restrictions and Prohibitions on End Uses

Retail Only: Restrictions and Prohibitions on End Uses			
Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
Permanent Year-Round	Landscape - Limit landscape irrigation to specific times	Irrigation limited to once every other day and prohibited between 10:00 a.m. and 5:00 p.m. on any day	No
Permanent Year-Round	Landscape - Other landscape restriction or prohibition	Irrigation with a watering device not continuously attended limited to no more than fifteen minutes watering per day per station. This does not apply to very low-flow drip type irrigation systems	No
Permanent Year-Round	Other - Prohibit use of potable water for washing hard surfaces	-	No
Permanent Year-Round	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	-	No

Retail Only: Restrictions and Prohibitions on End Uses			
Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
Permanent Year-Round	Other	No watering during or within 48 hours after measurable rainfall	No
Permanent Year-Round	Landscape - Prohibit certain types of landscape irrigation	Irrigation of landscapes outside of newly constructed homes and buildings must comply with regulations established by the California Building Standards Commission and the Department of Housing and Community Development	No
Permanent Year-Round	CII - Lodging establishment must offer opt out of linen service	-	No
Permanent Year-Round	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	Leaks, breaks, and other malfunctions must be corrected within seven days of receiving notice from the City	No
Permanent Year-Round	Water Features - Restrict water use for decorative water features, such as fountains	Operating a water fountain or other decorative water feature that does not use recirculated water is prohibited	No
Permanent Year-Round	Other	Installation of single pass cooling systems is prohibited in buildings requesting new water service	No
Permanent Year-Round	Other	Installation of non-re-circulating water systems is prohibited in new commercial conveyor car wash and new commercial laundry operations.	No
1	Landscape - Limit landscape irrigation to specific times	Irrigation limited to once every other day and prohibited between 10:00 a.m. and 5:00 p.m. on any day	No
1	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	Washing automobiles limited to once every other day except at commercial car wash establishments	No
1	Pools and Spas - Require covers for pools and spas	-	No

Retail Only: Restrictions and Prohibitions on End Uses			
Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
1	CII - Restaurants may only serve water upon request	-	No
2	Other	Fire hydrant use limited to fire-fighting, system testing, and other construction activities or for other activities necessary to maintain public health, safety, and welfare	Yes
2	Landscape - Limit landscape irrigation to specific days	Irrigation permitted only on Tuesdays and Saturdays and prohibited between 10:00 a.m. and 5:00 p.m. on any day	Yes
2	Landscape - Prohibit certain types of landscape irrigation	Agricultural users and commercial nurseries are exempt from Stage 2 water restrictions but required to curtail all non-essential water use.	Yes
2	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	Washing automobiles permitted with use of hand-held bucket or similar container or at commercial car washes.	Yes
2	Landscape - Limit landscape irrigation to specific days	Watering of golf course and recreational fields permitted only on Tuesdays and Saturday before the hours of 10:00 a.m. and after the hours of 6:00 p.m. Golf course greens may be watered on any day	Yes
2	Other	Use of fire hydrants limited to fire-fighting, system testing, and related activities for construction activities or for other activities necessary to maintain public health, safety, and welfare	Yes
2	CII - Restaurants may only serve water upon request	Irrigation permitted only on Tuesdays and Saturdays during the hours before 10:00 a.m. and after the hours of 5:00 p.m.	Yes
3	Landscape - Limit landscape irrigation to specific days	Agricultural users and commercial nurseries shall use water before the 10:00 a.m. and after 6:00 p.m. Watering livestock and irrigating propagation beds permitted any time	Yes

Retail Only: Restrictions and Prohibitions on End Uses			
Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
3	Landscape - Limit landscape irrigation to specific times	Washing of automobiles is prohibited. at commercial car washes and where public health, safety, and welfare reasons	Yes
3	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	Water use at commercial car washes not from reclaimed or recycled water shall be reduced in volume by 20%	Yes
3	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	Use of water-softening devices is prohibited	Yes
3	Other	Watering golf courses and recreational fields permitted only on Tuesdays and Saturdays before the hours of 10:00 a.m. and after 6:00 p.m. except for golf course greens	Yes
3	Landscape - Limit landscape irrigation to specific days	-	Yes
3	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	-	Yes
3	Other	New construction meters or permits for unmetered services prohibited. Construction water prohibited for earth work or road construction purposes.	Yes
4	Landscape - Prohibit all landscape irrigation	-	Yes
4	Landscape - Prohibit certain types of landscape irrigation	Water for agricultural or commercial nursery purposes, except for livestock watering, is prohibited.	Yes
4	Other water feature or swimming pool restriction	Filling or refilling swimming pools, spas, ponds, and artificial lakes is prohibited	Yes
4	Landscape - Other landscape restriction	Watering of all golf course areas is prohibited	Yes

Retail Only: Restrictions and Prohibitions on End Uses			
Stage	Restrictions and Prohibitions on End Users	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
	or prohibition		
4	Landscape - Other landscape restriction or prohibition	Watering of parks, school grounds, and recreation fields is prohibited, except for rare plant or animal species	Yes
4	Other	Water for commercial, manufacturing, or processing purposes shall be reduced in volume by 50%	Yes
4	Other	Water for air conditioning is prohibited	Yes
NOTES:			

5.5.2 Penalties

The City may immediately install a flow restricting device in the customer in violation of any of the restrictions listed in the previous section. The customer shall pay fifty dollars ($50) for the installation and removal of the flow restricting device.

5.5.3 Consumption Reduction Methods

Table 5-4 lists the consumption reduction methods that will be used to reduce water use in restrictive stages.

Table 5-4: Stages of Water Shortage Contingency Plan - Consumption Reduction Methods

Retail Only: Stages of Water Shortage Contingency Plan - Consumption Reduction Methods		
Stage	Consumption Reduction Methods by Water Supplier	Additional Explanation or Reference
1	Other	Stage 1 Water Conservation Measures
2	Other	Stage 2 Water Conservation Measures
3	Other	Stage 3 Water Conservation Measures
4	Other	Stage 4 Water Conservation Measures
NOTES:		

5.6 Impacts to Revenue

The actions described above to address a range of water shortage conditions have the potential to impact the City's revenues and expenditures. To assess these impacts, the City calculated the revenue impacts resulting from a 10, 25, and 50 percent reduction in sales as compared to a base year that was based on an estimate of normal year baseline. Other factors incorporated into the analysis included water losses, pricing structure and avoided costs. The results of this analysis are shown below in Table 5-5.

Table 5-5: Revenue Impacts Analysis

Demand	Baseline	10%	25%	50%
Water Purchased/Produced (HCF)	10,481,407	9,433,266	7,861,055	5,240,704
Groundwater (AF)	7,899,170			
Imported Water (AF)	2,582,237			
Water Losses (HCF)	532,260	479,073	399,227	266,152
Water Sales (HCF)	9,949,104	8,954,194	7,461,828	4,974,552
Tier 4 (>500) (%)	25.0%	25.0%	25.0%	25.0%
Tier 3 (251 - 500) (%)	7.0%	7.0%	7.0%	7.0%
Tier 2 (37 - 250) (%)	21.0%	21.0%	21.0%	21.0%
Tier 1 (0 - 36) (%)	47.0%	47.0%	47.0%	47.0%
Tier 4 (HCF)	2,487,276	2,238,548	1,865,457	1,243,638
Tier 3 (HCF)	696,437	626,794	522,328	348,219
Tier 2 (HCF)	2,089,312	1,880,381	1,566,984	1,044,656
Tier 1 (HCF)	4,676,079	4,208,471	3,507,059	2,338,039
Total	9,949,104	8,954,194	7,461,828	4,974,552
Commodity Rates				
Tier 4 (>500) ($)	3.08	3.08	3.08	3.08
Tier 3 (251 - 500) ($)	3.00	3.00	3.00	3.00
Tier 2 (37 - 250) ($)	2.91	2.91	2.91	2.91
Tier 1 (0 - 36) ($)	2.83	2.83	2.83	2.83
Revenue				
Tier 4 Revenue	$7,660,810	$6,894,729	$5,745,608	$3,830,405
Tier 3 Revenue	$2,089,312	$1,880,381	$1,566,984	$1,044,656
Tier 2 Revenue	$6,079,897	$5,471,908	$4,559,923	$3,039,949
Tier 1 Revenue	$13,233,303	$11,909,973	$9,924,977	$6,616,652
Total	$29,063,323	$26,156,990	$21,797,492	$14,531,661
Fixed Monthly/Bimonthly Charge Revenue	$2,936,677	$2,936,677	$2,936,677	$2,936,677
Total Rate Revenue	$32,000,000	$29,093,668	$24,734,169	$17,468,339
Revenue Lost		**($2,906,332)**	**($7,265,831)**	**($14,531,661)**
Variable Costs				
Sources of Supply, Pumping	$14,822,000	$13,339,800	$11,116,500	$7,411,000

Demand	Baseline	10%	25%	50%
Unit Costs ($/HCF)				
Sources of Supply, Pumping	$1.41	$1.41	$1.41	$1.41
Avoided Costs		**$1,482,200**	**$3,705,500**	**$7,411,000**
Net Revenue Change		**($1,424,132)**	**($3,560,331)**	**($7,120,661)**
Rate Revenue Increase Required		**4.66%**	**12.52%**	**28.62%**

The City receives water revenue from a commodity charge, a fixed customer minimum charge and a capital recovery charge. The rates have been designed to recover the full cost of water service in the commodity charge. Therefore, the cost of purchasing water and producing groundwater would decrease as the usage or sale of water decreases. Should an extreme shortage be declared and a large reduction in water sales occurs for an extended period of time, the Water Services Division would reexamine its water rate structure and monitor projected expenditures. In most cases, the City would first utilize water reserve funds to meet the adjusted revenues. If needed, the City would additionally increase rates to overcome revenue lost.

The City will also follow the allocation plan guidelines of MWDOC as adopted by Metropolitan once an extreme shortage is declared. This allocation plan will be enforced by Metropolitan using rate surcharges. MWDOC will follow the guidelines of the allocation plan and impose the surcharge that Metropolitan applies to its member agencies that exceed their water allocation. The City would correspondingly impose surcharges or penalties in accordance with its ordinance on excessive use of water.

5.7 Reduction Measuring Mechanism

Under normal water supply conditions, potable water production figures are recorded daily. Daily production figures will be reported to the Public Works Director, who will then compare the weekly production to the target weekly production to verify that the reduction goal is being met. If reduction goals are not being met, monthly reports will be sent to the City Council. Totals are reported weekly to the Chief Water Operator. Totals are reported monthly to the Public Works Director and incorporated into the water supply report.

The City will participate in monthly member agency manager meetings with both MWDOC and OCWD to monitor and discuss monthly water allocation charts. This will enable the City to be aware of import and groundwater use on a timely basis as a result of specific actions taken responding to the City's Water Shortage Contingency Plan.

6 RECYCLED WATER

Recycled water opportunities have continued to grow in Southern California as public acceptance and the need to expand local water resources continues to be a priority. Recycled water also provides a degree of flexibility and added reliability during drought conditions when imported water supplies are restricted.

Recycled water is wastewater that is treated through primary, secondary and tertiary processes and is acceptable for most non-potable water purposes such as irrigation, and commercial and industrial process water per Title 22 requirements.

6.1 Agency Coordination

The City does not own or operate wastewater treatment facilities and sends all collected wastewater to Orange County Sanitation District (OCSD) for treatment and disposal. OCWD is the manager of the Orange County Groundwater Basin and strives to maintain and increase the reliability of the Basin through replenishment with imported water, stormwater, and advanced treated wastewater. OCWD and OCSD have jointly constructed and expanded two water recycling projects to meet this goal that include: 1) OCWD Green Acres Project (GAP) and 2) OCWD GWRS.

6.1.1 OCWD Green Acres Project

OCWD owns and operates the GAP, a water recycling system that provides up to 8,400 AFY of recycled water for irrigation and industrial uses. GAP provides an alternate source of water that is mainly delivered to parks, golf courses, greenbelts, cemeteries, and nurseries in the cities of Costa Mesa, Fountain Valley, Newport Beach, and Santa Ana. Approximately 100 sites use GAP water, current recycled water users include Mile Square Park and Golf Courses in Fountain Valley, Costa Mesa Country Club, Chroma Systems carpet dyeing, Kaiser Permanente, and Caltrans. The City does not receive any GAP water.

6.1.2 OCWD Groundwater Replenishment System

OCWD's GWRS receives secondary treated wastewater from OCSD and purifies it to levels that meet and exceed all state and federal drinking water standards. The GWRS Phase 1 plant has been operational since January 2008, and uses a three-step advanced treatment process consisting of microfiltration (MF), reverse osmosis (RO), and ultraviolet (UV) light with hydrogen peroxide. A portion of the treated water is injected into the seawater barrier to prevent seawater intrusion into the groundwater basin. The other portion of the water is pumped to ponds where the water percolates into deep aquifers and becomes part of Orange County's water supply. The treatment process described on OCWD's website is provided below (OCWD, GWRS, 2015).

GWRS Treatment Process

The first step of the treatment process after receiving the secondary treated wastewater is a separation process called MF that uses hollow polypropylene fibers with 0.2 micron diameter holes in the sides. Suspended solids, protozoa, bacteria and some viruses are filtered out when drawing water through the holes to the center of the fibers.

The second step of the process consists of RO, semi-permeable polyamide polymer (plastic) membranes that water is forced through under high pressure. RO removes dissolved chemicals, viruses and pharmaceuticals in the water resulting in near-distilled-quality water that requires minerals be added back in to stabilize the water. This process was used by OCWD from 1975 to 2004 at their Water Factory 21 (WF-21) to purify treated wastewater from OCSD for injection into the seawater intrusion barrier.

The third step of the process involves water being exposed to high-intensity UV light with hydrogen peroxide (H_2O_2) for disinfection and removal of any trace organic compounds that may have passed through the RO membranes. The trace organic compounds may include N-Nitrosodimethylamine (NDMA) and 1-4 Dioxane, which have been removed to the parts-per trillion level. UV disinfection with H_2O_2 is an effective disinfection/advanced oxidation process that keeps these compounds from reaching drinking water supplies.

OCWD's GWRS has a current production capacity of 112,100 AFY with the expansion that was completed in 2015. Approximately 39,200 AFY of the highly purified water is pumped into the injection wells and 72,900 AFY is pumped to the percolation ponds in the city of Anaheim where the water is naturally filtered through sand and gravel to deep aquifers of the groundwater basin. The Basin provides approximately 72 percent of the potable water supply for north and central Orange County.

The design and construction of the first phase (78,500 AFY) of the GWRS project was jointly funded by OCWD and OCSD; Phase 2 expansion (33,600 AFY) was funded solely by OCWD. Expansion beyond this is currently in discussion and could provide an additional 33,600 AFY of water, increasing total GWRS production to 145,700 AFY. The GWRS is the world's largest water purification system for indirect potable reuse (IPR).

6.2 Wastewater Description and Disposal

The Garden Grove Sanitary District (GGSD) was formed in 1924 for the purpose of providing sanitary sewer service to portions of Orange County including the city of Garden Grove, which was unincorporated Orange County at that time. GGSD provided sewer service to most areas within the corporate boundaries of the City, as well as portions of the cities of Stanton, Anaheim, Orange, Santa Ana, and Westminster. In 1997, the Orange County Local Agency Formation Commission revised the boundaries of the GGSD and reorganized it as a subsidiary district of the City.

The City sewer system includes 312 miles of sewer lines, 9,700 manholes and four lift stations that connect to OCSD's trunk system to convey wastewater to OCSD's treatment plants. OCSD has an extensive system of gravity flow sewers, pump stations, and pressurized sewers. OCSD's Plant No. 1 in Fountain Valley has a capacity of 320 million gallons per day (MGD) and Plant No. 2 in Huntington Beach has a capacity of 312 MGD. Both plants share a common ocean outfall, but Plant No. 1 currently provides all of its secondary treated wastewater to OCWD's GWRS for beneficial reuse. The 120-inch diameter ocean outfall extends 4 miles off the coast of Huntington Beach. A 78-inch diameter emergency outfall also extends 1.3 miles off the coast.

Table 6-1 summarizes the City's wastewater collected by GGSD and transported to OCSD's system in 2015. No wastewater is treated or disposed in the City's service area as OCSD treats and disposes all of the City's wastewater.

Table 6-1: Wastewater Collected Within Service Area in 2015 (AF)

Retail: Wastewater Collected Within Service Area in 2015					
Wastewater Collection			Recipient of Collected Wastewater		
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated?	Volume of Wastewater Collected in 2015	Name of Wastewater Treatment Agency Receiving Collected Wastewater	Treatment Plant Name	Is WWTP Located Within UWMP Area?
Garden Grove Sanitary District	Estimated	15,632	OCSD	Plant No. 1 / Plant No. 2	No
Total Wastewater Collected from Service Area in 2015:		15,632			
NOTES:					

6.3 Current Recycled Water Uses

There are currently no recycled water uses within the City's service area.

6.4 Potential Recycled Water Uses

While the City recognizes the potential for beneficial reuse in their service area, there is no source of recycled water supply in proximity to the City. The City's wastewater is conveyed to OCSD's regional treatment facilities where the wastewater is treated, recycled, or discharged to the ocean. Recycled water analyses performed over the years have shown that local treatment and reuse facilities are not feasible. The City supports, encourages, and contributes to the continued development of recycled water and potential uses throughout the region with OCWD's GWRS.

6.4.1 Direct Non-Potable Reuse

The City does not have any direct non-potable uses within their service area and does not currently have the potential for non-potable reuse as a result of nonexistent or planned recycled water infrastructure.

6.4.2 Indirect Potable Reuse

The City benefits from OCWD's GWRS system that provides indirect potable reuse through replenishment of Orange County's Groundwater Basin with water that meets state and federal drinking water standards.

6.5 Optimization Plan

The City does not use recycled water, therefore, there is no need for a recycled water optimization plan. In other areas of Orange County, recycled water is used for irrigating golf courses, parks, schools, businesses, and communal landscaping, as well as for groundwater recharge. Analyses have indicated that present worth costs to incorporate recycled water within the City are not cost effective as compared to purchasing imported water from MWDOC, or using groundwater. The City will continue to conduct feasibility studies for recycled water and seek out creative solutions such as funding, regulatory requirements, institutional arrangement and public acceptance for recycled water use with MWDOC, OCWD, Metropolitan and other cooperative agencies.

7 FUTURE WATER SUPPLY PROJECTS AND PROGRAMS

7.1 Water Management Tools

Resource optimization such as desalination and IPR minimize the City's and region's reliance on imported water. Optimization efforts are typically led by regional agencies in collaboration with local/retail agencies.

7.2 Transfer or Exchange Opportunities

Interconnections with other agencies result in the ability to share water supplies during short term emergency situations or planned shutdowns of major imported water systems. The City maintains four connections to the Metropolitan system and nine emergency interconnections with surrounding agencies. These interconnections have the ability to transfer a totally of approximately 22,500 GPM into the City's distribution system. Emergency interconnections result in approximately 13,200 GPM of flow.

MWDOC continues to help its retail agencies develop transfer and exchange opportunities that promote reliability within their systems. Therefore, MWDOC will look to help its retail agencies navigate the operational and administrative issues of transfers within the Metropolitan distribution system. Currently, there are no transfer or exchange opportunities.

7.3 Planned Water Supply Projects and Programs

The City has identified the following planned design and construction projects.

Rehabilitate Well 19 - construct new wellhead and perform SCADA improvements.

7.4 Desalination Opportunities

The City has not investigated seawater desalination as a result of economic and physical impediments.

Brackish groundwater is groundwater with a salinity higher than freshwater, but lower than seawater. Brackish groundwater typically requires treatment using desalters.

7.4.1 Groundwater

Between the years of 1990 and 2005, the City participated in a blending agreement with OCWD where they were allowed to pump above the BPP, but would pay an adjusted BEA. The adjusted BEA allowed the City to deduct the additional expenses that were incurred from the blending project. The Lampson Well Nitrate Blending Project is not only beneficial to the City, but benefits the Orange County Groundwater Basin by cleaning the Talbert Aquifer of nitrates. Under the agreement, the City was allowed to extract 4,000 AFY from wells containing high nitrate concentrations. Currently, OCWD considers the City’s BEA-exempt agreement to be expired.

The Garden Grove Nitrate Blending Project is located at the City’s Lampson Reservoir site. Groundwater pumped from two wells, No. 28 and No. 23 (intermittently) are blended in order to meet the MCL for nitrate.

7.4.2 Ocean Water

The City has not investigated ocean desalination as a result of economic and physical impediments.

8 UWMP ADOPTION PROCESS

Recognizing that close coordination among other relevant public agencies is key to the success of its UWMP, the City worked closely with entities such as MWDOC to develop and update this planning document. The City also encouraged public involvement by holding a public hearing for residents to learn and ask questions about their water supply.

This section provides the information required in Article 3 of the Water Code related to adoption and implementation of the UWMP. Table 8-1 summarizes external coordination and outreach activities carried out by the City and their corresponding dates. The UWMP checklist to confirm compliance with the Water Code is provided in Appendix A.

Table 8-1: External Coordination and Outreach

External Coordination and Outreach	Date	Reference
Encouraged public involvement (Public Hearing)	5/31/16 & 6/7/16	Appendix F
Notified city or county within supplier's service area that water supplier is preparing an updated UWMP (at least 60 days prior to public hearing)	3/21/16	Appendix E
Held public hearing	6/14/16	Appendix E
Adopted UWMP		Appendix F
Submitted UWMP to DWR (no later than 30 days after adoption)		
Submitted UWMP to the California State Library and city or county within the supplier's service area (no later than 30 days after adoption)		
Made UWMP available for public review (no later than 30 days after filing with DWR)		

This UWMP was adopted by the City Council on DATE, 2016. A copy of the adopted resolution is provided in Appendix F.

A change from the 2004 legislative session to the 2009 legislative session required the City to notify any city or county within its service area at least 60 days prior to the public hearing. As shown in Table 8-2, the City sent a Letter of Notification to the County of Orange on DATE, 2016 to state that it was in the process of preparing an updated UWMP (Appendix E).

Table 8-2: Notification to Cities and Counties

Retail: Notification to Cities and Counties		
County Name	60 Day Notice	Notice of Public Hearing
Orange County	☑	☑
NOTES:		

8.1 Public Participation

The City encourages community participation in developing its urban water management planning efforts. For this UWMP update, a public meeting was held on DATE, 2016 to review and receive comments on the draft plan before City Council approval.

Notices of public meetings were posted in the City Hall. Legal public notices for the meeting were published in the local newspaper and posted at City facilities. Copies of the draft plan were available at the City Clerk and Utility Department offices. A copy of the published Notice of Public Hearing is included in Appendix E.

8.2 Agency Coordination

The City's water supply planning relates to the policies, rules, and regulations of its regional and local water providers. The City is dependent on imported water from Metropolitan through MWDOC, its regional wholesaler. The City is also dependent on groundwater from OCWD, the agency that manages the Santa Ana River Groundwater Basin. As such, the City involved these water providers in this 2015 UWMP at various levels of contribution.

8.3 UWMP Submittal

8.3.1 Review of 2010 UWMP Implementation

As required by California Water Code, the City summarized Water Conservation Programs implemented to date, and compared them to those planned in its 2010 UWMP.

8.3.2 Comparison of 2010 Planned Water Conservation Programs with 2015 Actual Programs

As a signatory to the memorandum of understanding (MOU) regarding urban water use efficiency, the City's commitment to implement BMP-based water use efficiency program continues today. For the City's specific achievements in the area of conservation, please see Section 4 of the UWMP.

8.3.3 Filing of 2015 UWMP

The City Council reviewed the Final Draft Plan on DATE, 2016. The five-member City Council approved the 2015 UWMP on DATE, 2016. See Appendix F for the resolution approving the Plan.

By July 1, 2016, the City's Adopted 2015 UWMP was filed with DWR, California State Library, County of Orange, and cities within its service area, if applicable.

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San Diego County Water Authority, 2003. Quantification Settlement Agreement.

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Water Systems Optimization, 2016. California Department of Water Resources: Water Audit Manual.

APPENDIX A

UWMP Checklist

APPENDIX B

Standardized Tables

APPENDIX C

Groundwater Management Plan

APPENDIX D

City Ordinance

APPENDIX E

Notification of Public and Service Area Suppliers

APPENDIX F

Adopted UWMP Resolution

APPENDIX G

Bump Methodology

APPENDIX H

AWWA Water Loss Audit Worksheet

APPENDIX I

Water Use Efficiency Implementation Report

APPENDIX J

CUWCC BMP Report

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