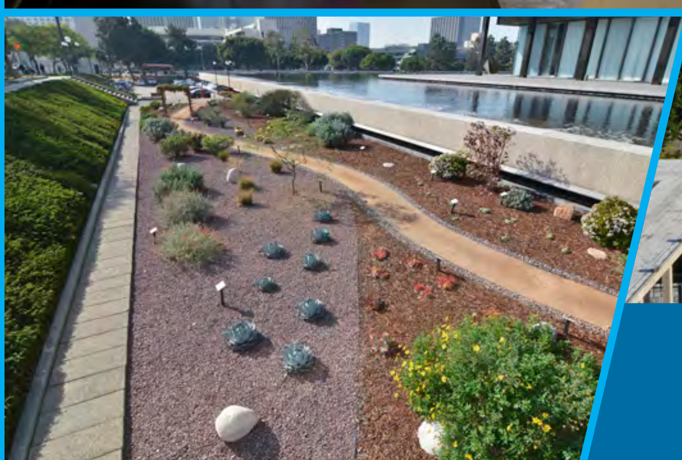


LA DWP

Urban Water Management Plan

2020

ladwp.com/UWMP

RESOLUTION NO. 021 226

WHEREAS, the California Urban Water Management Planning Act (UWMP Act), as codified in Water Code Section 10610 et seq., requires California water suppliers to prepare and adopt an Urban Water Management Plan (UWMP) every five years that describes their historical and future efforts in the area of water resources and adopt a Water Shortage Contingency Plan (WSCP); and

WHEREAS, the Los Angeles Department of Water and Power (LADWP) has prepared an update to the City of Los Angeles' (City) UWMP and a new WSCP in compliance with the UWMP Act; and

WHEREAS, the adoption of a UWMP and WSCP is an eligibility requirement for various water system grant and loan funding opportunities administered by the State of California; and

WHEREAS, the UWMP identifies current and planned supplies to meet all anticipated demands over the 25-year planning period under average, single-dry, and multi-dry year hydrology; and

WHEREAS, the WSCP identifies six standard water shortage levels and associated shortage response actions to address up to and exceeding 50 percent reduction in water supply, as described in the City's Emergency Water Conservation Plan; and

WHEREAS, the development of the UWMP and WSCP included public meetings, public involvement, and the incorporation of oral and written public comments prior to final adoption; and

WHEREAS, the final UWMP and WSCP must be adopted by the Board of Water and Power Commissioners and submitted to the California Department of Water Resources no later than July 1, 2021.

NOW, THEREFORE, BE IT RESOLVED, that LADWP's 2020 UWMP and WSCP are hereby adopted.

BE IT FURTHER RESOLVED that the President or Vice President of the Board, or the General Manager or such person as he shall designate in writing or his designee, and the Secretary, Assistant Secretary, or the Acting Secretary of the Board be and they are hereby authorized and directed to approve said UWMP and WSCP for and on behalf of LADWP.

I HEREBY CERTIFY that the foregoing is a full, true, and correct copy of a Resolution adopted by the Board of Water and Power Commissioners of the City of Los Angeles at its meeting held MAY 2 5 2021

Acting Secretary

APPROVED AS TO FORM AND LEGALITY
MICHAEL N. FEUER, CITY ATTORNEY

APR 29 2021

BY
MELANIE A. TORY
DEPUTY CITY ATTORNEY

Table of Contents

2020
Urban Water Management Plan

Executive Summary

Chapter 1: Introduction

Chapter 2: Water Demand

Chapter 3: Water Conservation

Chapter 4: Los Angeles Aqueduct System

Chapter 5: Local Groundwater

Chapter 6: Watershed Management

Chapter 7: Recycled Water

Chapter 8: Operation NEXT Water Supply Program

Chapter 9: Metropolitan Water District Supplies

Chapter 10: Metropolitan Water District Supplies

Chapter 11: Water Supply Reliability and Financial Integrity

Chapter 12: Climate Change and Water and Energy Nexus

Appendices

List of Exhibits

2020 **Urban Water Management Plan**

Executive Summary

Chapter 1: Introduction

Chapter 2: Water Demand

Chapter 3: Water Conservation

Chapter 4: Los Angeles Aqueduct System

Chapter 5: Local Groundwater

Chapter 6: Watershed Management

Chapter 7: Recycled Water

Chapter 8: Operation NEXT Water Supply Program

Chapter 9: Metropolitan Water District Supplies

Chapter 10: Other Water Supplies

Chapter 11: Water Supply Reliability and Financial Integrity

Chapter 12: Climate Change and Water and Energy Nexus

List of Case Studies

2020 **Urban Water Management Plan**

Glossary of Abbreviations and Terms

2020 **Urban Water Management Plan**

Agencies

AVEK	Antelope Valley-East Kern Water Agency
AWWA	American Water Works Association
BOE	City of Los Angeles Department of Public Works, Bureau of Engineering
BWP	Burbank Water and Power
LASAN	City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment
Caltrans	California Department of Transportation
CalWEP	California Water Efficiency Partnership
CBWRP	Central Basin Water Rights Panel
CDFW	California Department of Fish and Wildlife
CITY	City of Los Angeles
CSLC	California State Lands Commission
CRB	Colorado River Board of California
CUWCC	California Urban Water Conservation Council
CVWD	Coachella Valley Water District
DDW	State Water Resources Control Board Division of Drinking Water
DTSC	California Department of Toxic Substance Control
DWA	Desert Water Agency
DWR	California Department of Water Resources
GBUAPCD	Great Basin Unified Air Pollution Control District
GSAs	Groundwater Sustainability Agencies
IAP	Independent Advisory Panel
IID	Imperial Irrigation District
LACDPH	Los Angeles County Department of Public Health
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LARWQCB	Los Angeles Regional Water Quality Control Board

MWD	Metropolitan Water District of Southern California
NWRI	National Water Research Institute
PPIC	Public Policy Institute of California
PVID	Palo Verde Irrigation District
RWQCB	Regional Water Quality Control Board
SCAG	Southern California Association of Governments
SWRCB	State Water Resources Control Board
USEPA	United States Environmental Protection Agency
WBMWD	West Basin Municipal Water District
WRD	Water Replenishment District of Southern California

Facilities and Locations

AVGB	Antelope Valley Groundwater Basin
AWPF	Advanced Water Purification Facility
AWTF	Advanced Water Treatment Facility
BAY-DELTA	San Francisco Bay and Sacramento-San Joaquin River Delta
BOU	Burbank Operable Unit
BWRP	Burbank Water Reclamation Plant
CRA	Colorado River Aqueduct
DCTWRP	Donald C. Tillman Water Reclamation Plant
ECLWRF	Edward C. Little Water Recycling Facility
EOC	Emergency Operations Center
HAWPF	Hyperion Advanced Water Purification Facility
HWRP	Hyperion Water Reclamation Plant
JWPCP	Joint Water Pollution Control Plant
LAA	Los Angeles Aqueducts (First and Second)
LAAFP	Los Angeles Aqueduct Filtration Plant
LAGWRP	Los Angeles/Glendale Water Reclamation Plant
LAWA	Los Angeles World Airports
NHOU	North Hollywood Operable Unit
RRWP	Regional Recycled Water Program
SFB	San Fernando Basin
SWP	State Water Project
TIWRP	Terminal Island Water Reclamation Plant
ULARA	Upper Los Angeles River Area

Measurements and Miscellaneous

AOP	Advanced Oxidation Process
AB	Assembly Bill
Act	Urban Water Management Planning Act
AF	Acre-Feet
AFY	Acre-Feet Per Year
ATRW	Advanced Treated Recycled Water
BDCP	Bay Delta Conservation Plan
BMP	Best Management Practices
CDI	Commercial Direct Install
CEE	Consortium of Energy Efficiency
CEQA	California Environmental Quality Act
CFS	Cubic Feet Per Second
CII	Commercial/Industrial/Institutional
CIP	Capital Improvement Program
CMIP3	Coupled Model Intercomparison Project 3
CMIP5	Coupled Model Intercomparison Project 5
COCs	Chemicals of Concern
CVP	Central Valley Project
CWC	California Water Code
DCP	Delta Conveyance Project
DPR	Direct Potable Reuse
EIR	Environmental Impact Report
EO	Executive Order
ERP	Emergency Response Plan
ESAP	Energy Savings Assistance Program
ESR	Energy Service Representatives
ETo	Evapotranspiration Rate
ETWU	Estimated Total Water Use
EWMP	Enhanced Watershed Management Program
FY	Fiscal Year (July to June)
FYE	Fiscal Year Ending
GAC	Granular Activated Carbon
GCM	Global Climate Models
GDAP	Groundwater Development and Augmentation Plan
GHG	Greenhouse Gases

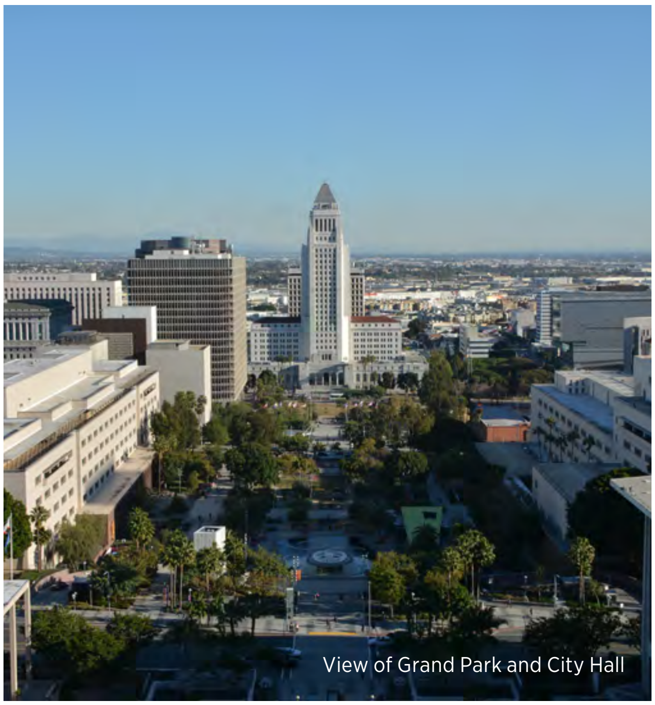
GLAC	Greater Los Angeles County
GPCD	Gallons Per Capita Per Day
GPD	Gallons Per Day
GPF	Gallons Per Flush
GPM	Gallons Per Minute
GSAs	Groundwater Sustainability Agencies
GSIS	Groundwater System Improvement Study
GSPs	Groundwater Sustainability Plans
GWAM	Groundwater Augmentation Model
GWR	Groundwater Replenishment
HCSM	Hydrogeologic Conceptual Site Model
HEIP	High Energy Improvement Program
HET	High Efficiency Toilet
I&I	Inflow and Infiltration
IAP	Independent Advisory Panel
IPR	Indirect Potable Reuse
IRP	Integrated Resources Plan
IRWMP	Integrated Regional Water Management Plan
KWh/AF	Kilowatt-Hour per Acre-Foot
LAASM	Los Angeles Aqueduct Simulation Model
LID	Low Impact Development
LOI	Letter of Intent
LORP	Lower Owens River Project
LRP	Local Resources Program
LSPC	Load Simulation Program
LTWA	Long Term Water Agreement
M&I	Municipal and Industrial
MAF	Million Acre-Feet
MAWA	Maximum Applied Water Allowance
MBR	Membrane Bioreactor
MCL	Maximum Contaminant Level
MF	Microfiltration
MFDT	Multi-Family Direct Therms
MGD	Million Gallons Per Day
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MWh	Megawatt-Hour

MWIP	Manhattan Wellfield Improvement Project
MWELO	Model Water Efficient Landscape Ordinance
NCP	National Contingency Plan
NDMA	N-nitrosodimethlamine
NdN	Nitrification/Denitrification
NL	Notification Level
NPDES	National Pollutant Discharge Elimination System
NPR	Non-Potable Water Reuse
NRW	Non-revenue Water
NWRI	National Water Research Institute
OLMP	Owens Lake Master Project
PCE	Perchloroethylene
PEIR	Programmatic Environmental Impact Report
PFAS	Per- and Polyfluroalkyl Substances
PFOA	Perfluorooctanoic Acid
PHET	Premium High Efficiency Toilet
pLAn	LA's Sustainable City Plan
PPB	Parts Per Billion
PPM	Parts Per Million
QSA	Quantification Settlement Agreement
RCP	Representative Concentration Pathway
RO	Reverse Osmosis
RRWP	Regional Recycled Water Program
RTP	Southern California Association of Governments Regional Transportation Plan
RWAG	Recycled Water Advisory Group
RY	Runoff Year (April to March)
SB	Senate Bills
SCMP	Stormwater Capture Master Plan
SCWP	Safe, Clean Water Program
SGMA	Sustainable Groundwater Management Act
SIP	State Implementation Plan
SGFs	Sewer Generation Factors
SWA	Surface Water Augmentation
SNMP	Salt and Nutrient Management Plan
SQFT	Square Foot
TAF	Thousand Acre-Feet
TAP	Technical Assistance Program

TCE	Trichloroethylene
TDMLs	Total Maximum Daily Loads
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TWB2	Tillage with Shallow Flood Best Available Control Measure Backup
ULF	Ultra-Low Flush
URWS	Urban Retail Water Suppliers
UV	Ultra-Violet
UWMP	Urban Water Management Plan
VOCs	Volatile Organic Compounds
WBICs	Weather-Based Irrigation Controllers
WCM	Water Conservation Model
WCPS	Water Conservation Potential Study
WCSB	West Coast Sea Barrier
WQBELs	Water Quality Based Effluent Limits
WSA	Water Supply Assessment
WSCP	Water Shortage Contingency Plan
WSDM	Water Surplus and Drought Management Plan
WSIP	Water Savings Incentives Program
WYs	Water Year (October to September)
20x2020	Reduce Per Capita Water Use by 20 Percent by 2020; Senate Bill x7-7

Downtown Los Angeles Skyline from the John Ferraro Building

Executive Summary


View of Grand Park and City Hall

ES.1 Overview and Purpose of Plan

In 1902, the City of Los Angeles (City) created a municipal water system by acquiring title to all properties of a private water company. In 1925, the Los Angeles Department of Water and Power (LADWP) was established by a new city charter. The availability of water has significantly contributed towards the economic development of the City. LADWP has supported the City's need for water resources as it has developed from a town with a population of approximately 142,000 residents in 1902, into the nation's second largest city with over 4 million residents, encompassing a 472-square mile area. As the largest municipal utility in the nation, LADWP provides safe, reliable, and cost-effective water and power in a customer-focused and environmentally responsible manner.

Overview of Water Issues

LADWP has a strong history of water resources management and integrated resource planning. Faced with increasing water demands and multi-year dry periods, LADWP is addressing the challenge of providing a reliable water supply for a growing population by expanding local water supply programs and reducing demands on purchased imported water. LADWP continues to make significant investments in local groundwater, recycled water, stormwater capture, and water conservation and use efficiency to further diversify its water supply portfolio. In April 2019, LADWP, in conjunction with the City, developed short-term and long-term sustainability targets through L.A.'s Green New Deal, to form a more reliable and resilient water supply. LADWP is committed to meet all the City's water needs while increasing supply reliability, reducing imported water purchases, and increasing locally produced water by continuing to:

- Achieve significant water conservation and water use efficiency enhancements
- Increase stormwater capture capacity
- Maximize water reuse
- Maximize and expand groundwater production
- Maintain and increase operational integrity of the Los Angeles Aqueduct and in-City water distribution systems
- Ensure continued reliability of the water supplies from the Metropolitan Water District of Southern California (MWD) through active representation of the City's interests on the MWD Board
- Meet or exceed all Federal and State standards for drinking water quality

Purpose of Plan

The California Urban Water Management Planning Act (Act) requires that every urban water supplier prepare and adopt an Urban Water Management Plan (UWMP) every five years, first effective on January 1, 1984. Since its original enactment, there have been several amendments to the Act. The main purpose of the UWMP is to forecast future water demands and water supplies under average and dry hydrologic conditions; identify future water supply projects; and provide a reliability assessment for average, single dry year, and multi-dry years and assess near term drought risk.

LADWP's 2020 UWMP presents the general policies which guide LADWP's decision-making process to maintain and secure a sustainable water supply for the City. The UWMP serves two purposes:

- It is the master plan for water supply and resources management consistent with LADWP's goals and policy objectives; and
- It provides full compliance with the requirements of the Act.

Major Events and Code Changes Since 2015 UWMP

A number of major events have occurred since LADWP prepared its 2015 UWMP:

- The historic multi – dry year period in California started in 2012, continued through 2016 and ended with record precipitation in 2017.
- In 2019, Mayor Eric Garcetti issued an update to the LA Sustainable City pLAn (L.A.'s Green New Deal). L.A.'s Green New Deal was developed in collaboration with LADWP and includes targets to increase local water supplies through recycled water, stormwater capture, conservation, and water use efficiency.
- In July 2020, California Governor Gavin Newsom's Water Resilience Portfolio was issued. The portfolio outlined goals and actions for the state to address its water challenges. The portfolio focused on 3 priorities – (1) maintaining access to safe and clean drinking water, (2) establishing voluntary agreements to collaboratively manage water resources and protect fish and wildlife, and (3) advancing the Delta Conveyance Project.

Multiple new requirements have been added to the UWMP Act since completion of the 2015 UWMP, including:

- Addition of a seismic risk assessment and mitigation plan (Senate Bill (SB) 664)
- Inclusion of a water shortage contingency plan with six standard water shortage levels (SB 606)
- Drought risk assessment for a five-year historic sequence (SB 606 and Assembly Bill (AB) 1414)
- Reporting of energy intensity (SB 606)
- Considerations for climate change impacts (SB 606)
- Annual water supply and demand assessment after 2020, the first of which should include a narrative that describes water demand management measures that the supplier plans to implement to achieve its urban water use objective by January 1, 2027 (AB 1414).

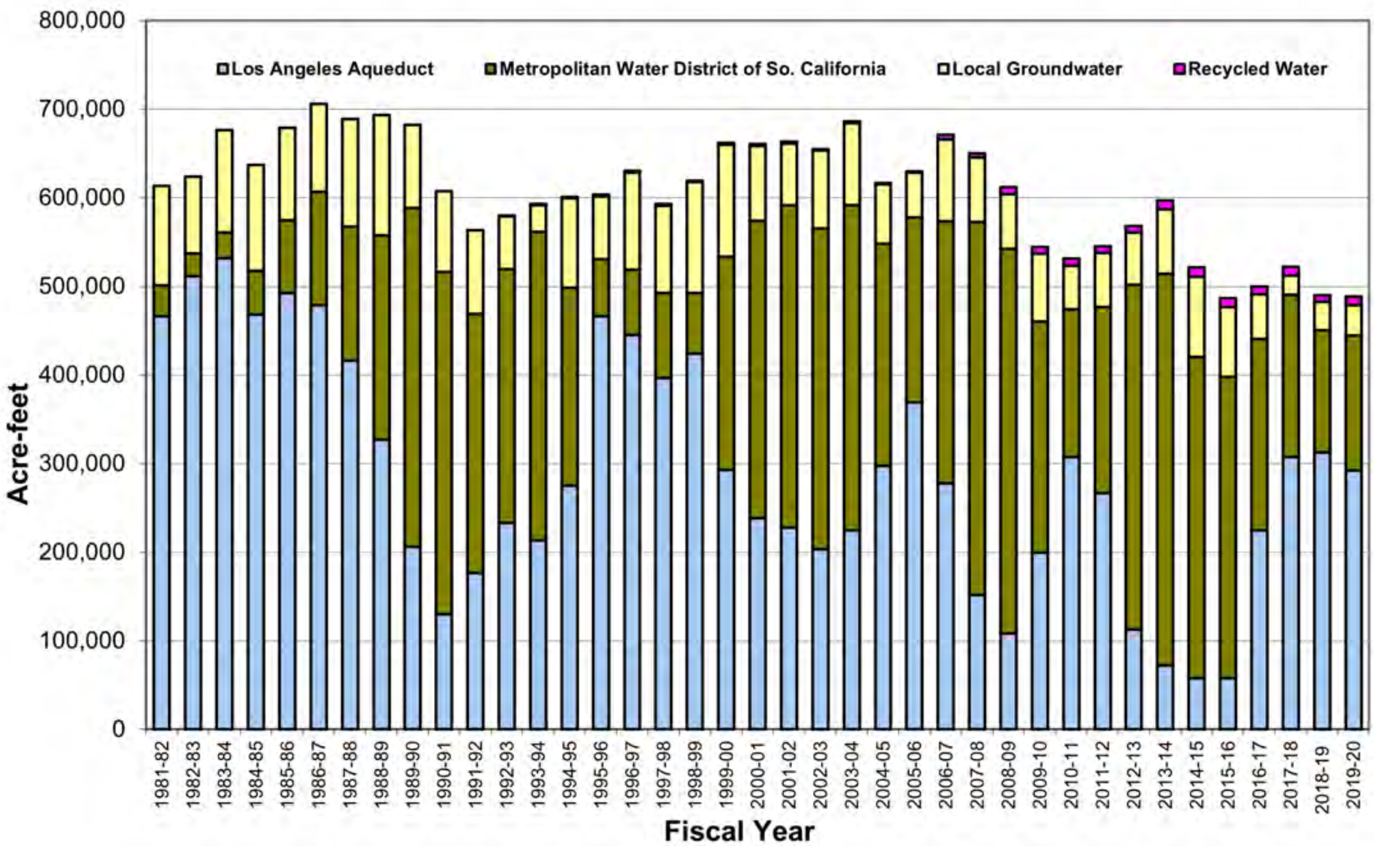
Exhibit ES-A
Main Sources of LADWP's Water Supply

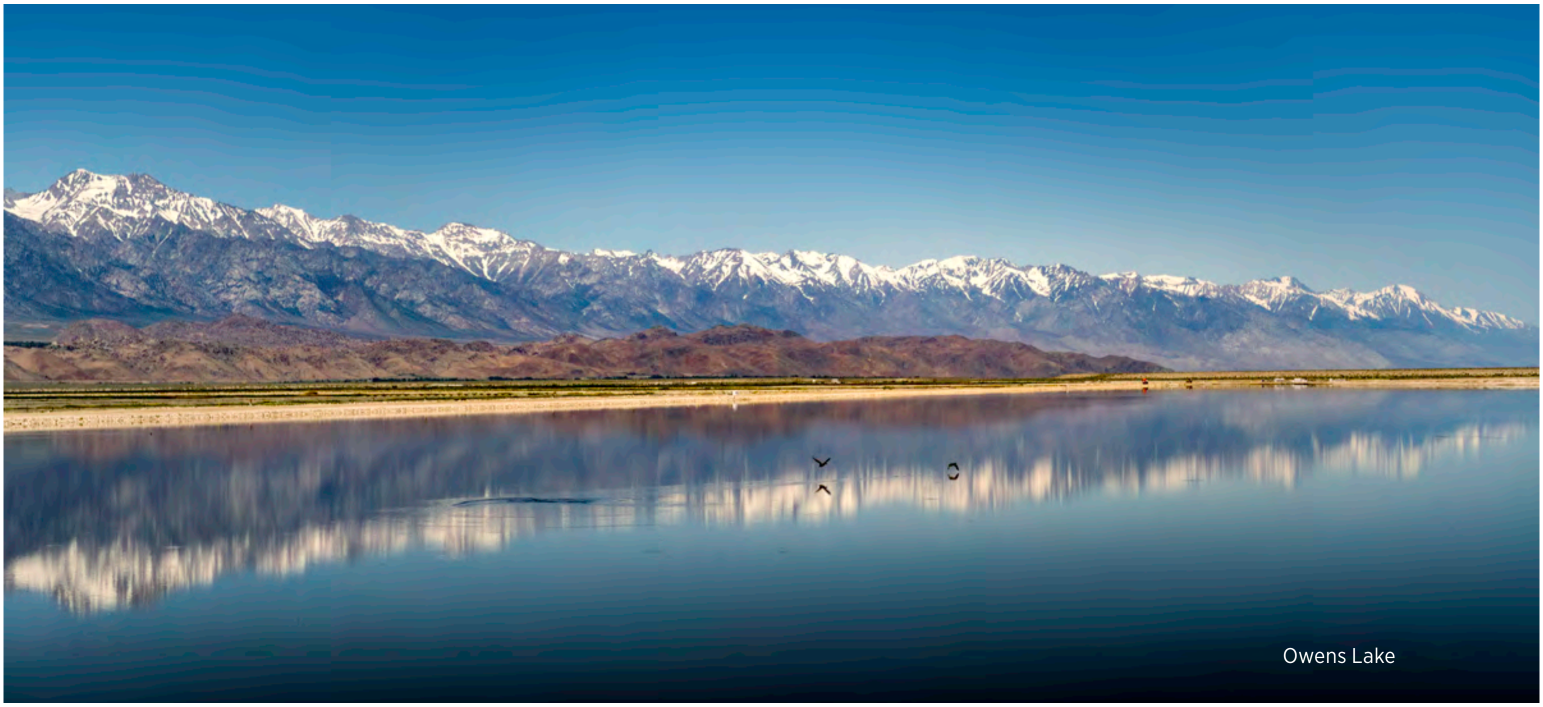
ES.2 Existing Water Supplies

Primary sources of water for the LADWP service area are the Los Angeles Aqueducts (LAA), local groundwater, State Water Project (supplied by MWD), and Colorado River Aqueduct (supplied by MWD). Exhibit ES-A illustrates the general location of these supplies. Expansion in recycled water, or water reuse, is anticipated to play a significant role in the local supply strategy. Supplies from the LAA, State Water Project, and Colorado River Aqueduct are classified as imported because they are sourced from outside LADWP's service area. Many of LADWP's traditional water supply sources are becoming increasingly constrained due to hydrologic variability, environmental regulations, and groundwater basin contamination. To mitigate these impacts on supply resources, LADWP is continuing on the path towards sustainability by investing in conservation, water use efficiency, water recycling, stormwater capture, and local groundwater development and remediation, while also protecting its imported water supplies.

Exhibit ES-B summarizes the historical water supplies from the period of FY 1981/82 to 2019/20. Despite an increase in population of over one million people seen during this period, the City's average water usage in 2020 is below the average amount of water used in the 1970s. Over the last twenty years, demands have undergone a drastic reduction from a peak of 689,467 AF in FY 2003/04 to a near record low of 487,591 AF in FY 2019/20, a 29 percent reduction.

Exhibit ES-B
LADWP Historical Water Supply from FY 1981/82 to 2019/20

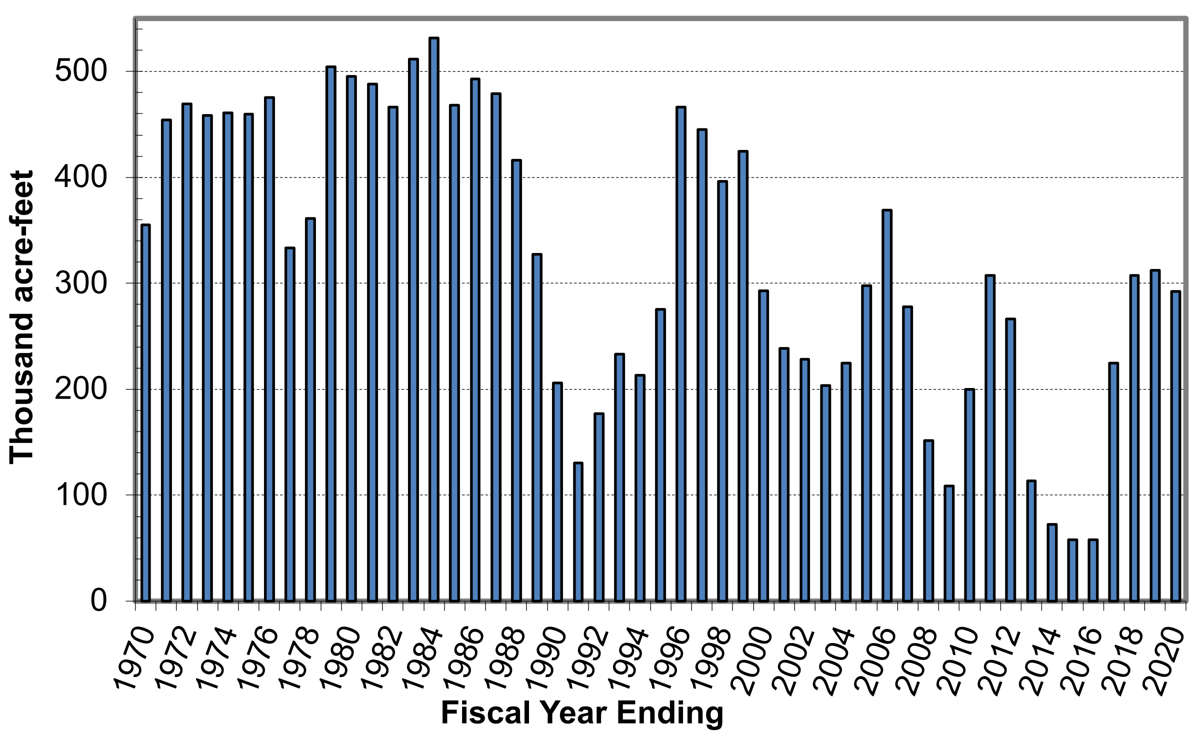




LAA

Since its construction in the early 1900's, the LAA historically provided the vast majority of water for the City. Annual LAA deliveries are dependent on snowfall in the Eastern Sierra Nevada. Years with abundant snowpack result in larger water deliveries from the LAA, and reduced purchases of supplemental water from MWD. At its peak in fiscal year (FY) 1983-84, the LAA delivered 531,729 acre-feet (AF) to the residents of the City. Concerns over environmental impacts have required the City to reallocate approximately one-half of the LAA water supply to other uses within the Owens Valley and Mono Basin. Between 1992 and 2020, the City provided approximately 177,000 acre-feet per year (AFY) of water to supply a variety of environmental projects throughout the Eastern Sierra. The cyclical nature of hydrology and environmental obligations affecting LAA annual deliveries over the last 30 years is shown in Exhibit ES-C.

Exhibit ES-C
Historical Los Angeles Aqueduct Deliveries



Local Groundwater

A key resource that the City has relied upon as a major component of its local water supply portfolio is local groundwater. Over the last five years local groundwater has provided approximately 8 percent of the total water supply for Los Angeles, and since 1970 has provided up to 23 percent of total supply during extended dry periods when imported supplies become impacted. During the 2012-2016 historic dry period, imported water deliveries from MWD and the LAA declined dramatically. As a result, increased local groundwater production played an important role to meeting demands. Local groundwater resources will become increasingly more important to the City's future strategy to address hydrologic variability. In recent years, contamination issues have impacted LADWP's ability to fully utilize its local groundwater entitlements. Furthermore, reduced groundwater elevations in local basins have resulted from decades of expanding urbanization, increasing impervious hardscape, and channelization of stormwater runoff. Aging wellfields and distribution system infrastructure have also presented challenges to the development and use of the City's local groundwater resources.

In response to these issues, LADWP has renewed its focus on sustainable management of its local groundwater basins. Responding to groundwater contamination issues has been a high priority for LADWP. Expanded basin remediation systems are under development in the City's main groundwater basin, the San Fernando Basin (SFB), to remove contamination from the local groundwater basin for the betterment of the environment and to restore the beneficial uses of this important basin. LADWP continues to invest in stormwater recharge projects to restore local groundwater basin levels by enhancing and enlarging existing stormwater capture facilities. LADWP is making investments in advanced treatment systems in the SFB to produce purified recycled water for groundwater replenishment. Together these multiple investments will help augment the City's groundwater and ensure basin water elevations remain sustainable for many decades into the future. LADWP also continues to operate its groundwater resources conjunctively. During wet years, stormwater capture is maximized and water from the LAA is diverted into local spreading grounds. This strategy allows for greater replenishment to the local groundwater basins during wet and normal periods and prevents conditions of severe overdraft when groundwater pumping is increased during dry periods.

Recycled Water

As early as 1960, the City recognized the potential for water recycling and invested in infrastructure that produced water of tertiary quality, a high treatment standard for wastewater. In 1979, LADWP began delivering tertiary quality recycled water to the Department of Recreation and Parks for irrigation of various areas in Griffith Park. Today LADWP serves approximately 179 sites in the City with recycled water for irrigation, industrial, and environmental beneficial uses. There are approximately 200 individual customer service accounts, with several projects containing multiple customer accounts at a single location. Recycled water produced for FY 2019/20 was 36,392 AFY, inclusive of municipal industrial, and environmental reuse. All recycled water used within the City undergoes, at a minimum, tertiary treatment and disinfection and meets or exceeds local and state requirements designed to ensure public safety. As part of LADWP's effort to maximize water reuse, it has partnered with other agencies to initiate the Operation NEXT Water Supply Program which seeks to strengthen the City's long-term resiliency and sustainability by maximizing water reuse from the Hyperion Water Reclamation Plant (HWRP).

MWD Supply

As a wholesaler, MWD sells supplemental water to all of its 26 member agencies. LADWP is exclusively a retailer and has historically purchased supplemental imported supplies from MWD to meet City's demands. As a percentage of LADWP's total water supply, purchases of supplemental water from MWD is on average 42 percent between FY 2015/16 to FY 2019/20. LADWP aims to help improve regional supply reliability by reducing its dependence on purchased imported water through the development of local supplies.

ES.3 Water Demand

Water demands are driven by a number of factors:

- Demographics – population, number of single-family homes, and number of employees
- Socioeconomics – price of water, personal income, family size, economy, mandatory conservation effect, and passive water conservation
- Conservation – passive conservation from plumbing codes and landscape ordinances, passive conservation from behavioral changes, and active conservation from the City's various active conservation programs
- Weather – historical weather patterns including daily maximum temperature and precipitation
- Non-revenue water – the difference between total water consumption and billed water use

Demographics and Climate

Over four million people currently reside in the LADWP service area, which is slightly larger than the legal boundary of the City. LADWP provides water service outside the City's boundary to portions of West Hollywood, Culver City, and small parts of the County of Los Angeles. The population within LADWP's service area increased from 2.97 million in 1980 to 4.04 million in 2020, representing an average annual growth rate of approximately 0.8 percent. The total number of housing units increased from 1.10 million in 1980 to 1.44 million in 2020, representing an average annual growth rate of 0.8 percent. During this time, average household size increased from 2.7 persons in 1980 to 2.8 persons in 2020. Employment grew by about 0.7 percent annually from 1980 to 1990, but declined from 1990 to 2010 as a result of two economic recessions. The first recession began in 1991 and was followed by another larger recession beginning in 2008. Only recently has employment begun to return to the employment level experienced in 1990. Overall, employment decreased by about 0.3 percent annually from 1990 to 2010 and between 2010 and 2020 increased by approximately 1.7 percent reflecting an improved economy.

Demographic projections for the LADWP service area are based on the Southern California Association of Governments' (SCAG) demographic growth forecast for their 2020 Regional Transportation Plan (RTP). MWD collaborates with SCAG to aggregate demographic data for each of its 26 member agencies' service areas using service area boundaries. LADWP and MWD have adopted these demographic projections for water demand forecast in their respective UWMPs. Exhibit ES-D summarizes these demographic projections for the LADWP service area. Service area population is expected to continue to grow over the next 25 years at a rate of 0.64 percent annually. This rate is similar to the historical 0.7 percent annual growth rate from 1980 to 2020, and will lead to approximately 765,112 new residents over the next 25 years.

Weather in the City is considered mild, which is a major attribute that attracts businesses, residents, and tourists to the City. Because of its relative dryness, Los Angeles' climate has been characterized as Mediterranean. Exhibit ES-E provides a summary of average monthly rainfall, maximum temperatures, and evapotranspiration readings.

Exhibit ES-D
Demographic Projections for LADWP Service Area

Demographic	2025	2030	2035	2040	2045
Population	4,243,478	4,374,240	4,520,870	4,670,693	4,806,396
Housing					
Single-Family	628,359	639,280	647,403	657,614	667,311
Multi-Family	906,120	969,198	1,037,051	1,100,361	1,157,553
Total Housing	1,534,479	1,608,479	1,684,455	1,757,976	1,824,864
Persons per Household	2.77	2.72	2.68	2.66	2.63
Employment					
Commercial	1,897,438	1,953,634	2,011,968	2,066,096	2,105,798
Industrial	94,073	91,003	87,910	84,264	79,680
Total Employment	1,991,511	2,044,637	2,099,878	2,150,360	2,185,478

Source: 2020 Regional Transportation Plan, Southern California Association of Governments

Exhibit ES-E
Average Climate Data for Los Angeles 1995-2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°F)[1]	68.65	68.58	70.69	72.80	74.51	77.73	83.01	84.57	83.53	79.25	73.54	67.90	75.40
Average Precipitation (inches)[1]	3.22	3.36	1.90	0.75	0.35	0.07	0.02	0.00	0.15	0.62	0.85	2.48	13.77
Average ETo (inches)[2]	2.15	2.45	3.79	4.73	5.20	5.53	6.22	6.12	4.70	3.53	2.45	2.00	48.87

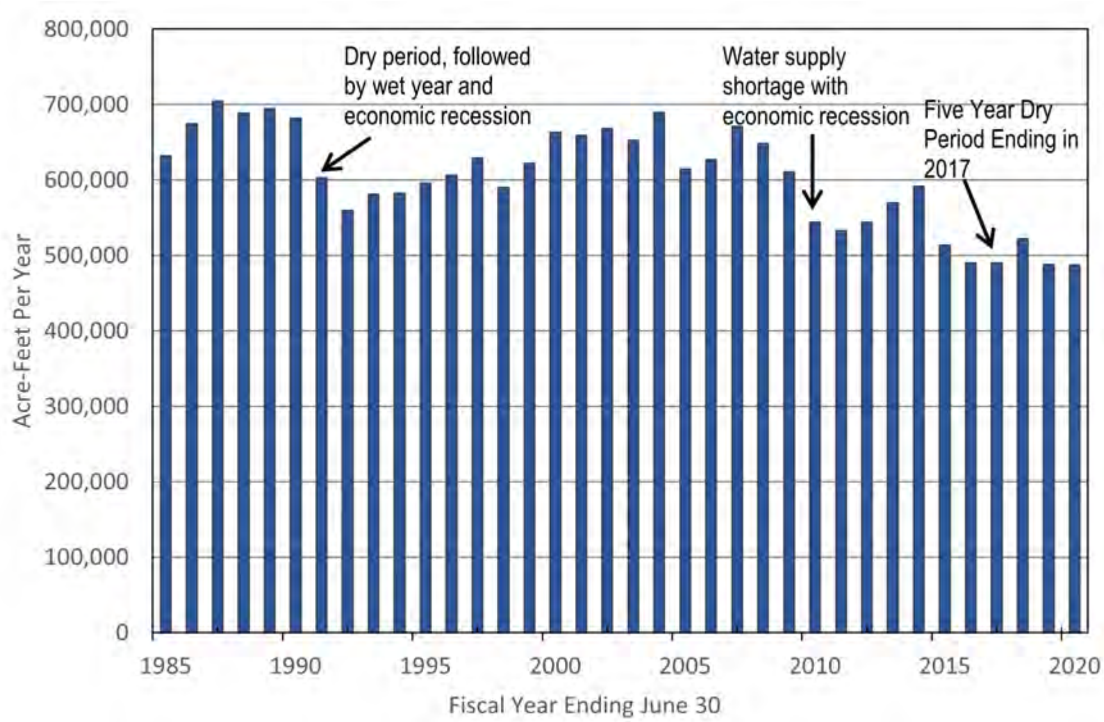
1. 1995-2020, Los Angeles Downtown USC Weather Station, USW00093134

2. www.cimis.water.ca.gov. Average of Santa Monica (Id. 99) and Pomona (Id. 78) from 1995 through 2020

Historical Water Use

Exhibit ES-F presents the historical annual water demand for LADWP. As seen in this exhibit, total water demand varies from year to year and is influenced by a number of factors such as population growth, weather, water conservation, water use efficiency, dry periods, and economic activity. In 2009, an extended dry period required LADWP to impose mandatory conservation under the Emergency Water Conservation Plan. Three days per week outdoor watering restrictions were put in place in 2009, which corresponds to Phase II restrictions under the current Emergency Water Conservation Plan, and remains in place today. Starting in FY 2012/13 dry conditions returned, and the City experienced some of its driest weather on record. These conditions continued through FY 2014/15 and triggered State and City mandatory conservation measures. Reduced water use as a result of these mandatory measures has continued beyond the end of the recent dry period in 2017 and LADWP is continuing to invest in conservation and water use efficiency efforts to ensure the most efficient use of water throughout the City.

Exhibit ES-F
Historical Total Water Demand in LADWP's Service Area



Prior to 1990, population growth in the City was a good indicator of total demands. From 1980 to 1990, population in the City grew at 1.7 percent annually. Water demands during this same ten-year period also grew at 1.7 percent annually. However, after 1991, LADWP began implementing water conservation measures that prevent water demands from returning to pre-1990 levels. Average water demands in the last five years from FY 2015/16 to FY 2019/20 are lower than they were 50 years ago in the 1970s, despite the fact that over one million additional people now live in the City.

Exhibit ES-G shows the breakdown in average total water use between LADWP's major demand sectors and non-revenue water. Non-revenue water consists of unbilled authorized consumption and water losses. Unbilled authorized consumption is the volume of non-revenue water for uses such as mainline flushing to improve water quality and firefighting. Water losses are broken down into two categories: apparent losses and real losses. Apparent losses include meter inaccuracies and theft. Real losses include piping distribution system leakage. Historically, non-revenue water has averaged 6.3 percent of total water demand over the period FY 1991-2020. This consistently low non-revenue percentage over the last 30 years shows that LADWP has an efficient, well-maintained water system. Although total water use has varied substantially from year to year, the breakdown in percentage of total demand between sectors remains largely unchanged.

In order to assess the potential for water use efficiency and target conservation programs, it is important to characterize water use in terms of indoor and outdoor demands. As with most water utilities, LADWP does not have separate irrigation meters for most of its customers. LADWP conducted an analysis to determine indoor and outdoor water uses for its major billing categories. The analysis concluded that the City's total indoor water use was approximately 64.8 percent of the total water use during the study period from fiscal year ending 2016 to 2020 (see Exhibit ES-H).

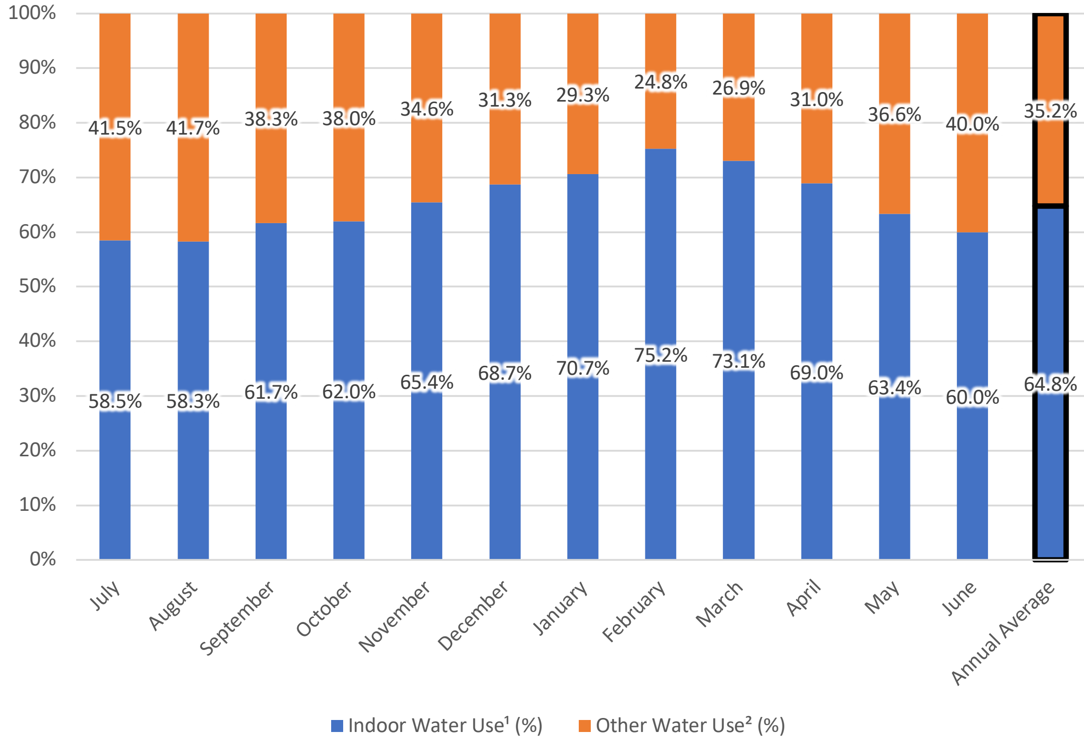
Exhibit ES-G
Breakdown in Historical Water Demand by Sector for LADWP's Service Area

Fiscal Year Ending Average	Single-Family		Multi-Family		Commercial		Industrial		Government		Non-Revenue[1]		Total
	AF	%	AF	%	AF	%	AF	%	AF	%	AF	%	AF
2016-2020	**170,660**	**35%**	**141,088**	**28%**	**88,680**	**18%**	**14,938**	**3%**	**39,628**	**8%**	**40,690**	**8%**	**495,685**
2011-2015	206,652	37%	161,592	29%	96,832	18%	17,855	3%	43,573	8%	26,139	6%	552,768
2006-2010	236,154	38%	180,277	29%	106,964	17%	23,196	4%	42,956	7%	30,617	5%	620,165
2001-2005	239,754	37%	190,646	29%	109,685	17%	21,931	3%	41,888	6%	52,724	8%	656,628
1996-2000	222,748	36%	191,819	31%	111,051	18%	23,560	4%	39,421	6%	33,696	5%	622,295
1991-1995	197,322	34%	177,104	30%	110,724	19%	21,313	4%	38,426	7%	39,364	7%	584,253
30-Year Average	**212,215**	**36%**	**173,755**	**30%**	**103,990**	**18%**	**20,465**	**3%**	**40,982**	**7%**	**37,205**	**6%**	**588,611**

[1] Calculated using AWWA Water Audit Software

Note: Percentages may not add up to 100% due to rounding

Exhibit ES-H
Estimated Monthly Indoor1[1] and Other[2] Water Use (Average of FYE 2016-2020 Data)



1. Indoor water use consists of uses that contribute to sewer flows only
2. Other water use consists of uses that do no contribute to sewer flows, including but not limited to consumptive and outdoor uses

Water Demand Forecast

LADWP has developed a water demand forecast for each of its major categories of demand. This allows LADWP to better understand trends in water use and develop effective conservation and water use efficiency programs. The methodology used for the demand forecast is called a modified unit use approach. Exhibit ES-I shows water demand projections, with and without conservation out to 2045.

Exhibit ES-I
LADWP Water Demand Projections by Sector

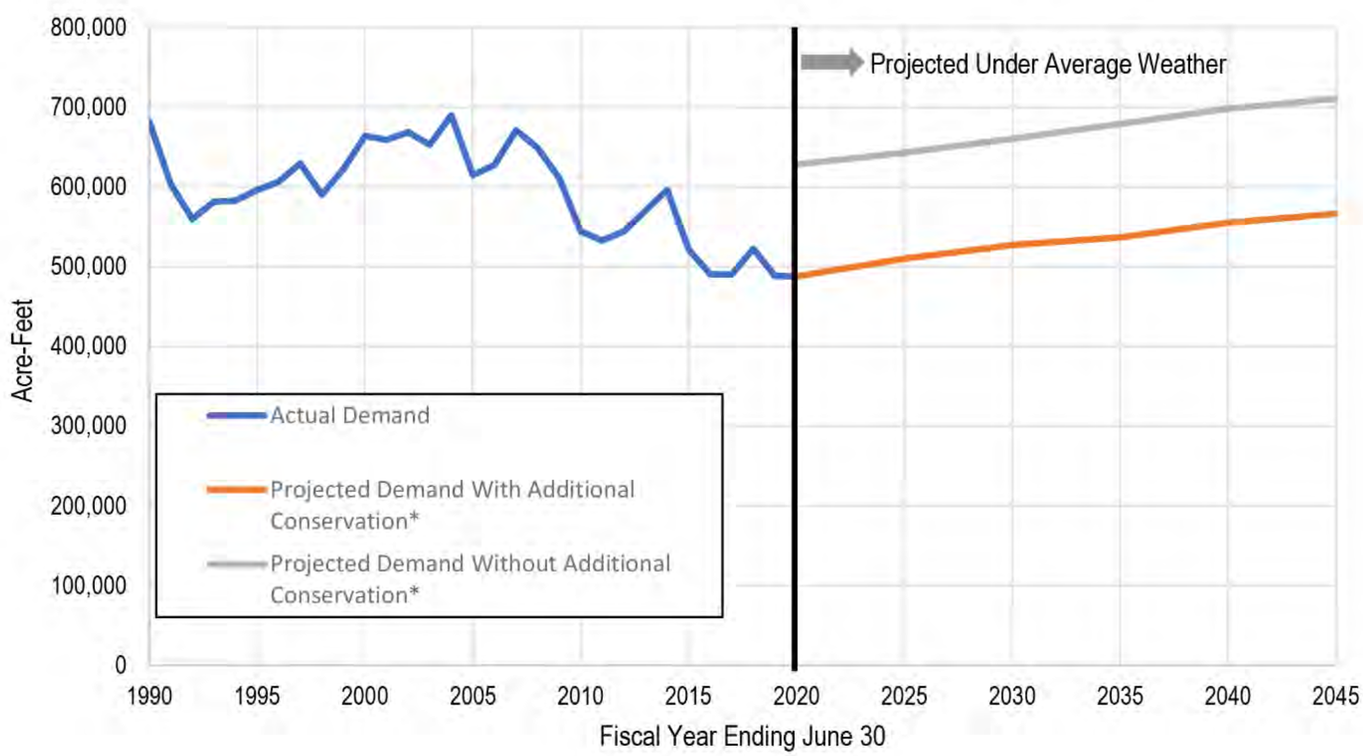
Year	Single-family	Multi-family	Commercial/ Government	Industrial	NRW	Additional Conservation Savings*	Total
2025	228,529	192,727	156,407	13,651	51,321	133,133	509,501
2030	233,366	205,728	157,341	12,902	50,826	133,506	526,658
2035	237,297	219,798	158,236	12,171	51,334	142,688	536,148
2040	242,761	233,602	159,030	11,418	51,026	143,351	554,486
2045	246,779	244,853	157,680	10,503	50,687	144,752	565,751

*Additional Conservation Savings includes projected future active and passive savings and additional retained passive savings.

LADWP completed its comprehensive Water Conservation Potential Study in 2017 that evaluated the remaining active and passive conservation that exists citywide relative to a FYE 2014 baseline. This study also evaluated new conservation measures from technical, customer acceptance and cost-effectiveness perspectives. The results from the study help establish LADWP's water use efficiency goals of reducing per capita water use to 100 gallons per capita per day (gpcd) by 2035 and maintain this usage through 2050. This reduction equates to a 25 percent reduction from FYE 2014 per capita usage. These water demand targets are shown and compared to the water demand forecast without additional conservation to identify the additional levels of water savings needed into the future (see Exhibit ES-J).

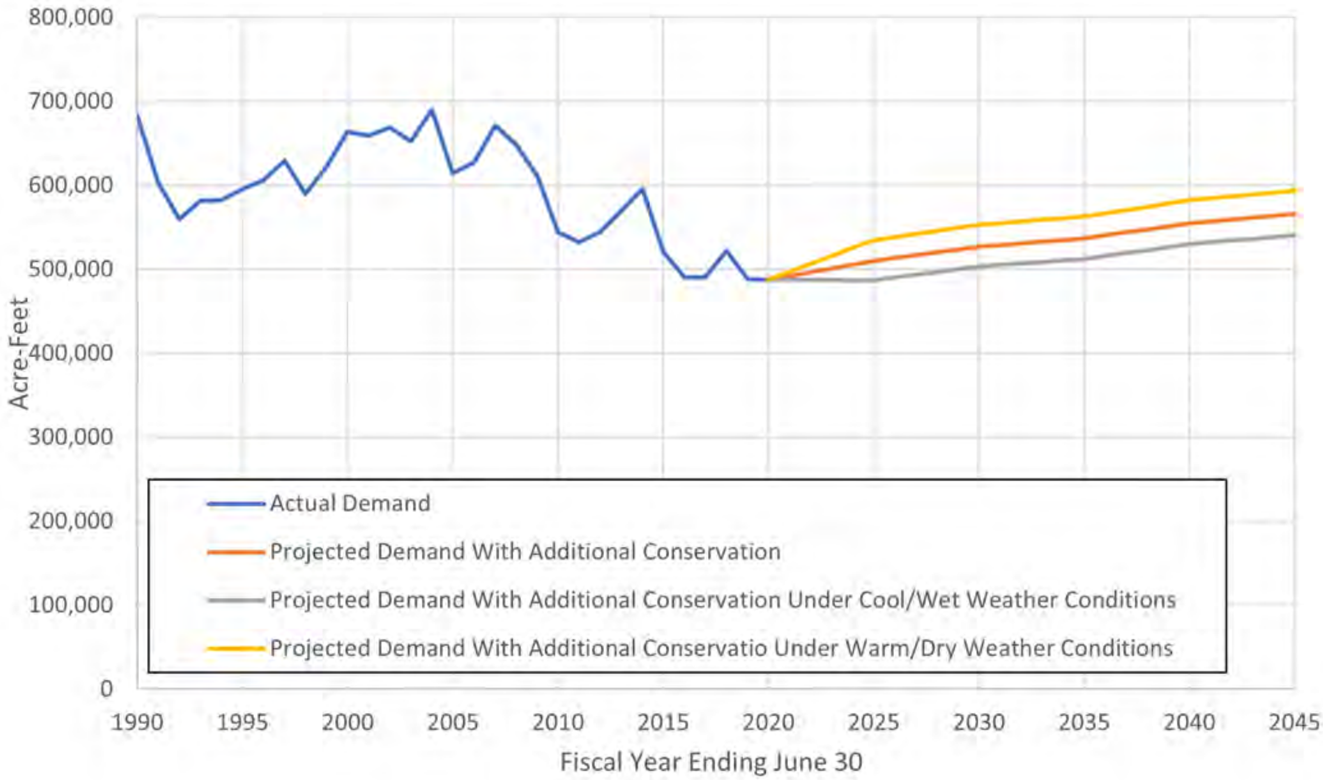
Exhibit ES-K shows that projected water demands can vary by approximately plus or minus five percent in any given year due to average historical weather variability. This means that water demands under cool/wet weather conditions could be as much as five percent lower than normal demands; while water demands under hot/dry weather conditions could be as much as five percent higher than normal demands.

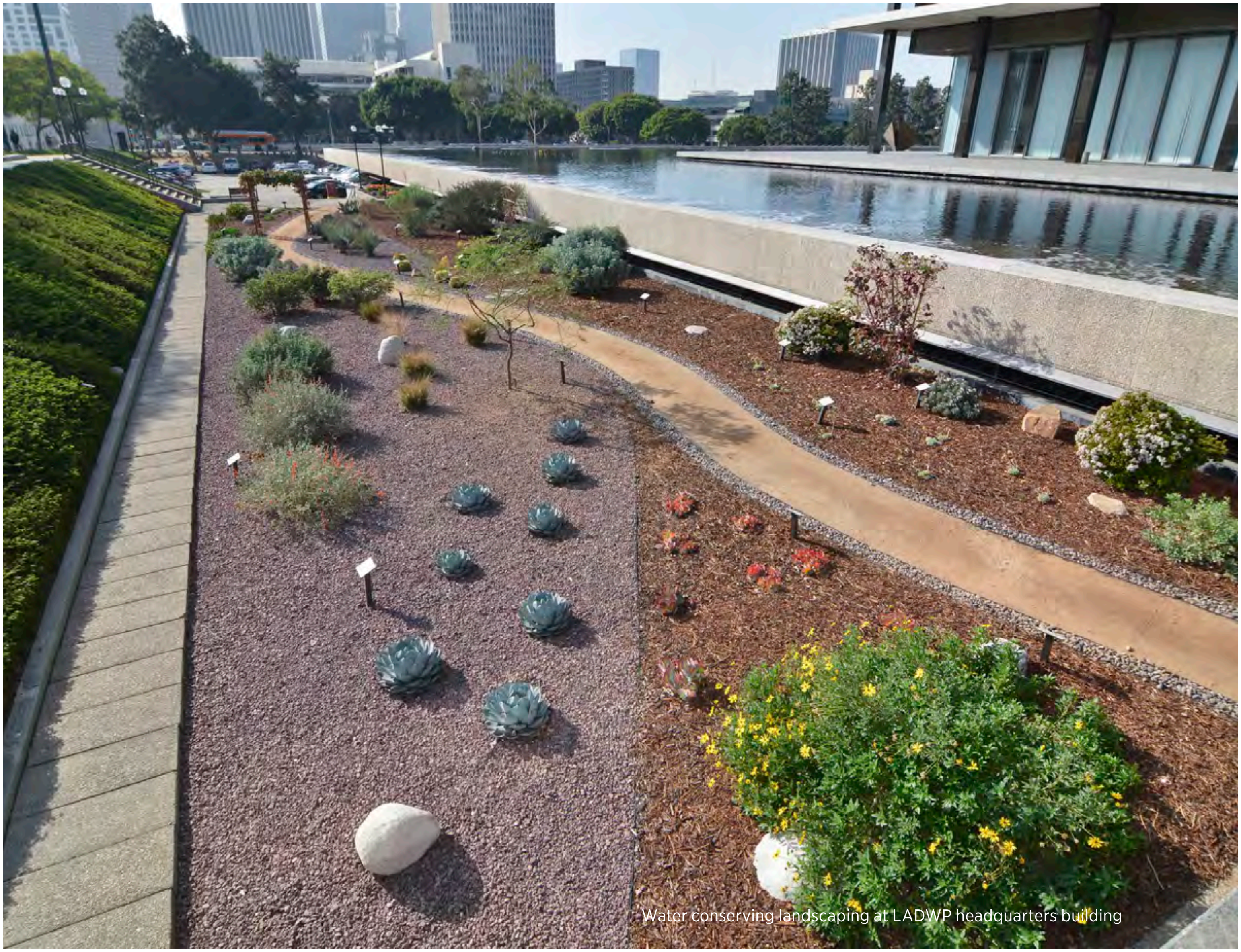
Exhibit ES-J
Comparing Water Demand Forecast with and without Conservation



*Additional conservation measured relative to FYE 2014 water demand

Exhibit ES-K
Projected Water Demand Weather Variability





Water conserving landscaping at LADWP headquarters building

ES.4 Water Conservation

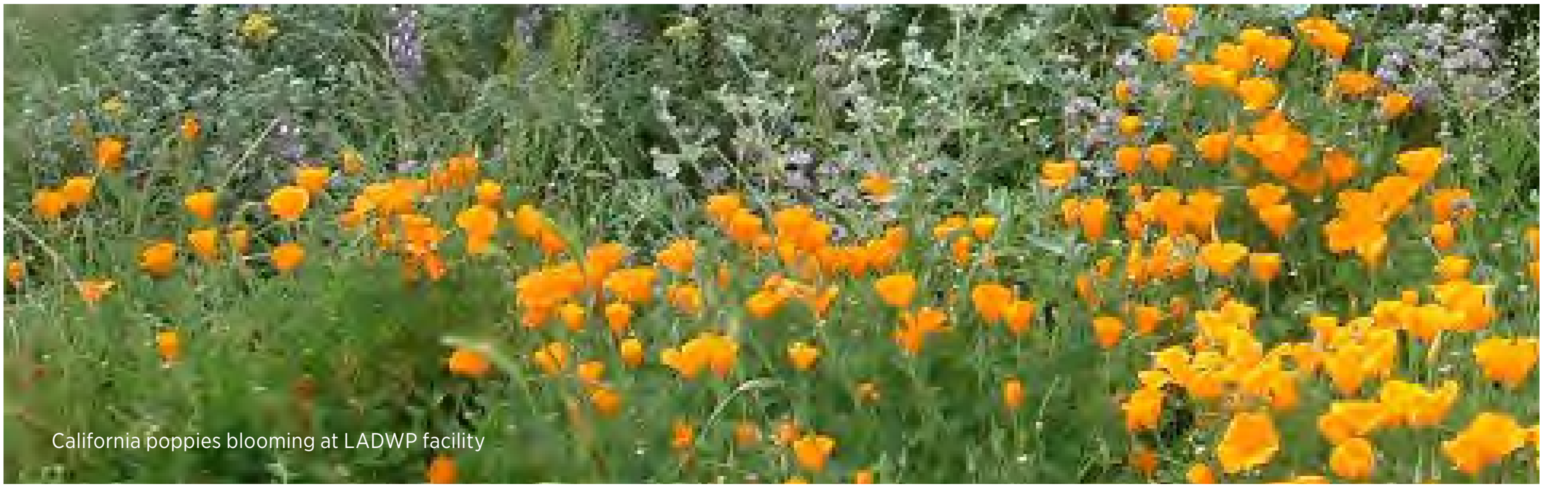
Conservation and water use efficiency have significant effects on the City's water use patterns and their benefit to reducing demand and pressure on other supplies have become a permanent part of LADWP's water management philosophy. The City has long recognized since the 1980's that water conservation is a core strategy to improve long term water use efficiency and water supply reliability for its customers. Through its investments in conservation, it is estimated that more than 150,000 AFY of historical savings has been achieved. As a result, the City has become a national leader in water use efficiency. In the future, conservation will continue to be an important part of maintaining long term water supply reliability and is a key component of LADWP's goals to reduce potable water use per capita by 25 percent by 2035.

Historical Conservation

The City's water usage today is lower than it was in the 1970s despite an increase in population of over one million people and reflects the success and importance of the City's conservation strategy. Exhibit ES-L shows historical conservation savings through FY 2019/20 based on the estimated annual savings achieved through LADWP and MWD rebate programs, as well as the savings achieved through codes, ordinances, and behavior changes resulting from customer outreach and educational programs. The estimated cumulative annual active savings since the inception of LADWP's conservation program totals 150,912 acre-feet per year (AFY). Additional non-rebated conservation savings from codes, ordinances, and changes in customer behavior due to outreach and educational programs are considered passive savings.

Exhibit ES-L
Historical City of Los Angeles Conservation

Fiscal Year	Additional Annual Active Installed Savings (AF)	Cumulative Annual Active Additional Savings (AF)	Annual Passive Savings (AF)	Annual Total Savings (AF)
Prior to 1990/1991	31,825	31,825	-	-
1990/1991	4,091	35,916	76,350	112,266
1991/1992	8,670	44,586	105,593	150,179
1992/1993	3,286	47,872	58,546	106,418
1993/1994	4,961	52,833	60,928	113,761
1994/1995	4,041	56,874	62,084	118,958
1995/1996	4,642	61,516	52,648	114,164
1996/1997	2,376	63,892	33,720	97,612
1997/1998	2,637	66,529	30,434	96,963
1998/1999	2,781	69,310	38,305	107,615
1999/2000	3,532	72,842	80,909	153,751
2000/2001	3,078	75,920	79,527	155,447
2001/2002	2,452	78,372	95,428	173,800
2002/2003	2,630	81,002	94,463	175,465
2003/2004	3,257	84,259	84,023	168,282
2004/2005	3,299	87,558	114,428	201,986
2005/2006	2,404	89,962	118,574	208,536
2006/2007	2,095	92,057	116,922	208,979
2007/2008	782	92,839	110,628	203,467
2008/2009	3,127	95,966	149,567	245,533
2009/2010	4,269	100,235	183,080	283,315
2010/2011	2,495	102,730	185,640	288,370
2011/2012	1,993	104,723	183,852	288,575
2012/2013	2,122	106,845	187,444	294,289
2013/2014	3,977	110,822	189,689	300,511
2014/2015	7,211	118,033	273,017	391,050
2015/2016	7,833	125,866	296,966	422,831
2016/2017	2,441	128,307	291,627	419,934
2017/2018	1,796	130,103	292,265	422,368
2018/2019	19,494	149,597	260,012	409,608
2019/2020	1,315	150,912	266,533	417,445


California poppies blooming at LADWP facility

Water Conservation Goals

Water conservation and use efficiency reduce demand that typically rises over time with growth in population and commerce. Achieving LADWP's water supply goals will require multiple strategies to achieve and maintain water use reductions, including: investments in state-of-the-art technology; rebates and incentives promoting installation of water-efficient fixtures and appliances; expansion and enforcement of prohibited water uses; reductions in outdoor water use; extending education and outreach efforts; and encouraging regional conservation efforts. LADWP's multi-faceted conservation and water use efficiency program includes tiered volumetric water rates, education and awareness programs, financial incentives for the installation of water-efficient devices, distribution of free water-saving fixtures and materials, specialized direct install programs, a Technical Assistance Program (TAP) that provides tailored incentives for business and industry, and landscape irrigation efficiency programs. Conservation and water use efficiency are a foundational component of LADWP's water resource planning efforts and will continue to be central to the City's water use efficiency goals over the long term.

Existing Programs, Practices, and Technologies to Achieve Water Conservation

LADWP has developed many progressive water conservation and use efficiency programs in conjunction with state and local conservation ordinances and plumbing codes to achieve water conservation throughout its service area and customer classes. These include:

- State laws and City ordinances - such as the Model Water Efficient Landscape Ordinance, installation of efficient fixtures, plumbing retrofit ordinance, and Emergency Water Conservation Plan Ordinance;
- Conservation pricing – use of an ascending tier rate structure that is completely volumetric pricing applying a lower first tier rate for water within a specified allocation and higher successive tier rate for every billing unit exceeding the first tier allocation;
- Water Conservation Outreach Program – includes education in schools, public awareness/support campaigns, Hands on Workshops, and seminars
- Rebate programs – participation in MWD's SoCal Water$mart Program for single-family residences, MWD's Save Water Save a Buck Program for CII customers and multi-family residences, and LADWP inhouse programs

Water Conservation Potential Study

LADWP completed the country's largest and most comprehensive Water Conservation Potential Study (WCPS) in 2017 which provided a better understanding of how historical water conservation investment efforts have impacted existing water use efficiency and device saturation levels. The WCPS evaluated the remaining potential in water conservation and use efficiency for its service area, as well as City-owned facilities and prioritized future investments in the City. LADWP's water savings goals were developed based on the results from the WCPS, which showed that LADWP has a maximum cost-effective savings potential of approximately 140,000 AF of additional savings compared to the FY 2013/14 baseline.

Central to the WCPS was the development of a robust Water Conservation Model (WCM) to help forecast potential water savings opportunities, which will be able to help LADWP develop a cost-effective conservation strategy to maximize water savings going forward.

ES.5 Future Water Supplies

LADWP maintains a diversified water supply portfolio strategy and continues to make substantial investments in local groundwater, recycled water, stormwater capture, and water conservation and use efficiency. Local water supplies tend to be more reliable than imported water because they have less variability due to climate, weather, and environmental restrictions. Additionally, by investing in these local supplies, the City's urban environment can be protected and enhanced. As the City's population and economy expand, local water supplies will be the cornerstone of meeting the City's need for additional water supplies. Future local water supplies identified below will further diversify LADWP's water supply portfolio and augment the existing water supplies described in Section ES.2, *Existing Water Supplies*.

Recycled Water System at the Donald C. Tillman Water Reclamation Plant

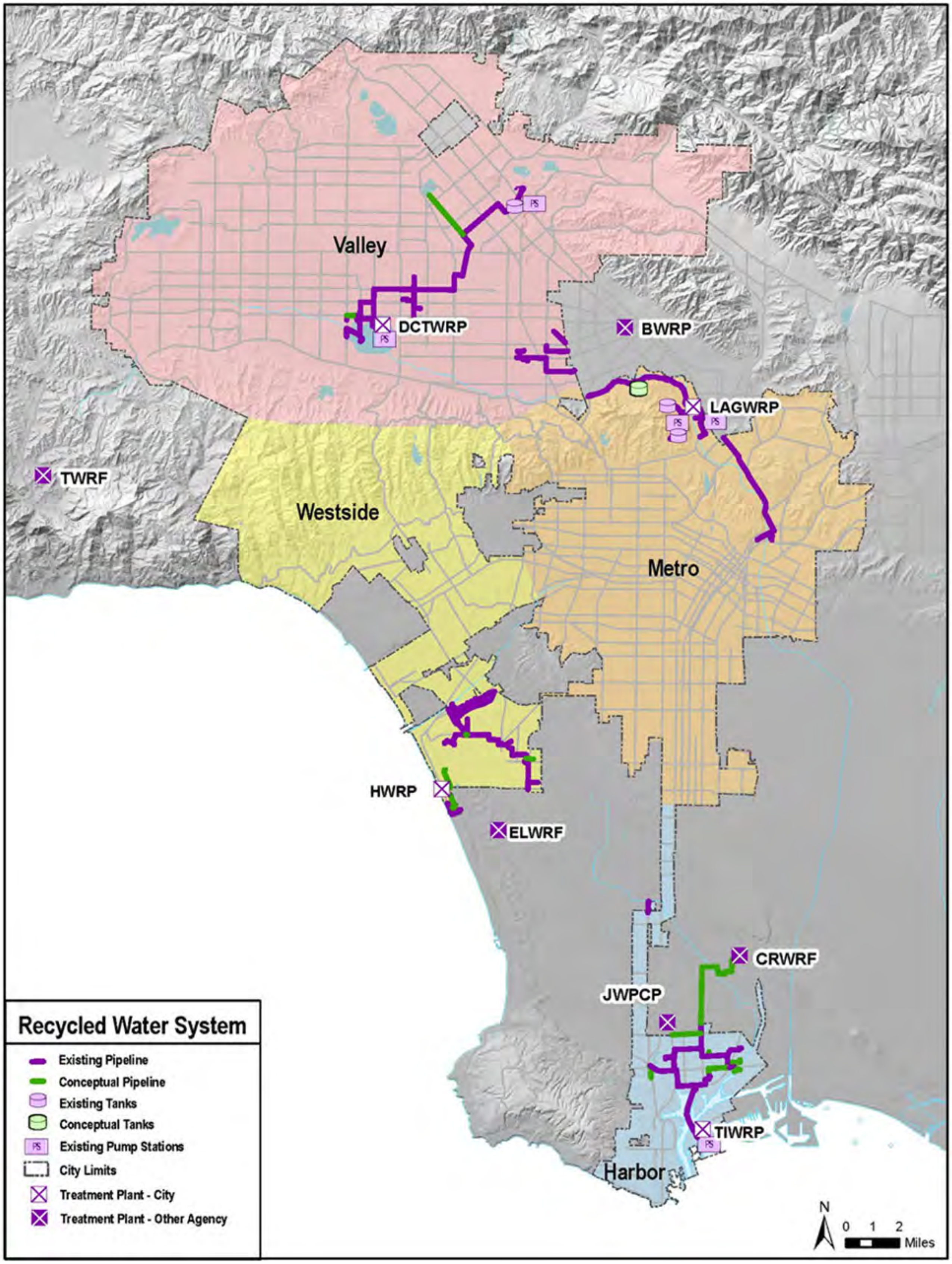
Water Recycling

LADWP is committed to maximizing use of recycled water in the City's water supply portfolio. Future recycled water projects will continue to build on the successful implementation of these prior projects so that recycled water becomes a more prominent component of the City's water supply portfolio. Expansion of recycled water use to offset potable demands has been recognized as one method that will help LADWP achieve its goal of improving the local sustainability of its water supply. LADWP is working in conjunction with the City of Los Angeles Department of Public Works Bureau of Sanitation and Environment (LASAN) and Bureau of Engineering (BOE), to develop non-potable reuse projects for irrigation and industrial uses. In addition, the City is pursuing a groundwater replenishment (GWR) project to replenish the SFB with highly treated recycled water and Operation NEXT to maximize water reuse of recyclable water originating from HWRP.

Wastewater Treatment Infrastructure

LADWP's water recycling program is dependent on the City's wastewater treatment infrastructure and wastewater treatment facilities located within and outside of the City's boundaries. LASAN is responsible for the planning and operation of the City's wastewater treatment infrastructure and wastewater treatment facilities. The City's wastewater system serves 573 square miles, 456 square miles of which are within the City. Wastewater service is also provided to 29 non-City agencies through contract services. The treated effluent from the City's four wastewater plants is utilized by LADWP to meet recycled water demands both inside and outside the City. Exhibit ES-M shows the City's recycled water systems and water reclamation facilities that serve as sources of recycled water. The City's water recycling program seeks to displace the use of potable water with recycled water for non-potable uses where infrastructure is available.

Exhibit ES-M
Sources of Recycled Water



Recycled Water Planning Efforts

LADWP is committed to maximizing use of recycled water in the City's water supply portfolio including non-potable reuse and potable reuse. Recycled water milestones include: producing 1.0 million gallons per day of recycled water at HWRP by 2021 through expansion of the pilot membrane bioreactor technology, recycling 7,000 AFY of water at Donald C. Tillman Water Reclamation Plant (DCTWRP) for groundwater recharge by 2025, and increasing non-potable reuse by an additional 8,000 AFY by 2035.

Groundwater Replenishment

LADWP and LASAN are continuing to implement the Los Angeles Groundwater Replenishment (LA GWR) Project to convey recycled water from DCTWRP to the Hansen Spreading Grounds for percolation into the San Fernando Groundwater Basin. The Initial Phase of the LA GWR Project will spread recycled water at Hansen Spreading Grounds. Infrastructure required to implement the LA GWR Initial Phase include additional treatment and facilities to convey product water to the spreading basins. A 54-inch recycled water trunk line already connects to the Hansen Spreading Grounds, having been constructed as a part of the previous recycled water spreading initiative under the East Valley Water Recycling Project.

Future phases of the LA GWR Project will include advanced treatment to meet or exceed evolving regulatory requirements, and may include increasing the supply of recycled water by recapturing flows of recycled water that flow through nearby lakes. Future phases may include the construction of injection wells and connecting to additional spreading grounds, such as Pacoima Spreading Grounds or Tujunga Spreading Grounds, which would require additional pipeline infrastructure.

Recycled Water Use Projections

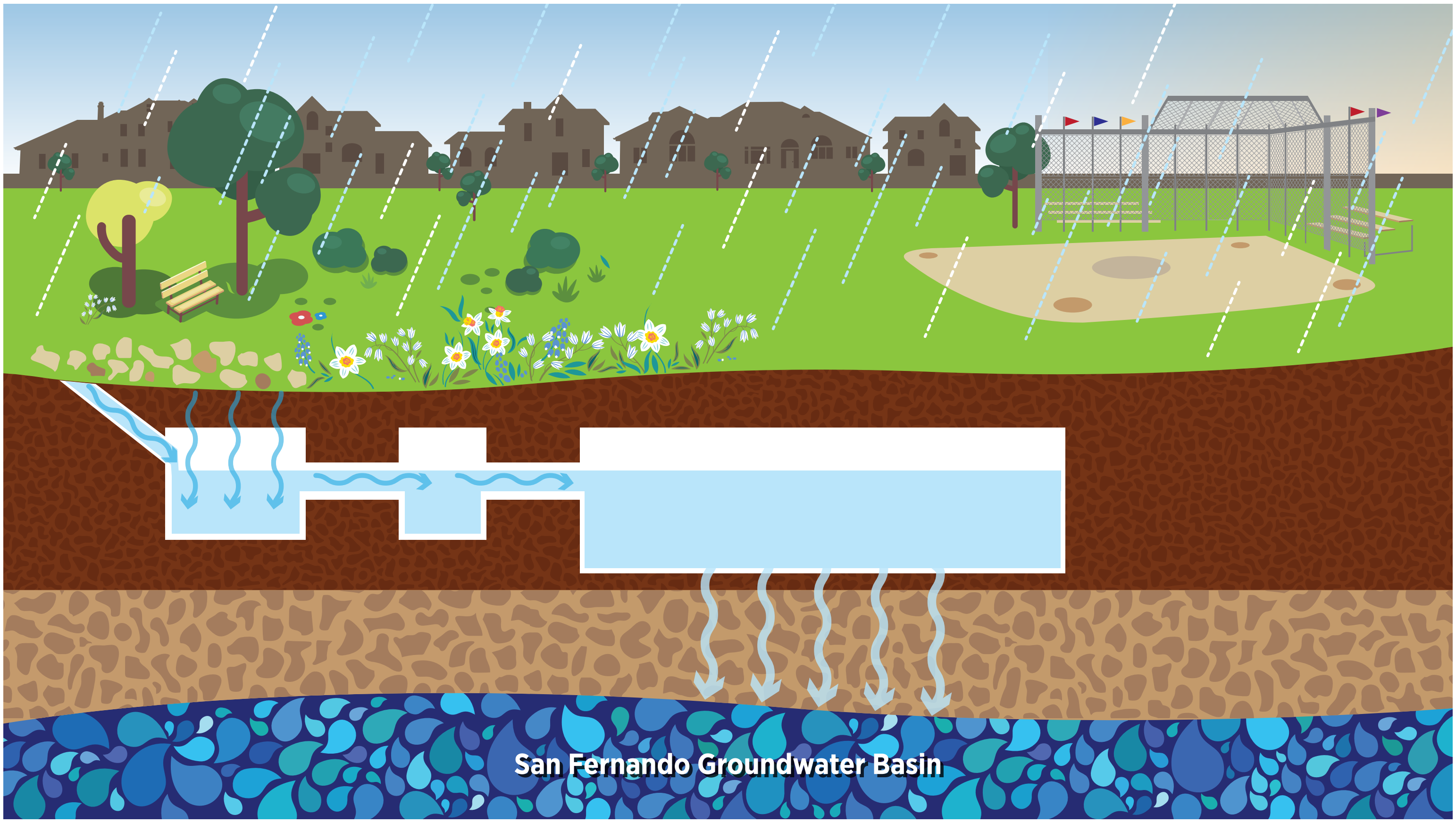
Recycled water projections in five-year increments beginning in FY 2019/20 through FY 2044/45 are presented in Exhibit ES-N. LADWP recycled water use is projected to reach 50,900 AFY in FY 2024/25 and further increase to 67,600 AFY through FY 2044/45. Environmental reuse is expected to remain constant at 26,600 AFY.

Operation NEXT

The Operation NEXT Water Supply Program aims to maximize water reuse of recyclable water originating from HWRP. When completed, advanced treated recycled water supplies from HWRP will further help to diversify the City's water supply portfolio by augmenting groundwater supplies, replenishing groundwater basins, and providing opportunities for other potential potable reuse applications. Key ongoing efforts within Operation NEXT include a membrane bioreactor and advanced water purification facility demonstration project.

Exhibit ES-N
Recycled Water Use Projections

Category	Projected Use (AFY)				
	FY 24/25	FY 29/30	FY 34/35	FY 39/40	FY 44/45
Municipal and Industrial Uses	17,300	29,200	29,700	29,800	30,000
Indirect Potable Reuse (Groundwater Replenishment)	7,000	11,000	11,000	11,000	11,000
Subtotal	24,300	40,200	40,700	40,800	41,000
Environmental Use	26,600	26,600	26,600	26,600	26,600
Total	50,900	66,800	67,300	67,400	67,600



Typical process of distributed stormwater infiltration

Stormwater Capture

Stormwater runoff from urban areas is an underutilized local water resource. Within the City, the majority of stormwater runoff is directed to storm drains and ultimately channeled into the ocean. This unused stormwater carries many pollutants that are harmful to marine life and public health. In addition, local groundwater aquifers that could be replenished by stormwater are receiving less recharge than in past historical times due to increased urbanization. Urbanization has increased the City's hardscape, which has resulted in less infiltration of stormwater and a decline in groundwater elevations. In response, LADWP completed a Stormwater Capture Master Plan (SCMP) in 2015 to comprehensively evaluate stormwater capture potential within the City.

Stormwater capture can be achieved by increasing infiltration into groundwater basins (i.e., groundwater recharge) and by onsite capture and reuse of stormwater for landscape irrigation (i.e., direct use). Conservatively, additional stormwater capture projects will provide for increased groundwater recharge in the amount of 66,000 AFY and increased direct use in the amount of 2,000 AFY, using both centralized and distributed projects and programs. A conservative estimate of total stormwater capture potential in 2035 is 132,000 AFY, which includes both existing and additional new stormwater capture. Under a more aggressive approach, total stormwater capture potential in 2035 could be up to 178,000 AFY.

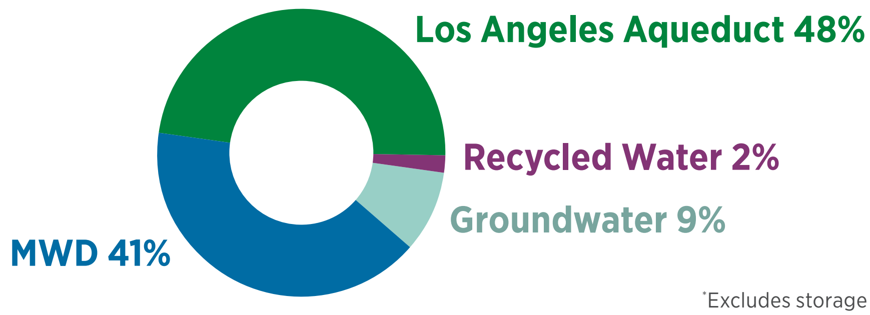
Groundwater recharge using captured stormwater is a major source for replenishing groundwater supplies, addressing the overall long-term decline in groundwater basin elevations, protecting the safe yield of the groundwater basin, and ensuring the long-term water supply reliability of the SFB. Proposed centralized projects will enable the City to utilize its stored water credits in a sustainable manner to prevent conditions of overdraft in the basin. The UWMP projects that by 2045 there will be a minimum of 15,000 AFY of increased groundwater pumping in the SFB due to water supply augmentation through centralized stormwater infiltration. Anticipating that stored groundwater will rebound in response to enhanced groundwater recharge, LADWP will work with the ULARA Watermaster to continue observing actual basin elevations and re-evaluate basin safe yield to allow additional increases in groundwater production over time as SFB elevations rebound.

Under LADWP's current implementation strategy, the total estimated stormwater capture capacity is projected to be 155,000 AFY by 2035.

ES.6 Water Supply Reliability

To determine the overall service area reliability, LADWP defined three hydrologic conditions: average year (30-year median hydrology from FY 1985/86 to FY 2014/15); single-dry year (repeat of the 1989/90 hydrology); and multi-dry year (repeat of FY 1987/88 to FY 1991/92 hydrology). Exhibit ES-O illustrates the current supply mix for the five-year average from FY 2015/16 to FY 2019/20. Exhibits ES-P and ES-Q illustrates the future supply mix for FY 2044/45 under average and single dry year conditions, respectively. The projected supply portfolio under multiple dry year (year 3) conditions is similar to that under single dry year conditions. LADWP does not anticipate water shortages as demands are met by the available supplies under all hydrologic scenarios.

Exhibit ES-O
LADWP Supply Reliability FYE 2016-2020 Average
Total Supply*: 497,386 AF



*Excludes storage change

Exhibit ES-P
LADWP Supply Reliability Under Average Year Conditions in Fiscal Year 2044-45
Total Supply: 710,500 AF

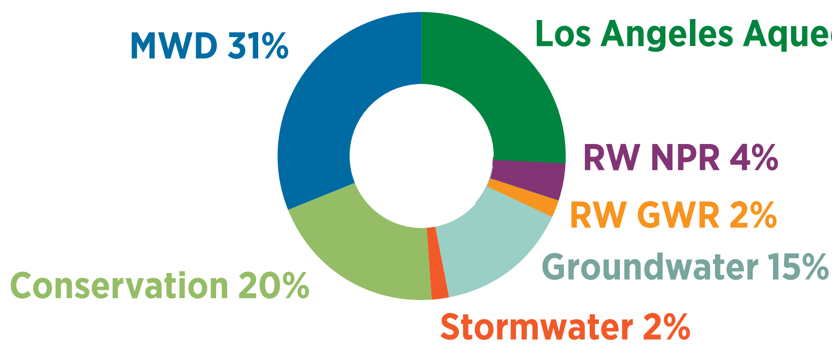
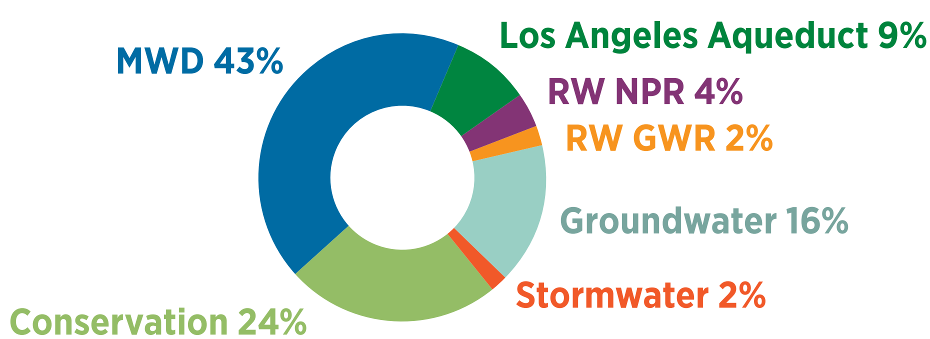


Exhibit ES-Q
LADWP Supply Reliability Under Single Dry Year/Multiple Dry Year (Year 3) Conditions in Fiscal Year 2044-45
Total Supply: 746,000 AF



Water Supply Reliability Assessment

To demonstrate LADWP's water supply reliability, Exhibit ES-R summarizes the water demands and supplies for single dry year conditions through FY 2044/45, which represents the City's planned supply portfolio to meet projected water demands under the most critical hydrologic conditions. Exhibit ES-S summarizes the water demands and supplies for average year conditions, which has the highest probability of occurring. Exhibit ES-T tabulates the service reliability assessment for multiple dry year conditions.

Exhibit ES-U presents the drought risk assessment for the driest five-year sequence from 2021 to 2025, as required by the UWMP Act, indicating LADWP will be able to maintain reliability during dry period; simulating LAA hydrology from LADWP's driest five consecutive year sequence from FYE 1988-1992.

Exhibit ES-R
Service Area Reliability Assessment for Single Dry Year

Demand and Supply Projections (in acre-feet)	Dry Year Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**674,700**	**693,200**	**712,700**	**732,700**	**746,000**
Post-Conservation Demand	**509,500**	**526,700**	**536,100**	**554,500**	**565,800**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	165,200	166,500	176,600	178,200	180,200
Los Angeles Aqueduct[4]	70,800	70,200	69,600	69,000	68,500
Groundwater					
- Entitlements[5]	121,300	121,300	121,300	120,700	120,700
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	385,600	406,200	423,200	423,700	425,400
MWD Water Purchases With Existing/Planned Supplies	289,100	287,000	289,500	309,000	320,600
Total Supplies	**674,700**	**693,200**	**712,700**	**732,700**	**746,000**

[1] Total Demand with existing passive conservation prior to FYE 14.

[2] Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

[3] Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

[4] Los Angeles Aqueduct supply is estimated to decrease 0.1652% per year due to climate impacts.

[5] LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Exhibit ES-S
Service Area Reliability Assessment for Average Weather Year

Demand and Supply Projections (in acre-feet)	Average Year Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**642,600**	**660,200**	**678,800**	**697,800**	**710,500**
Post-Conservation Demand	**509,500**	**526,700**	**536,100**	**554,500**	**565,800**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	133,100	133,500	142,700	143,300	144,700
Los Angeles Aqueduct[4]	190,400	188,900	187,300	185,800	184,200
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	385,600	406,200	423,200	423,700	425,400
MWD Water Purchases With Existing/Planned Supplies	181,400	180,200	183,700	204,100	216,800
Total Supplies	**642,600**	**660,200**	**678,800**	**697,800**	**710,500**

[1] Total Demand with existing passive conservation prior to FYE 14.

[2] Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

[3] Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

[4] Los Angeles Aqueduct supply is estimated to decrease 0.1652% per year due to climate impacts.

[5] LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Exhibit ES-T
Service Area Reliability Assessment for Multiple Dry Years

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year 1 (1988) Fiscal Year Ending on June 30				
	2025	**2030**	**2035**	**2040**	**2045**
Total Water Demand[1]	**657,900**	**675,800**	**694,900**	**714,400**	**727,400**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	150,300	149,200	158,800	160,000	161,700
Los Angeles Aqueduct[4]	133,700	132,600	131,500	130,400	129,300
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	421,700	439,400	455,400	455,000	455,800
MWD Water Purchases With Existing/Planned Supplies	236,200	236,400	239,500	259,400	271,600
Total Supplies	**657,900**	**675,800**	**694,900**	**714,400**	**727,400**

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year 2 (1989) Fiscal Year Ending on June 30				
	2025	**2030**	**2035**	**2040**	**2045**
Total Water Demand[1]	**661,700**	**679,700**	**698,900**	**718,500**	**731,500**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	154,100	153,100	162,800	164,100	165,800
Los Angeles Aqueduct[4]	119,500	118,600	117,600	116,600	115,700
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	531,700	557,700	580,900	580,100	581,100
MWD Water Purchases With Existing/Planned Supplies	130,000	122,000	118,000	138,400	150,400
Total Supplies	**661,700**	**679,700**	**698,900**	**718,500**	**731,500**

Exhibit ES-T (continued)

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year 3 (1990) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**674,800**	**693,200**	**712,800**	**732,700**	**746,000**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	167,200	166,600	176,700	178,300	180,300
Los Angeles Aqueduct[4]	70,800	70,200	69,600	69,000	68,500
Groundwater					
- Entitlements[5]	121,309	121,309	121,309	120,709	120,709
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	387,609	406,309	423,309	423,809	425,509
MWD Water Purchases With Existing/Planned Supplies	287,191	286,891	289,491	308,891	320,491
Total Supplies	**674,800**	**693,200**	**712,800**	**732,700**	**746,000**

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year 4 (1991) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**661,600**	**679,600**	**698,900**	**718,400**	**731,500**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	154,000	153,000	162,800	164,000	165,800
Los Angeles Aqueduct[4]	119,700	118,800	117,800	116,800	115,800
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	411,400	429,400	445,700	445,400	446,400
MWD Water Purchases With Existing/Planned Supplies	250,200	250,200	253,200	273,000	285,100
Total Supplies	**661,600**	**679,600**	**698,900**	**718,400**	**731,500**

Exhibit ES-T (continued)

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year 5 (1992) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**655,700**	**673,600**	**692,600**	**712,000**	**724,900**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	148,100	147,000	156,500	157,600	159,200
Los Angeles Aqueduct[4]	141,900	140,700	139,500	138,400	137,300
Groundwater[5]					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	427,700	445,300	461,100	460,600	461,300
MWD Water Purchases With Existing/Planned Supplies	228,000	228,300	231,500	251,400	263,600
Total Supplies	**655,700**	**673,600**	**692,600**	**712,000**	**724,900**

[1] Total Demand with existing passive conservation prior to FYE 14.

[2] Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

[3] Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

[4] Los Angeles Aqueduct supply is estimated to decrease 0.1652% per year due to climate impacts.

[5] LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Exhibit ES-U
Service Area Drought Risk Assessment

Demand and Supply Projections (in acre-feet)	Drought Risk Assessment (1988-1992) Fiscal Year Ending on June 30				
	2021	**2022**	**2023**	**2024**	**2025**
Total Water Demand[1]	**645,900**	**652,600**	**668,600**	**658,600**	**655,700**
Post-Conservation Demand	**494,200**	**497,100**	**500,600**	**504,700**	**507,600**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	151,700	155,500	168,000	153,900	148,100
Los Angeles Aqueduct[4]	134,600	120,100	71,000	119,900	141,900
Groundwater					
- Entitlements[5]	100,500	104,800	119,300	107,400	109,400
- Groundwater Replenishment	0	1,750	3,500	3,500	7,000
- Stormwater Recharge (Increased Pumping)	2,000	2,000	2,000	2,000	4,000
Recycled Water- Irrigation and Industrial Use	11,400	12,500	14,300	15,400	17,300
Subtotal	400,200	396,700	378,100	405,600	427,700
MWD Water Purchases With Existing/Planned Supplies	245,700	255,900	290,500	256,500	228,000
Total Supplies	**645,900**	**652,600**	**668,600**	**658,600**	**655,700**

[1] Total Demand with existing passive conservation prior to FYE 14.

[2] Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

[3] Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

[4] Los Angeles Aqueduct supply is estimated to decrease 0.1652% per year due to climate impacts.

[5] LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Water Shortage Contingency Plan (WSCP)

As required by California Water Code (CWC) Section 10632, LADWP has developed a WSCP, which is included as Appendix I, that outlines the decision-making process LADWP utilizes each year to determine its water supply reliability. The WSCP outlines how LADWP will perform an annual water supply and demand assessment to identify potential water shortages and identifies six standard water supply shortage levels and corresponding shortage response actions as reflected in Exhibit ES-V.

Exhibit ES-V
LADWP Standard Water Shortage Levels and Response Actions

Water Shortage Level	Percent Shortage	Demand Reduction Response Actions	Supply Augmentation Response Actions
Level 1: No Shortage	Up to 10%	Conservation Ordinance Phase 1	N/A
Level 2: Moderate Shortage	Up to 20%	Conservation Ordinance Phase 2	
Level 3: Significant Shortage	Up to 30%	Conservation Ordinance Phase 3	Withdraw from available emergency storage along the Los Angeles Aqueduct System and local groundwater basins
Level 4: Severe Shortage	Up to 40%	Conservation Ordinance Phase 4	
Level 5: Critical Shortage	Up to 50%	Conservation Ordinance Phase 5	
Level 6: Supercritical Shortage	Greater than 50%	Conservation Ordinance Phase 6	

To determine the appropriate shortage level in the future, LADWP will assess water supply conditions per the procedures outlined in the Appendix I, Section 3 – *Annual Water Demand and Supply Assessment*. A detailed summary of shortage response actions is also included in Appendix I. LADWP's shortage response actions include a mix of prohibitions on end use, demand reduction methods, and supply augmentation. The City's Emergency Water Conservation Plan (Conservation Ordinance) describes prohibitions on end use and demand reduction methods that will be employed by LADWP in the event of a shortage. Supply augmentation actions will include withdrawing from available emergency supplies along the LAA system and/or local groundwater basins. The WSCP also lists re-evaluation and improvement procedures LADWP will use to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed. The WSCP will be re-evaluated at least every five years in coordination with the UWMP update or at the discretion of LADWP. In addition to shortage planning, the WSCP describes how LADWP is planning for a catastrophic supply interruption, including a large seismic event at the regional and local scale.

Water Quality Issues

Water quality is an important and necessary consideration in all water management and supply reliability strategies. Current and foreseeable water quality issues can reduce the reliability of supplies. LADWP closely monitors water quality issues regarding source water challenges and proposed regulations at the local, state, and federal levels. LADWP also proactively researches and invests in advanced and emerging technologies to ensure continued safety and reliability of the City's water supplies.

LADWP continuously strives to surpass the water quality standards and requirements and do so in an effective and affordable way for our customers. By managing state-of-the-art water treatment processes, maintaining and operating treatment facilities, and vigilantly monitoring and testing the water, LADWP has been meeting or exceeding all health-based drinking water standards. Drinking water standards are set by the U.S. Environmental Protection Agency and the State Water Resources Control Board Division of Drinking Water.

Climate Risks

LADWP is considering the impacts of climate change on its water resources as an integral part of its long-term water supply planning. Climate impacts are a global-scale concern, but are particularly important in the Western United States where water supplies are already limited. To better understand these impacts, LADWP actively monitors climate risks to the LADWP service area locally and to the watersheds of LADWP's imported supplies. These watersheds span across the Western United States and include the Eastern Sierra Nevada, Northern Sierra Nevada, and the Colorado River Basin where water supplies from the LAA, SWP, and CRA originate, respectively.

Water Demand and Local Impacts

As discussed in Section ES.3, *Water Demands*, shifts in weather conditions can influence water demands by approximately five percent when compared to average conditions. LADWP evaluated the potential effects of climate impacts on water demands by utilizing future projections of precipitation and temperature obtained from global climate models (GCMs). These GCMs were analyzed to establish scenarios of the potential range of climate impacts for the Los Angeles area. These scenarios are characterized as projected hot and dry, warm and wet, and average modeled climate futures. The greatest increase in demands over the baseline in 2045 occurs in the hot & dry scenario, which projects an increase in demands of 37,400 AF (seven percent increase), followed by the central tendency scenario at 20,400 AF (four percent increase), and the warm and wet scenario at 2,200 AF (less than one percent increase).

Los Angeles Aqueduct Impacts

To address the possible climate risk on the LAA, LADWP completed a climate change study in 2011 (2011 Climate Study) on the Eastern Sierra Nevada region to evaluate potential impacts to the LAA system. The 2011 Climate Study results suggest an increase in temperature of 8°F, a reduction in precipitation of 10 percent, and a reduction of snowpack in the Eastern Sierra Nevada region by the end of the 21st century.

Recently, LADWP worked with the University of California, Los Angeles to complete a Climate Change Study Update (2020 Climate Study) to analyze potential changes since the completion of the 2011 Climate Study due to several advances in global climate modeling. Results of the 2020 Climate Study show steady temperature increases throughout the remainder of the 21st century and are similar to the 2011 Climate Study. The results from the 2020 Climate Study continue to be analyzed to provide inputs to hydrologic runoff models to estimate changes in deliveries into the LAA system. The projected runoff findings help better inform operational decisions and assist in developing strategies for improved management of supplies along the LAA system.

Water and Energy Nexus

A new requirement for the 2020 UWMP under CWC Section 10631.2 is to include any readily obtainable information or an estimate of the amount of energy used to process water supplies, such as energy used to extract, divert, convey, treat, store, and distribute. Energy intensity reporting can be beneficial for water utilities because it identifies associated energy savings and greenhouse gas reduction opportunities for water conservation savings programs.

The most energy intensive source of water for LADWP is water purchased from MWD, which imports SWP supplies via the California Aqueduct and Colorado River supplies via the CRA. LADWP also imports water via the LAA, which is a net producer of energy. The next most energy intensive sources for LADWP are local sources of water which include groundwater and recycled water. Recycled water is a more energy intensive source than groundwater, but still has a lower energy intensity than imported MWD water.

ES.7 Financing

Funding for water resource programs and projects are primarily provided through LADWP water rates, with supplemental funding provided by MWD, and local, state, and federal grants. LADWP will also seek reimbursement from potential responsible parties to assist with groundwater remediation program costs. To fund future programs, LADWP will utilize a combination of the following funding sources:

- Water Rates – The revenue collected through LADWP's current water rates is the primary funding source for resource programs designed to achieve the City's goals for conservation, water recycling, stormwater capture, and remediating the contamination in the SFB.

- MWD – Currently provides funding through their Local Resources Program (LRP) for the development of water recycling, groundwater recovery, and seawater desalination. The LRP incentive structure offers three options: sliding scale incentives up to $340/AF over 25 years, sliding scale incentives up to $475/AF over 15 years, or fixed incentives up to $305/AF over 25 years. MWD also promotes conservation through its Conservation Credits Program, which includes rebates and incentives.

- Local Funds - In November 2018, LA County voters passed Measure W to create the Safe, Clean Water Program which supports funding for stormwater capture. The Safe, Clean Water Program imposes a special parcel tax of 2.5 cents per square foot of impermeable surface area on private property within the LACFCD. The tax will generate up to $285 million per year, which will be used to improve water quality and supply, promote community investment benefits with a focus on disadvantaged communities, and implement nature-based solutions.

- State Funds – Funds for recycling, groundwater, conservation, water use efficiency, and stormwater capture have been available on a competitive basis though voter approved initiatives, such as Propositions 50, 84 and 1. Proposition 1 allocates $900 million to prevent or clean up contaminated groundwater. Occasionally low or zero-interest loans are also available through State Revolving Fund programs.

- Federal Funds – Federal funding for recycling is available through the U.S. Army Corps of Engineers, via periodic Water Resource Development Act legislation, and the U.S. Bureau of Reclamation's Title XVI program.

- Potentially Responsible Parties - LADWP may be able to recover some costs for groundwater remediation from potentially responsible parties.

ES.8 Conclusion

LADWP's 2020 UWMP not only meets the current requirements of the Act, but also outlines new long-term strategies for water supply and resource management for the next 25 years. It lays out a detailed plan to develop a sustainable water supply portfolio that includes increasing local water supplies and water conservation by FY 2044/45 and to reduce its dependence on purchased imported supplies. In the event of water shortages, LADWP will implement its WSCP and take reasonable actions to balance water demand with limited water supplies. Based on the overall service area reliability assessment in compliance with CWC Section 10635(a), LADWP anticipates all demands are met by the available supplies under all hydrologic scenarios.

Chapter One

Introduction

1.0 Overview

In 1902, the City of Los Angeles (City) had a population of approximately 142,000 residents and formed a municipal water system by acquiring title to a private water company. In 1925, the Los Angeles Department of Water and Power (LADWP) was established by the City Charter. LADWP has met the City's increasing need for water resources as it developed into the nation's second largest city with over 4.0 million residents, encompassing a 472-square-mile service area. As the largest municipal utility in the nation, LADWP provides safe, reliable, and cost-effective water and power in a customer-focused and environmentally responsible manner.

LADWP has a strong record of water resources management and integrated resource planning. Faced with increasing water demands and extended dry periods, LADWP is addressing the challenge of providing a reliable water supply for a growing population by expanding local water supply programs and reducing demands on purchased imported water. LADWP continues to make significant investments in local groundwater, recycled water, stormwater capture, and water conservation and use efficiency to further diversify its water supply portfolio. In April 2019, LADWP, in conjunction with the City, developed short-term and long-term sustainability targets, as presented in L.A.'s Green New Deal, to form a more reliable, sustainable, and resilient water supply. LADWP is committed to meeting all the City's current and future water needs while increasing supply reliability, reducing imported water purchases, and increasing locally produced water by continuing with the strategy to:

- Achieve significant water conservation and water use efficiency enhancements
- Increase stormwater capture capacity
- Maximize water reuse
- Maximize and expand groundwater production
- Maintain and increase operational integrity of the Los Angeles Aqueduct (LAA) and in-City water distribution systems
- Ensure continued reliability of the water supplies from the Metropolitan Water District of Southern California (MWD) through active representation of the City's interests on the MWD Board
- Meet or exceed all Federal and State standards for drinking water quality

1.1 Purpose

LADWP's 2020 Urban Water Management Plan (UWMP) has two purposes: (1) it identifies long-term strategies for the City's reliable water supply and managing water resources consistent with LADWP's goals and policy objectives, and (2) it fulfills LADWP's obligations under the California Urban Water Management Planning Act (Act), as codified in California Water Code (CWC) Division 6, Part 2.6, Section 10610, et seq.

1.1.1 UWMP Requirements and Checklist

This 2020 UWMP complies with the Act, and details how LADWP plans to meet all of the City's water supply goals and objectives while serving customers' water needs. The Act became effective on January 1, 1984, and mandates that every urban water supplier that provides municipal and industrial water to more than 3,000 customers (or supplies more than 3,000 acre-feet per year (AFY)) prepare and adopt a UWMP every five years in compliance with state guidelines and requirements.

The Act was originally developed to address potential water supply shortages throughout California. It required information that focused primarily on water supply reliability and water use efficiency measures. Since its enactment in 1983, there have been several amendments, including Assembly Bill (AB) 2067 (2014), Senate Bill (SB) 1420 (2014); and with the most recent amendments adopted since 2016, including SB 664 (2015), SB 606 (2018), and AB 1414 (2019).

Some of the major amendments prior to 2016 include: a requirement for narrative description of water demand measures implemented over the past five years and future measures planned for implementation to meet 20 percent demand reduction targets by 2020, standard methodology for calculating distribution system water loss, mandatory electronic filing of UWMPs, voluntary reporting of passive conservation savings, and a requirement to analyze and define water features that are artificially supplied with water. Amendments since 2016 include the addition of a seismic risk assessment and mitigation plan, inclusion of a water shortage contingency plan with six standard water shortage levels, a drought risk assessment for a five-year historic sequence, reporting of energy intensity, considerations for climate change impacts, and an annual water supply and demand assessment after 2020; the first of which should include a narrative that describes water demand management measures that the supplier plans to implement to achieve its urban water use objective by January 1, 2027. A copy of the Act is provided in Appendix A, and a checklist cross-referencing Act requirement to applicable pages in this UWMP is provided in Appendix B.

With the amendments to CWC Sections 10631 and 10656 (through the passage of SB 610 and 221 in 2001 and SB x7-7 in 2009), UWMPs have become more important in the role of supporting developments. SB 610 and 221 require counties and cities to consider the availability of adequate water supplies for certain new large developments and to have written verification of sufficient water supply to serve them. UWMPs are identified as key source documents for this verification. Based on these statutes, LADWP prepares individual Water Supply Assessments for these new large developments. SB x7-7, the Water Conservation Act of 2009, requires water agencies to reduce per capita water use by 20 percent by 2020. Water users were required to set an interim target for 2015 and a final target for 2020 using one of four methodologies to calculate per capita water use. Excluding certain exceptions, failure to meet adopted targets will result in the ineligibility of a water supplier to receive state grants or loans.

1.2 Long Term Planning

LADWP has a strong record of working to ensure that its customers have reliable, safe, high quality water. These efforts date back to the early 20th century with the construction of the LAA. City investments in regional supplies, water rights, aqueducts, reservoirs, conservation, water use efficiency, and, more recently, in recycled water, groundwater basin remediation, and stormwater capture have allowed residents to enjoy a reliable water supply. Sound planning and timely investments in water supply infrastructure and water use efficiency have played a critical role in meeting the City's water needs, despite the region's Mediterranean climate and growing population.

Over the last 30 years, LADWP's water supply mix has changed due to the impacts from supply challenges resulting from significant reductions in LAA deliveries due to environmental reallocations and periods of dry hydrology, as well as significant reductions in groundwater pumping due to contamination in the City's largest groundwater aquifer, the San Fernando Basin (SFB). Despite significant achievements in conservation, water use efficiency, and enhanced water management efforts, these challenges have resulted in the increased reliance on purchased imported water in order to meet demands. As discussed in the associated sections of this UWMP, challenges to LADWP's water supplies include:

- Groundwater contamination;
- Urbanization;
- Reduced reliability of LAA and MWD imported supplies due to environmental obligations, competing demands for finite supplies, and climate change impacts; and
- Rising cost of and reliance on MWD purchased imported water.

LADWP continues to collaborate and coordinate with agencies at the local, regional, and state levels, such as MWD, Los Angeles County Flood Control District, Los Angeles County Sanitation Districts, and City of Los Angeles Department of Public Works Bureau of Sanitation and Environment (LASAN), as part of the local and regional integrated resources planning efforts.

1.2.1 Integrated Resources Planning

Integrated resources planning is a process used by many water, stormwater (flood control), and wastewater agencies to meet future goals in the most effective way possible while achieving multi-benefit goals with the greatest public support. The integrated resources planning process generally incorporates:

- Multiple objectives such as reliability, cost, water quality, environmental stewardship, and enhanced quality of life;
- Public stakeholders in an open, participatory process; and
- Partnerships with other agencies, institutions, and non-governmental organizations.

LADWP has been involved in integrated resources planning since the development of its first UWMP in 1985, which incorporated water conservation, recycled water, stormwater capture, and imported water purchased from MWD. LADWP is also an active participant in MWD's regional Integrated Resources Plan (IRP), first adopted in 1996 and subsequently updated in 2004, 2010, and 2015. The regional IRP focuses on achieving water supply reliability and environmental stewardship by increasing water conservation and recycled water, integrating management of local groundwater, and improving the reliability of imported water for MWD's six-county service area. In 1999, the City embarked on its first IRP for wastewater, stormwater, and water supply. LADWP was a key partner in this effort, working with LASAN. In 2014, the City's IRP was updated and rebranded as "One Water LA" to be even more collaborative, involving almost every City department. LADWP has also been an essential partner in the development of the Greater Los Angeles County Integrated Regional Water Management Plan (IRWMP). This plan, first developed in 2006, was updated in 2013 and approved in 2014. In addition, LADWP is a member of the Integrated Regional Water Management (IRWM) Leadership Committee and, along with the Council for Watershed Health, serves as co-chair of the of the Upper Los Angeles River Watersheds sub-region for the IRWM region.

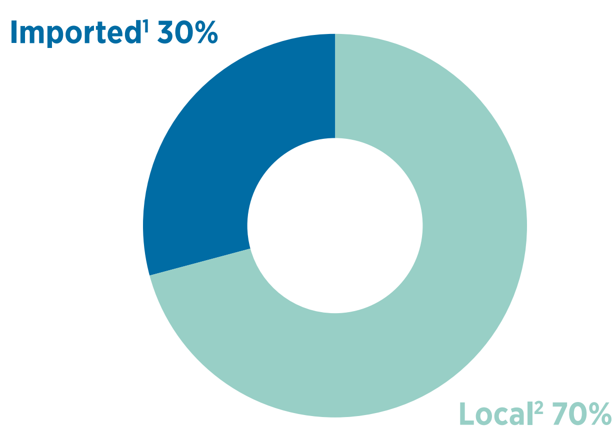
1.2.2 L.A.'s Green New Deal

L.A.'s Green New Deal updates the Sustainable City pLAn to prioritize water conservation and use efficiency and local water supply sources through four targets highlighted in the Green New Deal's *Local Water* section. These short- and long-term targets were developed collaboratively between LADWP and the City, and include several milestones and initiatives to form a more reliable, sustainable, and resilient water supply. LADWP is committed to the development of programs that advance these initiatives and will work towards achieving these long-term goals.

The first *Local Water* target aims to source 70 percent of the City's water locally, as shown in Exhibit 1A, and capture 150,000 AFY of stormwater by 2035. This target includes the following milestones:

- Increase stormwater capture to 75,000 AFY by 2021;
- Replace 108 miles of water mainlines by 2021 and 530 miles by 2028; and
- Reduce LADWP purchases of imported water by 50 percent by 2025 from the fiscal year 2013/14 baseline.

Exhibit 1A
Local Supply Goal



1 Imported supplies include LAA deliveries and purchased imported water from MWD. Total amount of water exported from the Eastern Sierra will remain consistent with historical exports.

2 Locally sourced water, potable and non-potable, shall be composed of all local groundwater production, historic and future hardware-based conservation savings, centralized and distributed stormwater capture and recharge, and all recycled water produced in the City. When determining the percentage of local water, the amount of recycled water provided to jurisdictions outside the City of Los Angeles shall be included in both the numerator and denominator of the calculation. (Defined in L.A.'s Green New Deal)

The second *Local Water* target aims to recycle 100 percent of all wastewater for beneficial reuse by 2035. Key milestones include:

- Produce 1.5 million gallons per day (MGD) of recycled water at Hyperion Water Reclamation Plant (WRP) for use at Los Angeles World Airports (LAWA) and other local facilities by 2021;

- Recycle 17,000 AFY (15 MGD) of water at Donald C. Tillman WRP to recharge into area groundwater basins by 2025; and

- Increase non-potable reuse of recycled water by an additional 6,000 AFY by 2025, and an additional 8,000 AFY by 2035.

The third *Local Water target* includes building at least 10 new multi-benefit stormwater capture projects by 2025, 100 by 2035, and 200 by 2050 to improve local water quality and increase local water supply.

The fourth *Local Water* target aims to reduce potable water use per capita by 22.5 percent by 2025 and 25 percent by 2035, and to maintain or reduce 2035 per capita water use through 2050. Water use in June 2014 (baseline) was 133 total gallons per capita per day. The milestone consists of:

- Expand existing programs and develop targeted campaigns to increase awareness on L.A.'s water policy goals by 2021.

The fifth and final target is to install or refurbish hydration stations at 200 sites, prioritizing municipally-owned buildings and public properties such as parks, by 2035. Key milestones include:

- Establish permanent drinking water access in Skid Row by 2021; and

- Provide drinking water access at five sites of highest need and install or retrofit hydration stations at municipal buildings by 2025.

The local water vision, strategies, and priority initiatives outlined in L.A.'s Green New Deal were developed collaboratively with LADWP and are integrated into the update of the UWMP.

1.3 Service Area Demand

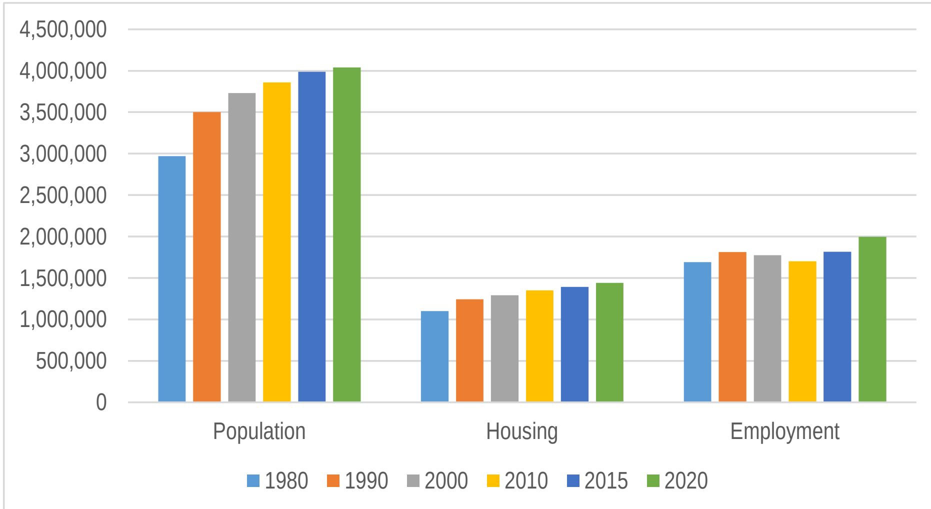
Demographics, land use, climate, and conservation influence LADWP's demand projections. The following sections outline these components.

1.3.1 Demographics

Over four million people reside in the LADWP service area, which is slightly larger than the legal boundary of the City. LADWP also provides water service to portions of West Hollywood, Culver City, and small parts of the County of Los Angeles.

The population within LADWP's service area increased from 2.97 million in 1980 to 4.04 million in 2020, representing an average annual growth rate of approximately 1 percent. The total number of housing units increased from 1.10 million in 1980 to 1.44 million in 2020, representing an average annual growth rate of 0.8 percent. During this time, average household size increased from 2.7 persons in 1980 to 2.8 persons in 2020. Employment grew by about 0.7 percent annually from 1980 to 1990, but declined from 1990 to 2010 as a result of two economic recessions. The first recession began in 1991 and was followed by another larger recession that began in 2008. Overall, employment decreased by about 0.3 percent annually from 1990 to 2010 and increased between 2010 and 2020 by approximately 1.7 percent, reflecting an improved economy. Exhibit 1B summarizes the historical demographics for the LADWP service area.

Exhibit 1B
Historical Demographics for LADWP Service Area



	Population	Housing	Employment
1980	2,970,000	1,100,000	1,692,000
1990	3,501,602	1,243,022	1,813,615
2000	3,732,579	1,290,440	1,773,895
2010	3,860,514	1,351,458	1,700,575
2015	3,987,622	1,393,994	1,817,840
2020	4,041,284	1,442,766	1,995,597

Demographic projections for the LADWP service area are based on the Southern California Association of Governments' (SCAG) demographic growth forecast for their 2020 Regional Transportation Plan (RTP). MWD collaborates with SCAG to aggregate demographic data for each of its 26 member agencies' service areas using service area boundaries. LADWP and MWD have adopted these demographic projections for water demand forecast in their respective UWMPs. SCAG and other regional California governments are projecting increases in housing over time to address the housing shortage that Southern California has experienced over the last two decades. Projected 2020 RTP data reflects these adjustments resulting in a reduction in persons per household seen in Exhibit 1C. The SCAG 2020 RTP was adopted by the Regional Council of the SCAG on September 3, 2020.

LADWP's service area population is expected to continue to grow over the next 25 years at a rate of approximately 0.7 percent annually. While this is substantially less than the historical 1.0 percent annual growth rate from 1980 to 2010, it will still lead to approximately 765,100 new residents over the next 25 years. According to SCAG's 2020 RTP, total housing is expected to grow at a slightly higher rate than population over the next 25 years at 1.1 percent annual growth versus 0.7 percent annual growth for population, and it is anticipated that household size will decline over the projection period.

The 2020 RTP projects that by 2045 the average household size will decrease to 2.63 persons per household. Throughout the projection period, multi-family housing units are expected to increase at almost four times the rate of single-family housing units (approximately 1.32 percent annual growth vs. 0.37 percent annual growth).

Employment is expected to increase by 0.36 percent annually throughout the projection period. This growth is primarily driven by the current and long-term opportunities available from the economic base within the five-county metropolitan region of Southern California. The economic base is wide-ranging and includes professional and business services, wholesale and retail trade, manufacturing, public administration, financial service industries, information, transportation, warehousing, utilities, construction, education and health services, and leisure and hospitality. Over the 25-year forecast period, industrial growth is expected to gradually decline between now and 2045 by 1.23 percent annually. Commercial employment is expected to increase by about 0.44 percent annually.

Exhibit 1C
Demographic Projections for LADWP Service Area

Demographic	2025	2030	2035	2040	2045
Population	4,243,478	4,374,240	4,520,870	4,670,693	4,806,396
Housing					
Single-Family	628,359	639,280	647,403	657,614	667,311
Multi-Family	906,120	969,198	1,037,051	1,100,361	1,157,553
Total Housing	1,534,479	1,608,479	1,684,455	1,757,976	1,824,864
Persons per Household	2.77	2.72	2.68	2.66	2.63
Employment					
Commercial	1,897,438	1,953,634	2,011,968	2,066,096	2,105,798
Industrial	94,073	91,003	87,910	84,264	79,680
Total Employment	1,991,511	2,044,637	2,099,878	2,150,360	2,185,478

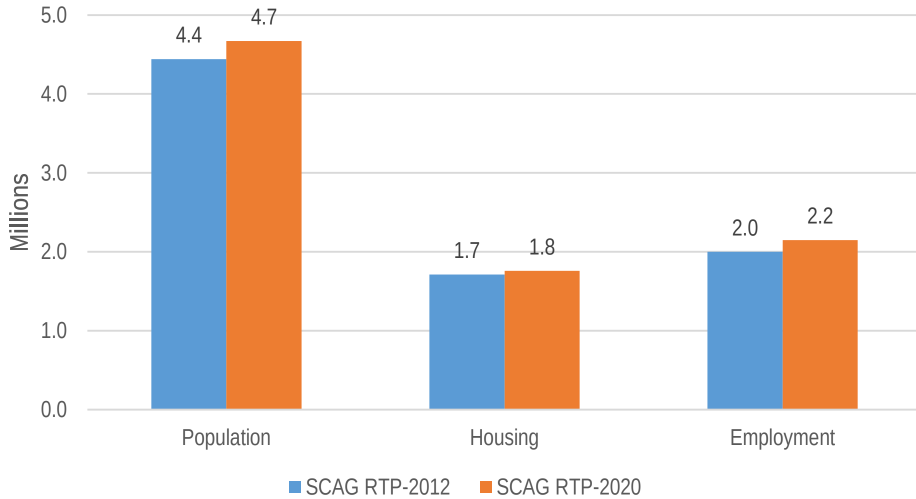
Source: 2020 Regional Transportation Plan, Southern California Association of Governments

The 2020 UWMP presents demographic projections that are higher for population, employment, and housing, when compared to the data presented in the LADWP's 2015 UWMP. The housing projection displays less single-family housing units and more multi-family housing units when compared to the 2015 UWMP. The demographic projections in the 2015 UWMP were based on SCAG's 2012 RTP. The current 2020 projections incorporate the latest population, households, and employment data from multiple local, state, and federal agencies. Exhibit 1D shows the differences between the SCAG demographic projections for the RTP in 2012 and 2020.

For the forecast year 2040, the City's population was projected to be 4.47 million under the SCAG 2012 RTP and 4.67 million under the 2020 RTP, a difference of approximately 229,000. Housing was projected to be 1.71 million in 2040 under the SCAG 2012 RTP and 1.76 million under the SCAG 2020 RTP, a difference of approximately 50,000 units. Employment was forecast to be 2.0 million in the SCAG 2012 RTP and 2.15 million in the newest RTP. Exhibit 1D compares these different demographic projections for the LADWP service area for the year 2040.

Demographic projections are primary drivers of water demand forecasting. It is important to use the latest and best information available, as the accuracy of these projections may lead to an over-estimate or under-estimate of future water demands. During the UWMP planning process, LADWP used the latest available demographic projections for its water demand forecast. Currently, the latest available projections are in the 2020 RTP.

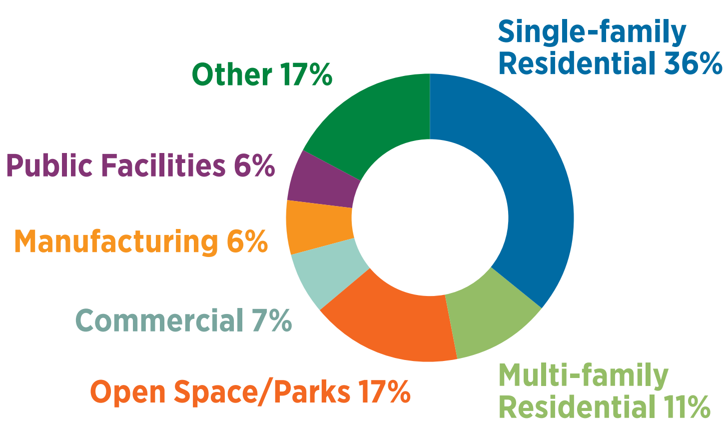
Exhibit 1D
Comparison of SCAG Demographic Projections for LADWP Service Area Between 2012 and 2020 RTP Forecasts for Year 2040



1.3.2 Land Use

The City is comprised of approximately 302,832 acres. Residential development constitutes approximately 47 percent of the total land use within the City. Within the residential land use category, single-family residential is the largest at approximately 110,000 acres or 36 percent of the total land use within the City. Multi-family residential is at approximately 33,000 acres or 11 percent of the total land use. Open space/parks are the second largest land use within the City at approximately 17 percent. Commercial, public facilities and manufacturing land uses combined account for approximately 19 percent of the total. Public facilities include land uses such as libraries, public schools, and other government facilities. Exhibit 1E provides a breakdown of the land uses within the City. The "Other" category includes City port and airport, transportation, freeways, parking, rights of way, hillsides, and other miscellaneous uses that are not zoned.

Exhibit 1E
City of Los Angeles Land Uses



Land Use Types	Acres
Single-family Residential[1]	110,117
Multi-family Residential	33,089
Subtotal Residential	143,206
Open Space/Parks	50,829
Commercial	22,637
Manufacturing	17,685
Public Facilities	18,349
Other[2]	50,126
Total	302,832

Source: http://planning.lacity.org/

1. Includes agriculture use as defined by City of Los Angeles, Department of City Planning
2. Includes specific plans, transportation, freeways, parking, rights of way, hillsides, and other miscellaneous areas that are not zoned.

1.3.3 Climate

Weather in the City is considered mild, which is a major attribute that attracts businesses, residents, and tourists. Because of its relative dryness, the City's climate has been characterized as Mediterranean. Exhibit 1F provides a summary of average monthly rainfall, maximum temperatures, and evapotranspiration readings.

The City's average monthly maximum temperature is 75 degrees Fahrenheit based on the period of 1995-2020. This is based on data from the Los Angeles Downtown weather station. Total precipitation averages 13.77 inches per year, with over 92 percent of this total amount typically falling during the period of November through April. The standard annual average evapotranspiration rate (ETo) for the City area is 48.87 inches per year. ETo measures the loss of water to the atmosphere by evaporation from soil and plant surfaces and transpiration from plants. ETo serves as an indicator of how much water plants need for healthy growth.

Exhibit 1F
Average Climate Data for Los Angeles 1995-2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°F)[1]	68.65	68.58	70.69	72.80	74.51	77.73	83.01	84.57	83.53	79.25	73.54	67.90	75.40
Average Precipitation (inches)[1]	3.22	3.36	1.90	0.75	0.35	0.07	0.02	0.00	0.15	0.62	0.85	2.48	13.77
Average ETo (inches)[2]	2.15	2.45	3.79	4.73	5.20	5.53	6.22	6.12	4.70	3.53	2.45	2.00	48.87

1. 1995-2020, Los Angeles Downtown USC Weather Station, USW00093134
2. www.cimis.water.ca.gov. Average of Santa Monica (Id. 99) and Pomona (Id. 78) from 1995 through 2020

1.3.4 Conservation

In the last twenty years, water demands in the City have undergone a drastic reduction from a peak of 689,467 AF in FY 2003/04 to 487,591 AF in FY 2019/20. Several sequences of multi-year dry periods have led to diminishing supplies and increased efforts in conservation and water use efficiency. Most recently, the start of a multi-year dry period in 2012 resulted in diminished supplies from the LAA and historically heavy reliance on purchased MWD water. This drove increased efforts in conservation that resulted in a 29 percent demand reduction in 2019/20 from 2003/04. Recent legislation continues to influence future conservation planning efforts:

- SB X7-7 (the Water Conservation Act of 2009) stipulated that water agencies achieve a 20 percent reduction in urban per capita water use by December 31, 2020. LADWP used one of the four appropriate methods in its 2015 UWMP to develop a final reported 2020 target of 142 gallons per capita per day (gpcd). LADWP's actual gpcd in 2020 was 106 gpcd, less than the revised interim target for Method 3.

- Amendments to Water Code Division, 6, Part 2.55 through AB 1668 (2018) set new standards for efficient indoor residential water use while charging the Water Board and Department of Water Resources to recommend updated standards for outdoor residential uses and Commercial, Industrial and Institutional (CII) uses by 2021. The temporary volumetric standards for residential indoor water use are 55 gpcd until January 2025, then 52.5 gpcd until 2030, then 50 gpcd.

LADWP seeks to achieve a 22.5 percent per capita water use reduction by 2025 followed by a 25 percent per capita water use reduction in 2035 as discussed in Section 1.2 above. These target reductions are based on a 133 gpcd use in June 2014, yielding a target of 100 gpcd by 2035 and maintaining at 100 gpcd through 2050.

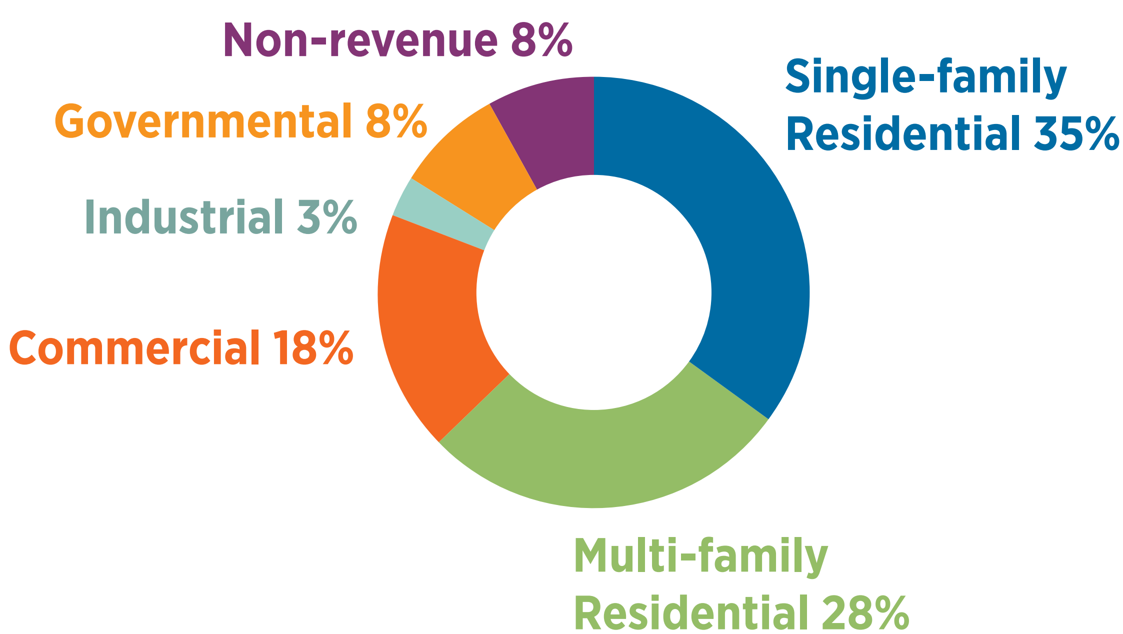
1.3.5 COVID-19

Since early 2020, the COVID-19 pandemic has imposed massive health and economic burdens on communities around the world and in the United States, affecting every sector of society, including the vitally important water sector. The full extent of impacts of the COVID-19 pandemic on the water sector are still evolving, but one area that has come to the forefront is the effect on municipal water demand. Available data from the end of FY 2020 suggests that residential water demand has increased (due to more customers working from home) while non-residential demand has decreased (due to the overall economic slowdown and mandated shut-downs). The net result is a total water demand that remains unchanged in 2020 when compared to 2019. The slowdown in the economy from COVID-19 may have impacts over the next several years, which may affect both residential and non-residential water demand projections. Potential impacts from COVID-19 will be monitored in the near term and incorporated into LADWP's water demand and supply planning for the future as necessary.

1.3.6 Current Water Demand

LADWP maintains historical water use data separated into the following categories: single-family residential, multi-family residential, commercial, industrial, government, and non-revenue water. Single-family residential water use is the largest category of demand in LADWP's service area, representing about 35 percent on average during the previous five years. Multi-family residential water use is the next largest category of demand, representing about 28 percent on average based on the previous five years. Industrial use is the smallest category, representing only 3 percent of the total demand. Non-revenue water is the difference between total water delivered to the City and total water sales. Exhibit 1G depicts the five-year average service area demands. Chapter 2, *Water Demand* provides an in-depth look at water demand trends and projections for the next 25 years.

Exhibit 1G
Service Area Demands Five-Year Average (FYE 2016-FYE 2020)

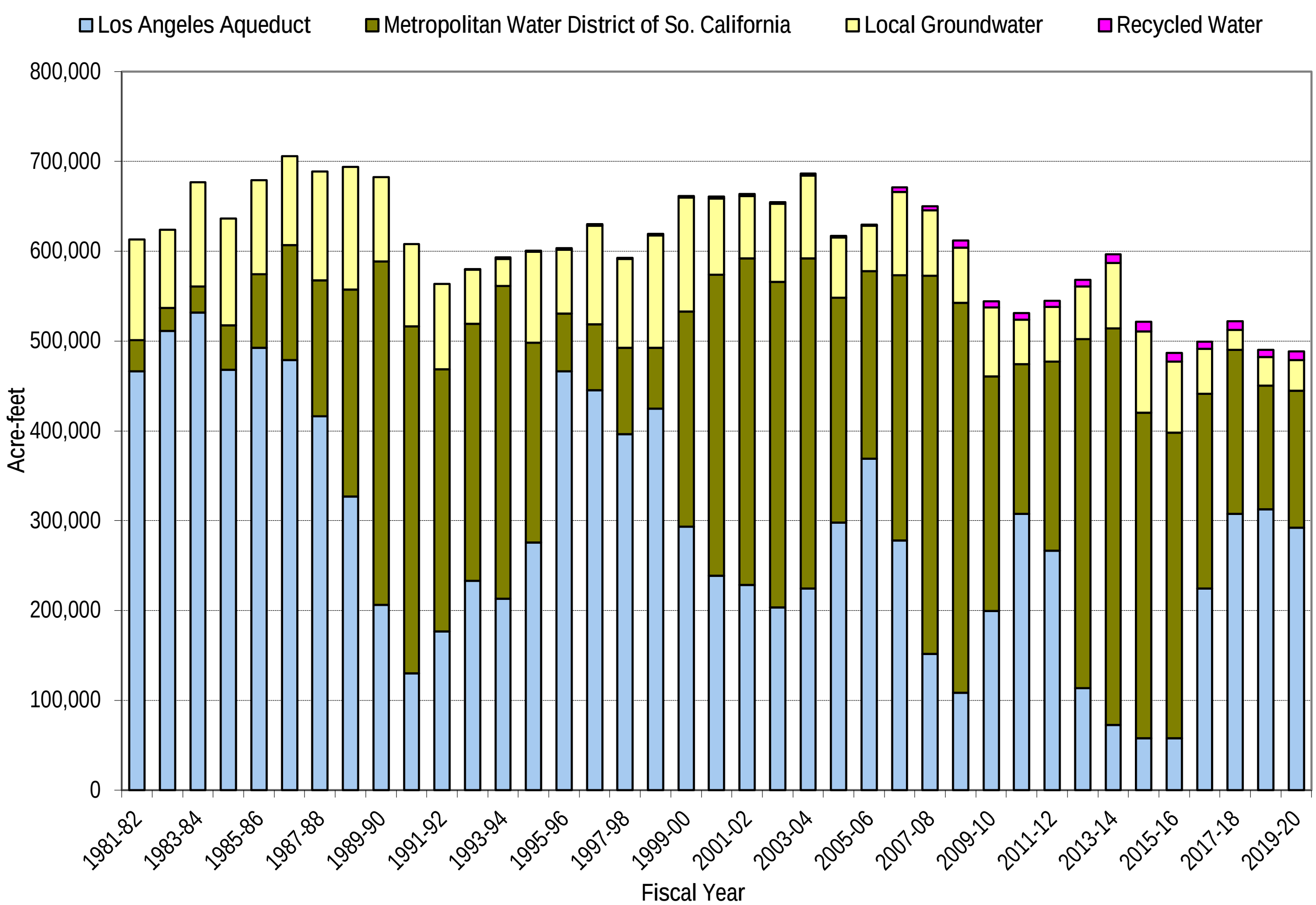


1.4 Service Area Supply

Sources of water for LADWP's service area are the LAA, local groundwater, recycled water, and imported supplemental water purchased from MWD. Water from the LAA and MWD are classified as imported because they are obtained from outside LADWP's service area. Groundwater is local and obtained within the service area. The City's stormwater capture efforts, while not a direct supply, will help replenish, support the health of local groundwater basins, and enhance overall supply reliability. Recycled water, another local supply source, is becoming a larger part of LADWP's overall supply portfolio. Supply sources face increasing constraints including hydrologic variability, potential climate impacts, groundwater basin contamination, and reallocation of water for environmental obligations. To mitigate these impacts on supply sources, LADWP has developed a path towards sustainability as outlined in the 2020 UWMP, and is continuing to invest in conservation and water use efficiency, water recycling, stormwater capture, and local groundwater development and remediation. LADWP is also exploring the development of additional storage through groundwater storage programs to facilitate conjunctive use and improvements to existing surface water reservoirs. Additional storage capacity will allow LADWP to build storage reserves during wet periods and utilize stored supplies during dry periods to increase reliability under uncertain hydrologic conditions. Exhibit 1H illustrates historical water supplies from FY 1981/82 to 2019/20.

The water supply five-year averages from FY 2015/16 to FY 2019/20 include: 48 percent from the LAA, 8 percent from local groundwater, 42 percent from MWD, and 2 percent from recycled water. Combined, LAA and purchased imported supplies from MWD make up on average approximately 90 percent of the City's total supplies.

Exhibit 1H
LADWP Historical Water Supply Sources FY 1981/82 to 2019/20



Chapter Two
Water Demand

2.0 Overview

Understanding water demands and the factors that influence them over time is critical to water supply planning. LADWP maintains historical water use data separated into six categories: single-family residential, multi-family residential, commercial, industrial, governmental, and non-revenue water. This categorization of demand allows LADWP to better evaluate water use trends over time and to implement more targeted water conservation and water use efficiency measures.

2.1 Historical Water Use

Exhibit 2A presents the historical water demand on LADWP. As seen in this exhibit, total water demand varies from year to year, and is influenced by a number of factors such as population growth, weather, climate change, water conservation, water use efficiency, dry periods, and economic activity. In 2009, a three-year dry period coinciding with an economic recession required LADWP to impose mandatory conservation. Three days per week outdoor watering restrictions were put in place in 2009, which correspond to Phase II restrictions under the current Emergency Water Conservation Plan. Customer demands began increasing with the end of that dry period and the beginning of the economic recovery. Starting in fiscal year (FY) 2012/13 dry conditions returned, and the City of Los Angeles (City) experienced some of its driest weather on record. These conditions continued through FY 2014/15 and triggered state and local mandatory conservation measures which led to reductions in water use that continued beyond the end of the recent dry period in 2017.

Prior to 1990, population growth in the City was a good indicator of total demands. From 1980 to 1990, population in the City grew at 1.7 percent annually. Water demands during this same 10-year period also grew at 1.7 percent annually. However, after 1991, LADWP began implementing more stringent water conservation measures that prevented water demands from returning to pre-1990 levels. Average water demands in the last five years from FY 2015/16 to FY 2019/20 are about the same as they were over 50 years ago, despite an increase of over one million additional people now living in the City. This is evident by examining per person (or per capita) water use since 1990 (see Exhibit 2B). In FY 1989/90, per capita water use was 173 gallons per day (gpd). By FY 1999/00, per capita water use fell to 159 gpd, which represents an eight percent reduction. In FY 2019/20, per capita water use was 106 gpd, which represents a 39 percent decrease from FY 1989/90—reflecting the state and City mandates to reduce water use in response to the record California dry period.

Exhibit 2A
Historical Total Water Demand in LADWP's Service Area

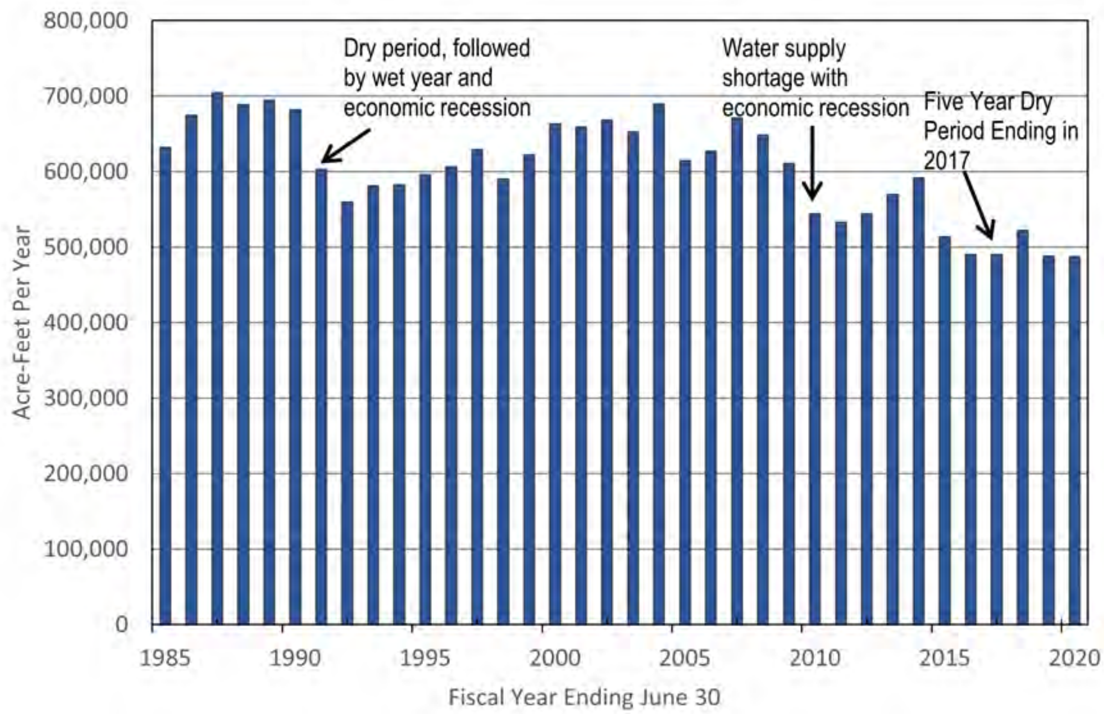
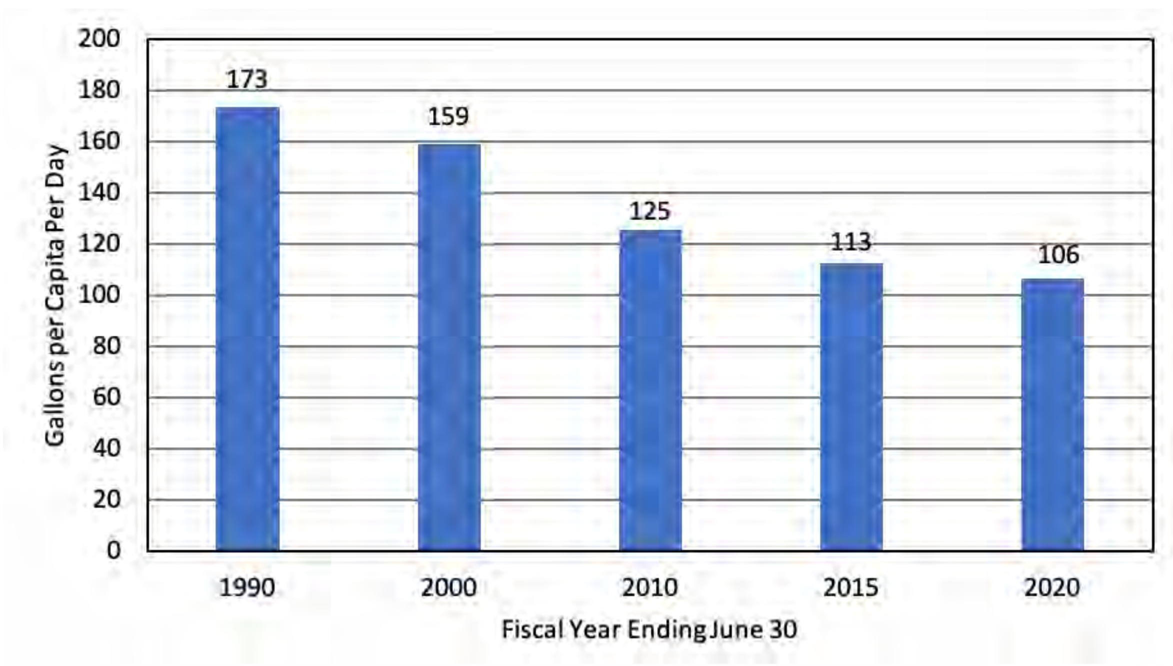


Exhibit 2B
Historical Per Capita Water Use in LADWP's Service Area



2.1.1 Water Use by Sector

Exhibit 2C shows the breakdown of average total water use between LADWP's major demand categories and non-revenue water. The breakdown is shown in five-year intervals for the past 30 years. For the period fiscal year ending (FYE) 2016-2020, single-family residential water use comprises the largest category of demand in LADWP's service area, representing about 35 percent of the total. Multifamily residential water use is the next largest category of demand, representing about 28 percent of the total. Commercial, Industrial, and Institutional/Governmental (CII) water use combined represents 29 percent of the total. Finally, non-revenue use is the smallest category, representing the remainder of the total demand (about eight percent). Although total water use has varied substantially from year to year, the breakdown in percentage of total demand between the major demand categories has not.

Exhibit 2C
Breakdown in Historical Water Demand by Customer Class

Fiscal Year Ending Average	Single-Family		Multi-Family		Commercial		Industrial		Government		Non-Revenue[1]		Total
	AF	%	AF	%	AF	%	AF	%	AF	%	AF	%	AF
2016-2020	**170,660**	**35%**	**141,088**	**28%**	**88,680**	**18%**	**14,938**	**3%**	**39,628**	**8%**	**40,690**	**8%**	**495,685**
2011-2015	206,652	37%	161,592	29%	96,832	18%	17,855	3%	43,573	8%	26,139	6%	552,768
2006-2010	236,154	38%	180,277	29%	106,964	17%	23,196	4%	42,956	7%	30,617	5%	620,165
2001-2005	239,754	37%	190,646	29%	109,685	17%	21,931	3%	41,888	6%	52,724	8%	656,628
1996-2000	222,748	36%	191,819	31%	111,051	18%	23,560	4%	39,421	6%	33,696	5%	622,295
1991-1995	197,322	34%	177,104	30%	110,724	19%	21,313	4%	38,426	7%	39,364	7%	584,253
30-Year Average	**212,215**	**36%**	**173,755**	**30%**	**103,990**	**18%**	**20,465**	**3%**	**40,982**	**7%**	**37,205**	**6%**	**588,611**

1. Calculated using AWWA Water Audit Software
Note: Percentages may not add up to 100% due to rounding

Non-Revenue Water

Non-revenue water consists of unbilled authorized consumption and water losses. Unbilled authorized consumption is the volume of non-revenue water for uses such as mainline flushing to improve water quality and firefighting. Water losses are broken down into two categories: apparent losses and real losses. Apparent losses include meter inaccuracies and theft while real losses include leakage from distribution system pipelines.

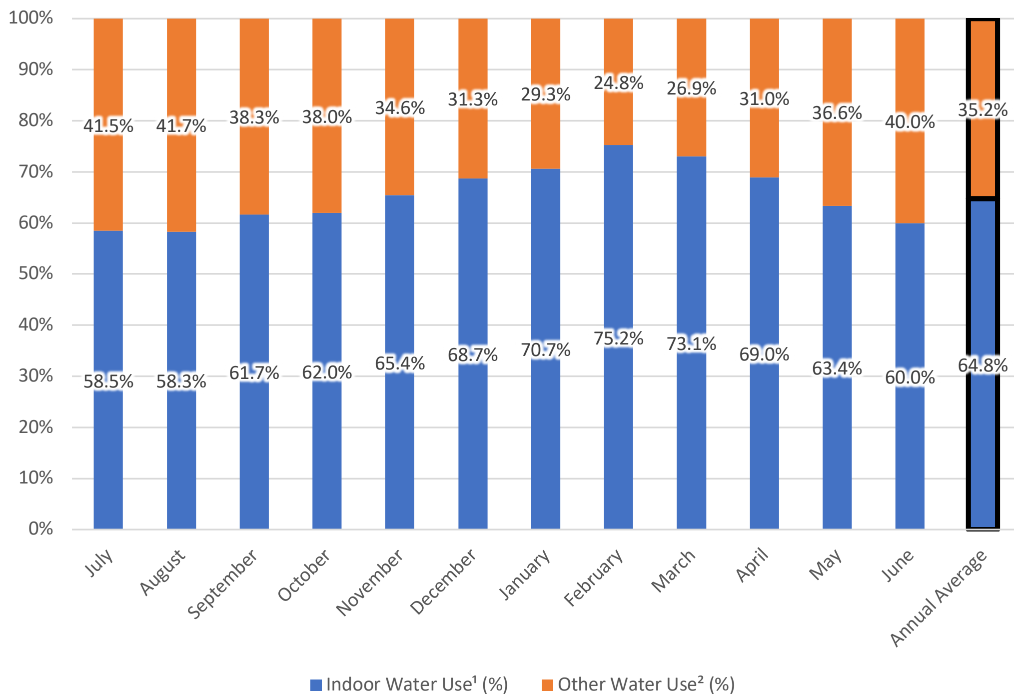
Non-revenue water has varied in recent years. In FY 2019/20, non-revenue water was estimated at 7.2 percent, based on the American Water Works' Association's (AWWA) Free Water Audit Software. The AWWA Water Audit worksheets for FY 2019/20 are provided in Appendix E. Historically, non-revenue water has averaged 6.3 percent of total water demand over the period FYE 1991-2020. This consistently low level of non-revenue water over the last 30 years indicates that LADWP has an efficient, well-maintained water system. LADWP is committed to continuing to reduce its non-revenue water loss percentages through its Water Loss Task Force, as discussed in Chapter 3, *Water Conservation*, Section 3.2.3, *Existing Conservation Program*.

2.1.2 Indoor and Outdoor Water Use

To estimate indoor and other/outdoor water use by sector, LADWP first estimated total indoor water use using wastewater flows estimated for the LADWP water service area. This analysis also accounted for inflow and infiltration (I&I). Wastewater I&I occurs when stormwater seeps into unsealed manholes and groundwater infiltrates into the wastewater collection system via cracks in sewer pipes. Wastewater I&I occurs mainly in winter, when precipitation is higher. Removing estimates of wastewater I&I provides a better accounting of indoor water use. Comparing the total indoor use to the total water supplied over the same period provided an estimate for total outdoor/other use.

A summary of the analysis results for the last five-year average (FYE 2016-2020) is presented in Exhibit 2D. Based on this analysis, it is estimated that indoor water use represents approximately 64.8 percent of total water demand annually. As shown in Exhibit 2D, other water use is somewhat greater during summer months compared to winter months. This difference in monthly indoor water use was much greater in past years, but due to increased water use efficiency, continued conservation ordinance implementation, and customer irrigation behaviors, outdoor water use has decreased in LADWP's service area.

Exhibit 2D
Estimated Monthly Indoor Water Use[1] and Other Water Use[2]
(Average of FYE 2016-2020 Data)



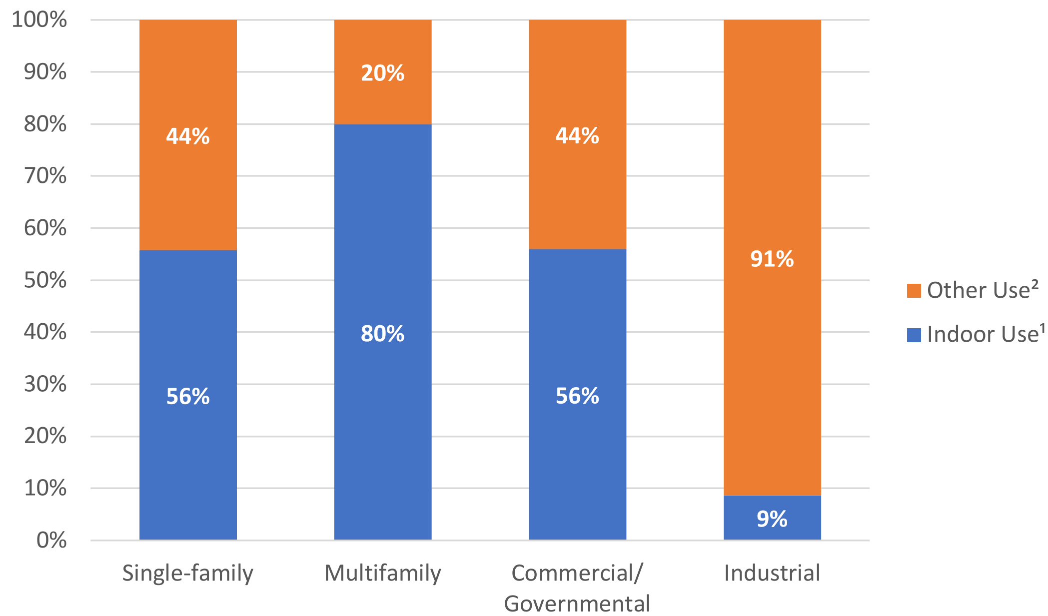
[1] Indoor water use consists of uses that contribute to sewer flows only

[2] Other water use consists of uses that do not contribute to sewer flows, including but not limited to consumptive and outdoor uses

Next, to estimate indoor water uses by sector, a new method based on sewer service charge by billing sector, and calibrated water use for certain major categories of customers (e.g., hotels, industrial, City users) was used to provide an estimate for consumptive uses. End uses of water were based on work performed for the Water Conservation Potential Study (WCPS) and sewer flows, derived from LADWP water customer surveys, and supplemented by CII end use studies in California. These end uses (indoor and outdoor) were combined and then compared and calibrated to actual water use for the base year period of FY 2013/14.

Using the system-wide estimates of indoor/outdoor water use from the first analysis (shown in Exhibit 2D), adjustments were made to obtain the sector split between indoor and other uses from the sewer discharge and water end use analysis. Exhibit 2E presents the sector split between indoor and other uses over the same five-year average period from Exhibit 2D above.

Exhibit 2E
Estimate of Sector Indoor Water Use[1] and Other Water Use[2]
(Average of FYE 2016-2020 Data)



[1] Indoor water use consists of uses that contribute to sewer flows only

[2] Other water use consists of uses that do not contribute to sewer flows, including but not limited to consumptive and outdoor uses

2.2 Water Demand Forecast

2.2.1 Demand Forecast Methodology

LADWP has developed a water demand forecast for each of its major categories of demand. This allows the City to better understand trends in water use and develop effective conservation and water use efficiency programs. The methodology used for the demand forecast is called a modified unit use approach. The following steps are used in this approach:

Step 1: Estimate baseline per unit water use – take each billed category of water demand (e.g., single-family, industrial) for a base (or starting) period and divide by associated demographic driver (e.g., number of single-family homes or number of industrial employees). This baseline per unit water use includes all water conservation up until this point of time.

Step 2: Modify the estimated baseline per unit water use to account for future changes in the following socioeconomic variables: price of water, personal income, household size, economy, and dry period conservation effect.

Step 3: Multiply modified per unit water use for each category in Step 2 by the associated projected demographic drivers in order to obtain projected water demands by billed category. Note that these per unit water use factors do not include future active or passive conservation from new or potential codes and ordinances.

Step 4: Estimate non-revenue water (the difference between total water consumption and billed water use) by applying a non-revenue water use factor and add non-revenue water to the billed category water demands in Step 4 in order to get a forecast of total water consumption.

Step 5: A final water use adjustment is made by reducing each customer classes' (and non-revenue) total water use by projected future active and passive conservation savings. Once this is applied, we have the total post-conservation water use projection for LADWP's service area.

2.2.2 Applying the Methodology

In Step 1 of this method, a baseline demand was computed from FYE 2014 historical water demands in single-family, multifamily, commercial/government, and industrial sectors. FYE 2014 was selected as the baseline because that year aligned with the base year for LADWP's Water Conservation Potential Model, which is described in detail in Chapter 3, *Water Conservation*, Section 3.3.2, *Conservation Potential Summary & Progression*. For each of these categories, the average water demand was divided by a demographic driver that could be projected into the future. The result of this calculation is a water demand expressed as a unit water use. Exhibit 2F presents the billed water use by sector, historical driver variables (occupied housing units and employment) from the Metropolitan Water District of Southern California (MWD), and the estimated water unit use factors.

Exhibit 2F
Base Year Water Unit Use Factors (FYE2014)

Fiscal Year Ending	Single-Family Residential	Multifamily Residential	Commercial/ Government	Industrial
Annual Historical Billing Data (AFY)				
2014	217,541	164,797	147,670	19,156
Historical Driver Variables (Occupied Housing for Residential, Employment for Non-Residential)				
2014	599,820	772,246	1,751,256	129,045
Water Unit Use Factors (Gallons Per Day/Driver)				
2014	324	191	75	133

Projections of driver variables are shown in Exhibit 2G for LADWP's water service area, based on the Southern California Association of Governments' (SCAG) draft 2020 Regional Transportation Plan (RTP20), obtained from MWD. Data for occupied housing units and employment projections serve as direct inputs into LADWP's Demand Forecast Model. Between 2020 and 2045, single-family housing units and commercial/government employment is projected to grow slightly (roughly a 10 percent total increase), while multifamily housing units is projected to grow substantially (roughly a 39 percent total increase). Industrial employment, on the other hand is projected to decrease by 27 percent from 2020 to 2045.

Exhibit 2G
Projection of Driver Variables for LADWP's Water Service Area*

Year	Single-Family Housing Units	Multifamily Housing Units	Commercial and Government Employees	Industrial Employees
2020	608,005	834,761	1,887,011	108,586
2025	628,359	906,120	1,897,438	94,073
2030	639,280	969,198	1,953,634	91,003
2035	647,404	1,037,051	2,011,968	87,910
2040	657,615	1,100,361	2,066,096	84,264
2045	667,311	1,157,553	2,105,798	79,680

* Note: LADWP's water service area is slightly larger than the City proper.

Step 2 in the demand forecasting methodology involves modifying these baseline unit water use rates to account for changes in the following socioeconomic variables: price of water, median household income, and household size. The modified unit use method requires elasticities that define the mathematical relationship between the per unit use and the explanatory variables mentioned above. A positive elasticity indicates water use will increase as explanatory variables increase; whereas a negative elasticity indicates that water use will decrease as explanatory variables increase. Elasticities were derived from an econometric water demand model used for the MWD Integrated Water Resources Plan, 2015 Update. Exhibit 2H provides the derived elasticities utilized in LADWP's Demand Forecast Model. Note that the price elasticities for the single-family and commercial/government and industrial sectors are a dual coefficient elasticity. The single-family sector price elasticity is derived as a function of the median lot size. The commercial/government and industrial sectors price elasticity is derived as a function of the share of manufacturing employment to total employment.

Exhibit 2H
LADWP Demand Forecast Model Elasticities

Sector	Average Water Price	Household Size	Income	Lot Size
Single-family	**2020** = -0.122 **2045** = -0.007	0.10	0.29	0.69
Multifamily	-0.110	0.14	0.17	0.16
Commercial/Government and Industrial	**2020** = -0.287 **2045** = -0.335			

Projections of the model explanatory variables were obtained through a combination of RTP20 and other assumptions. Household size is projected to 2045 from RTP20 which also forecasted median household income in the City. However, the income forecast was deemed not reasonable when compared to other SCAG regional projections (e.g., projections of Los Angeles County, Orange County, and San Diego County). Thus, an assumed real increase growth rate of 1.0 percent annually was used in the Demand Forecast Model. Average price of water was assumed to grow at a real rate (above inflation) of 1.5 percent annually based on net increases of MWD water rates. Median lot size was assumed to remain constant from 2020 to 2045. The City of Los Angeles Department of Planning reports the median lot size for single-family homes as approximately 6,500 square feet (SQFT) which was used from 2020 to 2045.

2.2.3 Future Conservation Targets

LADWP completed its comprehensive Water Conservation Potential Study in 2017 that evaluated the remaining active and passive conservation that exists citywide relative to a FYE 2014 baseline. The results from the study help establish LADWP's water use efficiency goals of reducing per capita water use to 100 gallons per capita per day (gpcd) by 2035 and maintain this usage through 2050. This reduction equates to a 25 percent reduction from FYE 2014 per capita usage. Exhibit 2I summarizes the projected conservation savings, based on average conditions, needed to meet this water use targets.

Exhibit 2I
Additional Conservation Savings from FYE 2014 Required to Meet LADWP Water Demand Targets

Year	Projected Conservation Savings (Average Conditions) (AF)
2025	133,732
2030	133,506
2035	142,688
2040	143,351
2045	144,752

LADWP's historical non-revenue water (NRW) volume is presented in Exhibit 2J. NRW is the sum of apparent losses, real losses, unbilled metered consumption, and unbilled unmetered consumption. This is water which does not provide revenue potential to LADWP. NRW has averaged approximately 8.4 percent of total potable demand over the past five years. For planning purposes, the water demand forecast assumes that NRW will be reduced over time from 8.0 percent in 2025 to 7.1 percent in 2045. The assumptions for NRW from 2025 to 2045 are summarized in Exhibit 2K and capture additional water loss control efforts detailed in Chapter 3, *Water Conservation*, Section 3.2.3, *Existing Conservation Program*.Water loss control efforts will continue to evolve to meet future water loss standards as they are developed.

Exhibit 2J
Historical Non-Revenue Water for LADWP

Fiscal Year Ending	Total Potable Water Supplied (AF)	Unbilled Metered and Unbilled Unmetered Volume (AF)	Apparent Loss Volume (AF)	Real Loss Volume (AF)	Non-Revenue Water Volume (AF)	Non-Revenue Water Percentage (%)
2016	480,393	600	9,744	27,514	37,858	7.9
2017	482,113	2,744	8,870	30,432	42,046	8.7
2018	512,338	8,201	8,612	33,036	49,849	9.7
2019	480,754	4,312	6,630	28,341	39,283	8.2
2020	477,950	5,606	4,594	24,216	34,416	7.2
5-Year Average	**486,710**	**4,293**	**7,690**	**28,708**	**40,690**	**8.4**

Exhibit 2K
Projected NRW Used in LADWP Demand Model

Year	Projected NRW (%) of total demand
2025	8.0
2030	7.7
2035	7.6
2040	7.3
2045	7.1

2.2.4 Water Demand Forecast Results

Steps 3 and 4 of the water demand forecast method involves applying the projected NRW demand above and projecting unit water use by sector. Unit water use by sector is computed by applying demographic projections and derived demand elasticities to the baseline unit water use factor. The resulting water unit use factors for LADWP are presented in Exhibit 2L.

Exhibit 2L
LADWP Projections of Water Unit Use Factors by Sector

Year	Single-Family (gal/home/day)	Multifamily (gal/home/day)	Commercial/Government (gal/employee/day)	Industrial (gal/employee/day)
Unit Use Factors without Future Conservation*				
2025	325	190	74	130
2030	326	189	72	127
2035	327	189	70	124
2040	329	189	69	121
2045	330	189	67	118

* Future conservation is relative to FYE 2014 baseline usage.

The water use factors are then multiplied by the projected demographics for LADWP and the non-revenue water percentage is applied. NRW is projected to be reduced from 8.0 to 7.1 percent of total billed water consumption by 2045, as summarized in Exhibit 2K, and includes all unmetered water for fire protection, distribution system flushing, and other unaccounted water. Finally, in Step 5, the total water use is reduced by the projected additional future conservation savings; the result of these steps is the water demand forecast with passive conservation including codes, ordinances, conservation phases, and future active savings (see Exhibit 2M).

Without future water conservation, single-family water demand is forecasted to decline slightly from 2020 to 2045, commercial/government is forecasted to increase slightly, while multifamily demand is forecasted to grow moderately. Industrial water demand is expected to continue to decrease as industrial employment is projected to decrease. Total water production with future conservation is forecasted to increase by 11 percent from 2020 to 2045. Exhibit 2N compares historical water use data with the projections for water demand, with and without conservation to 2045.

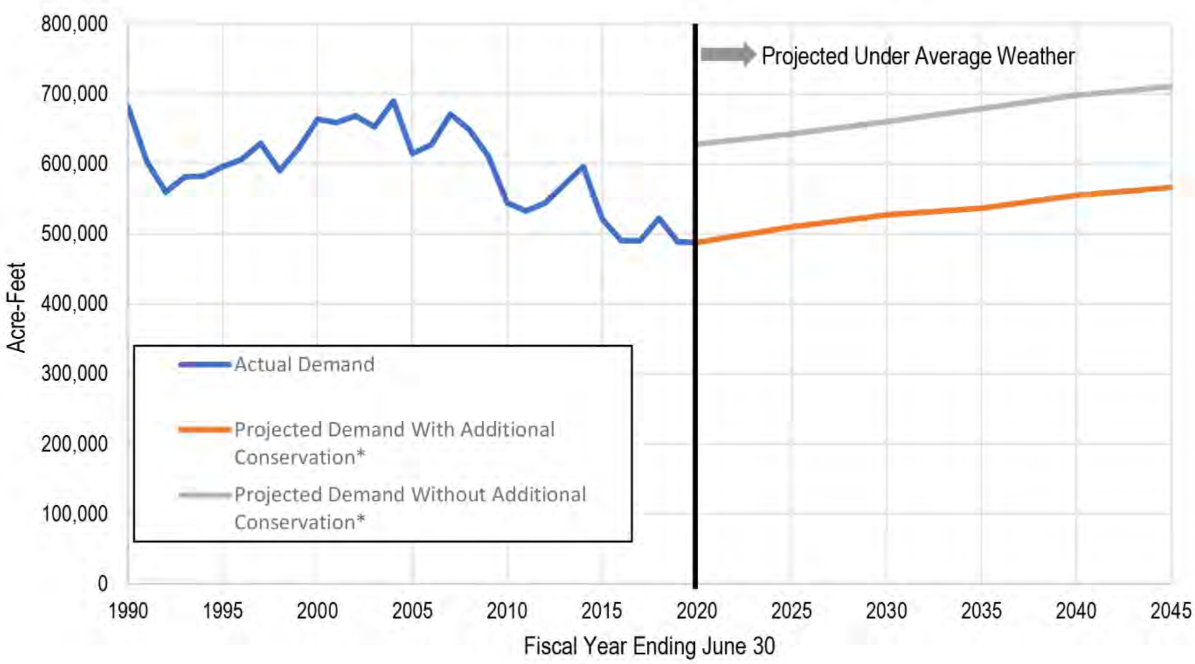
Exhibit 2M
LADWP Water Demand Projections by Sector

Year	Single-family (AF)	Multi-family (AF)	Commercial/ Government (AF)	Industrial (AF)	NRW (AF)	Additional Conservation Savings* (AF)	Total (AF)
2025	228,529	192,727	156,407	13,651	51,321	133,133	509,501
2030	233,366	205,728	157,341	12,902	50,826	133,506	526,658
2035	237,297	219,798	158,236	12,171	51,334	142,688	536,148
2040	242,761	233,602	159,030	11,418	51,026	143,351	554,486
2045	246,779	244,853	157,680	10,503	50,687	144,752	565,751

*Additional Conservation Savings includes projected future active and passive savings and additional retained passive savings.

Details on future active and passive savings are provided in Chapter 3, Water Conservation.

Exhibit 2N
Comparing Water Demand Forecast with and without Conservation

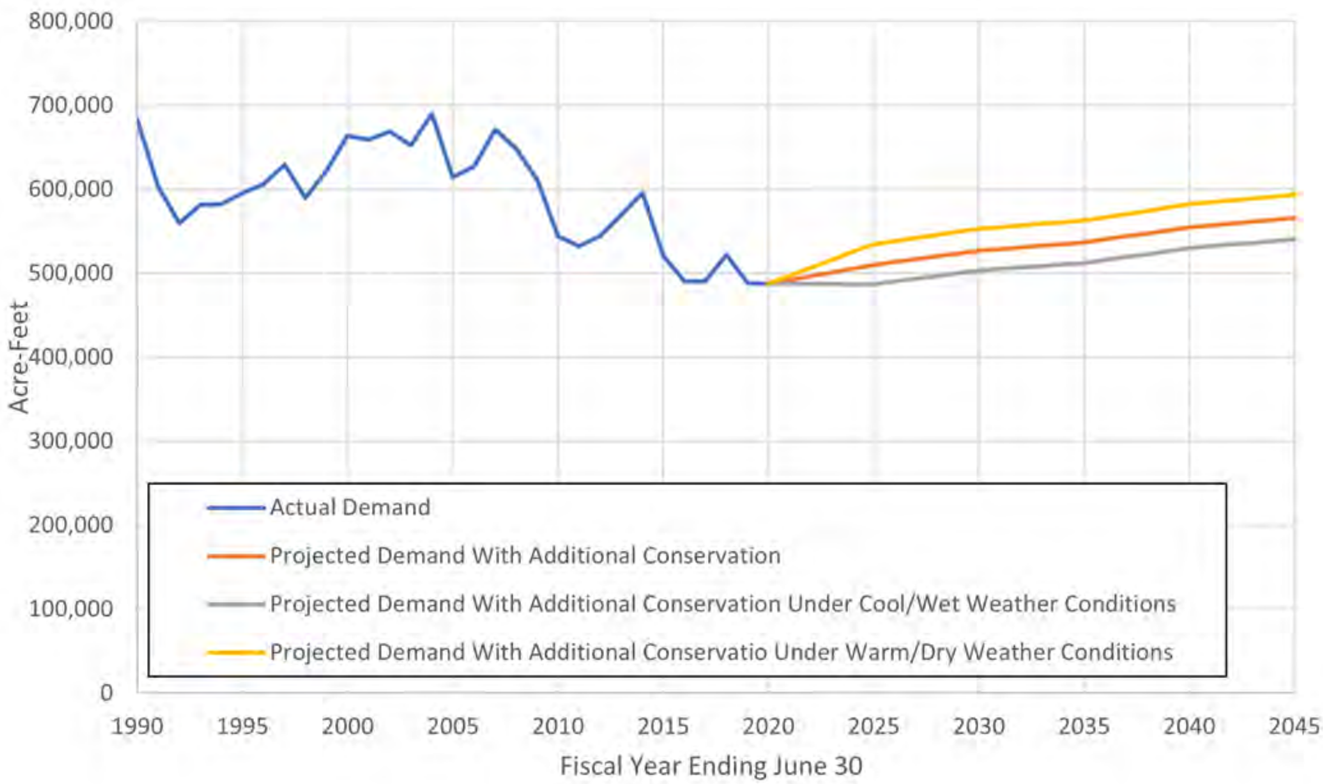


*Additional conservation measured relative to FYE 2014 water demand

2.2.5 Water Demand Forecast Weather and Climate Variability

In addition to the explanatory variable elasticities described above, the LADWP model also includes adjustment factors for weather and climate. These adjustment factors were derived from a statistical monthly water production model that was developed during the 2015 UWMP update process. This production model correlated total monthly water production for LADWP with the following variables: maximum monthly temperature, total monthly precipitation, unemployment, and phases of LADWP's drought ordinance. Under this approach, projected water demands can vary by approximately five percent due to weather variability. Exhibit 2O illustrates projected changes in total water demands as a response to different precipitation and temperature scenarios. Long-term climate impacts to demand are provided in Chapter 12, *Climate Change and Water Energy Nexus*, Section 12.1.1, *Water Demand and Local Impacts*.

Exhibit 2O
Projected Water Demand Weather Variability



2.2.6 Low-Income Water Demand Projections

The Urban Water Management Plan projections of water demands for low-income customers was also evaluated. LADWP maintains records of low-income water customers and for FY 2019/20, approximately 4.7 percent of the total number of single-family homes in the LADWP service area are classified as low-income. On average, these customers used about 10 percent less water per household than overall single-family customers. To forecast low-income single-family water demand, the 4.7 percent ratio of low-income to total single-family homes was applied to determine the total number of low-income single-family homes. The system wide per unit water use for single-family homes was reduced by 10 percent and multiplied by the total number of low-income single-family homes to determine low-income single-family water demand.

Because the water services of multifamily residential customers are not typically metered individually, a multifamily water account can represent upwards of 100 homes. Therefore, a different approach was used to determine low-income multifamily households. LADWP's power system does individually meter multifamily homes and classifies homes as low-income for rate relief purposes. Therefore, the ratio of current low-income multifamily power accounts to total multifamily homes in the LADWP service area was applied to the total projection of multifamily homes in order to determine the estimated number of future low-income multifamily homes. For the FY 2019/20, approximately 10 percent of the total number of multifamily homes in the LADWP service area are classified as low-income. Assuming that low-income multifamily homes also use 20 percent less water than overall multifamily homes, an adjusted per unit water use for multifamily homes was multiplied by the projected number of low-income multifamily homes to determine low-income multifamily water demand. Exhibit 2P presents the water demand forecast for low-income residential water customers.

Exhibit 2P
Water Demand Forecast for Low-Income Residential Customers
Fiscal Year Ending June 30

Low-Income Single-Family Customers	2025	2030	2035	2040	2045
Number of Homes	29,533	30,046	30,428	30,908	31,364
Household Water Use (Gallons/Day)*	211	204	199	195	193
Demand Forecast (Acre-Feet/Year)	6,984	6,873	6,766	6,760	6,779
Low-Income Multifamily Customers	**2025**	**2030**	**2035**	**2040**	**2045**
Number of Homes	90,612	96,920	103,705	110,036	115,755
Household Water Use (Gallons/Day)*	132	131	130	130	130
Demand Forecast (Acre-Feet/Year)	13,446	14,225	15,154	16,042	16,837
Total Low-Income Residential Customers	**2025**	**2030**	**2035**	**2040**	**2045**
Demand Forecast (Acre-Feet/Year)	20,430	21,097	21,920	22,801	23,616

* Assumes same reduced usage found in low-income single-family residential customers also applies to multifamily homes.

Chapter Three
Water Conservation

3.0 Overview

The City of Los Angeles (City) has long recognized that water conservation is the cornerstone of multiple strategies to improve water supply reliability for its residents. As such, LADWP has taken a leadership role in managing its demand for water by creating a robust program to reduce water waste, educate its customers in water conservation and efficient water use, incentivize the adoption of water saving devices in homes and businesses, and transform the City mindset on long-term water use behaviors.

Water conservation and water use efficiency are the two main approaches toward managing water use demands. Water conservation achieves this by changing the behaviors associated with water use to achieve the same results (e.g., shorter showers), and water use efficiency accomplishes it by upgrading the device to use less water without a change in behavior (e.g., replacing 2.0 gallon per minute (gpm) showerhead to 1.5 gpm). The City has experienced the following benefits from its water conservation and water use efficiency programs: (1) improvement in water supply reliability; (2) deferment and reduction in the size of water and wastewater system improvements; (3) monetary savings for customers that reduce their water consumption and help keep water bills low; (4) reduced runoff from landscape irrigation, which in turns improves the water quality of local rivers and the Pacific Ocean, and (5) reduced energy use for water treatment, water pumping and conveyance. As water conservation and water use efficiency reduces energy demands, it also reduces associated greenhouse gas emissions as an added benefit. Ultimately, the primary beneficiaries are LADWP's water customers and the natural environment.

Water conservation and water use efficiency efforts in the City began in the early 1900's with the installation of water meters on all water service connections. This foundational measure resulted in an estimated 30 percent reduction in overall water use. The City has historically increased its water conservation and water use efficiency efforts when faced with prolonged dry periods. During the 1976-77 dry period, the City became one of the first cities in Southern California to invoke mandatory water rationing. Another dry period occurred between 1987 to 1992 that lasted much longer and left a permanent imprint on LADWP water customers. In response to the water shortages caused by this dry period, LADWP created an extensive public awareness campaign and expanded its voluntary water use efficiency program. This program provided free low-flow showerheads and incentives for efficient toilets for homes and businesses. These hardware improvements, coupled with additional water conservation related habits, lessened the severity of the water shortage. Long after these dry periods ended, the water saving measures remained in place and served to significantly reduce the need to purchase imported water as the City continued to grow. Through the years that followed, LADWP expanded its water use efficiency program to include financial incentives to reduce industrial water waste, installed smart irrigation devices, and replace water-wasting grass lawns.

The most recent dry period, which occurred from 2012 to 2016, was one of the most severe dry periods experienced in California's history both in intensity and duration. In response, the City expanded its Water Conservation Outreach Programs, and updated the Emergency Water Conservation Plan (Conservation Ordinance), included as Appendix D, to include enforceable water waste provisions and mandatory outdoor watering restrictions.

During this time, local and state government offices and Metropolitan Water District (MWD) responded with aggressive requirements to chart a course for the future of water conservation in the City. The requirements enacted include: (1) MWD implemented its water supply allocation plan in 2015; (2) the California Governor implemented the first ever statewide mandatory water use restrictions in 2015 and also set a state-wide water use reduction target of 25 percent from 2013 levels; and (3) Mayor Garcetti released an Executive Directive in 2015 to enact water use reduction goals in collaboration with LADWP.

The aggressive requirements that took place during that critical time period served to help substantially reduce water use in the City and a majority of those reductions are observed to be permanent that remain today with minimal rebound effects. From fiscal year (FY) 2013/14 to FY 2019/20, total water use in the City decreased by 18 percent; single family residential use decreased by 20 percent; multi-family residential use decreased by 11 percent; commercial use decreased by 23 percent; industrial use decreased by 33 percent; and government use decreased by 21 percent. Despite an increase in population of over one million people, the City's average water usage today is below the average amount of water used in the 1970s (see Exhibit 3A).

Exhibit 3A
Historical City of Los Angeles Water Use

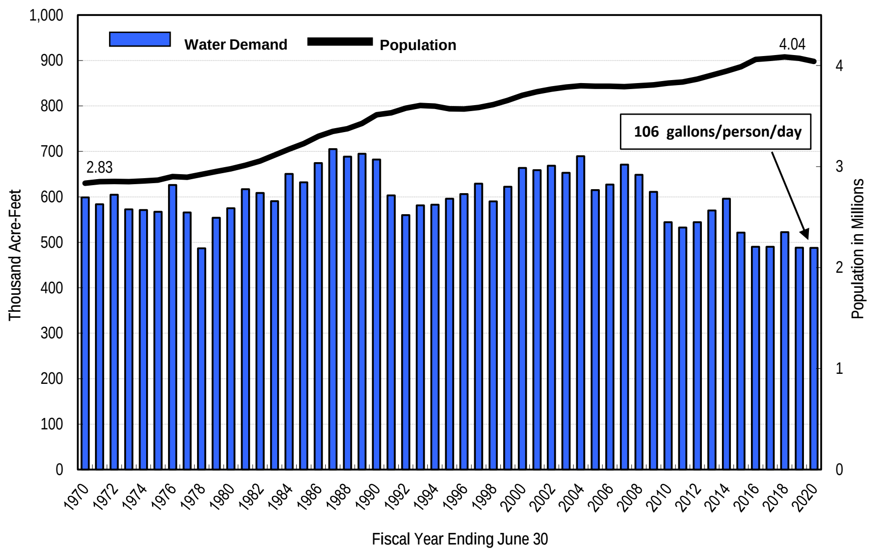


Exhibit 3B shows historical conservation savings for FY 1990/91 through FY 2019/20 based on the estimated annual savings achieved through LADWP and MWD rebate programs, as well as the savings achieved through codes, ordinances, and behavior changes resulting from customer outreach and educational programs. Cumulative annual water savings due to rebate programs are considered active savings. The cumulative annual active savings since the inception of LADWP's conservation program totals 150,912 acre-feet per year (AFY). Additional non-rebated conservation savings due to codes, ordinances, and changes in customer behavior due to outreach and educational programs are considered passive savings. External factors that are non-conservation related such as weather and economic conditions are not considered passive savings because of its short-term temporary effect and therefore not included in the passive savings calculations. The total annual passive savings achieved since program inception totals 266,533 AFY, which is a strong indication of LADWP customer's commitment to making conservation and efficiency a way of life in the City.

LADWP continually invests in cost-effective water conservation programs and water use efficiency measures. Currently, efforts are underway to further promote the turf replacement rebate program to more effectively enable LADWP customers to replace their thirsty grass lawns with water-saving California Friendly Landscaping by offering increased incentives and educational opportunities. These programs will also improve the water retention, biodiversity, and overall health of the City's watersheds while also saving water. LADWP is also focusing its efforts towards implementing unique programs to improve the water use efficiency of the commercial, industrial, and institutional (CII) customer sectors. LADWP includes other City departments in its planning process to ensure that mutual needs are addressed and broader City goals are achieved (e.g., landscape water use efficiency and dry weather runoff reduction).

Exhibit 3B
Historical City of Los Angeles Conservation

Fiscal Year	Additional Annual Active Installed Savings (AF)	Cumulative Annual Active Additional Savings (AF)	Annual Passive Savings (AF)	Annual Total Savings (AF)
Prior to 1990/1991	31,825	31,825	-	-
1990/1991	4,091	35,916	76,350	112,266
1991/1992	8,670	44,586	105,593	150,179
1992/1993	3,286	47,872	58,546	106,418
1993/1994	4,961	52,833	60,928	113,761
1994/1995	4,041	56,874	62,084	118,958
1995/1996	4,642	61,516	52,648	114,164
1996/1997	2,376	63,892	33,720	97,612
1997/1998	2,637	66,529	30,434	96,963
1998/1999	2,781	69,310	38,305	107,615
1999/2000	3,532	72,842	80,909	153,751
2000/2001	3,078	75,920	79,527	155,447
2001/2002	2,452	78,372	95,428	173,800
2002/2003	2,630	81,002	94,463	175,465
2003/2004	3,257	84,259	84,023	168,282
2004/2005	3,299	87,558	114,428	201,986
2005/2006	2,404	89,962	118,574	208,536
2006/2007	2,095	92,057	116,922	208,979
2007/2008	782	92,839	110,628	203,467
2008/2009	3,127	95,966	149,567	245,533
2009/2010	4,269	100,235	183,080	283,315
2010/2011	2,495	102,730	185,640	288,370
2011/2012	1,993	104,723	183,852	288,575
2012/2013	2,122	106,845	187,444	294,289
2013/2014	3,977	110,822	189,689	300,511
2014/2015	7,211	118,033	273,017	391,050
2015/2016	7,833	125,866	296,966	422,831
2016/2017	2,441	128,307	291,627	419,934
2017/2018	1,796	130,103	292,265	422,368
2018/2019	19,494	149,597	260,012	409,608
2019/2020	1,315	150,912	266,533	417,445

3.1 Water Conservation Requirements

This section presents State and City level water conservation ordinances created through legislation. LADWP works to implement these ordinances through its water supply planning process and has included them as baseline assumptions informing water demand forecasting used in this Urban Water Management Plan (UWMP). LADWP will continue to actively monitor the per capita water use, particularly in the context of all existing and new standards to ensure that target reductions are met in the future.

3.1.1 Legislation on Water Management Planning

In November 2009, Senate Bill (SB) X7-7 (the Water Conservation Act of 2009) stipulated that water agencies achieve a 20 percent reduction in urban per capita water use by December 31, 2020. In March 2016, Governor Brown's Executive Order (EO) B-37-16 charged the State Water Resources Control Board (Water Board) and the Department of Water Resources (DWR) with developing new water use targets, paving the way for Assembly Bill (AB) 1668 and SB 606 in May 2018. AB 1668 set new standards for efficient indoor residential water use while charging the Water Board and DWR to develop updated standards for outdoor residential uses and CII uses by 2021. SB 606 introduced a new calculation for an agency's urban water use objective.

Water Conservation Act of 2009

The Water Conservation Act of 2009, SB X7-7, required water agencies to reduce per capita water use by 20 percent by 2020 (20x2020). Water suppliers were required to set a water use target for 2020 and an interim target for 2015. Four methodologies are stipulated for calculating the water use target. The fourth method was developed by DWR. The four methodologies are:

- Method 1 – 80 percent of the water supplier's baseline per capita water use.
- Method 2 – Per capita daily water use is estimated using the sum of performance standards applied to indoor residential water use, landscape area water use, and commercial, industrial, and institutional water uses.
- Method 3 – 95 percent of the applicable State hydrologic region target as stated in the State's draft 20x2020 Water Conservation Plan.
- Method 4 – Developed through a public process. This method allows flexibility in its calculation to account for the highly diverse conditions of each agency's landscape, commercial, industrial, and institutional water needs and to give credit for past conservation efforts

LADWP used Method 3 in its 2015 UWMP to develop a final reported 2020 target of 142 gallons per capita per day (gpcd). LADWP's actual gpcd in 2020 was 106 gpcd, 36 gpcd less than the 2020 target for Method 3.

Exhibit 3C
20x2020 Base and Target Data Based on Method 3

20x2020 Required Data	Gallons Per Capita Per Day
Base Per Capita Daily Water Use[1]	
10-year Average	154
5-year Average	152
2015 Interim Target Using Method 3[1]	
2015 Interim Target	148
2015 Actual Use	115
2020 Target Using Method 3[1]	
95% of Hydrologic Regional Target (149 gpcd)	142
95% of Base Daily Capita Water Use 5-Year Average (152 gpcd)	145
2020 Target	142
2020 Actual Use	106

1. 20x2020 calculations documented in 2010 and 2015 UWMPs.

2018 Legislation on Water Management Planning

AB 1668 and SB 606 were enacted in 2018, with the intent to prepare the state for future dry periods. SB 606 mandates that starting in 2024, water suppliers annually calculate a multi-faceted annual urban water use objective. AB 1668 requires the Water Board adopt standards for the water use objective by June 30, 2022.

The components of the AB 1668 and SB 606 urban water use objective include:

- Indoor residential water use;
- Outdoor residential water use;
- Outdoor irrigation for CII with dedicated irrigation meters;
- Water losses;
- Variances in water use; and
- A bonus incentive.

Performance measures for indoor and mixed CII water use are required in addition to the urban water use objective. The urban water use objective standards are discussed in the following sections.

Residential Indoor Water Use

AB 1668 includes the following volumetric standards for residential indoor water use. The DWR and Water Board may provide a recommendation to the legislature to change these standards in 2021:

- Until January 1, 2025: 55 gpcd.
- January 1, 2025 to January 1, 2030: the greater of 52.5 gpcd or a standard recommended by the Water Board and DWR.
- Starting January 1, 2030: the greater of 50 gpcd or a standard recommended by the Water Board and DWR.

Residential Outdoor Irrigation

AB 1668 notes that standards for outdoor residential water use are in development and will be ready for adoption and publication by June 30, 2022. The framework titled, "Making Water Conservation a California Way of Life: Implementing Executive Order B-37-16" (2017 Framework), suggests that new standards may be based on the principles of Model Water Efficient Landscape Ordinance (MWELO), relying on the location-specific reference evapotranspiration (ETo), an evapotranspiration adjustment factor, and the measured irrigable landscape area. AB 1668 directs the DWR to provide Urban Retail Water Suppliers (URWS) with the landscape area measurement for the service area in 2021, where landscape areas are expected to be classified as irrigable-irrigated, irrigable not currently irrigated, and not irrigated. Ultimately, the standards will be compared to the URWS' applied water for the outdoor residential sector during the annual urban water use objective reporting process starting January 1, 2024.

Outdoor Irrigation for Commercial, Industrial, and Institutional with Dedicated Irrigation Meters

AB 1668 notes that standards for CII sectors with dedicated irrigation meters for outdoor water use are in development and will be ready for adoption and publication by June 30, 2022. The 2017 Framework suggests that new standards may be based on the principles of MWELO, relying on the location-specific reference ETo), an evapotranspiration adjustment factor and the measured irrigable landscape area, similar to the standards for outdoor residential water use. LADWP is working to develop an analysis on CII sectors with dedicated irrigation meter water use for irrigable landscape areas to assist in managing new State requirements for landscape irrigation standards. Ultimately, the standards will be compared to the URWS' applied water for the outdoor CII sectors with dedicated outdoor irrigation meters during the annual urban water use objective reporting process starting January 1, 2024.

Distribution System Water Loss

AB 1668 defines loss validation actions instead of setting a water loss standard and also references SB 555. SB 555 was adopted in 2015 and requires the Water Board to adopt performance standards for water loss volumes for urban retail water suppliers by July 1, 2020. The 2017 Framework suggests the 2020 standards for system water loss will be expressed as a volume per connection and include calculations for leaks, losses, and non-revenue water used for maintenance and public safety.

Variances

AB 1668 requires the Water Board and DWR to recommend appropriate variances for unique water uses by October 1, 2021. Appropriate variances that would affect the water use objective include:

- Significant use of evaporative coolers;
- Significant populations of horses and other livestock;
- Significant fluctuations in seasonal populations;
- Significant landscaped areas irrigated with recycled water having high levels of total dissolved solids;
- Significant use of water for soil compaction and dust control;
- Significant use of water to supplement ponds and lakes to sustain wildlife;
- Significant use of water to irrigate vegetation for fire protection; and
- Significant use of water for commercial or noncommercial agricultural use.

The Water Board will post all urban retail water suppliers and the specific variances approved for each supplier on their website. As of January 2021, information is not yet available on the website.

Bonus Incentive

SB 606 defines a bonus incentive for urban water suppliers that deliver water from a source (namely a groundwater basin or reservoir) that is augmented by potable reuse water.

The bonus incentive serves to increase a suppliers' water use objective by a volume equal to the volume of potable reuse delivered to residential water users and to CII irrigation. The bonus incentive is limited by two potential volumes:

- No more than 15 percent of the supplier's water use objective for any potable reuse water produced at an existing facility; and
- No more than 10 percent of the supplier's water use objective for any potable reuse water produced at any non-existing facility.

Commercial, Industrial, and Institutional Performance Measures

AB 1668 notes that performance measures for CII indoor and mixed water use are in development and will be recommended for adoption by October 1, 2021. The measures shall be adopted on or before June 30, 2022.

The 2017 Framework following EO B-37-16 suggests that CII indoor and mixed use will not be restricted by a volumetric standard due to the wide range of uses within the CII sector. Instead, agencies will likely be required to implement three procedures:

1. Convert all landscapes over a specified size that are currently served by a mixed-meter CII account to dedicated irrigation accounts, either through the installation of a separate landscape meter or the use of equivalent technology.
2. Classify all CII accounts using the North American Industry Classification System (or another similar system). CII subsector water use benchmarks may be developed to help identify CII users with potential efficiency improvements.
3. Conduct water use audits or prepare water management plans for CII accounts over a specified size, volume, or percentage threshold.

3.1.2 LADWP Conservation Goals

In response to the 2012-2016 historic dry period, Mayor Garcetti issued an Executive Directive in October 2014, to establish a target of a 20 percent reduction in per capita water use by 2017. LADWP met this water use reduction target on January 1, 2017, three years earlier than the 2020 goal originally set in SB X7-7. LADWP plans to meet the remaining water use reduction targets of reducing gpcd water use by 22.5 percent and 25 percent by 2025 and 2035, respectively.

Accomplishing LADWP's water supply goals will require multiple strategies to achieve and maintain water use reductions, including: investments in state-of-the-art technology; rebates and incentives promoting installation of water-efficient fixtures and appliances; expansion and enforcement of prohibited water uses; reductions in outdoor water use; extension of education and outreach efforts; and encourage regional conservation efforts. LADWP's multi-faceted conservation program includes tiered volumetric water rates, education and awareness programs, financial incentives for the installation of water-efficient devices, free water-saving fixtures and materials, specialized direct install programs, a Technical Assistance Program (TAP) that provides tailored incentives for business and industry, and landscape irrigation efficiency programs. Conservation is a foundational component of LADWP's water resource planning efforts and will continue to be central to the City's water conservation and efficiency goals over the long term.

3.2 Existing Programs, Practices, and Technology

LADWP has developed many progressive water conservation and water use efficiency programs to fulfill State requirements and meet LADWP's goals. LADWP utilizes these programs in conjunction with state and local conservation ordinances and plumbing codes to achieve water conservation and water use efficiency throughout its service area and customer classes.

3.2.1 State Laws and City Ordinances

State Laws

In addition to the Water Conservation Act of 2009, and the 2018 Legislation on Water Management Planning, multiple legislative bills have been enacted in the past few years requiring water agencies to create measures increasing water conservation, establishing new plumbing standards, and linking grants and loans to the implementation of best management practices (BMPs).

The Water Conservation in Landscaping Act of 2006, AB 1881, reduces outdoor water waste through improvements in irrigation efficiency and selection of plants requiring less water. The act required an update to the existing MWELO and adoption of this ordinance or an equivalent ordinance by local agencies no later than January 1, 2010. If any agency failed to adopt the ordinance or its equivalent, then the MWELO was automatically mandated by statute. For new construction and redevelopment projects, the ordinance requires development of water budgets for landscaping, reduction of erosion and irrigation related runoff, utilization of recycled water if available, irrigation audits, development of requirements for landscape and irrigation design, and scheduling of irrigation based on localized climate.

On April 1, 2015, Governor Brown issued an Executive Order to revise the State MWELO (Ordinance). The Ordinance was revised on July 15, 2015, and represents a new statewide standard for irrigation of urban landscapes. In its simplest form, it increases water efficiency standards for new landscaping and retrofits via more efficient landscape irrigation systems, graywater systems, onsite stormwater capture, and it places limits on total turf areas allowed. The threshold size for applicability was reduced from 2,500 square feet to 500 square feet for new residential, commercial, industrial and institutional projects.

For sites under 2,500 square feet, a less prescriptive checklist can be used for compliance rather than the more complex approach required in the Ordinance. The prescriptive checklist limits the maximum turf area to 25 percent of the landscape area for residential areas and prohibits turf in non-residential areas. The prescriptive checklist also allows the option of utilizing graywater to meet compliance requirements.

Sites greater than 2,500 square feet, or smaller sites choosing the standard approach required in the Ordinance, may have turf areas exceeding 25 percent of the landscape area. However, these sites must comply with a more stringent maximum applied water allowance than what is contained in the 2010 MWELO. The maximum allowed water allowance has been lowered from 70 percent of the reference evapotranspiration to 55 percent for residential projects and 45 percent for non-residential projects. Additionally, high water use plants with a plant water use factor greater than 0.7 are prohibited from use in street medians. According to "A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California, The Landscape Coefficient Methods and Water Use Classification of Landscape Species" prepared by the University of California Cooperative Extension and DWR, cool season turf grasses have a plant water use factor of 0.8, effectively prohibiting cool season turf from street medians.

Compliance with the Governor's revised State MWELO or a local ordinance at least as effective was required of water agencies by December 1, 2015. If any agency fails to adopt the ordinance or its equivalent, then the revised State MWELO is automatically mandated by statute. In the City, the Department of Building and Safety is the responsible agency for implementing and enforcing MWELO requirements.

In 2009, AB 1465, Urban Water Management Planning, was approved to include language in the UWMP Act requiring water suppliers that are members of the California Urban Water Conservation Council (CUWCC) and are complying with the CUWCC's "Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California" to describe their water demand management measures in their respective UWMPs. However, as the CUWCC is now defunct, this requirement no longer exists. The CUWCC was re-established as the California Water Efficiency Partnership (CalWEP), and continues to promote, educate, and develop new frontiers and practices for water agencies as well as institutional and industry partners to utilize in meeting future water conservation regulatory targets.

In recent years, there have been numerous new requirements to increase the water use efficiency of plumbing devices, specifically, in AB 715 (2007), SB 407 (2009), and the CALGreen Building Standards. AB 715 requires that all toilet and urinal fixtures sold through retail or installed in existing and new residential and commercial building meet the high efficiency standards by January 1, 2014. SB 407 does not address the sale of plumbing fixtures, but adds a requirement that beginning in January 1, 2017, all residential and commercial property sales must disclose all non-efficient plumbing fixtures. CALGreen had an effective date of January 1, 2011, and requires use of water-efficient plumbing fixtures for all new construction and renovations of residential and commercial properties. On April 8, 2015, the California Energy Commission approved new standards for urinals not to use greater than 0.125 gallons per flush (gpf), pursuant to Governor Brown's Executive Order (EO B-29-15). Also included are new standards reducing the flow of bathroom faucets to 1.2 gallons per minute (gpm).

In 2016, Governor Brown signed into law SB 814, which requires that in times of limited water supplies, residential customers, such as single-family and multi-family housing customers, would be prohibited from excessive water use. SB 814 also requires that urban water retail suppliers identify high water consumers and develop methods to discourage excessive water use, which may include the establishment of water use ordinances that apply penalties for excessive water use.

City Ordinances

Since 1988, the City has utilized ordinances as a tool to reduce water waste, beginning with the adoption of its first version of a plumbing retrofit ordinance. The ordinance mandated installation of water-efficient devices in all existing residential and commercial properties and installation of water-efficient landscaping in all new construction. Toilets were required to use less than 3.5 gpf, urinals less than 1.5 gpf, and showerheads less than 2.5 gpm. Customers with three acres or more of turf were required to reduce water consumption by 10 percent from 1986 levels or face a 100 percent surcharge on their water bills.

In 1998 the ordinance was amended, requiring the installation of Ultra Low Flush (ULF) toilets and water-saving showerheads prior to the close of escrow. This progressive requirement is now being implemented with the help of local real estate professionals.

The City further increased its water efficiency mandates in 2009 with adoption of the High Efficiency Plumbing Fixture Ordinance. This ordinance establishes water efficiency requirements for new developments and renovations of existing buildings by requiring installation of high efficiency plumbing fixtures in all residential and commercial buildings. Exhibit 3D summarizes the minimum requirements for new construction and replacement of fixtures in existing buildings.

Exhibit 3D
Water Efficiency Requirements Ordinance Summary

Device	Requirement
High Efficiency Toilets	1.28 gallons per flush
Urinals	0.125 gallons per flush
Faucets	
Indoor Faucets (Maximum)	2.2 gallons per minute
Private Lavatory Faucets	1.5 gallons per minute
Public Use Lavatory Faucets[1]	0.5 gallons per minute
Pre-rinse Spray Valve	1.6 gallons per minute
Showerheads	2.0 gallons per minute
Dishwashers	
Commercial Dishwashers	0.62 to 1.16 gallons per rack (depending on type)
Domestic Dishwashers	5.8 gallons per cycle
Cooling Towers	5.5 cycles of concentration
Single-Pass Cooling Systems	Prohibited[2]

1. Metering faucets shall not deliver more than 0.25 gallons per cycle.

2. Single pass cooling systems are prohibited unless installed for health and safety purposes.

Leading by example, LADWP began retrofitting all of its facilities with efficient water fixtures well in advance of the effective date of the ordinance. LADWP completed upgrading its 600 buildings to water efficient faucets, toilets, urinals, and showerheads in 2019. LADWP also repaired leaks, malfunctioning flush valves and faulty pressure reducing valves.

Effective June 6, 2016, the Citywide Water Efficiency Standards Ordinance amended the Los Angeles Municipal Code to reduce water use in buildings through the Los Angeles Green Building Code and Los Angeles Plumbing Code. These mandatory citywide water efficiency standards require buildings to implement water saving technologies and water efficient landscapes. This ordinance applies to both new construction and renovations of existing buildings. It also ensures compliance with the California Department of Water Resources Model Water Efficient Landscape Ordinance.

In May 1996, the City passed Landscape Ordinance No. 170,978 for the efficient use of outdoor water. This ordinance was amended in 2009 to comply with the Water Conservation in Landscaping Act of 2006 and the State MWELO. The City is currently implementing standards set by the July 15, 2015 State MWELO revision, which has the highest standards for outdoor water use efficiency enacted to date.

LADWP first adopted the Conservation Ordinance in the early 1990's in response to limited water supply conditions. LADWP Subsequently adopted four amendments to the Conservation Ordinance. The amendments expanded prohibited uses, increased penalties for violating the ordinance, added an additional phase, modified water conservation requirements, and deterred unreasonable use of water.

On April 19, 2016, the City Council once again amended the Conservation Ordinance. The fifth amendment increased penalties for each additional violation issued, thereby discouraging repeat offenders. The amendment also added a new violation to discourage the unreasonable use of water. Prior to this amendment, LADWP lacked the ability to effectively penalize high water users who consistently use unreasonable amounts of water. The latest amendment gives LADWP the tools and authority to penalize these users.

The Conservation Ordinance defines six phases of incrementally stringent water use restrictions which increase water use prohibitions and mandates with each sequential phase. Phase I prohibited use requirements are in effect permanently, regardless of water supply conditions. Exhibit 3E summarizes the six phases as defined in the latest amendment. The Conservation Ordinance is the primary component of LADWP's Water Shortage Contingency Plan (WSCP), which provides for a sufficient and continuous supply of water in the event of various water supply shortage levels in the service area. LADWP's WSCP can be found in Appendix I.

Exhibit 3E
Emergency Water Conservation Plan Ordinance Restrictions by Phase

Phase	Restrictions
I	No use of a water hose to wash paved surfaces except to alleviate immediate safety or sanitation hazards.
	No use of water to clean, fill, or maintain levels in decorative fountains, ponds, lakes or similar structures used for aesthetic purposes unless a recirculating system is used.
	No drinking water shall be served unless expressly requested in restaurants, hotels, cafes, cafeterias, or other public places where food is sold, served, or offered for sale.
	No leaks from any pipes or fixtures on a customer's premises; failure or refusal to fix leak in a timely manner shall subject the customer penalties for a prohibited use of water.
	No washing vehicles with a hose if the hose does not have a self-closing water shut-off device attached or the hose is allowed to run continuously while washing a vehicle.
	No irrigation during rain or within 48 hours after a measurable rain event.
	No irrigation between 9am and 4pm, except for public and private golf courses and professional sports fields to maintain play areas and event schedules. System testing and repair is allowed if signage is displayed.
	All irrigation of landscape with potable water using spray head and bubblers shall be limited to no more than ten minutes per water day per station. All irrigation of landscape with potable water using standard rotors and multi-stream rotary heads shall be limited to no more than 15 minutes per cycle and up to 2 cycles per water day per station. Exempt from these restrictions are irrigation systems using very low-flow drip-type irrigation when no emitter produces more than 4 gallons of water per hour and micro-sprinklers using less than 14 gallons per hour.
	No watering or irrigation of any lawn, landscape, or other vegetated area shall occur in a manner that causes or allows excess or continuous water flow or runoff onto an adjoining sidewalk, driveway, street, gutter, or ditch.
	No installation of single-pass cooling systems shall be permitted in buildings requesting new water service.
	No installation of non-recirculating systems shall be permitted in new conveyor car wash and new commercial laundry systems.
	Operators of hotels and motels shall provide guests with the option of choosing not to have towels and linens laundered daily.
	No large landscape areas shall have irrigation systems without rain sensors that shut off the irrigation systems. Large landscape areas with approved weather-based irrigation controllers registered with LADWP are compliant.
II	All prohibited uses in Phase I shall apply, except as provided.
	No landscape irrigation shall be permitted on any day other than Monday, Wednesday, or Friday for odd-numbered street address and Tuesday, Thursday, or Sunday for even-numbered street addresses. If a street address ends in 1/2 or any fraction it shall conform to the permitted uses for the last whole number in the address. For non-conserving nozzles (spray head sprinklers and bubblers) watering times shall be limited to no more than 8 minutes per watering day per station for a total of 24 minutes per week. For conserving nozzles (standard rotors and multi-stream rotary heads watering times shall be limited to no more than 15 minutes per cycle and up to two cycles per watering day per station for a total of 90 minutes per week.
	Irrigation of sports fields may deviate from non-watering days to maintain play areas and accommodate event schedules with written notice from LADWP. However, a customer must reduce overall monthly water use by LADWP's Board of Water and Power Commissioners adopted degree of shortage plus an additional 5% from the customer baseline water usage within 30 days.
	If written notice is received from LADWP, large landscape areas may deviate from the non-watering days if the following requirements are met: 1) approved weather-based irrigation controllers registered with LADWP; 2) Must reduce overall monthly water use by LADWP's Board adopted degree of shortage plus an additional 5% from the customer baseline within 30 days; 3) Must use recycled water if available.
	These restrictions do not apply to drip irrigation supplying water to a food source or to hand-held hose watering of vegetation, if the hose is equipped with a self-closing water shut-off device, which is allowed every day during Phase II, except between the hours of 9am and 4pm.

Phase	Restrictions
III	All prohibited uses in Phases I and II shall apply, except as provided.
	No landscape irrigation shall be permitted on any day other than Monday and Friday for odd-numbered street address and Thursday, or Sunday for even-numbered street addresses. If a street address ends in 1/2 or any fraction it shall conform to the permitted uses for the last whole number in the address. For non-conserving nozzles (spray head sprinklers and bubblers) watering times shall be limited to no more than 8 minutes per watering day per station for a total of 16 minutes per week. For conserving nozzles (standard rotors and multi-stream rotary heads watering times shall be limited to no more than 15 minutes per cycle and up to two cycles per watering day per station for a total of 60 minutes per week.
	Recommend use of pool covers.
	Recommend washing of vehicles at commercial car wash facilities.
	Upon written notice from LADWP irrigation of sports fields may deviate from non-watering days to maintain play areas and accommodate event schedules. However, a customer must reduce overall monthly water use by LADWP's Board of Water and Power Commissioners adopted degree of shortage plus an additional 5% from the customer baseline water usage within 30 days.
	If written notice is received from LADWP, large landscape areas may deviate from the non-watering days if the following requirements are met: 1) approved weather-based irrigation controllers registered with LADWP; 2) Must reduce overall monthly water use by LADWP's Board adopted degree of shortage plus an additional 5% from the customer baseline within 30 days; 3) Must use recycled water if available
	These restrictions do not apply to drip irrigation supplying water to a food source or to hand-held hose watering of vegetation, if the hose is equipped with a self-closing water shut-off device, which is allowed every day during Phase III, except between the hours of 9am and 4pm.
IV	All prohibited uses in Phases I, II, and III shall apply, except as provided.
	No landscape irrigation shall be permitted on any day other than Monday for odd-numbered street address and Tuesday for even-numbered street addresses. If a street address ends in 1/2 or any fraction it shall conform to the permitted use for the last whole number in the address. For non-conserving nozzles (spray head sprinklers and bubblers) watering times shall be limited to no more than 8 minutes per watering day per station for a total of 8 minutes per week. For conserving nozzles (standard rotors and multi-stream rotary heads watering times shall be limited to no more than 15 minutes per cycle and up to two cycles per watering day per station for a total of 30 minutes per week.
	Use of swimming pool covers on all residential swimming pools when not in use.
	No washing of vehicles allowed except at commercial car washes.
	No filling of decorative fountains, ponds, lakes, or similar structures used for aesthetic purposes, with potable water.
	Irrigation of sports fields may deviate from the specific non-watering days with written notice from LADWP. However, a customer reduces overall monthly water use by LADWP's Board of Water and Power Commissioners adopted degree of shortage plus an additional 10% from the customer baseline water usage within 30 days.
	If written notice is received from LADWP, large landscape areas may deviate from the specific non-watering days if the following requirements are met: 1) approved weather-based irrigation controllers registered with LADWP; 2) Must reduce overall monthly water use by LADWP's Board adopted degree of shortage plus an additional 10% from the customer baseline within 30 days; 3) Must use recycled water if available.
	These restrictions do not apply to drip irrigation supplying water to a food source or to hand-held hose watering of vegetation, if the hose is equipped with a self-closing water shut-off device, which is allowed every day during Phase IV, except between the hours of 9am and 4pm.
V	All prohibited uses in Phases I, II, III, and IV shall apply, except as provided.
	No landscape irrigation is allowed.
	No filling of residential swimming pools and spas with potable water.
	If written notice is received from LADWP, golf courses and professional sports fields may apply water to sensitive areas, such as greens and tees, during non-daylight hours and only to the extent necessary to maintain minimum levels of biological viability.
VI	All prohibited uses in Phases I, II, III, IV, and V shall apply, except as provided.
	The LADWP Board of Water and Power Commissioners is authorized to implement additional water prohibitions based on the water supply situation.

Specific procedures for determining the initiation and termination of a phase are provided in the Conservation Ordinance. Phases are initiated through recommendations provided by LADWP to the Mayor and City Council (Council).

The Conservation Ordinance, as mentioned before also sets penalties for violations of prohibited uses outlined in Sections 10632 (a) (1) and (a) (4). The penalties vary by water meter size. For water meters smaller than two inches the following penalties shall apply:

1. The first violation consists of a written warning.

2. The second violation within the preceding 12-month period will result in a surcharge in the amount of $100 added to the customer's water bill.

3. The third violation within the preceding 12-month period will result in a surcharge in the amount of $200 added to the customer's water bill.

4. The fourth violation within the preceding 12-month period will result in a surcharge in the amount of $300 added to the customer's water bill.

5. After a fifth violation or subsequent violation within the preceding 12-month period, LADWP may install a flow-restricting device of 1 gpm capacity for services up to 1 ½ inches in size and comparatively sized restrictors for larger services or terminate a customer's service, in addition to the aforementioned financial surcharges. Such action shall only be taken after a hearing held by LADWP.

For water meters two inches and larger the following penalties shall apply:

- The first violation consists of a written warning.

- The second violation within the preceding 12-month period will result in a surcharge in the amount of $200 added to the customer's water bill.

- The third violation within the preceding 12-month period will result in a surcharge in the amount of $400 added to the customer's water bill.

- The fourth violation within the preceding 12-month period will result in a surcharge in the amount of $600 added to the customer's water bill.

- After a fifth violation or subsequent violation within the preceding 12-month period, LADWP may install a flow-restricting device or terminate a customer's service, in addition to the aforementioned financial surcharges. Such action shall only be taken after a hearing held by LADWP.

3.2.2 Conservation Pricing

Since 1993, LADWP has used an ascending tier rate structure that is entirely volumetric based pricing. LADWP's water rates were restructured in 2016 to incorporate and further reinforce foundational water conservation, water use efficiency, and financial principles. The rates, approved by the City Council on March 15, 2016, were first proposed to the Board of Water and Power Commissioners in July 2015, and followed by 5 months of extensive community outreach at over 90 Neighborhood Council, community, business and civic meetings and webinars.

LADWP's rate design is influenced by a variety of factors, including the importance of additional conservation and water use efficiency in response to more frequent dry periods facing California and the need to comply with legal and regulatory requirements. These considerations headline the following objectives LADWP has established to guide its rate design. Primary objectives of the rate restructuring include:

- Minimizing individual bill impacts for low water usage customers;

- Complying with all guiding legal principles;

- Recovering costs identified in the updated water cost of service study;

- Aligning water supply costs to sources of supply;

- Retaining water-budget rate structure and marginal-cost based conservation principles;

- Achieving full recovery of costs (without over-billing) in a cost causative manner;

- Implementing symmetrical decoupling mechanism for base rate revenue;

- Helping facilitate economic development;

- Simplifying where possible;

- Making bills easier to understand; and

- Considering implications for LADWP's customer care and billing system

Particular unique features of the rate restructuring include:

- Budget based allocations based on five lot size groups and three temperature zones – This structure was first introduced in the early 1990's rate process through a Blue Ribbon Commission appointed to promote conservation, water use efficiency, and rate equity.

- Seasonal rates – Allocations are adjusted seasonally to reinforce the opportunity to conserve in winter months beyond summer outdoor usage.

- Four-tiered rate for single dwelling-unit residential – The four tiers build on the previous two tier structure, providing a first-tier indoor water use base allocation, a second-tier allocation based on California Friendly Landscaping efficient outdoor use, a third-tier allocation capturing high outdoor water use, and a fourth-tier allocation for excessive use. In keeping with cost of service principles, the incremental pricing for the tiers is based on the cost of water supply and, for the third and fourth tiers, added pumping and storage costs.

- 100 percent Volumetric Pricing – Rates do not include a flat-rate charge. This is perhaps the single greatest pricing signal the rates structure provides. Minimizing water use directly minimizes billing.

- Decoupling – LADWP included a method to allow recovery of revenue if sales decrease due to increased conservation and water use efficiency, as well as a means to eliminate over collection of revenue if water sales increase. By eliminating the linkage between volume of sales and revenue collection (decoupling), the rate structure provides financial stability and removes inherent barriers to conservation and water use efficiency.

- Revenue predictability – The five-year rate increase provides LADWP the opportunity to plan ahead with a greater level of certainty for project funding.

3.2.3 Existing Conservation and Water Use Efficiency Programs

LADWP operates a multifaceted water conservation program focused on reducing water demand, improving water use efficiency, and compliance with state mandated water use requirements. Individual program initiatives are designed to maximize water savings and cost effectiveness, but more importantly the initiatives seek to normalize water-saving behaviors by empowering City residents to incorporate water efficient practices into their everyday life.

LADWP has implemented active water savings measures by incentivizing LADWP customers to install water saving technology in their homes and businesses. These active savings measures are water demand management measures which include rebates for installation of efficient devices, direct install programs, and tailored incentive programs for the CII sector. The water savings resulting from active savings measures are estimated by tracking the number of incentivized device installations and calculating the cumulative savings for each type of device.

In addition to these active savings measures, LADWP has also invested heavily in educational and public awareness/support campaigns to empower customers to become advocates for water use efficiency. LADWP has also dedicated efforts into developing codes, ordinances, and standards for customers to follow as described previously in this chapter and works to enforce these requirements to help instill the concept of everyone becoming stewards of water use efficiency in the City. These indirect forms of conservation, known as passive savings programs, have proven to be worthwhile investments for LADWP. Quantifying the exact water savings resulting from passive savings programs is difficult, but trends in water use clearly show that these programs have influenced behavioral changes resulting in significant reductions in water consumption. The cultural shift towards water saving behaviors began during water shortage periods and has grown over time to account for the majority of the water savings observed in the City. More recently, when compared to previous dry periods, the lasting effect of this shift in behavioral changes has become more permanent as customers have adapted to using water efficiently in both dry and wet periods. In effect, water conservation has truly become a way of life in the City.

Awareness/Support Measure Programs

Awareness/support measures can be classified as direct or indirect. Direct measures include full metering of water use, assessment of volumetric sewer charges, and a tiered rate structure that promotes efficient use. Indirect measures include providing educational materials for schools, community and customer presentations, maintaining a customer contact hotline, and a wide range of information distributed through customer bills, advertising in public venues, LADWP's website, and direct mail. Indirect awareness/support measures provide the foundation for the conservation movement by raising water use awareness, water conservation program visibility, and encouraging community involvement.

Over the last several years, LADWP has greatly expanded its Water Conservation Outreach Program. The program calls on customers to increase their conservation efforts and is designed to instill the understanding that water conservation is the cultural norm in the City. These goals are achieved through the joint implementation of innovative marketing strategies and community outreach activities.

The program includes the following strategies:

- Earned Media Opportunities: Through the distribution of regular and timely news releases, LADWP Communication and Public Affairs group generates broadcast interviews and print articles in various media outlets about water conservation and available water use efficiency programs.

- Social Media: Program facts, scheduled events, web links, reminders, videos, photos, and other relevant water conservation information shared regularly via Twitter, Facebook, Next Door, Instagram, Vimeo and YouTube. In addition to organic posts which are free, paid advertisement placements are also used to promote programs and share information.

- Print Materials: Branded print materials including flyers, Frequently Asked Questions, and fact sheets available for distribution at all relevant venues, such as community fairs.

- Media Advertising Campaign: Campaign messages using paid advertising in the following: television, radio, newspapers, magazines, bus tails, movie screens, sporting venues and online ads.

Marketing strategies are complemented by year-round community outreach activities including LADWP-hosted water conservation and landscaping workshops, neighborhood council meetings, and community events. These public information opportunities are further enhanced by sponsorships and strategic partnerships with elected officials, other water agencies, non-profit organizations, and businesses like home improvement stores that host other related activities that can help LADWP reach customers effectively with our key messages.

LADWP's Water Conservation Media Advertising Campaign (Campaign) is continually updated to keep customers engaged and to avoid message fatigue. In 2013, LADWP focused its Campaign on its California Friendly Landscaping Incentive Program. As a result of the messaging, the program saw a 10-fold increase in applications. LADWP's 2014 Campaign focused on educating residents on the importance of conserving during the dry period. Media messaging concentrated on LADWP's three day per week outdoor watering restrictions, voluntary conservation measures residents could take, and LADWP's water use efficiency rebates.

From 2015 to 2018, LADWP implemented the new "Save the Drop" message into its Campaign. The messaging was a partnership between the Mayor's Office and LADWP. Outreach materials included public service announcements, radio spots, event handouts, and signage on the sides of Bureau of Sanitation trucks. The Campaign also partnered with celebrities such as Steve Carrell, Jaime Camil, and Moby for public service announcements airing on TV, cinema, and radio.

Recent additions to the education and marketing activities have expanded LADWP engagement with adults and school aged children. Hands on Workshops, launched in 2019, allow customers to participate in a two-day turf replacement project at a residential property. Customers get to learn about and experience how to properly remove turf, contour the surface for rainwater capture, perform sheet mulching, install drip irrigation where necessary, and plant CA friendly plants for a successful project. Additionally, the Environmental Teacher Institute Series allows LADWP to assist teachers in identifying the nexus between water education and Next Generation Science Standards. LADWP subject matter experts provide in-person and virtual classroom presentations on water conservation and water use efficiency. Lastly, LADWP's presence on a series of virtual Poppy Hour chats hosted by the Theodore Payne Foundation, provided an opportunity to share the long-term water use efficiency benefits of planting low water use native plants.

The LADWP's Community Partnership Program has provided an opportunity to partner with local non-profit organizations on water conservation and water use efficiency messaging and education. Non-profit organizations respond to LADWP's call for proposals that address specific outreach challenges, LADWP then awards grants to these organizations to help implement their proposed programs, while conveying shared messaging on water conservation and water use efficiency. LADWP consistently receives creative solutions from proposers that provide educational opportunities, creative programming, and engaging water-centric messages. Feedback from participants is then used to establish future water conservation and water use efficiency programming. Recent Community Partnership Program at-large grant recipients have included Theodore Payne Foundation, Tree People, Mujeres de la Tierra, SELVA International and the Los Angeles Beautification Team. Past projects included California Friendly plant maintenance workshops, humorous bilingual plays to instill environmental stewardship in target communities, and a certification program for sole proprietor Spanish speaking gardeners to learn how to maintain newly established California Friendly landscapes.

Residential Conservation Programs

LADWP first developed and launched residential conservation programs during the dry period of 1987-1992. The ULF Toilet Rebate Program began in 1990, followed two years later by the ULF Toilet Distribution Program. A well-received free installation service component was added to the ULF Toilet Distribution Program in 2003, which included free water-saving showerheads, faucet aerators and replacement toilet flapper valves. Today, distribution of free faucet aerators and showerheads continues for all single family, multi-family, and commercial customers.

In 2008, the MWD initiated the region-wide SoCal Water$mart Program for residential water use efficiency rebates. This program replaced previous LADWP rebate programs, and other rebate programs offered by water service providers throughout the MWD service area. This MWD sponsored program administers uniform rebate amounts across the entire MWD service area, and provides a clearinghouse for processing rebates for all MWD member agency customers. MWD Member Agencies have the option of supplementing the MWD-offered baseline rebate amounts to their customers and LADWP has voluntarily increased rebate amounts offered to its customers for nearly all qualifying products.

Exhibit 3F summarizes the residential water use efficiency savings programs for FY 2015/16 through FY 2019/20. During this period, an estimated annual savings of 15,709 AFY was achieved, inclusive of LADWP in-house programs. This is in addition to previous cumulative water use efficiency savings attributed to the residential programs. Rebate amounts provided in Exhibit 3F are the total device rebates, which include the base MWD rebate and the additional LADWP-supplemented rebate amounts.

California's appliance efficiency regulations (Title 20) set a high standard for toilet efficiency by prohibiting the sale of toilets using more than 1.28 gpf, after January 1, 2016. Therefore, in order to further increase toilet efficiency standards, MWD and LADWP replaced the rebate for high efficiency toilets (HETs), which use 1.28 gpf, with a rebate for Premium HETs (PHETs) which use 1.1 or less gpf. LADWP provides a $60 increase for PHETs combined with the $40 rebate offered by the MWD SoCalWaterSmart program for a total rebate of $100 per toilet. To be eligible for a rebate, a PHET must replace a toilet using 1.6 gallons or greater per flush. The HET/PHET rebate program has been highly successful with 68,158 units installed between FY 2015/16 and 2019/20, equating to over 1,537 AFY in water savings.

The High Efficiency Clothes Washer Rebate Program is managed through SoCal Water$mart Program and is co-funded through MWD and LADWP. LADWP provides a $315 increase in addition to the MWD rebate of $85 for a total rebate of $400 per clothes washer. Rebates are offered for high efficiency clothes washers that meet the Consortium of Energy Efficiency (CEE) Tier 1 standard. This standard requires clothes washers to have a water factor of 3.7 or less. The water factor is the measure of gallons of water consumed per cubic feet of laundry capacity. Between FY 2015/16 and 2019/20, a total of 24,853 High Efficiency Clothes Washer rebates were paid providing an estimated total savings of 815 AFY.

LADWP customers receive a rebate on efficient sprinkler head nozzles of $2/nozzle through the SoCal Water$mart Program in addition to the $4/nozzle provided by LADWP for a total of $6/nozzle, limited to the cost of the device. Efficient nozzles distribute water more uniformly across a landscape area and minimize overspray and wind drift, significantly reducing water waste. In addition to the savings associated with efficient nozzles, an update to California's Appliance Efficiency Regulation (Title 20) standards requires sprinkler bodies manufactured and sold in California after October 1, 2020, must contain pressure regulating devices and must be compliant with the Environmental Protection Agency's WaterSense specifications. This requirement will further improve sprinkler efficiency levels by creating a uniform pressure gradient for all sprinkler heads, regardless of a customer's water service line pressure. Replacing standard sprinkler bodies with pressure regulating sprinkler bodies can result in savings of up to 18 percent, according to the California Energy Commission. Between FY 2015/16 and 2019/20, over 17,090 efficient rotating nozzles were incentivized to LADWP residential customers, saving approximately 55 AFY.

Exhibit 3F
Residential Conservation Programs and New Savings for FY 2015/16 through 2019/20

Device Type/Program	Rebate Amount	Devices Installed	Estimated Annual Savings (AFY)
SoCal Water$mart Program			
High Efficiency Toilets (1.28 gpf or less)	$100	57,979	1,426
Premium High Efficiency Toilets (1.1 gpf or less)	$100	10,179	111
High Efficiency Clothes Washers (Must meet CEE Tier 1 Standard)	$400	24,853	815
Sprinkler head Rotating Nozzles (30 minimum)	$6 each	17,090	55
Weather Based Irrigation Controller	$200 per controller for landscape area < 1 acre and $35 per station for landscape areas > 1 acre	13,801	545
Turf Replacement	$3.00 per square foot (Up to 5,000 square feet)	22,781,735	3,076
Soil Moisture Sensors	$200 per controller for landscape area < 1 acre and $35 per station for landscape areas > 1 acre	20	1
Rain Barrels - OR - Cistern	Up to $50 per rain barrel (limit two units); Up to $500 per cistern (limit one unit) Customers may only apply for either the rain barrel rebate or the cistern rebate (not eligible to receive both)	86,568	167
		Subtotal SoCal Water$mart Programs	**6,196**
LADWP In-house Programs			
High Efficiency Showerheads	Free	41,395	669
Residential Faucet Aerators	Free	39,163	108
Home Energy Improvement Program - Showerheads	Free	13,736	226
Home Energy Improvement Program - Faucet Aerators	Free	14,110	40
Home Energy Improvement Program - High Efficiency Toilets	Free	4,226	155
Conservation Kit Distribution – Showerheads	Free	382,565	6,299
Conservation Kit Distribution – Faucet Aerators	Free	719,789	2,016
		Subtotal LADWP In-house	**9,513**
		Total Residential Savings	**15,709**

Rebates for weather-based irrigation controllers (WBIC) are also jointly funded through the SoCal Water$mart Program and LADWP. The SoCal Water$mart program contributes $80 per WBIC and $35 per station for landscapes over an acre. LADWP adds an additional incentive of $120 per WBIC, resulting in a $200 rebate for LADWP customers. WBICs receive weather updates to automatically adjust the watering schedule and reduce unneeded watering. Between FY 2015/16 and FY 2019/20, 13,801 LADWP customers received rebates for WBICs, saving approximately 545 AFY.

Soil moisture sensor systems are rebated at the same rate as, and as an alternative to, WBIC systems. The SoCal Water$mart program contributes $80 per soil moisture controller and $35 per station in addition to the LADWP funding of $120 per Controller for a total rebate of $200 per controller and $35 per station. Customers are not eligible for a soil moisture sensor system rebate if they have already received a rebate for a WBIC system.

LADWP created the California Friendly Landscaping Program, a multifaceted turf removal and landscaping rebate program which incentivizes turf replacement in the City. When customers transform their turf to California Friendly landscaping, they receive a rebate of $2.00 per square foot through the SoCal Water$mart Program and an additional $1.00 per square foot from LADWP. LADWP customers may receive a total of $3.00 per square foot up to a maximum of 5,000 square feet per customer. Approximately 22.8 million square feet of turf rebates were issued between FY 2015/16 and FY 2019/20, which equates to savings of approximately 3,076 AFY.

The California Friendly Landscaping Program builds upon previous LADWP turf replacement programs by creating required guidelines included to improve the aesthetics and overall sustainability of the landscape transformations. In order to receive a rebate, customers must incorporate a stormwater retention feature, remove impermeable hardscapes, modify irrigation features, and adhere to other guidelines. Additionally, LADWP now requires the installation of 3 plants per 100 SF of turf replaced. This guideline replaced the previous requirement where 50 percent of the landscaped area was required to be covered by California Friendly plants. LADWP continues to modify the program to make it more accessible for customers and increase customer interest.

Previously, LADWP allowed for programs which incentivized landscape contractors to replace turf on behalf of customers. These programs drew high amounts of participation and greatly reduced the amount of turf in the City, resulting in large amounts of water saved during a critical dry period.

The California Friendly Landscaping Programs have effectively transformed the landscape of the City. By August of 2020, over 50 million square feet of turf were rebated in the City since inception of the program. For perspective, in April of 2015, Governor Brown's executive order to replace 50 million square feet of turf across the whole of California was single handedly accomplished by the City.

Rebates for Rain Barrel purchases are available for up to the total amount of $50 per rain barrel ($35 MWD +$15 LADWP). Customers are eligible for a maximum of two rain barrels which must be at least 50 gallons in capacity. Rebates for cisterns are available for up to $500 per cistern ($350 MWD + $150 LADWP). Customers are eligible for one rebate towards a cistern of a minimum size of 200 gallons. The cistern rebate amount increases proportionally up to a maximum cistern capacity of 1,000 gallons. Between FY 2015/16 and FY 2019/20, rebates were issued for 86,568 rain barrels and cisterns producing a savings of approximately 167 AFY.

Water-saving showerheads and faucet aerators remain available to LADWP customers free of charge. Approximately 423,960 high efficiency showerheads and 758,952 faucet aerators were distributed between FY 2015/16 and FY 2019/20 saving approximately 9,092 AFY of water. During the past year, approximately 520,328 water efficient retrofit kits were distributed throughout the City. The kits included two water efficient showerheads, three faucet aerators (two for the bathroom and one for kitchen faucets) and multi-language literature containing information regarding water conservation and water use efficiency.

LADWP's Home Energy Improvement Program (HEIP) is an in-house direct install program whereby LADWP representatives visit single family residences to provide free assessments to identify cost-effective upgrades and repairs applicable to the customer. The HEIP program uses the results of these assessments to then have skilled repair technicians perform device upgrades which save water and electricity. The program focuses on upgrading showerheads, faucet aerators and toilets in regards to water saving devices. Through this program, between FY 2015/16 and FY 2019/20, approximately 13,736 showerheads, 14,110 faucet aerators, and 4,226 toilets were installed saving approximately 421 AFY.

Commercial, Industrial, and Institutional Water Use Efficiency Programs

The CII sectors represent some of the largest volume water users in LADWP's customer base, and therefore represent a great deal of water savings potential as well. LADWP, in partnership with MWD, has developed and implemented a commercial rebate program within the SoCal Water$mart Program, designed specifically for customers in the CII sector and multi-family residences with five or more units. In the CII sector, the program provides rebates for water saving plumbing fixtures, food service equipment, and landscaping equipment. Within the multi-family sector, the program provides rebates for premium high efficiency toilets, and landscape equipment. In addition, packaged water use efficiency solutions are being developed for specific business sectors. Efforts are also underway to better promote the financial incentives available that make water use efficiency more cost effective for business and industry. LADWP takes full advantage of regional programs for many product rebates offered through MWD for the CII sector, and adds supplemental funding to increase the rebate amount provided for LADWP CII customers.

The Save Water Save a Buck Program (now known as the Commercial Water Conservation Program) was launched in 2001 to provide menu-based rebates for water use efficiency measures applicable to many types of CII facilities. Categories of products eligible for rebates, rebate amounts, number of rebates, and estimated savings for the period FY 2015/16 through FY 2019/20 are provided in Exhibit 3G. As a result, an estimated annual savings of 16,939 AFY was achieved, inclusive of LADWP in-house and partnership programs. Rebate amounts provided in Exhibit 3G include the base MWD rebate combined with the additional supplemental amount provided by LADWP.

Exhibit 3G
CII Current Water Use Efficiency Programs and New Savings for FY 2015/16 through 2019/20

Device Type/Program	Rebate Amount	Devices Installed	Estimated Annual Savings (AFY)
SoCal Water$mart Program			
High Efficiency Toilets	Up to $250	24,350	599
Premium High Efficiency Toilets (1.1 gpf or less replacing > 1.6 gpf)	Up to $250	156,965	2,587
Zero and Ultra Low Water Urinals (upgrade from > 1.5 gpf with 0 gpf or 0.125 gpf)	$500 each	1,694	208
Cooling Tower Ph/Conductivity Controller	$3000 each	38	74
Cooling Tower Conductivity Controller	$625 each	1	0.6
Air Cooled Ice Machine (Must be Tier III)	$1,000 each	33	5
Connectionless Food Steamer	$600 compartment	160	40
Dry Vacuum Pump (maximum 2.0 horsepower)	$125 per 0.5 horsepower	2	0.2
Weather Based Irrigation Controller/Central Computer irrigation Controller	$50 per station	6,807	95
Soil Moisture Sensor System	$50 per irrigation controller station	0	0
Large Rotary Nozzle (8 head minimum)	$13 per head	19,846	87

Device Type/Program	Rebate Amount	Devices Installed	Estimated Annual Savings (AFY)
Rotating Sprinkler Nozzles for Irrigation (30 nozzle minimum)	$6 each	13,904	37
Turf Replacement Program	$3 per square foot for 250 SF to 50,000 SF; $1.00 per square foot for 50,001 SF to 7 acre maximum.	1,925,193	260
In-stem Flow Regulator (25 device minimum)	$2 per device	10,597	32
Plumbing Flow Control Valve (20 device minimum)	$5 per device	5,806	49
Laminar Flow Restrictor (20 device minimum)	$10 per restrictor	3,766	89
		SoCal Water$mart Programs Subtotal	**4,163**
LADWP Managed Programs			
CII Landscape Program (Turf Removal)	$2 per square foot	1,667,241	225
Commercial Showerheads	Free of charge for LADWP Customers	14,632	237
Commercial Faucet Aerators	Free of charge for LADWP Customers	17,918	81
Technical Assistance Program	$1.75 per 1,000 gal saved over 2 yrs. -OR- Up to $250,000 for water saving Products	953	744
LADWP Facility Retrofits (Turf & Fixtures)	-	108,930	23
Recreation and Parks Department Irrigation Efficiency Program	-	265,828	389
Commercial Direct Install Program (CDI) (toilet, showerhead, aerator, nozzle)	-	12,186	176
Multi-Family Direct Thermal Savings Program (MFDT - SoCal Gas Co. Partnership) (Showerheads & Aerators)	-	128,706	1,011
Energy Savings Assistance Program (ESAP - SoCal Gas Co. Partnership) (Aerators, showerheads, shower valve, tub spout, shower adapter, shower diverter valve)	-	57,503	396
Conservation Kit Distribution – Showerheads	Free of charge for LADWP Customers	447,092	7,362
Conservation Kit Distribution – Faucet Aerators	Free of charge for LADWP Customers	841,195	2,356
		LADWP Managed Programs Subtotal	**13,000**
		Total CII Savings	**17,163**

Since September of 2009 LADWP has offered a turf removal program specifically for commercial properties. The current rebate, in partnership with MWD, is $3.00 per SF (250 SF to 50,000 SF) and $1.00 per SF (for 50,001 SF to 7 acres); for projects that do not qualify for the MWD regional program, LADWP provides rebates of $2.00 per SF. Between FY 2015/16 and 2019/20 approximately 3.59 million SF of turf was removed which has saved approximately 485 AFY.

Water-saving showerheads, faucet aerators, and pre-rinse spray nozzles are available to LADWP CII customers free of charge upon request. Bathroom faucet aerators (1.0, or 0.5 gpm), 1.3 gpm kitchen faucet aerators, and 1.5 gpm showerheads are provided free of charge. Approximately 461,724 showerheads, and 859,113 faucet aerators were distributed between FY 2015/16 and 2019/20 saving approximately 10,036 AFY.

LADWP implements various programs in-house and through partnerships in order to cost-effectively conserve water. The following are programs directed towards CII customers, as well as multifamily residences of five units or more:

- Recreation and Parks Department MOU – This MOU is a partnership program targeted to conserve water in public recreational and parks areas through retrofit of common water fixtures and conversion of landscapes to either use recycled water for irrigation or to replace turf with California Friendly plants.

- Los Angeles Unified School District MOU – Through this MOU, the program provides direct installation and incentives for energy and water efficient fixtures, education and awareness, and pilot of new technologies. Incentives are provided for installation of water efficient fixtures including showerheads, faucet aerators, toilets, and urinals.

- Commercial Direct Install (CDI) Program – The CDI program simplifies the process of installing efficient water and energy fixtures for qualifying commercial businesses operations. Through this program, trained Energy Service Representatives (ESRs) conduct free energy and water use assessments for business customers and recommend appropriate equipment installations. With the customer's consent, ESR's install the recommended equipment at a time convenient for the customer. Water use efficiency upgrades include pre-rinse spray nozzles, showerheads, faucet aerators, and toilets.

- Energy Smart/Multi-Family Direct Therms (MFDT) Program - This direct install program is in partnership with the Southern California Gas Company and targets multi-family customers who benefit through the installation of efficient fixtures and appliances to reduce water and gas use. LADWP's Water Conservation Program provides funding for water efficient devices such as showerheads and faucet aerators. More recently in 2020, premium high efficiency toilets were added.

- Energy Savings Assistance Program (ESAP) – This direct install program is a California utility program targeted for low income households. LADWP partnered with Southern California Gas Company to administer the installation of water efficient fixtures including showerheads and faucets.

- Technical Assistance Program (TAP) – Established in 1992, the program was created to provide customized incentives for retrofitting water-intensive equipment in the CII or multi-family customer sector. TAP encourages site-specific projects, and the incentives are based on a given project's water savings. Financial incentives of up to $250,000 are available for projects demonstrating water savings. Incentive rebate payments are calculated at the rate of $1.75 per 1,000 gallons saved over a two-year period with a cap not to exceed the actual cost of the installed product. Projects must save a minimum of 150,000 gallons over a two-year period and operate for a minimum of five years. The TAP program promotes innovative solutions to saving water. Some of the past innovative solutions include cooling tower controller upgrades, x-ray processor recirculation systems, and groundwater recycling systems. A few examples of Innovative TAP programs are described in the following case studies:

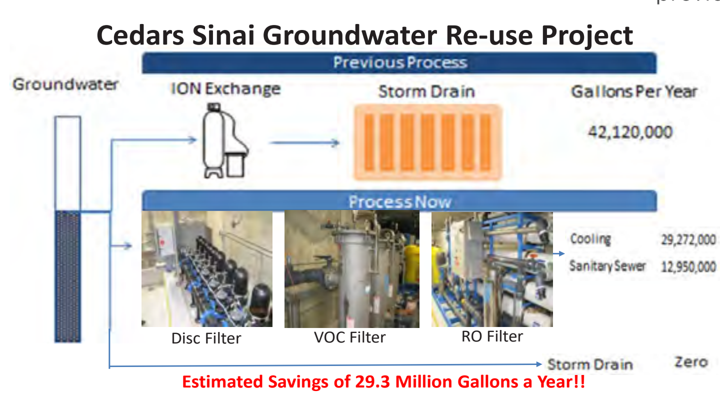
Case Study:
Cedars Sinai Water Reuse Project

Background
LADWP is developing innovative ways to conserve water and utilize local water sources to reduce dependence on imported water. Groundwater is a promising local water source that is produced through aquifer dewatering operations. The Cedars Sinai Medical Campus (Cedars Sinai) in West Hollywood implemented a novel groundwater treatment system to utilize local groundwater, which dramatically reduced the hospital's potable water demand and corresponding water bill.

Project Summary
Cedars Sinai is situated above an active groundwater aquifer, which requires that water be periodically pumped and diverted from the base of the building to maintain the structural stability of the hospital. Before the installation of the new groundwater treatment system, Cedars Sinai pumped and treated the groundwater to adhere to local and federal discharge limits before releasing it to the storm drain, as required by their industrial waste permit. Roughly 42 million gallons of groundwater was treated and discharged each year, which accumulated costly storm drain discharge and permitting fees.

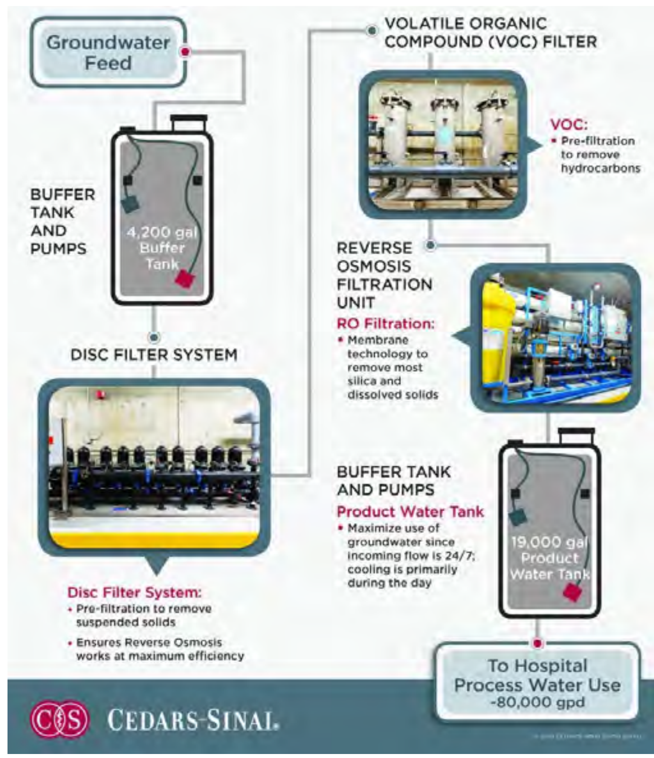
Project Implementation
Recognizing an opportunity to utilize the discharged groundwater, Cedars Sinai partnered with Rethink H2O (an outside contractor) to install a groundwater treatment system to treat the groundwater for use in the building's air conditioning cooling towers. A five-step treatment process prepares the pumped water for use in the hospital's cooling towers. A pumping system then delivers the treated water to the cooling towers, which provide cooling for the building's air conditioning system.

LADWP provided funding for the project through its Technical Assistance Program (TAP) at an amount of $155,355, which helped to offset the total project cost of $1.2 million dollars. The project has a short return on investment of less than 5 years due to annual water bill savings, LADWP's TAP rebate, and additional funding of $168,000 provided through the Metropolitan Water District's Water Savings Incentive Program.



Before and After Treatment Process Diagram Showing Re-Purposing of Dewatered Groundwater

Benefits
As shown in the figure below, this groundwater treatment system has resulted in dramatic water savings for Cedars Sinai. The treated groundwater now provides 50-80 percent of the water used in the building's cooling towers, saving an estimated 80 thousand gallons per day or 29.3 million gallons (90 acre-feet) of LADWP-supplied potable drinking water every year. This is equivalent to the amount of water used by 360 single-family homes in one day. This project also reduces Cedar Sinai's average annual water bill by $263,000.



Detailed Groundwater Treatment Process Diagram

This case study serves as a successful example of a business investing in water efficiency and utilizing a previously overlooked water resource. Cedars Sinai, with the assistance of LADWP's TAP program and MWD's Water Savings Incentive Program, greatly improved their water efficiency, and also reduced the amount of water discharged into the storm drain. Incentivizing water use synergies in commercial applications is a clear winner in promoting water use efficiency. LADWP hopes to continue encouraging the optimized use of local water resources in Los Angeles through TAP and other rebate programs, and expects to partner with more customers on similar projects. By implementing more projects like this, LADWP will grow less dependent on imported water, which ensures a resilient water future for Los Angeles.

Case Study: Water Conservation - City Hall East Uses New Technology to Achieve Water Savings

LADWP incentivizes the utilization of advanced technology to create water conservation savings in Los Angeles. With help from TAP funding, the City of Los Angeles implemented a new and advanced water treatment technology in the cooling towers of one of its main buildings, City Hall East. This bold step on behalf of the City, dramatically reduced the amount of water used by City Hall East and created a precedent for future cooling tower retrofits of public buildings.

Background

City Hall East is an 18-story building housing approximately 530,000 square feet of City administrative office space. Four large cooling towers reside on the roof of the building: two 500-ton towers and two 800-ton towers (pictured below)

View of City Hall East

Each cooling tower has two fans and two water retention basins that work together to achieve the necessary evaporative cooling for the building's air conditioning system. This evaporative mechanism consumes vast amounts of water and also concentrates naturally occurring minerals and substances in the cooling tower basin water. This basin water was previously managed through the addition of acids, chemical dispersants, scaling inhibitors, and biocides to prolong the usability of the water and prevent equipment damage. These traditional chemical methods proved to be expensive, inefficient, and caused a buildup of minerals (scaling) in the appliances.

Project Summary

The General Services Department (GSD) utilized LADWP TAP funding to replace the original water treatment regimen with a state-of-the-art water treatment mechanism created by the company Dynamic Water Technologies and Universal Environmental Technologies (DWT-UET). The DWT-UET system operates externally to the cooling tower basin by pumping the cooling tower water though a reactor which treats the water using an automated process.

This automated process treats the basin water through electrolysis, whereby electricity is used to augment the chemical make-up of the water. This process lowers the pH, accelerates the precipitation/removal of scalants within the reactor, and reacts with chloride to produce chlorine, a natural biocide. The reactor also dynamically manages the pH of the water to avoid potential corrosion. This technology drastically reduced water use, minimized water released into the sewer, and completely eliminated the use of harsh and dangerous chemicals in the process.

Benefits

In an effort to advance sustainable technology, the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) conducted an independent review on the installation of the DWT-UET system. The resulting study analyzed the benefits brought about by the installation of the system when compared to the traditional water treatment regimen.

The system saves approximately 1.16 million gallons of water a year, which is a 20% reduction in water use. The reduction in blowdown water (water released to the sewer) is equal to the amount of water saved, which is approximately 1 million gallons per year. The annual monetary savings due to reduced system maintenance, decreased water purchases, and lowered sewer service costs amount to approximately $34,105 per year with a total cost of $188,674 (including TAP funding), the system's simple payback period is approximately 5.5 years.

Water Treatment Reactor

The system also precisely maintains conditions in the cooling tower water to prevent scaling and corrosion. Furthermore, during the first two months of operation, the system removed 507 pounds of scale from the cooling tower piping, which will improve the operational efficiency and extend the life of the equipment. Implementing this water saving technology successfully helped the customer save money and helped the City save water. LADWP will continue to provide incentives for this technology and other water-saving technologies throughout its service territory.

Recognizing that a substantial amount of water is used outdoors for irrigation, LADWP offers a variety of resources to assist customers interested in transforming traditional, high water using landscape to water-efficient sustainable landscaping. LADWP is committed to providing educational opportunities to promote water efficient landscape transformations. Customers are encouraged to attend workshops that explain the benefits of installing low water use California Friendly plants, efficient irrigation systems, mulch, and water capture features.

Residents are encouraged to register for LADWP's California Friendly Landscape Training classes. The classes offer fundamental information about the benefits of using California Friendly plants and outdoor best management practices that result in lower water usage. Participants learn about soil composition, site design, plant selection and efficient irrigation. Customers that are interested in implementing a landscape transformation can also attend a class on turf removal or garden design. Additionally, LADWP customers are eligible to participate in Hands on Workshops (HOW), located in the front yard of a residential home where they can apply principles learned in the classroom training. HOW attendees participate in an actual landscape transformation and learn about turf removal techniques, rain barrel installation, rain water capture, healthy soil construction and efficient irrigation. In addition, a copy of the curriculum is available online for all customers.

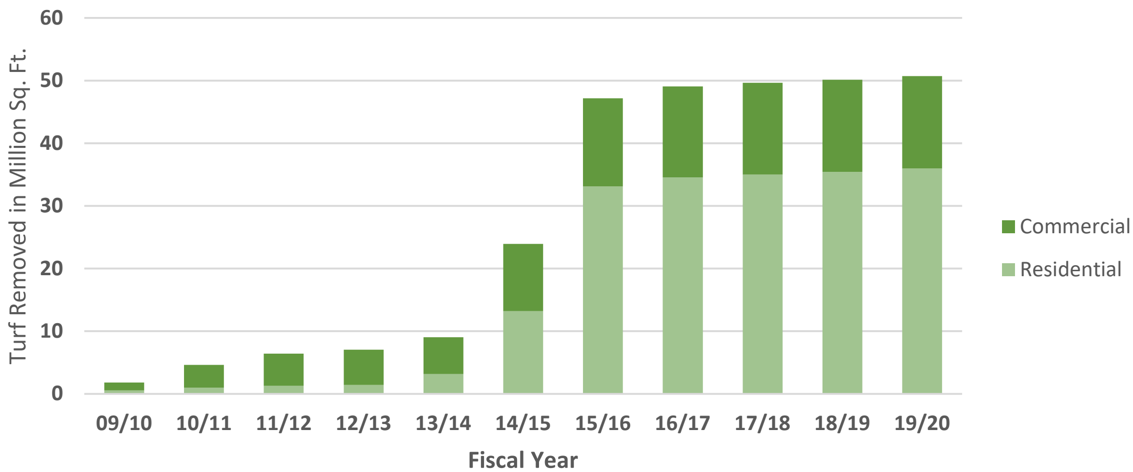
In Fall 2014, LADWP created its dedicated California Friendly Landscaping Website (www.ladwp.cafriendlylandscaping.com) to provide resources to residents interested in replacing turf with California Friendly Landscaping. The California Friendly Landscape website is an interactive tool that allows customers to take virtual tours of California Friendly gardens, search for climate appropriate plants, and create shopping lists of plants for easy reference when visiting nurseries. Customers can also access planting templates created for the City's regional climates. The templates can be used by the homeowner or provided to a contractor for installation of a California Friendly landscape.

Leading by example, LADWP has implemented a program to retrofit outdoor landscaping at LADWP's own facilities to California Friendly and native plantings with efficient irrigation systems. Over 1,821,063 square feet of retrofitted or newly constructed California Friendly landscaping has been installed at LADWP facilities. To demonstrate the beauty and appeal of a water efficient landscaping, LADWP's John Ferraro Building's California Friendly Garden was redesigned to showcase a variety of plants used primarily in Mediterranean and Southwestern landscape designs. The newly designed garden includes educational signage explaining the benefits of introducing California Friendly plants and displays smartphone scannable QR (quick response) codes which conveniently display specific plant information on a mobile device.

Public engagement is an important component in advancing the water efficient landscaping paradigm. Partnerships with non-profits and organizations afford LADWP the opportunity to reach large numbers of customers. LADWP staff attend community events to disseminate information about resources available to help customers to reduce their outdoor water use. Notable events that LADWP has attended include the Los Angeles Auto Show, Theodore Payne Native Garden Tour, Natural History Museum's Nature Fest, and Summer Nights in the Garden series.

Turf removal has grown tremendously over the last few years thanks to LADWP's generous turf replacement rebates, and its extensive outreach and education on California Friendly sustainable landscaping. Between FY 2009/10 through FY 2019/20, LADWP and its customers have removed over 50.7 million SF of turf as shown in Exhibit 3H. As mentioned before, LADWP successfully surpassed the State's goal of 50 million SF of turf removal for the State of California, just by LADWP customer's actions alone. The City Park Irrigation Efficiency Program, a joint effort between the Department of Recreation and Parks and LADWP, seeks to improve the irrigation efficiency of public parks. Through this program, City parks with inefficient irrigation systems, leaks, and runoff problems are identified and upgraded with water efficient distribution systems, sprinkler heads, smart irrigation controllers, and California Friendly landscaping. In many cases, parks are upgraded to use recycled water to avoid the use of potable water for irrigation. Since the program began in 2007, 25 park upgrades have been completed. Additionally, this program functions as an educational venue providing trade training and employment opportunities for the youth of the City.

Exhibit 3H
Cumulative Residential and Commercial Square Feet of Turf Removed by Fiscal Year



Sustainable Landscaping

LADWP recognizes that, in addition to furthering water-efficient landscaping, it needs to focus on a more sustainable, "Watershed Approach". The Watershed Approach is a holistic and integrated approach for landscape sustainability that transcends water-use efficiency to address a variety of related benefits including abatement of dry-season runoff, onsite retention of stormwater, embedded energy savings, reduced green waste generation, reduced greenhouse gas emissions, reduced pesticide application, and enhanced wildlife habitat in urban settings. The Watershed Approach is meant to be a system-wide upgrade to the urban landscape environment.

In efforts to promote sustainable landscaping, LADWP has worked closely with non-profit organizations to offer a variety of outreach and educational opportunities. LADWP also partnered with a non-profit organization to offer professional training on managing sustainable landscapes to sole proprietor gardeners. By adopting the Watershed Approach, LADWP will not only work towards its water savings goal, but it will also promote a balance between water conservation and efficiency, watershed protection, environmental stewardship, economic prosperity, and quality of life.

Water Loss Control

Water loss control consists of the management and reduction of non-revenue water, apparent losses, and real losses. Apparent losses are non-physical losses that occur due to customer meter inaccuracies, data handling errors, and water theft. Real losses are physical water losses such as leaks, breaks, and overflows. Real losses can be further characterized as reported leaks (leaks that are reported and repaired), unreported leaks (leaks that are uncovered through proactive leak detection), and background leaks (volume lost through continuously running seeps and drips).

Maintaining water system infrastructure reduces water waste and allows for greater accountability. Infrastructure maintenance is a high priority for LADWP. LADWP maintains a 24 hour, seven days per week leak response operation and immediately repairs major blowouts that impact public safety. Since 2013, LADWP has accomplished significant reductions in its average mainline leak repair time by 71 percent and its average service leak repair time by 62 percent. Ongoing programs such as pipeline replacement, meter replacement, pressure management, and leak detection preserve the operational integrity of LADWP water facilities and reduce water losses.

In 2013, LADWP completed a Water Loss Audit and Component Analysis study that included a full-scale assessment of LADWP's databases and tracking efforts, as well as a pilot project that performed leak detection and analyzed pressure and leakage in three service zones within the distribution system. As part of the study, a water loss audit was performed using American Water Works Association (AWWA) water audit software and provided a full accounting of the water balance of LADWP's system. Furthermore, a component analysis was conducted to breakdown system leakage into reported, unreported, and background leaks. The goal of the study was to determine economic optimum level of water losses, and identify, prioritize, and recommend efficient and cost-effective intervention strategies to minimize real and apparent water losses.

Upon the completion of the Water Loss Audit and Component Analysis study, LADWP established a Water Loss Task Force in 2014, consisting of over 100 LADWP staff to work on addressing the recommendations from the previous study. The resulting Water Loss Task Force Action Plan (Action Plan) serves as a strategic guide that will coincide with LADWP's ongoing pipe replacement plan to maintain infrastructure reliability. The Action Plan addresses meter inaccuracies, database management, equipment testing, leak detection and prevention, and improved tracking of water balance volumes. The Action Plan includes an assessment of feasibility, cost-effectiveness, and other benefits associated with implementation of the recommendations from the previous Water Loss Audit and Component Analysis study. In addition, the recommendations improve LADWP's Water System efficiency and assist in meeting California SB 555 requirements. This bill requires urban retail water suppliers to submit validated water loss audits annually to DWR and requires the State Water Resources Control Board to develop water loss performance standards by July 1, 2020.

As part of LADWP's Water Infrastructure Plan, LADWP has exponentially ramped up its mainline replacement cycle to reach its goal of a 100-year pipe replacement cycle by 2023. Additionally, the LADWP Water System's Asset Management Group, along with the Water Distribution Division, has developed a predictive model to determine mainline replacement priority by evaluating factors that contribute to water main deterioration. The results of this model and

Mainline Replacement on Valley Oak Drive

LADWP's asset management likelihood and risk of failure methodology can be used to focus replacement resources on pipe segments that are more likely to fail and disrupt services.

LADWP has also made significant progress in replacing and/or retrofitting water meters through its meter replacement program that started in 1988. As a result of extended flow or usage, the moving parts in a water meter can wear down and begin to under-register the actual water consumption. The meter replacement program has been valuable in ensuring the accuracy of the approximately 725,000 meters within the City. Large-sized meters (3-in and larger) in the system are replaced by prioritizing meters with the highest consumption to maintain high accuracy and reduce apparent water losses. In addition, LADWP conducts an annual representative bench testing of over 1,000 small meters (2-in and smaller). The results of the study are utilized to develop the replacement program of approximately 30,000 small meters annually, targeting the poorest performing meters.

To reduce real losses attributed to background leakage, LADWP is working to improve pressure management. We have installed over 100 pressure monitoring devices targeting the leakiest zones and are in the process of implementing system wide pressure monitoring. The pressure recorders have the capability of collecting 256 samples per second. This pressure management tool will be utilized to develop an advanced hydrologic model to assist in determining optimal operating pressures in each pressure zone. Lastly, pressure management will help eliminate surges in pressure that have the potential to cause leaks or ruptures in our distribution system. This will extend infrastructure lifespan and reduce real losses.

In addition, in 2017 we implemented a real-time leak reporting system to assist field crews during leak repair events. This application is integrated into our GIS system and automatically identifies valve shut off locations required to isolate the leak and customers that are affected by the shutdown. The program streamlines leak reporting by allowing repair crews to directly import leak event characteristics through hand-held mobile devices. This program reduces real losses by decreasing the leak repair response time and allows us to share more accurate and up-to-date information with our customers.

Installation of a Pressure Logger

To reduce unreported leakage in the distribution system, LADWP has piloted multiple acoustic leak detection technologies to assist with pinpointing and repairing leaks in our distribution. Our leak detection program is a multi-phased approach assessing the performance of a particular technology before pursuing full-scale implementation. LADWP has installed fixed leak loggers to capture data and is currently recommending improvements to the technology based on preliminary results. In addition, manual leak survey crews are used to locate leaks and make repairs. This program will reduce hidden water losses and improve system reliability.

Pinpointing Leaks Using Acoustic Leak Detection Equipment

As a result of proactive water loss strategies, LADWP has been able to maintain low levels of non-revenue water and water losses. LADWP has a five-year average non-revenue water percentage of 8.4 percent and its five-year average real losses in gallons per connection per day is 35. LADWP's Water Loss Task Force continues to implement water loss strategies as detailed in the Action Plan to maintain low non-revenue and real losses going forward.

Water Conservation Team

LADWP employs dedicated environmental experts, engineers, utility service and marketing specialists to design and manage its array of Water Conservation Programs. Staff stay up to speed on the latest innovations in water efficiency and are expected to maintain an active membership in the California Water Efficiency Partnership (CalWEP). Full-time personnel include effective managers and talented staff experienced in maintaining an effective and dynamic water conservation and water use efficiency program. Outside of LADWP offices, water efficiency solution experts conduct essential field work and engage with customers. LADWP even operates a Water Conservation Response Unit which investigates claims of water waste, educates customers about prohibited water uses, and issues citations for water waste when warranted. LADWP is dedicated to maintaining an effective team to meet the water conservation and water use efficiency challenges facing the City now and in the future.

3.3 LADWP Water Conservation Potential Study

LADWP completed the country's largest and most comprehensive Water Conservation Potential Study (WCPS) in 2017, which provided a better understanding of how historical investment efforts have impacted existing water use efficiency and device saturation levels. LADWP needed to fully understand the remaining water savings potential in each customer sector and water fixture type to adequately plan water conservation programs for the future.

3.3.1 Purpose of Study

The overarching goal of the WCPS was to help LADWP prioritize future water conservation and water use efficiency investments in the City by understanding the remaining potential water savings for its service area. The remaining potential was identified for each customer sector: single family residential, multi-family residential, commercial, industrial, institutional, and governmental. The results from the WCPS helped LADWP develop a targeted strategy to maximize water savings going forward. In addition, the WCPS played an important role in LADWP's management of its water resources to meet both State and City goals.

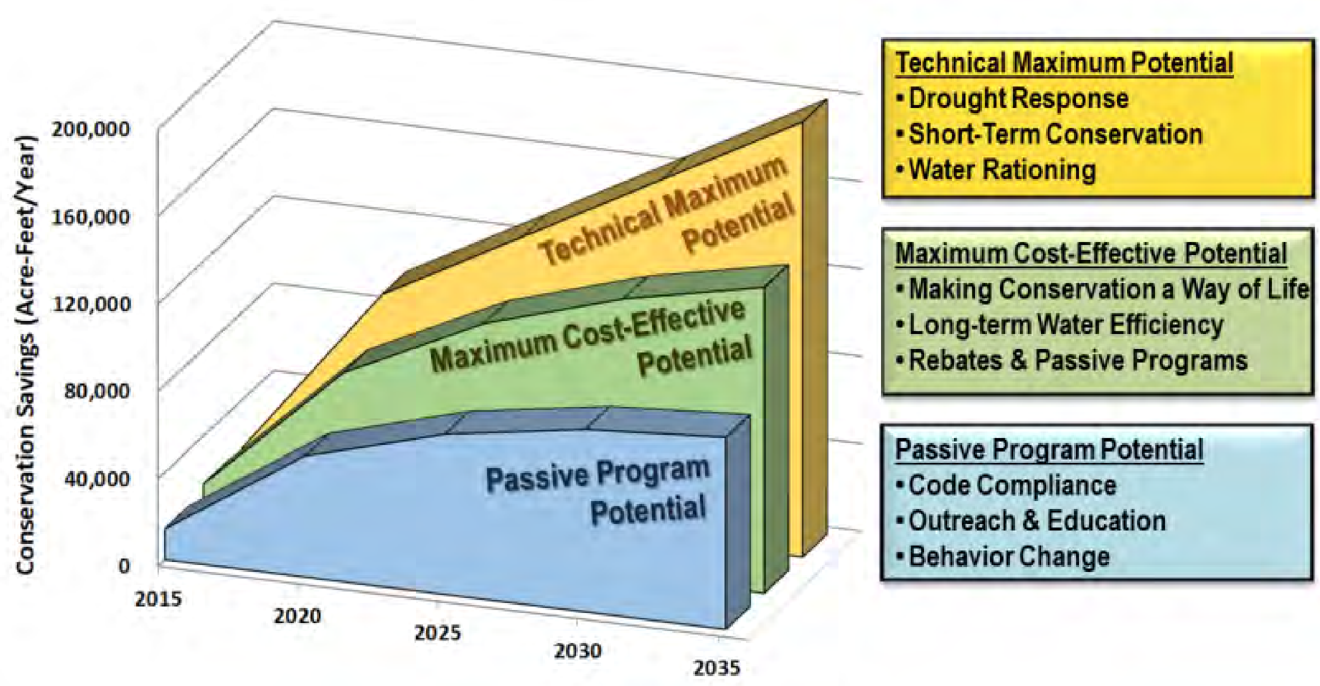
Central to the WCPS was the development of a robust Water Conservation Model (WCM) to project water savings potentials for the City into the future. In determining the WCPS future savings levels, the WCM considers baseline water use, demographic growth projections, and program data for each customer sector: The WCPS analyzes three different types of water saving levels (Exhibit 3I):

1. Technical Maximum Potential: The technical maximum potential represents the water savings that is achieved when all end uses of water are at the most efficient level given the current or emerging technology. The theoretical maximum potential is an estimate of the maximum potential savings, regardless of cost or social acceptability.

2. Maximum Cost-Effective Potential: The maximum cost-effective potential represents the potential which is achievable, cost-effective, and considers customer acceptance. Economic potential savings is determined by applying economic tests to the maximum achievable potential with the goal of developing cost-effective measures when compared to the relative cost of an alternative water supply (in this case, imported water from MWD). This maximum achievable potential that is cost-effective would require increased financial incentives and perhaps implementation of direct install programs for many of LADWP's water use efficiency programs.

3. Passive Program Potential: The passive program potential represents water savings that do not require incentives or significant utility costs to drive water savings. The first step in estimating passive program potential is to estimate the savings in water use that will occur through normal market forces, such as new development, remodeling, compliance with plumbing/building codes, landscape ordinances and behavioral changes. One new behavioral change that attributes to passive program potential is that Angelenos are "Making Water Conservation a Way of Life". They are not going back to their old ways of wasting water and instead, they are naturally conserving water in their daily lives as a result of effective messaging and outreach by LADWP through several unprecedented dry periods in the recent past.

Exhibit 3I
Levels of Conservation Potential



3.3.2 Conservation Potential Summary & Progression

The WCM that was developed as part of the WCPS projected the previously described three water conservation and water use efficiency potentials through FYE 2035, which are displayed in in Exhibit 3J. The results show that LADWP has the maximum cost-effective potential to reach a total water savings of 140,000 AFY by FYE 2035. For the technical maximum potential, the assumed efficiency of all end uses of water occurs on day one. The remaining water savings potentials increase over time based on the level of customer participation, derived by examining 1) historical levels of participation in LADWP's programs; 2) advanced levels of participation assuming increases in direct install programs, and; 3) increased levels of customer participation that would likely be driven by utility rebates that are in excess of current amounts and by State regulatory mandates and additional City ordinances.

In addition to the potentials identified in Exhibit 3J, the WCM has been modified to allow LADWP to input annual participation levels across all the incentive and direct install programs. By doing this, LADWP is able to update the saturation levels and remaining potentials in each sector water end use table, and allows for program adjustments as necessary to further drive potentials where available, and scale back others that have either reached full potential or where market factors have begun to drive participation on their own.

Single – Family Residential Sector

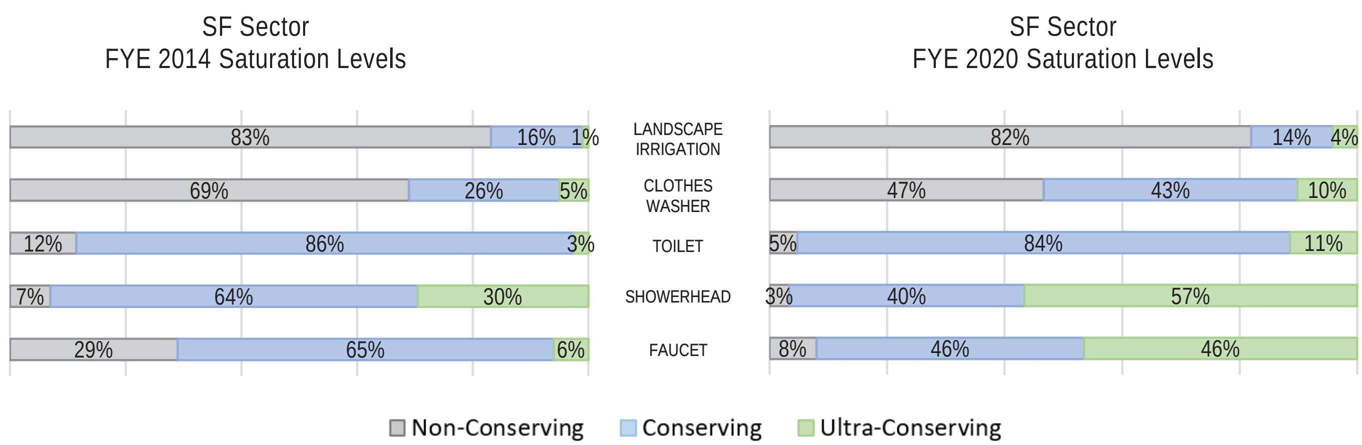
Using data from single-family telephone surveys and onsite verification surveys, the saturation of different efficiency levels was estimated for several end uses of water in FYE 2014 (see Exhibit 3K). The results indicate that despite the fact that over 80 percent of single-family homes in LADWP's service area were built prior to 1992 (before California plumbing code required new homes to have 1.6 gallon per flush toilets), the saturation of conserving toilets is quite high (over 80 percent). This would indicate that toilet rebate programs are reaching a saturation threshold and that natural market forces will drive efficiency for this end use of water. Remaining single-family residential water savings potential still exists in toilets at third highest for water savings potential in this sector per Exhibit 3L.

However, the end uses of water for clothes washers and landscaping have far greater potential for increased water efficiency. The study results showed that less than 35 percent of single-family homes have high-efficiency clothes washers and less than 20 percent of single-family homes have California Friendly landscapes in FYE 2014 per Exhibit 3K. This indicated that rebates that targeted clothes washers and sustainable landscaping would have a significant impact on reducing these end uses of water for the single-family sector going into the future.

Exhibit 3J
Water Conservation Potential Study Results (AFY)

WCPS Water Conservation Potentials	Fiscal Year Ending			
	2020	2025	2030	2035
Technical Maximum Potential	96,000	132,000	168,000	204,000
Maximum Cost-Effective Potential	77,000	107,000	127,000	140,000
Passive Program Potential	55,000	74,000	84,000	88,000

Exhibit 3K
Saturation for End Uses in Single Family Sector for FYE 2014 Compared to FYE 2020

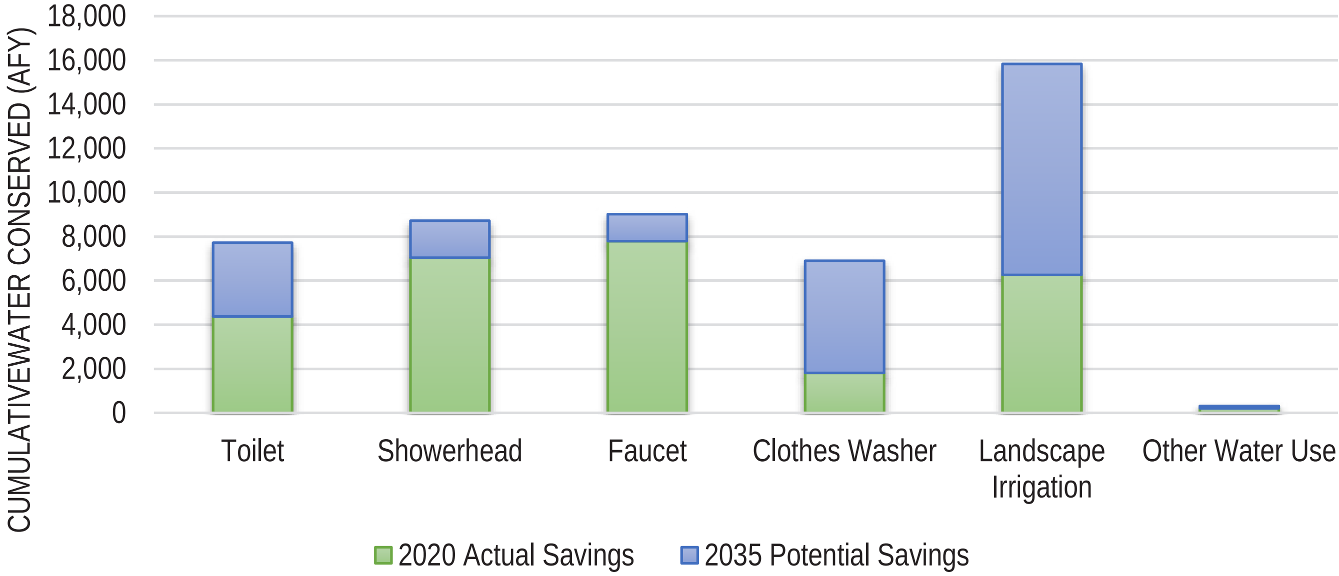


Fast forward to FYE 2020, LADWP is moving closer to achieving saturation for conserving and ultra-conserving devices in the single-family sector. Exhibit 3K illustrates increases in conserving and ultra-conserving fixtures including clothes washers (22 percent increase), toilets (7 percent increase), showerheads (4 percent increase), and faucets (21 percent increase) compared to six years prior in FYE 2014, for a total non-conserving clothes washers saturation levels to 47 percent. This was accomplished by increasing clothes washer rebates from $300 to $400 per unit. Non-conserving saturation levels for showerhead and faucets have also seen a major reduction with only three percent and eight percent remaining, respectively. This is due to sending conservation kits to our SF customers.

The maximum cost-effective potential in the single-family sector indicates there is potential water savings to meet the future water conservation goals.

Exhibit 3L breaks down the maximum cost-effective potentials in the single-family sector in FYE 2035 to give a better picture of which water end uses have the biggest water saving opportunities. According to Exhibit 3L, Landscape irrigation has the largest potential water savings followed by clothes washers and toilets. Achieving the water savings potentials will come from a combination of increased investments in active and passive programs. As discussed later in the future programs section, many efforts are in place to promote landscape irrigation such as the Turf Replacement Design Services as well as continuing educational programs. LADWP will also continue clothes washer and toilet rebate program and will consider increasing incentives as well. However, these projections are based on current opportunity (FYE 2020 conditions) and will rely on participation by customers. Actual participation levels will be updated annually.

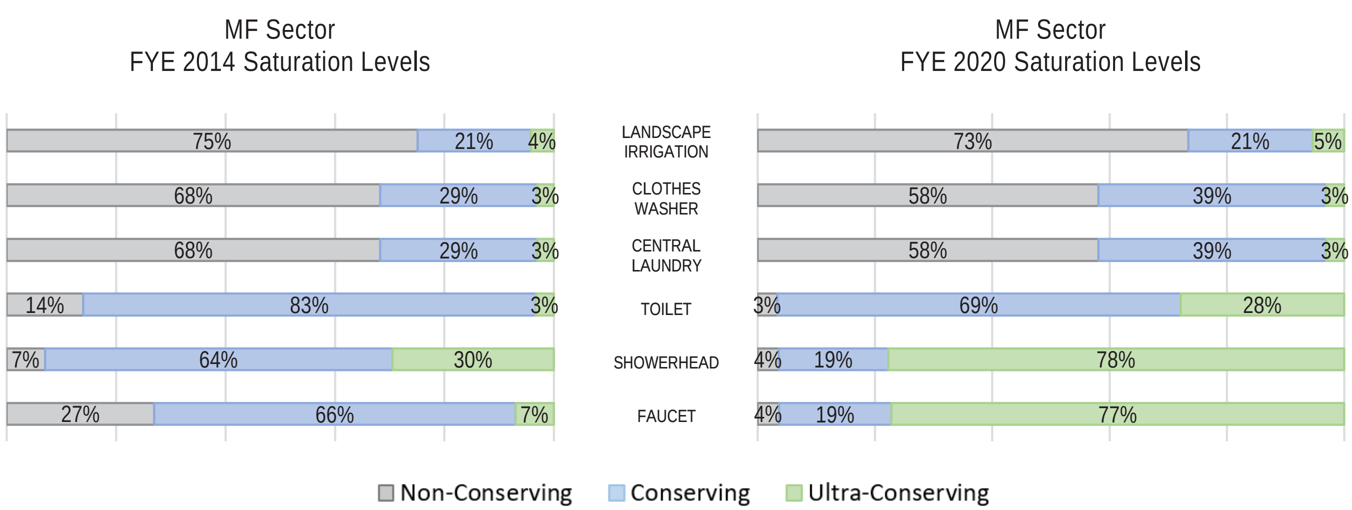
Exhibit 3L
Single-Family Sector FYE 2035 Maximum Conservation Potential



Multi-Family Residential Sector

Using data from the multi-family online survey, saturation of different efficiency levels was estimated for several end uses of water (see Exhibit 3M FYE2014). Similar to the single-family sector, the results indicate that older, non-conserving toilets are saturated in the multi-family sector with little potential remaining. In fact, over 80 percent of multi-family toilets are already at the conserving level, which is in large part thanks to LADWP's high-efficiency toilet rebates and direct install programs it offers to multi-family customers. The study survey results also indicated a remaining water savings potential for the multi-family sector for common area clothes washers and landscape irrigation improvements. The results showed that around 32 percent of multi-family homes have high-efficiency clothes washers and about 25 percent of the multi-family homes have California Friendly landscapes or no landscapes at all.

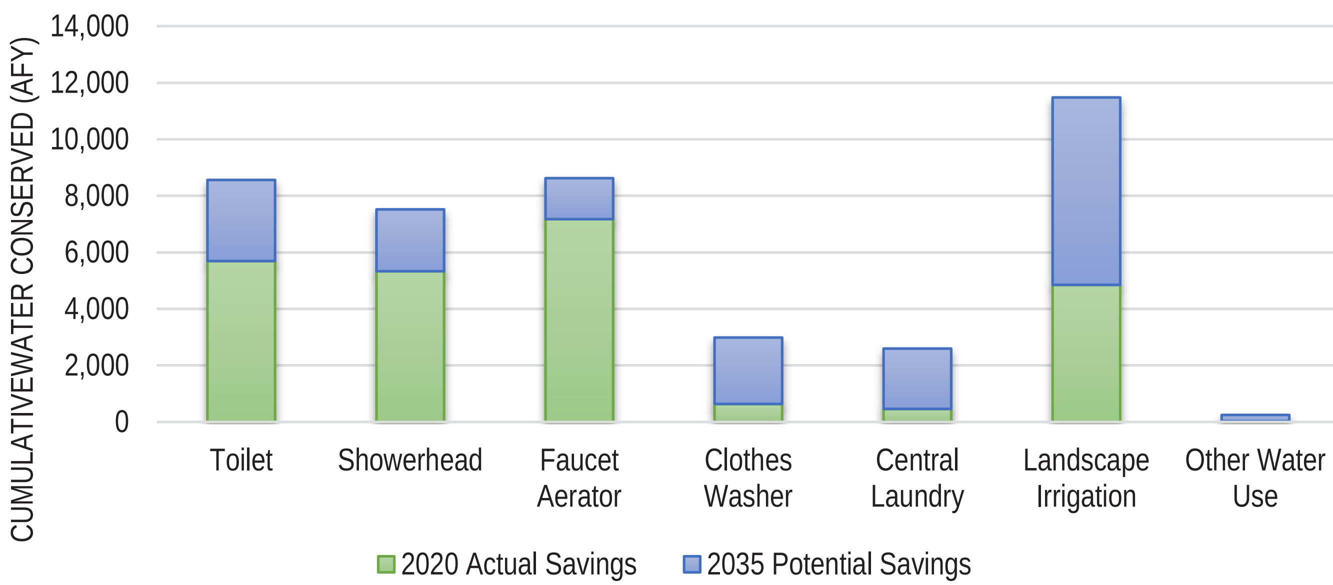
Exhibit 3M
Saturation for End Uses in Multi Family Sector for FYE2014 Compared to FYE2020



As of FYE 2020, from Exhibit 3M, LADWP is also moving closer to achieving higher saturation levels in the multi-family sector. LADWP has achieved almost full saturation in showerheads and faucets with only four percent and four percent non-conserving, respectively. Similar to SF, this was achieved by sending out conservation kits to customers that included free showerheads and faucets. This is a major accomplishment for LADWP, but comes with some uncertainty as the installation of many of those fixtures distributed was not verified. Future efforts are in place to verify the installations via customer surveys. Toilets are also near saturation with only three percent non-conserving remaining. This was due to successful partnerships for direct install programs and the generous incentive that drove the installation of ultra-conserving toilets in multi-family properties by outside vendors. Although, LADWP currently does not have a rebate incentive in place for clothes washers specifically in the MF sector, there was still a 10 percent decrease in non-conserving saturation because of code savings where irreparable clothes washers are replaced with efficient models. Additional efforts to provide a separate incentive for multi-family clothes washers and central laundry machines are currently being developed and evaluated.

The maximum cost-effective potential in the multi-family sector has enough water savings to meet future water conservation goals. Exhibit 3N breaks down the maximum cost-effective potentials in the multi-family sector in FYE 2035 to give a better picture on which water end uses have the largest water saving opportunities. As shown in Exhibit 3N, the highest water savings potential in the multi-family sector is landscape irrigation followed by toilets and clothes washers. Achieving the conservation potentials will come from a combination of increased investments in active and passive programs. LADWP is also looking into future programs to help increase landscape irrigation water savings such as direct installation of efficient irrigation nozzles as well as starting a clothes washer/central laundry facility incentive program. Toilet incentives were recently added to be a part of the MFDT program and will also be added to the ESAP program. However, these projections are also based on current opportunity (FYE 2020 conditions) and will rely on participation by customers. Actual participation levels will be updated annually.

Exhibit 3N
Multi-Family Sector FYE 2035 Maximum Conservation Potential

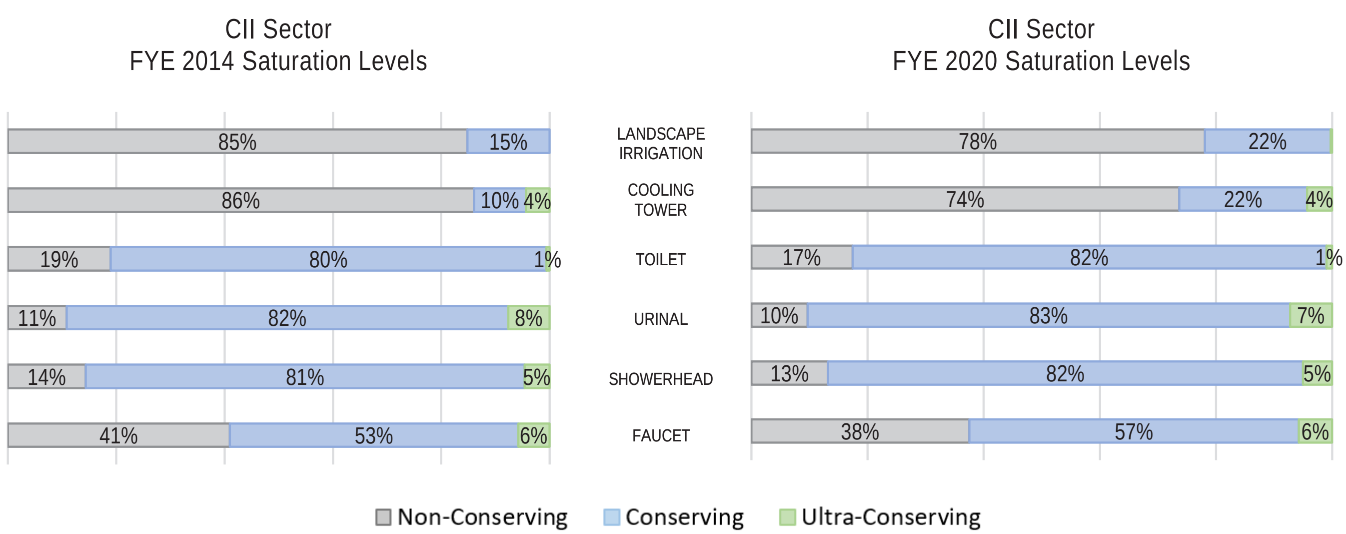


Commercial, Industrial, and Institutional (CII) Sector

Similarly, using data from CII sector rebate participation levels, water use refinements were determined for the commercial sector of the WCM. Saturation of different efficiency levels were estimated for several end uses of water (see Exhibit 3O FYE2014). Similar to the city-owned sector, the WCPS study results indicated that 85 percent of CII landscapes are still non-conserving and consist primarily of turf and is a strong opportunity for removing turf and replacing with California Friendly landscaping.

The cooling tower water end use showed the highest indoor conservation potential for the CII sector. Approximately 86 percent of cooling towers are inefficient (2.5 cycles of concentration (COC)) and also indicate great potential.

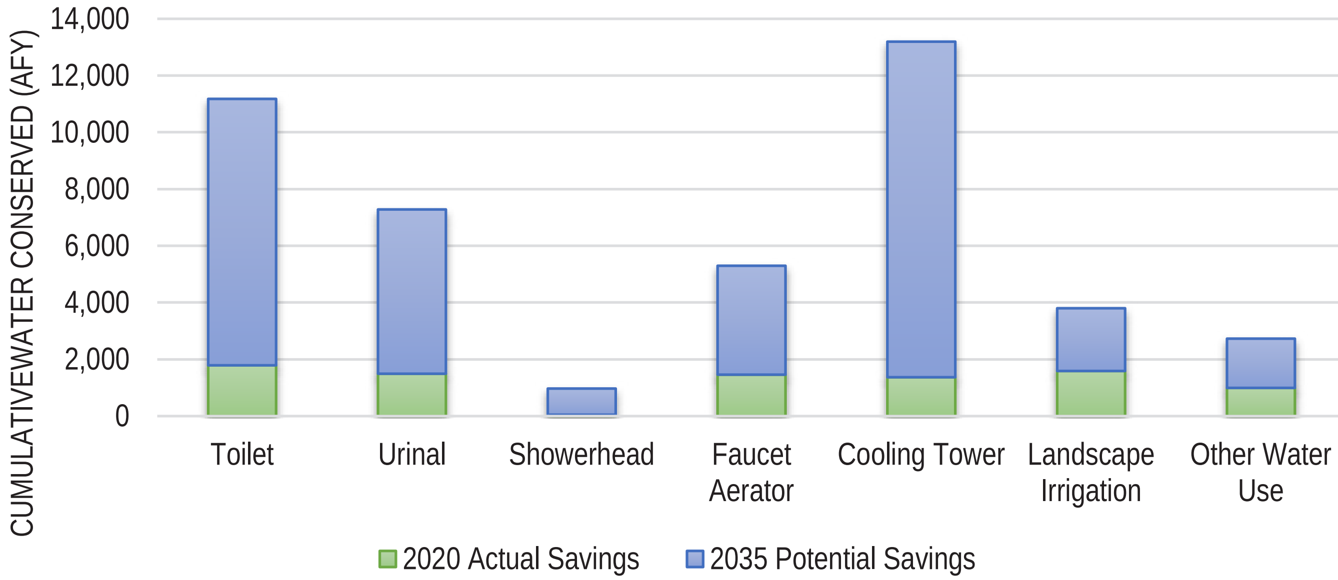
Exhibit 3O
Saturation for End Uses in CII Sector for FYE2014 Compared to FYE2020



As of FYE 2020, as shown in Exhibit 3O, LADWP showed progress in the cooling tower end use, which was identified as having the highest indoor non-conserving saturation level, with a 12 percent reduction of non-conserving presence in CII sector. Efforts are being made to develop a cooling tower inventory to provide cooling tower assessments and ultimately promote cooling tower incentives. Like all the previous sectors, CII lacks progress in landscape conversion. Additional efforts to encourage turf removal are discussed in Section 3.4. Like the multi-family sector, LADWP is exploring a direct install program to replace non-efficient nozzles and other landscape upgrades.

The maximum cost-effective potential in the CII sector indicates potential water savings to meet future water conservation goals. Exhibit 3P breaks down the maximum cost-effective potentials in the CII sector in FYE 2035 to give a better picture on which water end uses have the biggest water saving opportunities. Cooling towers shows the highest water savings potentials followed by toilets and urinals. Achieving the water savings potentials will come from a combination of increased investments in active and passive programs. Future CII programs to help increase water savings are discussed later in Section 3.4. These projections are based on current opportunity (FYE 2020 conditions) and will rely on participation by customers. Actual participation levels will be updated annually.

Exhibit 3P
CII Sector FYE 2035 Maximum Conservation Potential



City-Owned Sector

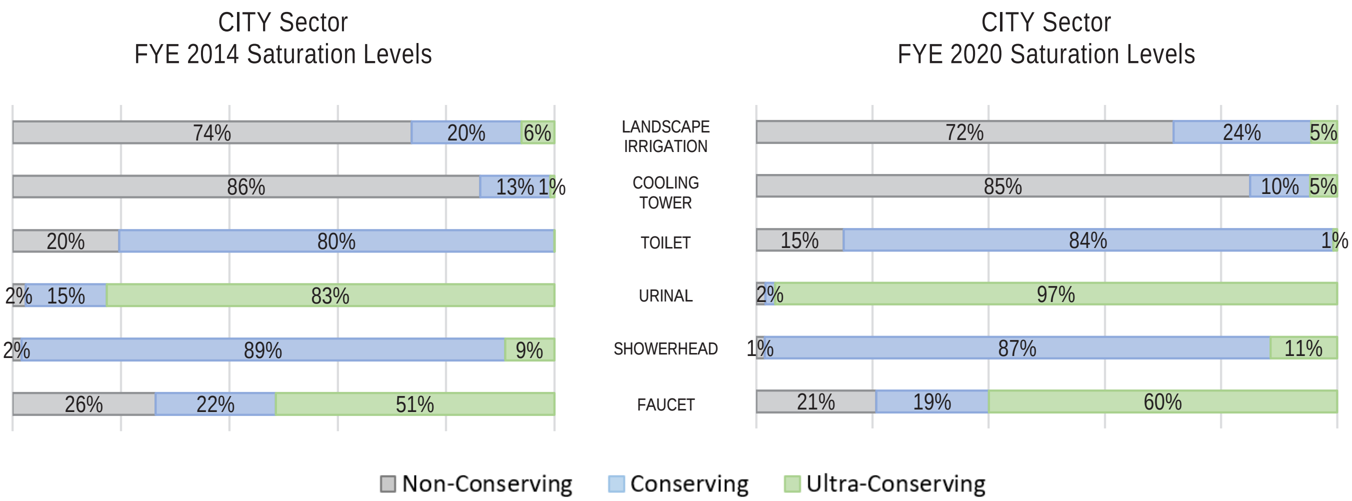
Using data from the City-owned facility water surveys as well as residential and CII sectors, water use refinements were determined for the government sector. During a five-month period, detailed water surveys of 100 City-owned facilities were conducted on-site

Trained water surveyors took measurements of water using devices and fixtures, took note of manufacturing details for cooling towers, measured landscape areas, identified landscape plants and irrigation sprinkler systems, and collected other important information. Results of indoor water using fixtures in City-owned facilities showed that toilets and urinals are over 80 percent saturated with conserving devices (1.6 gallons per flush toilet and 0.5 gallons per flush urinal). The largest remaining potential for indoor water use for City-owned facilities, based on this sample, is cooling towers, pre-rinse spray valves, and ice makers. With this City-owned facility on-site surveys, saturation levels of different efficiency levels were estimated for several end uses of water (see Exhibit 3Q).

With 74 percent of City-owned landscapes consisting primarily of turf, findings indicate a strong opportunity for removing turf and replacing with California Friendly landscaping. The WCPS recognizes that a significant portion of City-owned turf landscapes provide recreational benefits to the public, such as City park and sports field properties, and should be maintained. Nevertheless, significant water savings can be achieved by targeting non-functional/decorative turf areas in parks, medians, and other City-owned facilities.

The cooling tower water end use, like CII sector, also showed the highest indoor conservation potential for the City-owned sector. Approximately 86 percent of cooling towers are inefficient (2.5 COC). For reference, cooling towers in existing buildings are considered fairly water efficient when operating between the range of 4.5 to 6.5 COC (i.e. the number of times that cooling tower water can be recirculated before it needs to be discharged and replaced).

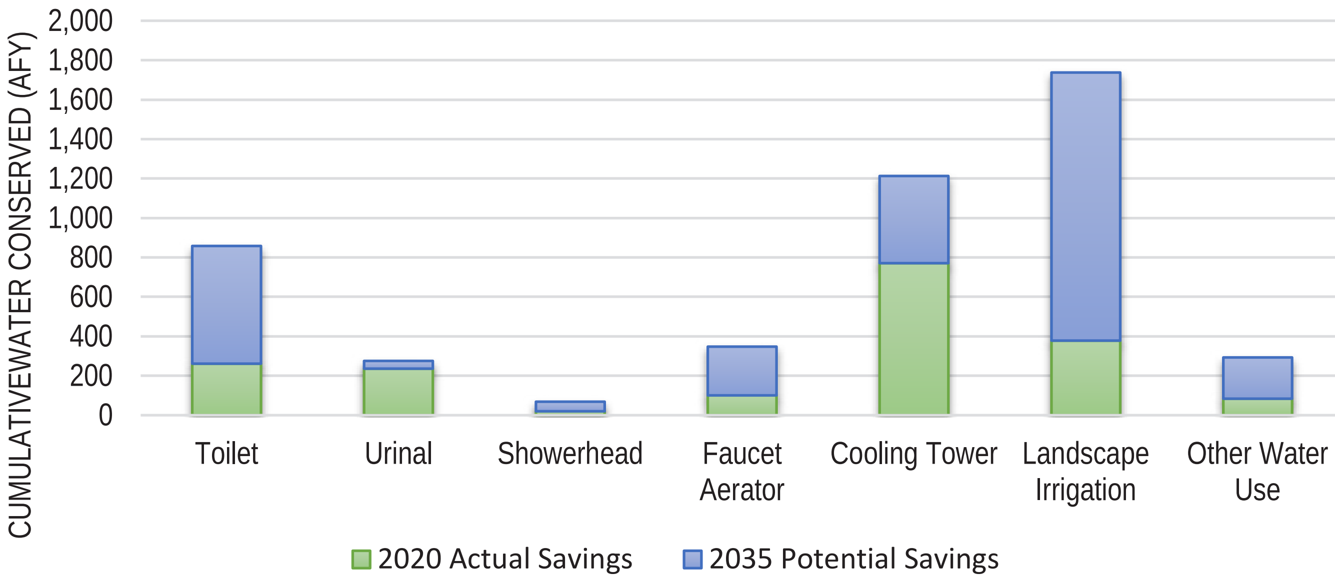
Exhibit 3Q
Saturation for End Uses in City Sector for FYE2014 Compared to FYE2020



Fast forward to FYE2020, from Exhibit 3Q, LADWP has had little progress in cooling towers, which was identified as the least saturated by the WCPS. However, similar to the CII sector, efforts are being made to develop a cooling tower inventory to guide staff to provide cooling tower assessments and ultimately promote cooling tower incentives. This effort is discussed more in detail in Section 3.4. Showerheads and urinals are near full saturation at one percent and two percent non-conserving saturation remaining, respectively.

The maximum cost-effective potential in the City-owned sector indicates enough water savings potentials to meet the future water conservation goals. Exhibit 3R breaks down the maximum cost-effective potential water savings in the city-owned sector in FYE2035 to give a better picture on which water end uses have the biggest water saving opportunities. As shown in Exhibit 3R, the highest water savings potential in the City-owned sector is landscape irrigation followed by toilets and cooling towers. To date, all LADWP facilities have been retrofitted with water efficient fixtures and landscaping. Many other city facilities are still lacking in water efficient fixtures due mostly to lack of funding. However, LADWP applied and was awarded the CalConserve Water Use Efficiency Loan Program for $3M. These zero interest loans will be distributed to interested City entities to assist in their water use efficiency retrofits. More details on the CalConserve Program will be discussed later in the chapter.
These projections are based on current opportunity (FYE2020) and will rely on participation by customers. Actual participation levels will be updated annually.

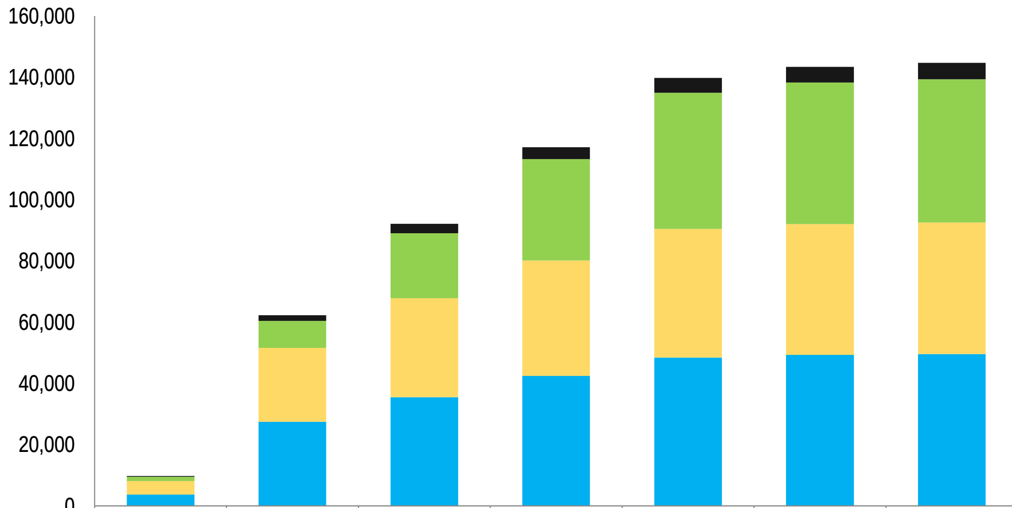
Exhibit 3R
City-Owned Sector FYE 2035 Maximum Conservation Potential



2045 WCM Projected Conservation Savings

The WCM is used to project the estimated water savings achievable with LADWP's Water Conservation Program. With future additional water conservation strategies and projects in mind (discussed in Section 3.4), LADWP is continuing to move forward towards the maximum cost-effective potential water savings through FYE 2045. Exhibit 3S presents the Current Program Scenario's water conservation potentials for each customer sector through FYE 2045. As mentioned before, these projections are largely based on customer participation and may change throughout the years. Potentials will be reassessed annually as actual FY data becomes available. As can be seen in Exhibit 3S, the effects of demand hardening are seen in the future projections beyond FYE 2035, given the lack of additional potential that remains in LADWP service territory.

Exhibit 3S
Current Program Scenario Conservation Savings to FYE 2045



	2015	2020	2025	2030	2035	2040	2045
City	268	1,850	3,068	3,941	4,793	5,101	5,372
CII	1,395	8,743	21,208	33,069	44,455	46,228	46,813
MF	4,392	24,167	32,318	37,732	42,006	42,651	42,927
SF	3,762	27,482	35,539	42,433	48,501	49,371	49,639

3.4 Future Programs, Practices, and Technology

The WCM is now used as a planning tool to help LADWP plan its future water conservation programs, focusing on obtaining additional active and passive water savings in the water end uses that have the most non-conserving devices still remaining for each of the customer sectors.

Single-Family Residential Future Programs

Home Water Use Reports

In December 2014, LADWP initiated its Home Water Use Report Pilot Program (Pilot). LADWP conducted this multi-year pilot to test the effectiveness of a customer engagement program that used data analytics and behavioral science to deliver customized consumption information, messaging, and water saving recommendations in the form of Home Water Use Reports to single family residential customers. Recipients could also access an online customer portal to view detailed information about their usage and recommendations for improving water use efficiency. Using data analytics and algorithms, customers are provided feedback on how their water use compares to other customers with similar property and household characteristics.

The program has resulted in roughly 4.2 percent average water savings among the 73,000 single family residential customers receiving the Home Water Use Reports. This resulted in associated savings of over 2.3 billion gallons of water since the inception of the program. Based on positive feedback from customers and the resulting water savings, LADWP intends to expand the Home Water Use Reports to all single-family residential customers in the coming years, which will increase the total number of recipients to just under 500,000 accounts.

Leak Detection Monitoring Devices

LADWP is working with MWD to provide an incentive for customers to install leak detection/flow monitoring devices. LADWP will utilize this new technology to help reduce water waste by incentivizing customer-side products that help track and manage customer water use on a real time basis. Notifications can be delivered to customers in the event of a leak being detected so customers can respond to and address the issue immediately. Customers will have access to the water usage data 24/7 via a mobile app or online to help encourage water use reduction, and LADWP will be provided a utility portal to assist in advising customers on water use efficiency practices. LADWP will also be able to advertise rebate programs and educational programs on the interface. Some products being evaluated even offer customers the ability to instantly shut off water directly from their phone in the event of catastrophic leaks when away from their homes.

Turf Replacement Design Services

Customers have indicated that "lack of design knowledge" is a barrier to removing their turf and installing a sustainable landscape. LADWP launched a program in 2021 that provides free landscape designs to single-family residential customers. These landscape designs will be developed with input from the customer and will be compliant with the turf replacement rebate terms and conditions. Upon completion of the landscape design, the homeowner will receive a digital and hard copy that showcases the latest in sustainable watershed design features and California Friendly Landscaping. The customer can then submit this design along with their application for a turf replacement rebate. These designs will not only take into consideration the customers' plant and water capture feature preferences, but will also accommodate a customer's planned budget for their project to try and fit the scope within that targeted budget amount.

Multi-Family Residential Future Programs

Direct Install Partnership Expansions

As discussed above, LADWP plans to continue its partnerships with other utilities to take advantage of direct install programs already underway in the multi-family sector. LADWP recently added premium high efficiency toilets to the MFDT program with So Cal Gas Company, and is planning to add the same to the Energy Savings Assistance Program (ESAP) to help reach those remaining non-conserving toilets and also convert some conserving toilets to ultra-conserving models.

Common Area High Efficiency Clothes Washer Incentives

LADWP is working with MWD on a potential incentive for common area high efficiency clothes washer installation/use. Many multifamily housing units have these laundry rooms in their buildings but may still be using older machines that are using more water than is necessary. Identifying a methodology to incentivize these types of installations is challenging because the use profile varies amongst different building types, and many larger residences may lease equipment from companies that service those machines and provide a turn-key solution. LADWP is working to modify the TAP incentive to allow for leasing companies of this type to receive some incentive for changing out their machines with high efficiency models.

CII/City-Owned Future Programs

Cooling Tower/Water Fixture Inventory

LADWP is planning to develop an inventory of cooling towers and commercial water fixtures within the service territory. Surveys will be sent and to identify interested customers in a cooling tower and property assessment. After the assessment, LADWP will be able to provide customized and direct marketing for efficiency upgrades to those customers with inefficient cooling tower systems and fixtures to help identify the benefits and return on investment in upgrading their water use efficiency.

Technical Assistance Program

LADWP is developing a more streamlined approach for TAP incentives and is also working to increase the incentive amount for customized projects. The proposed new incentive approach will be based on standardized water savings performance measures and will be paid every 6 months with an increased incentive of $2.50 per 1,000 gallons saved over a one or two-year period providing a faster payment term and higher incentive amount that will further encourage customer participation. Additional increases to the $250,000 incentive limit are also being explored to improve the return on investment for larger, more complicated projects.

CalConserve Loan Program

LADWP is working to begin administering zero interest loans to City Departments alongside various incentive programs to fund efficiency improvements at City facilities. Loans will be funded via the Prop 1 CA Water Use Efficiency Revolving Fund Loan Program and through LADWP's existing incentive programs. Based on the results from the program effectiveness with other City Departments, LADWP will explore the potential for expansion to the entire CII sector.

As LADWP continues to gather more data and analyze customer participation in current and future programs, additional programs and strategies will be added in order to bring LADWP closer to meeting the goals set forth in the Water Conservation Potential Study to meet the milestones for water use reduction.

3.5 Costs & Funding

LADWP has invested more than $250 million in water conservation and efficiency during the last 10 years. Conservation is the cornerstone of LADWP's water demand management strategy. Ongoing investments will be made subject to funding availability and LADWP's ability to implement such programs cost effectively.

The cost of LADWP individual water conservation and efficiency programs between FYE 2016 to FYE 2020 ranges from about $60/AF to $1,200/AF. Further, LADWP saves water overall at an average cost of approximately $410/AF.

Outside sources of funding are sought to supplement the LADWP's budget for conservation. LADWP is committed to acquiring additional grant funding for conservation projects and programs.

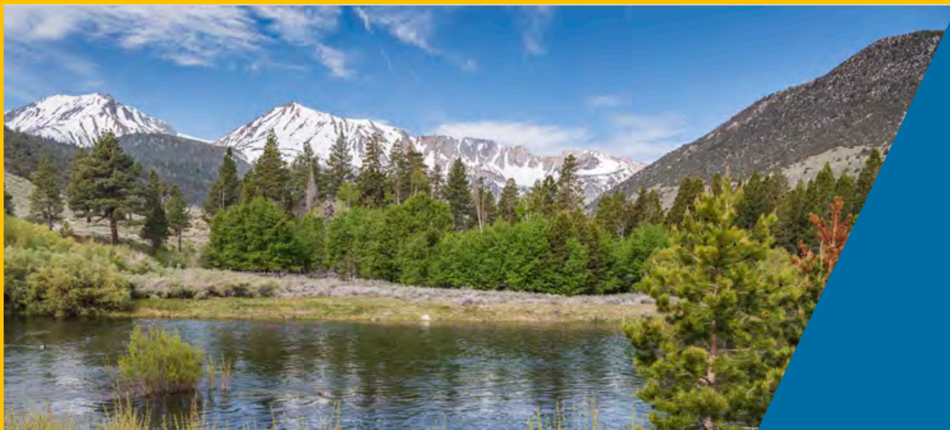
Currently, the funding sources for conservation are:

- **Water Rates** – Water conservation and efficiency programs are primarily funded through a portion of the revenue collected from the sale of water. This portion of revenue is determined by the Water Supply Cost Adjustment Factor (WSCAF), which is the percentage of the total cost of water dedicated towards the development of current and future water supplies. Guidelines for determining the WSCAF are described in more detail in the latest Water Rates Ordinance, updated in 2016 (Appendix C). The factor is adjusted semi-annually based on projections of revenue and expenses related to those various supply sources, of which, conservation is one. The rate for the water supply adjustment varies according to the tiers and is based on the cost to purchase water from various sources.

- **MWD Conservation Credits Program** - MWD offers both commercial and residential rebates to member agency customers that install qualifying conservation devices. LADWP supplements the MWD rebates with additional funding for rebates to accelerate the effectiveness of the rebate programs within LADWP's service territory. In addition, MWD reimburses LADWP for pre-approved projects LADWP administers when completed. The reimbursement is funded through dedicated funding MWD allocates towards the operation of Member Agency Administered (MAA) programs. Examples of these programs include LADWP partnerships with Southern California Gas Company for direct install programs and programs like our Commercial Direct Install program.

- **Outside Agency Co-Funding** – Stakeholders and outside agencies other than LADWP often realize benefits from conservation projects within LADWP's service territory. In these cases, the outside agencies contribute funds in addition to the funding provided by LADWP. One example of this co-funding approach is the MFDT program, which is co-funded by the Southern California Gas Company. This program focuses on improving the efficiency of both natural gas and water use devices, thereby saving both energy and water. Another example is the MWD Water Savings Incentive Program (WSIP), which is modeled similar to LADWP's TAP incentive for customized projects. The WSIP program is a "pay-for-performance" incentive which complements LADWP TAP funding to partially reimburse customers for installing unique water-saving infrastructure that is not part of the SoCal Water$mart menu of incentives.

- **Grant Funding** - LADWP actively pursues State and Federal grants and other funding opportunities for water conservation. In August of 2018, LADWP executed a zero-interest $3 Million loan agreement through the Proposition 1 - CalConserve Water Use Efficiency Revolving Fund Loan (CalConserve) Program administered by DWR. The CalConserve Program functions as a revolving fund, which distributes zero-interest loans to local water agencies to enact water conservation and water use efficiency projects within their service territory. Once local water agencies receive the loan, the water agency issues loan funds to City agencies for water efficiency programs, and also provides cost matches for the loan funding. Each City agency, and in turn each water agency, must pay back the loan amount to the State on a pre-arranged schedule. The overarching goal of the funding is to enable water providers to achieve the state-required urban water use mandate targets, and provide City agencies with up front funding to implement efficiency programs and spread that cost over a longer payback period to minimize impacts to their revenue. LADWP is currently developing processes through which City agencies may apply to receive loan funding to implement eligible water conservation projects in their purview.



Chapter Four

Los Angeles Aqueduct System

4.0 Overview

Local water supplies have been an integral part of the City of Los Angeles (City) history. The City's population and economy was initially supported through a combination of local surface flows, primarily from the Los Angeles River, and local groundwater pumping, primarily from the San Fernando Basin. When it became apparent that the local groundwater supply and local surface flows were insufficient to meet the future water needs of the City, the residents of Los Angeles, under the leadership of William Mulholland, approved by a 10 to 1 margin a $23 million bond measure to construct the First Los Angeles Aqueduct. This investment was equal to 12 percent of the entire City's assessed valuation at that time. Construction of the First Los Angeles Aqueduct was completed in 1913. Then in 1940, an additional $40 million was spent to extend the first aqueduct 40 miles north from the Owens River to Mono Basin, see Exhibit 4A.

Exhibit 4A
Los Angeles Aqueduct System

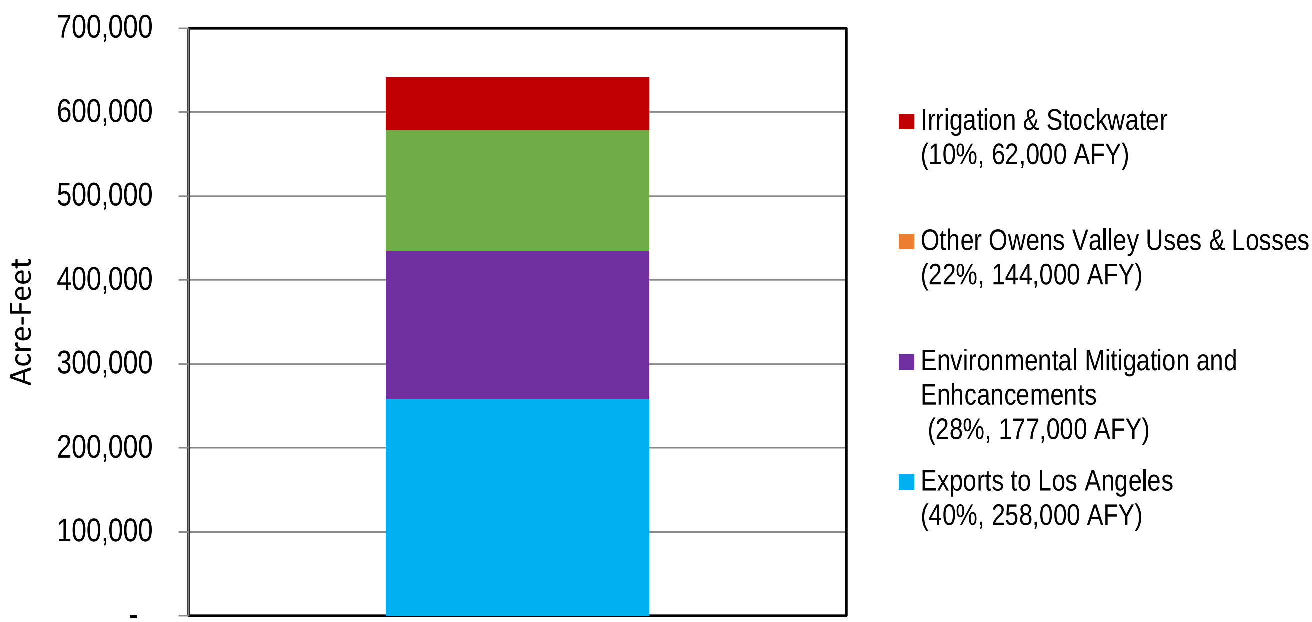
To meet the additional water needs of its population, a second barrel of the Los Angeles Aqueduct was constructed, later to become known as the Second Los Angeles Aqueduct. Construction of the Second Los Angeles Aqueduct was completed in 1970. The second aqueduct increased the City's capacity to deliver water from the Mono Basin and the Owens Valley to the City from 485 cubic feet per second (cfs) to 775 cfs. The value of the City's historical investment in the Los Angeles Aqueduct (LAA) System is substantial. For over a century, the City has benefited from this investment through the delivery of high-quality, cost-effective water supplies from the Eastern Sierra Nevada.

At its peak in fiscal year (FY) 1983-84, the LAA delivered 531,729 acre-feet (AF) to the residents of the City. Concerns over environmental impacts have required the City to reallocate approximately one-half of the LAA water supply to other uses within the Owens Valley and Mono Basin. Between 1992 and 2020, the City provided approximately 177,000 acre-foot per year (AFY) of water to supply a variety of environmental projects throughout the Eastern Sierra. As indicated in Exhibit 4B, LAA deliveries to the City comprise 40 percent of the total water supply from the Eastern Sierra Nevada in an average year, from runoff year (RY) 1992/93 to RY 2019/20. RY is measured from April 1st to March 31st of the following year. The majority of rainfall runoff from precipitation in the Eastern Sierra Nevada stays in the Mono Basin, Owens River, and Owens Valley Basin, supplying environmental and other uses.

Within the Owens Valley, the primary framework that governs LADWP environmental operations is the Long Term Water Agreement (LTWA). The LTWA is a stipulated court order between Inyo County and LADWP, issued in 1991, which established an overall goal for managing groundwater resources within Inyo County. The intent is "to avoid certain described decreases and changes in vegetation, and to cause no significant effect on the environment which cannot be acceptably mitigated, while providing a reliable supply of water for export to the City and for uses in Inyo County." The LTWA does not impact LADWP's surface water rights, but manages LADWP's groundwater pumping, and groundwater use within Inyo County. The LTWA also requires LADWP to implement and maintain a variety of "Enhancement/Mitigation Projects." Prior to implementation of the LTWA, average water uses and losses in Owens Valley totaled 216,000 AFY. After implementation, these uses and losses increased to 287,000 AFY.

In the Mono Basin, LADWP historically diverted water from four tributary streams of Mono Lake. Between 1971 and 1988, LADWP averaged 83,400 AFY from the Mono Basin. Beginning in 1989, with the issuance of a landmark California Supreme Court case, LADWP began to reduce exports to comply with legal requirements. In 1994, the State Water Resources Control Board (SWRCB) entered Decision 1631, which amended City water right licenses 10191 and 10192 to establish fishery protection flows for streams tributary to Mono Lake, and to protect public trust resources at Mono Lake and in the Mono Basin. Decision 1631 also set limits on LADWP water exports from the Mono Basin, which were set to a range of 0 to 16,000 AFY. Since 1994, LADWP's average Mono Basin export has been 12,000 AFY. Limiting water deliveries to the City from the LAA has directly led to increased dependence on imported water supplies from the Metropolitan Water District of Southern California (MWD). LADWP's purchase of supplemental water from MWD in FY 2013/14 was at an all-time high.

Exhibit 4B
Mono Basin and Owens Valley Water Use Allocations[1]



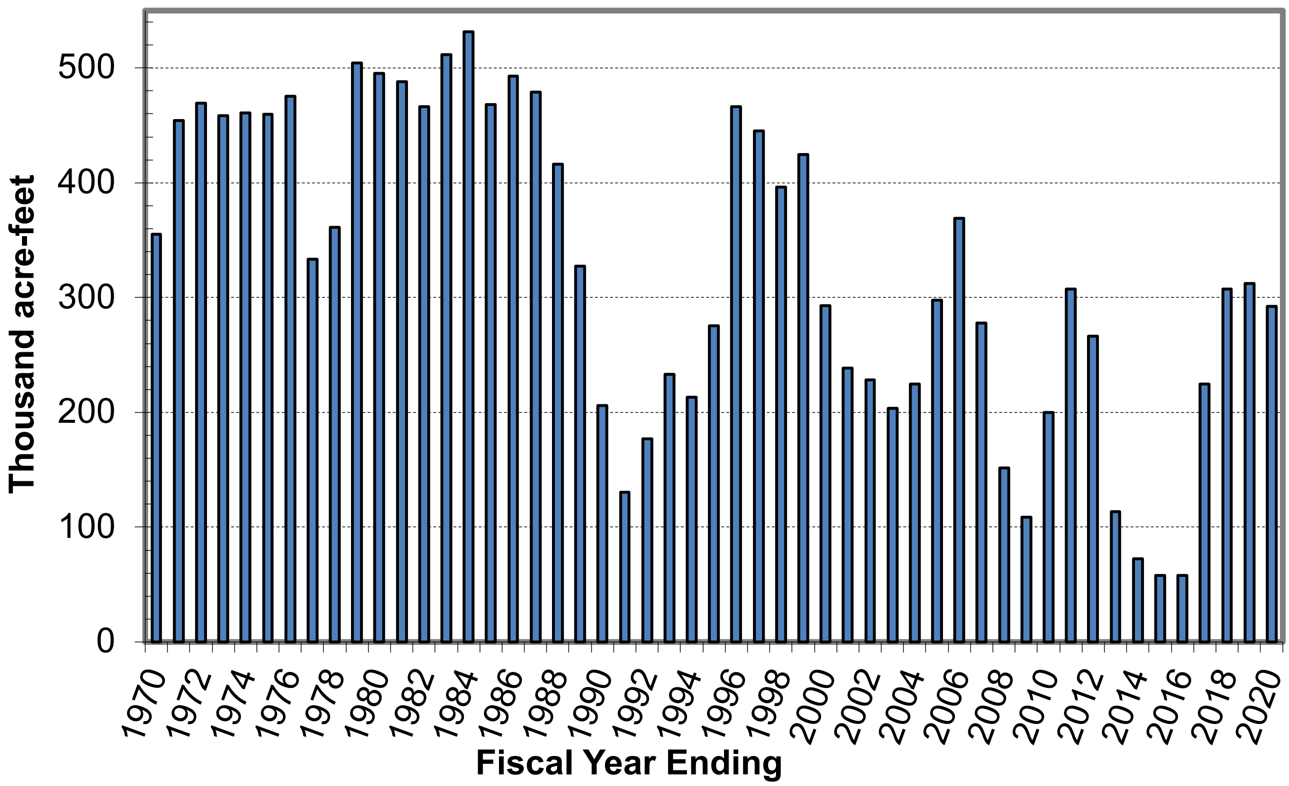
[1]The average post-Water Agreement year begins RY 1992/93 and ends RY 2019/20

4.1 Historical Deliveries

Annual LAA deliveries to the City are dependent on snowfall in the Eastern Sierra Nevada. Years with abundant snowpack result in larger water deliveries from the LAA, and typically reduced purchases of supplemental water from MWD. Conversely, low LAA deliveries in dry years increase the demand for supplemental water from MWD.

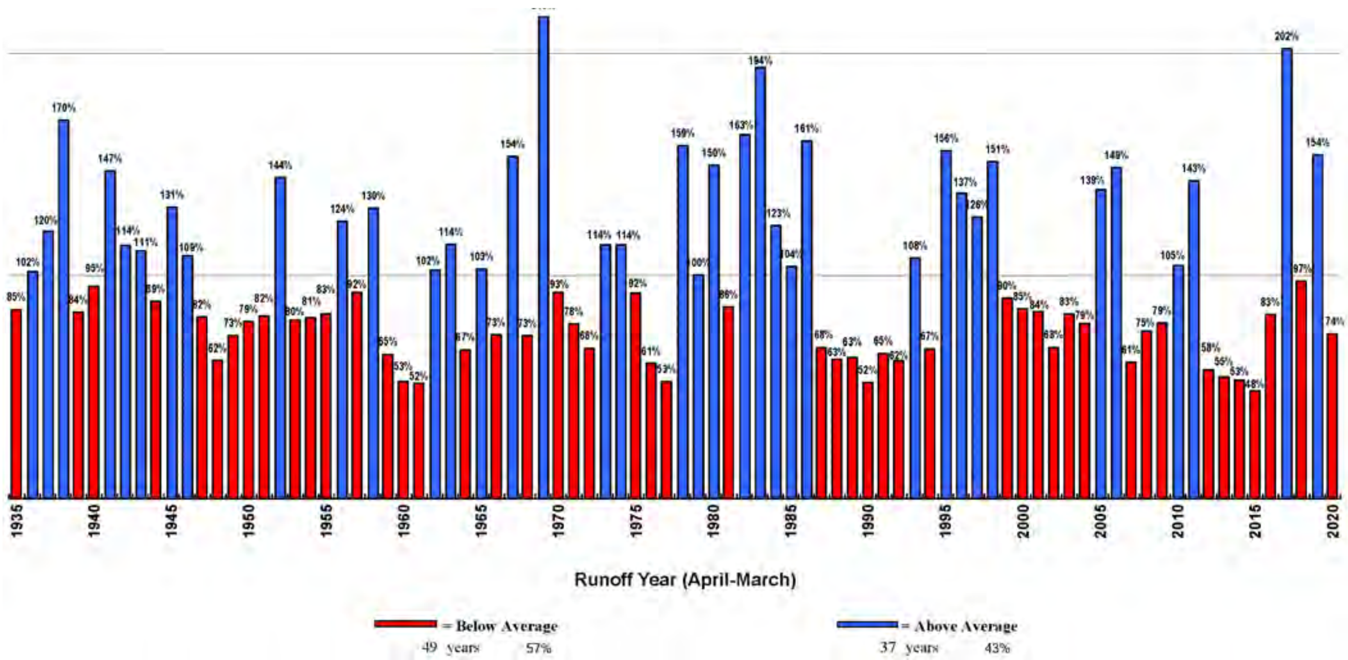
The impact to LAA water supplies due to varying hydrology in the Mono Basin and Owens Valley is amplified by the requirements to release supply water for environmental enhancement efforts in the Eastern Sierra Nevada. Since 1989, the City's water exports from Mono Basin have been significantly reduced to comply with State Water Board orders to enhance the Mono Basin's ecosystem. The cyclical nature of hydrology is exhibited best by LAA deliveries over the last 30 years, as shown in Exhibit 4C.

Exhibit 4C
Historical Los Angeles Aqueduct Deliveries



A long-term perspective of the general cycle of wet and dry years for the Owens Valley is evident in Exhibit 4D, particularly since the late 1960s. This graph shows Eastern Sierra runoff as a percent of normal, where 57 percent of years are below average. As illustrated, reliance solely on one water supply source is not practical. Therefore, the City relies on the LAA in combination with the Colorado River Aqueduct and the State Water Project as the City's primary imported water sources. These imported sources, combined with local groundwater, stormwater, recycled water, and conservation, make up the City's total water supply portfolio. This portfolio of water resources is fundamental to LADWP's ability to deliver safe and reliable water supply to meet the needs of over four million residents of the City.

Exhibit 4D
Eastern Sierra Nevada Runoff Owens Valley – Percent of Normal



4.2 Mono Basin and Owens Valley Supplies

Surface runoff from snowmelt in the Eastern Sierra Nevada Mountains is the primary source of supply for the LAA. The LAA extends approximately 340 miles from the Mono Basin to the City. Water is conveyed the entire distance by gravity alone through the First and Second LAAs. LADWP regulates deliveries to the Los Angeles Aqueduct Filtration Plant (LAAFP) through storage control at nine reservoirs. Six reservoirs are used for storage: Grant Lake, Long Valley, Tinemaha, North Haiwee, South Haiwee, and Bouquet Reservoirs. The remaining three reservoirs are used to regulate flow for hydroelectric power plant generation, which include Pleasant Valley, Fairmont, and Drinkwater Reservoirs. The total combined reservoir storage capacity of the system is 311,000 AF. Hydroelectric power is generated at 12 power plants along the LAA. Combined maximum capability of the power generation facilities is 215 mega-watts.

Additional infrastructure includes hundreds of miles of canals and ditches. Runoff reaches its peak in the late spring and early summer, after most of the year's precipitation has already occurred. The snowpack in the Eastern Sierra Nevada provides natural storage for the LAA system. This snowpack storage is necessary in light of the minimal storage capacity along the LAA system.

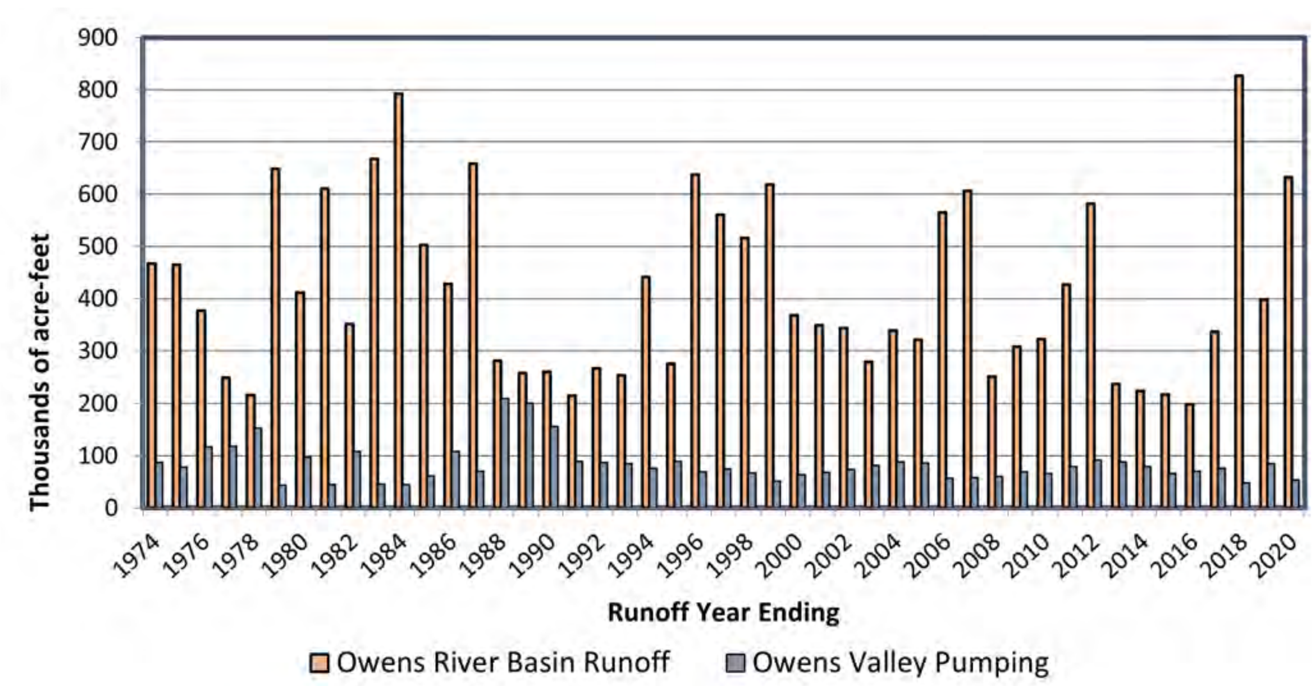
Water Rights

The City's water rights in the Eastern Sierra Nevada are comprised of riparian rights, pre-1914 appropriations, and post-1914 appropriation licenses held on various streams in the Mono Basin and Owens Valley. Riparian rights are for streamflow used on land adjacent to the stream. Appropriations by the City based on post-1914 water rights are made pursuant to licenses issued by the SWRCB. The majority of the City's water rights are pre-1914 water rights established prior to enactment of the State Water Commission Act. The most significant basis for export of surface water from the Eastern Sierra Nevada is an appropriation claim in 1905 to divert up to 50,000 miner's inches (1,250 cfs) from the Owens River at a location approximately 15 miles north of the town of Independence into the LAA for transport to Los Angeles. The City files supplemental statements (for riparian and pre-1914 water rights) and licensee reports (for post-1914 water rights) of water diversion and use with the SWRCB for its diversions during each calendar year.

The City's water right licenses in the Mono Basin were amended by the SWRCB in 1994 through the Mono Lake Basin Water Right Decision 1631. As of RY 2019/20, the Mono Lake water level was above the Water Right Decision 1631 trigger elevation of 6,380 feet; therefore, the amount of water now available for export from Mono Basin is 16,000 AF.

The primary groundwater right through which the City has developed groundwater resources in the Owens Valley is based on ownership of a majority of the land (approximately 252,000 acres) and associated water rights in the Owens Valley. Management of the groundwater supply in the Owens Valley is according to the LTWA. Groundwater Pumping is regulated under the LTWA by using vegetation water demand and available soil moisture to determine whether groundwater wells can be pumped. Groundwater is pumped from nine Owens Valley wellfields and began in 1970 after completion of the Second LAA. Since 1991, the average pumping has been less than 75,000 AF compared to 107,000 AF from 1974 to 1990, as shown on Exhibit 4E.

Exhibit 4E
Owens River Basin Runoff and Owens Valley Groundwater Pumping

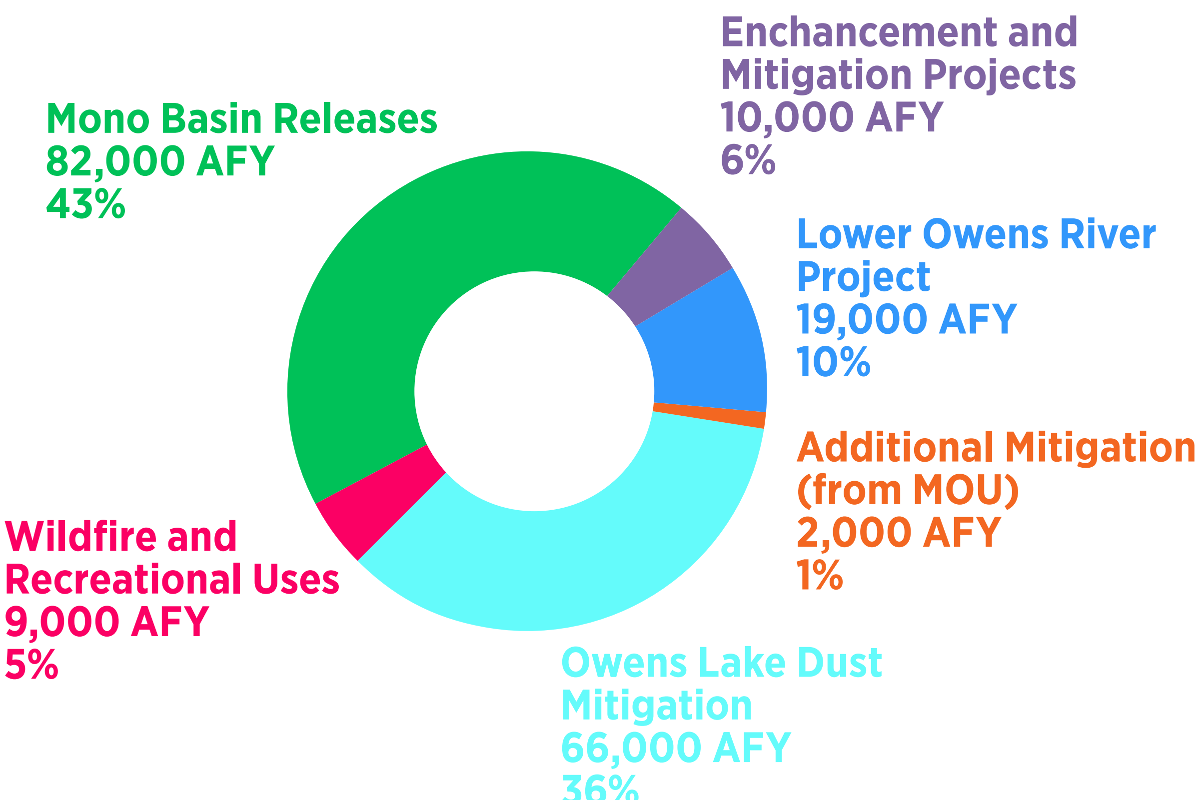


4.3 Environmental Enhancement and Mitigation

Over time, an increasingly larger portion of the LAA water supply has been reallocated to the Owens Valley environmental projects. As a result, the City's average supply for environmental enhancement in the Owens Valley and Mono Basin has amounted to 177,000 AFY. LADWP has attempted to compensate for the loss of traditional LAA water supplies by funding stormwater capture, conservation, water recycling programs in the City to augment locally developed supplies, and increased purchases of supplemental supplies from MWD.

Exhibit 4F illustrates the breakdown of LAA water supply by category. The environmental enhancement and mitigation projects that have been implemented as part of the City's commitment under the LTWA are also shown as part of Exhibit 4F. Among the environmental projects, LADWP is diverting 9,000 AFY for wildlife and recreational uses, 73,000 AFY for Mono Basin releases, 57,000 AFY for Owens Lake Dust Mitigation, 19,000 AFY for the Lower Owens River Project (LORP), 10,000 AFY of water from the LAA for Owens Valley environmental enhancement and mitigation projects, and 2,000 AFY for additional mitigation for the 1997 Memorandum of Understanding between the City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, and the Owens Valley Committee (1997 MOU).

Exhibit 4F
Mono Basin and Owens Valley Environmental Enhancement Commitments[1]



[1]The average post-Water Agreement year begins RY 1992/93 and ends RY 2019/20

Mono Basin

Exhibit 4G provides the maximum export levels from the Mono Basin under specified conditions as defined in the SWRCB Decision D1631 that was issued on September 28, 1994. Since the long-term average of Mono Basin exports before 1994 was approximately 85,000 AFY, the net reduction in water exports in the Mono Basin was estimated at 73,000 AFY of water, primarily from Grant Lake Reservoir, Lee Vining Creek, Walker Creek, Parker Creek, and Rush Creek when Mono Lake elevation was still above 6,391 feet. The Mono Lake annual average elevation reached 6,383 feet in RY 2019/20, which sets LADWP's allowable Mono Lake exports at 16,000 AF for RY 2020/21.

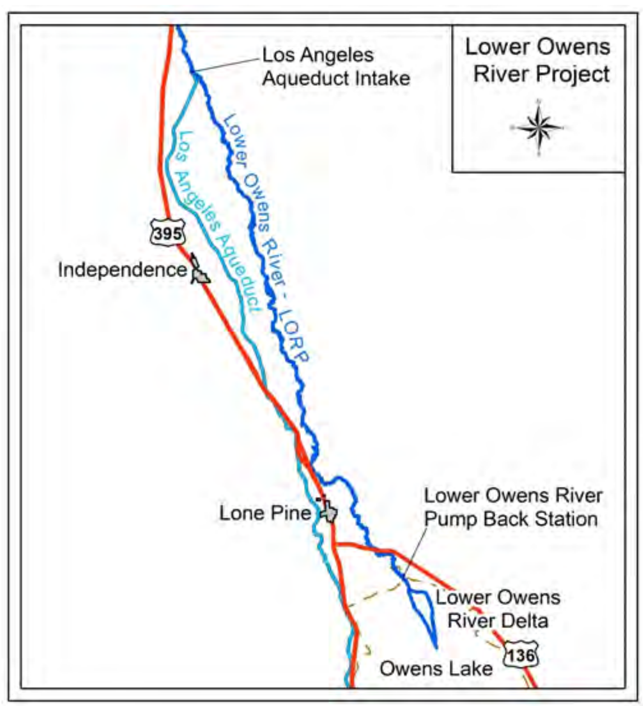
Exhibit 4G
Mono Lake Elevation and Exports

Mono Lake Elevation (feet)		Exports (AFY)
Transition Phase	<6,377	0
	6,377 - 6,380	4,500
	6,380 - 6,391	16,000
Post - Transition Phase (begins when Mono Lake Elevation reaches 6,391 ft.)	<6,388	0
	6,388 - 6,391	10,000
	> 6,391	export all runoff less minimum stream flow requirements and stream restoration flows

Lower Owens River Project

Beginning December 2006, the LORP, depicted in Exhibit 4H, was implemented to create a warm water fishery along a 62-mile section of the Owens River. The LORP releases water near the LAA intake facility and a pump back station located downstream returns flows to the LAA and/or to Owens Lake for dust control measures. In accordance with the 1997 MOU and the approved Environmental Impact Report (EIR), annual monitoring reports are prepared to measure project success. The LORP EIR describes requirements for LORP flows. It is estimated that the long-term use and transit losses from the project are approximately 19,000 AFY.

Exhibit 4H
Lower Owens River Project Area



4.4 Owens Lake Dust Mitigation Program

Historically, the Owens River was the main source of water for Owens Lake. Diversion of water from the river, first by farmers in the Owens Valley and then by the City, contributed to the lake being reduced to a small brine pool. Regulators concluded that the exposed lakebed became a major source of windblown dust, resulting in the United States Environmental Protection Agency (USEPA) classifying the southern Owens Valley as a serious non-attainment area for particulates (dust), also known as PM10 emissions, in 1991. The PM standard includes Particulate Matter with a diameter of 10 micrometers or less (0.0004 inches or one-seventh the width of a human hair). USEPA's health-based national air quality standard for PM10 is below 50 microgram per cubic meter for an annual mean and below 150 microgram per cubic meter for daily concentration.

As a result of PM10 emissions exceeding regulations, the USEPA required California to prepare a State Implementation Plan (SIP) to bring the region into compliance with Federal air quality standards by 2006. In July 1998, LADWP entered into a Memorandum of Agreement with the Great Basin Unified Air Pollution Control District (GBUAPCD) that: 1) delineated the dust producing areas on the lakebed that needed to be controlled; 2) specified what measures must be used to control the dust; and 3) outlined a timetable for implementation of the control measures.

The Memorandum of Agreement was incorporated into a formal air quality control SIP by the GBUAPCD, and the plan was approved by the USEPA in October 1999. The regulators approved only three methods of dust control: Shallow Flooding, Managed Vegetation, and Gravel Cover. Two of these methods require significant use of water and, while gravel cover is a waterless method and requires low maintenance, its widespread use is limited because the California State Lands Commission (CSLC) believes gravel does not promote public trust values.

In addition, starting with the 1998 SIP, the GBUAPCD issued multiple SIPs and associated dust control orders throughout the years, which significantly increased LADWP's obligations from the original 16.5 square mile dust control area to today's total of 48.6 square miles with implementation of the 2016 SIP. Exhibit 4I provides a summary of the square miles of dust mitigation ordered by the SIPs.

Exhibit 4I
Owens Dust Mitigation Area Ordered By SIPs

SIP	Total Area Mitigated (Square Miles)
1998	16.5
2003	29.8
2008	43
2013	45
2016	48.6

2014 Stipulated Judgment

In 2011, a dispute arose between LADWP and GBUAPCD regarding GBUAPCD's requirements for LADWP to control dust from additional areas at Owens Lake, beyond those areas identified in the 2008 SIP, followed by a series of appeals to the California Air Resources Board. This dispute occurred concurrently with one of the most severe dry periods in California history, causing major water supply reliability concerns. After extensive negotiations, LADWP and GBUAPCD reached a historic settlement agreement. The settlement agreement was memorialized by the Sacramento County Superior Court in a case entitled City of Los Angeles, et al. v California Air Resources Board, Sacramento Superior Court, Case No. 34-2013-80001451-CU-WM-GDS (Stipulated Judgment) on December 30, 2014. The Stipulated Judgment set an upper limit of 53.4 square miles, defined by the regulatory shoreline at 3,600 feet above sea level, that the City could potentially be ordered to mitigate dust from Owens Lake playa by the GBUAPCD.

Furthermore, the Stipulated Judgment allows LADWP to implement new waterless dust control measures on Owens Lake playa and includes a commitment by the GBUAPCD to collaboratively work with LADWP to develop other water efficient and non-water dust control methods for use on Owens Lake. The GBUAPCD has also agreed to support LADWP in securing the necessary approvals, right-of-ways, leases, and permits for installation of approved water efficient and waterless dust control measures from regulatory and oversight agencies such as the CSLC and the California Department of Fish and Wildlife (CDFW). As a result, LADWP succeeded in getting GBUAPCD's approval to expand the Shallow Flood Best Available Control Measure to include water-efficient dust control options. Exhibit 4J provides a description of the Best Available Control Measures.

Exhibit 4J
Dust Control Mitigation Best Available Control Measures

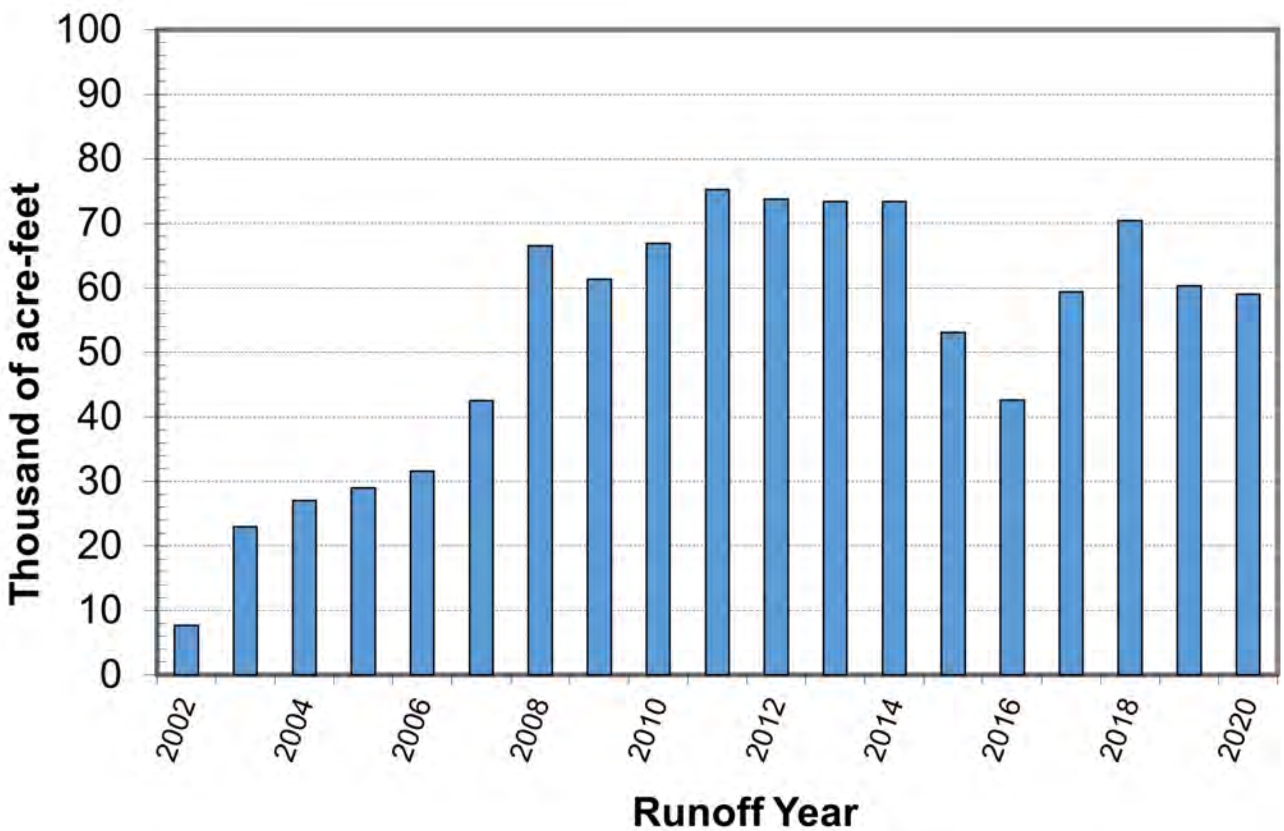
Dust Control Measures		Description
Shallow Flooding	Sheet Flooding (Lateral)	Releases water from arrays of low-flow water outlets spaced at intervals of between 60 and 100 feet along pipelines laid along lake bed contours. Pipelines are spaced between 500 and 800 feet apart. This arrayed configuration of water delivery creates large, very shallow sheets of braided water channels. Water depths in sheet flooded areas are typically at most a few inches deep. The lower edge of sheet flooded areas has containment berms to capture and pond excess flows. The water slowly flows across the typically very flat lake bed surfaces downhill to tail-water ponds where pumps recirculate the water back to the outlets. To maximize project water use efficiency, flows to sheet flow areas are regulated at the outlets so that only sufficient water is released to keep the soil wet. Any water that does reach the lower end of the control area is collected and recirculated back through the water delivery system.
	Shallow Flooding (Pond)	Water containment berms that allow ponds to be formed that submerge the emissive lake bed areas. These ponds are up to four feet deep. The containment berms are typically rock-faced to protect them from delivery to the pond area until the pond reaches a size and depth sufficient to submerge the required amount of emissive water. Water delivery then ceases until evaporation reduces the pond size to a set minimum.
	Dynamic Water Management	An operational modification of shallow flooding that allows for later start dates and/or earlier end dates to reduce water use in areas that have had historically low PM10 emissions.
	Tillage with Shallow Flood BACM Back-up (TWB2)	TWB2 consists of soil tilling within all or a portion of Shallow Flooding areas where sufficient shallow flood infrastructure and available water supply exists. Tilling involves running a plow through the Owens Lake playa to create deep furrows which reduce wind velocity and thereby dust emissions.
	Brine Shallow Flooding	Brackish water containment berms that allow ponds to be formed that submerge the emissive lake bed areas. These ponds are up to four feet deep. The containment berms are typically rock-faced to protect them from delivery to the pond area until the pond reaches a size and depth sufficient to submerge the required amount of emissive water. Brackish water delivery then ceases until evaporation reduces the pond size to a set minimum.
Managed Vegetation		Control measure consists of creating a farm-like environment from barren playa. The saline soil must first be reclaimed with the application of relatively fresh water and then planted with salt-tolerant plants that are native to the Owens Lake basin. Thereafter, soil fertility and moisture inputs must be managed to encourage rapid plant development and maintenance. Existing Managed Vegetation areas are irrigated with buried drip irrigation tubing and a complex network of buried drains to capture excess water for reuse on the Managed Vegetation area or in Shallow Flooding areas. Managed Vegetation is sustainable at Owens Lake only if salt from the naturally occurring shallow groundwater is prevented from rising back into the rooting zone.
Gravel Cover		Two to four-inch layer of coarse gravel laid on the surface of the Owens Lake playa will prevent emissions by preventing the formation of efflorescent evaporate salt crusts, because the large pore spaces between the gravel particles disrupt the capillary movement of saline water to the surface where it can evaporate and deposit salts. The gravel also creates a surface that has a high threshold wind velocity so that direct movement of the large gravel particles is prevented and the finer particles of the underlying lake bed soils are protected. Gravel Blankets are effective on essentially any type of soil surface.

Owens Lake Dust Mitigation Program Water Use

Since 2001, LADWP has diverted water from the LAA for the Owens Lake Dust Mitigation Program to supply water-using dust control measures, such as shallow flooding ponds and managed vegetation. Over the years, annual water use for Owens Lake significantly increased as a result of additional dust control orders. As a result, annual water use for Owens Lake reached a high point of over 75,000 AF. However, due to the water conservation measures in the 2014 Stipulated Judgment, LADWP has been able to slowly decrease water use by implementing new water-efficient dust control measures in recent years.

Exhibit 4K summarizes annual water use for the Owens Lake Dust Mitigation Program. It should be noted that water use on Owens Lake dipped between 2014 and 2016, due to a record setting dry period in California that significantly impacted snow pack in the Owens Valley and strained water supplies. In addition, during that period, three square miles of existing shallow flood ponds were taken out of service to allow for construction of the Phase 7a Project, and an additional four square miles of existing shallow flood ponds were taken out of service for construction of the water conservation project known as Tillage with Shallow Flood BACM Back-up (TWB2), see Exhibit 4J for a description of TWB2. Following this, in March 2017 the City's Mayor Eric Garcetti declared a local State of Emergency to protect lands and communities along the LAA from flooding. Consequently, overall water use increased from the previous calendar year due to increased water spreading activities necessary to mitigate the potential impacts of excess snowmelt runoff. Since completion of the Phase 9/10 Project, Owens Lake water use has remained steady at approximately 60,000 AFY.

Exhibit 4K
Yearly Water Use on Owens Lake



Owens Lake Master Project

LADWP's Owens Lake Master Project (OLMP) has been a 10-year ongoing effort to research multiple options that are cost-effective and optimize multiple benefits. Development of the OLMP has been a collaborative effort with governmental and non-governmental organizations.

The primary objective of the OLMP is to implement a flexible and adaptive management approach that:

- Mitigates dust emissions in compliance with governing air quality regulations;
- Conserves water use on Owens Lake to the greatest extent possible; and
- Maintains habitat and protects cultural resources.

Other major considerations incorporated into developing the OLMP include:

- Optimizing operational efficiency and flexibility;
- Adding infrastructure redundancy to decrease consequences of failure;
- Replacing aging and failing infrastructure to reduce the probability of failure; and
- Maintaining public trust values and improving public access and reducing LAA water used for dust mitigation by utilizing sustainable amounts of groundwater from beneath Owens Lake.

4.5 Water Quality

The City owns approximately 315,000 acres in Inyo and Mono Counties, most of which are leased for agricultural purposes. As land owners of much of the Mono Basin and Owens River watersheds, LADWP has placed strict limits on the extent of development impacting the City-owned watersheds. Snowmelt from the Eastern Sierra Nevada is a high-quality water source, containing very low concentrations of total organic carbon (TOC), bromide, and other constituents that can form disinfectant byproducts during the water treatment process. LADWP conducts routine monitoring of all its water supplies for over 170 constituents and contaminants. One hundred of these constituents and contaminants have enforceable standards.

In 2010, LADWP adopted the Owens Valley Land Management Plan to address potential impacts to the City's water supply, as well as potential effects to water quality. The plan identifies best management practices for recreation and range management that have been implemented in order to protect water quality. LADWP continues to utilize adaptive management, working with its lessees to insure water quality objectives contained with the Owens Valley Land Management Plan are achieved.

The LAA supply is the main source of natural arsenic in LADWP's water supply. The Owens River flows through volcanic formations and receives arsenic input from geothermal springs throughout the Owens Valley, however, most of the arsenic inputs come from Hot Creek in Long Valley. Geothermal springs in these areas have arsenic concentrations of around 200 parts per billion (ppb). Concentrations are dramatically reduced as water in the area mixes with snowmelt and other pristine water sources. Historic untreated LAA water arsenic concentrations have ranged from 10 to 74 ppb. During the last five years of routine compliance monitoring from 2015 to 2019, the highest arsenic concentration after treatment at Cottonwood Treatment Plant and the LAAFP was 5 ppb, while the average arsenic concentration within LADWP's water distribution system was 2.2 ppb, both well below the current Federal and State drinking water standard of 10 ppb set by USEPA in 2000. In anticipation of more stringent arsenic regulations in the future, LADWP is taking a proactive approach in addressing this issue by investigating and planning enhanced treatment.

LADWP completed an evaluation and preliminary design report for sedimentation basins at the Fairmont Reservoir site in December 2019, as a means of addressing current and future water quality regulations faced by LADWP, including arsenic. The Fairmont Sedimentation Plant is planned as pre-treatment to the LAAFP and is projected to be in service by 2027.

4.6 Projected Deliveries

Near-term water deliveries are forecasted for the LAA using two models, the Runoff Forecast Model and the Los Angeles Aqueduct Simulation Model (LAASM). These two models, used jointly, accurately predict the amount of water available from the LAA.

The Runoff Forecast Model is used to predict total Owens Valley and Mono Basin stream runoff. The model's estimating equations were developed using historical rainfall, snowfall, and streamflow data. Model inputs consist of six months of antecedent rainfall and streamflow data, as well as the final snowpack levels on April 1st. The model's output is the forecasted runoff for the Owens Valley and Mono Basin during the twelve-month period following April 1st, assuming that median rainfall occurs during those twelve months.

Runoff flows from the Owens Valley to the City are modeled by the LAASM. LAASM uses the output of the Runoff Forecast Model as input, along with estimates of various uses within the Owens Valley. LAASM uses estimating equations based on historical data to forecast various losses, including evaporation and infiltration, as well as other inflows such as unmetered springs. The final output from LAASM is the volume of LAA water projected to be delivered to the City.

Taking the foreseeable factors discussed earlier in this chapter into consideration, the expected annual long-term LAA delivery over the next 25 years, using the 30-year median hydrology from FY 1985/86 to 2014/15, is approximately 192,000 AFY for average years. Deliveries for a series of dry years, assuming a repeat of FY 1987/88 through 1991/92 hydrology, are expected to range from approximately 71,400 AFY to 143,000 AFY during FY 2020/21 through FY 2024/25. A single dry year of 71,400 AFY is expected with a repeat of FY 1989/1990 hydrology. An annual reduction factor due to climate impacts is applied for average, single dry, and multiple dry years. Detailed projections of LAA deliveries by year are provided in Chapter 11, *Water Service Reliability Assessment*.

4.7 LAA Delivery Cost

The costs associated with the LAA water supply are primarily infrastructure-related operation and maintenance costs, along with environmental enhancement activities. Therefore, the unit cost of importing water through the LAA to the City varies with the quantity of water delivered, which is highly dependent on hydrologic conditions. During dry years, the amount of water delivered to the City decreases, which results in an increase to the unit cost. Over the years, Eastern Sierra Enhancement/Mitigation Project costs have also contributed to rising overall LAA delivery unit costs. The Owens Lake Dust Mitigation Program and Lower Owens River Project are two examples. Exhibit 4L summarizes the historical unit cost of treated water from the LAA.

Exhibit 4L
Historical Unit Cost of LAA Treated Water

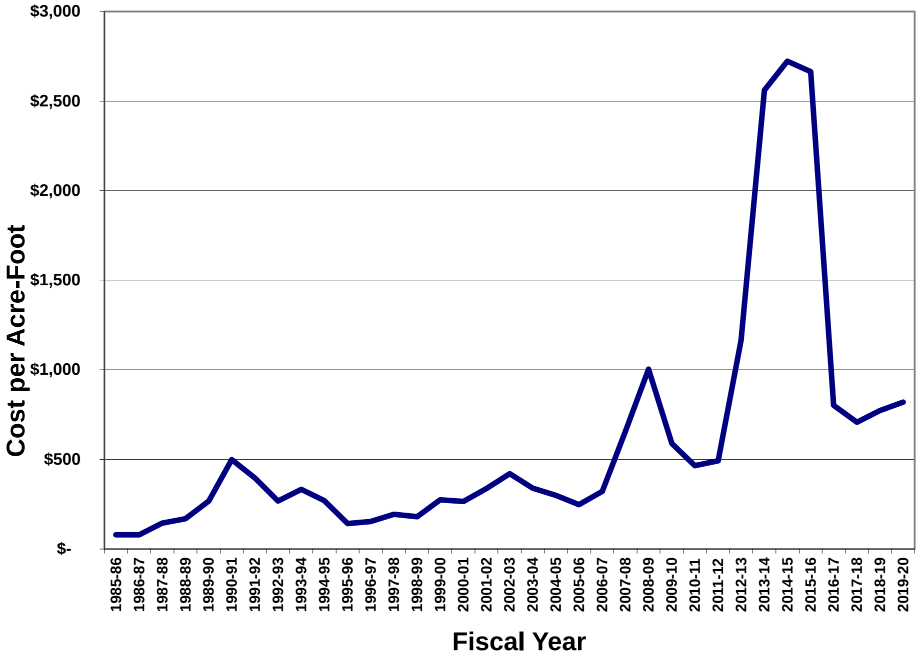


Exhibit 4M shows the unit cost of LAA treated water from FY 2015/16 to 2019/20. The 5-year weighted average unit cost was $859/AF, with unit costs in FY 2015/16 being higher due to reduced LAA deliveries.

Exhibit 4M
Annual Unit Cost

Fiscal Year	2015/16	2016/17	2017/18	2018/19	2019/20
Unit Cost per AF	$2,665	$801	$708	$772	$819

Blank Page

Chapter Five

Local Groundwater

5.0 Overview

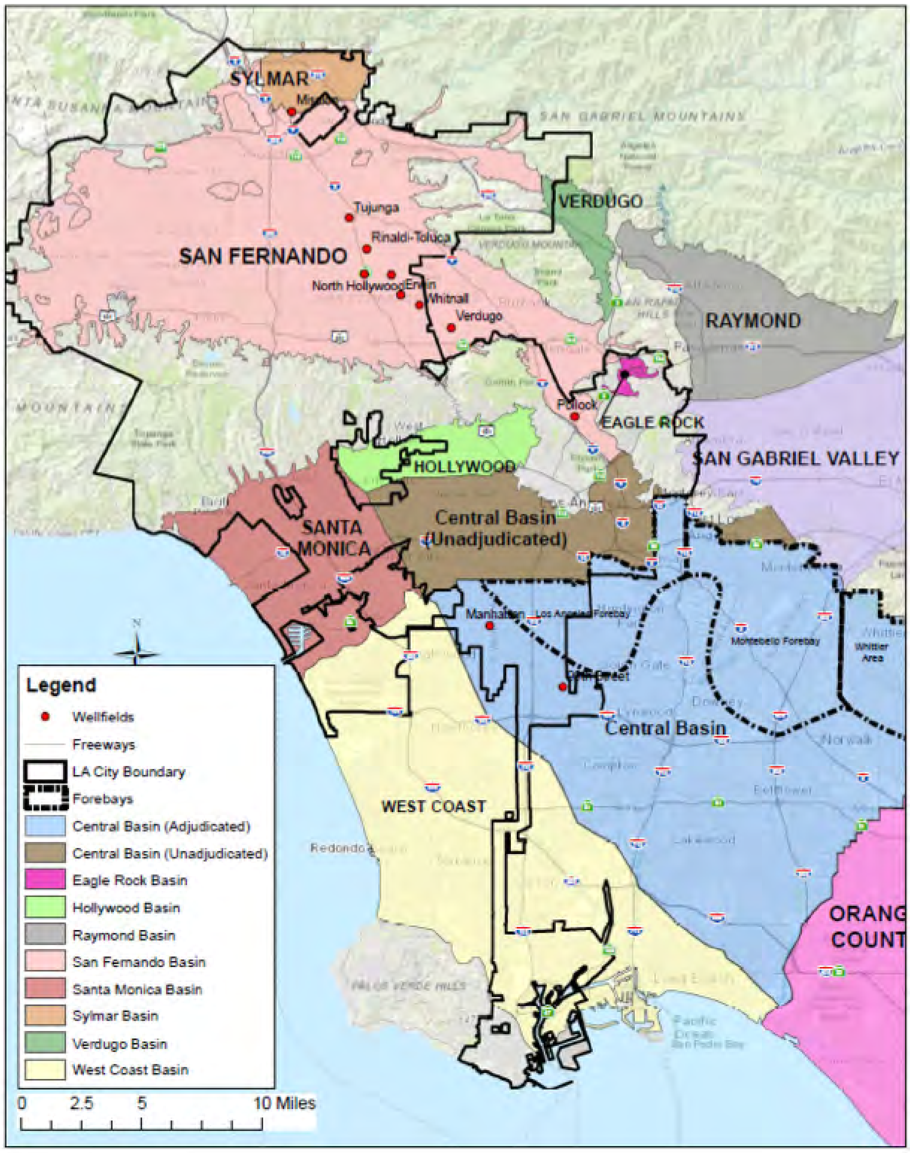
Local groundwater is a major component of the City of Los Angeles' (City) local water supply portfolio. Over the last five years, local groundwater has provided approximately 8 percent of the total water supply for the City, and since 1970 has provided up to 23 percent of the total water supply during extended dry periods when imported supplies were less reliable.

Several sources of local groundwater within the Los Angeles area are accessible to the City. Los Angeles area groundwater basins are shown on Exhibit 5A. The Upper Los Angeles River Area (ULARA) watershed, which includes the San Fernando Basin (SFB) and Sylmar Basin, is the principal groundwater resource where the City recharges and extracts local groundwater. The City also owns and extracts its local groundwater rights from the Central Basin and is entitled to produce water from the neighboring West Coast Basin. The unadjudicated Hollywood, Santa Monica, and northern Central Basins are local groundwater resources that do not currently provide groundwater to the City, but there is potential to develop future drinking water supplies for the City from these groundwater basins. In total, the City's groundwater rights can potentially supply more than 110,000 acre-foot per year (AFY) of groundwater.

While the City's groundwater rights are a critical component of local supply, the true value of the groundwater basins includes water storage. The SFB has an available storage capacity of 500,000 acre-feet (AF) and the West Coast and Central Basins have a combined available storage capacity of 500,000 AF. In the SFB, imported and recycled water recharged into the basin can be stored and pumped to meet future demands. Local groundwater basins represent the cornerstone of the City's future supply reliability strategy with over one million AF of available storage capacity.

North Hollywood West Groundwater Remediation Project

Exhibit 5A
Los Angeles Groundwater Basins



The presence of industrial contamination, including Volatile Organic Compounds (VOCs) and other hazardous substances, has impeded the City's ability to exercise the full extent of its groundwater rights. In the SFB alone, LADWP has 115 water supply wells, only 41 of which could be operated as of December 2020. In the neighboring Sylmar Basin, contamination has caused two of three water supply wells to be removed from service. Water supply wells in the Central Basin have been impaired, taken out of service, and demolished as a result of groundwater contamination concerns. Water quality problems associated with total dissolved solids (TDS), chloride, and hydrocarbon pollutants caused LADWP to discontinue utilizing its West Coast Basin facilities in 1980.

Furthermore, declining groundwater levels and potential overdraft conditions have become additional concerns for local groundwater basins where decades of expanding urbanization, increasing impervious hardscape, and channelization of stormwater runoff have diverted natural groundwater recharge away from local aquifers. Aging wellfields and distribution system infrastructure have also presented challenges to the development and use of the City's local groundwater resources.

Combined, these challenges have caused the City to renew its focus on sustainable management of its local groundwater basins. Responding to groundwater contamination issues has been a high priority of the City, particularly in the SFB. LADWP completed studies in

2015 to provide an analysis of groundwater quality and characterization of the extent of contaminants affecting the City's largest wellfields in the SFB. Expanded basin remediation systems are under development by LADWP to remove contamination from the SFB and to aid in restoring its beneficial use. The North Hollywood West Response Action is expected to become operational in 2021. The North Hollywood Central Response Action and the Tujunga Response Action are scheduled to become operational in 2023. In addition, LADWP has negotiated settlements with two major responsible parties that will provide treated groundwater from various existing and new wells in the eastern portion of the North Hollywood Wellfield area.

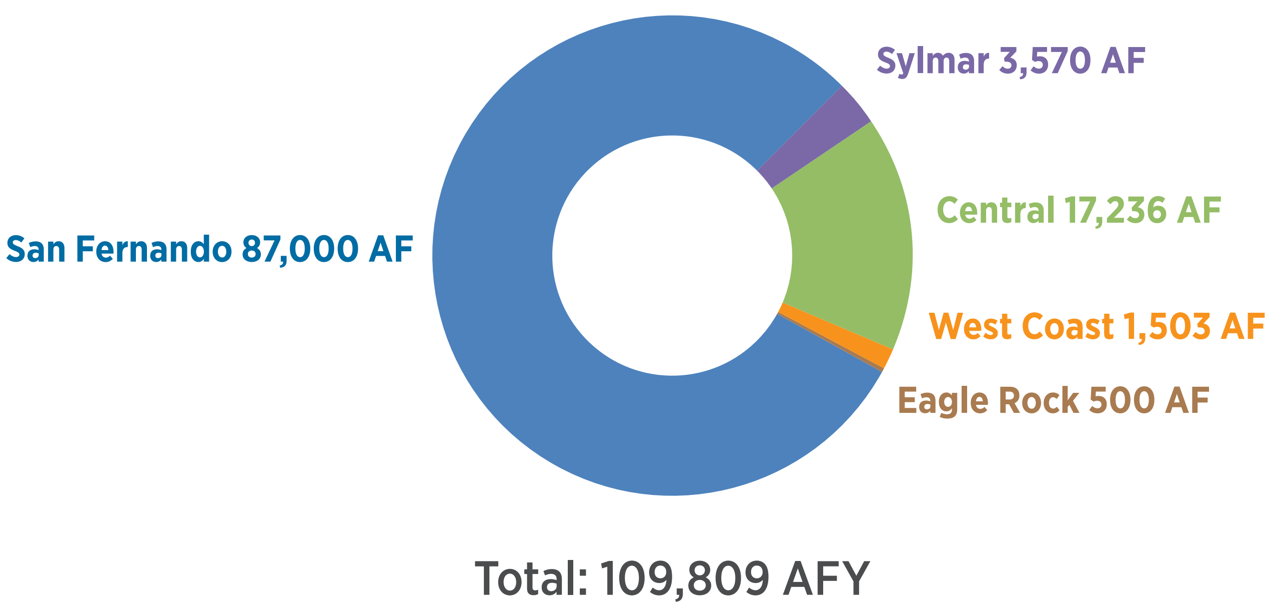
LADWP's efforts in the Sylmar and Central Basins have been focused on rehabilitation of LADWP's wellfields. Water supply wells impaired by contamination are being replaced to restore lost pumping capacity and improve water quality. LADWP is also evaluating whether response actions should be taken in these areas. LADWP's efforts in the West Coast Basin have been focused on identifying new production opportunities after localized contamination caused the discontinuation of operations at LADWP's Lomita Wellfield.

LADWP continues to invest in stormwater capture and recharge projects to restore local groundwater basin levels by enhancing and enlarging existing stormwater capture facilities, as discussed in Chapter 6, *Watershed Management*. Investments in advanced treatment systems in the SFB to produce purified recycled water for groundwater replenishment and potable reuse through groundwater augmentation are discussed in Chapter 7, *Water Recycling* and in Chapter 8, *Operation NEXT Water Supply Program*. These investments will help augment the City's groundwater and ensure future sustainability of local groundwater basin levels.

5.1 Groundwater Rights

Locally, the City holds water rights in the San Fernando, Sylmar, Eagle Rock, Central, and West Coast Basins. All of these basins have been adjudicated by California courts, and are governed by judicial decrees (each Judgment is provided in Appendix H). The City's combined adjudicated water rights in these basins are approximately 109,809 AFY, of which approximately 87,000 AFY is located in the SFB, 500 AFY in the Eagle Rock Basin, and 3,570 AFY in the Sylmar Basin. The City actively seeks new opportunities to purchase water rights as part of its efforts to increase local water supply resources. The City increased its Central Basin water rights from 15,000 AFY to 17,236 AFY through three purchase transactions completed between 2014 and 2015. The City's water rights in the West Coast Basin are 1,503 AFY, which the City may transfer to the Central Basin per the Third Amended Central Basin Judgment. Exhibit 5B graphically depicts the City's annual local groundwater entitlements by basin.

Exhibit 5B
Annual Local Groundwater Entitlement



The ULARA Groundwater Basin Adjudication

The ULARA watershed, in its entirety, is addressed in California Department of Water Resources (DWR) Bulletin 118 as basin number 4-012. The ULARA watershed encompasses four primary groundwater basins: San Fernando, Sylmar, Verdugo, and Eagle Rock Basins. The City's groundwater rights in these basins are recognized in the judicial decree of the Superior Court of the State of California for the County of Los Angeles in Case No. 650079, The City of Los Angeles v. City of San Fernando, et. al., dated January 26, 1979 (ULARA Judgment) and the subsequent Sylmar Basin Stipulations (Sylmar Stipulation). Appendix H contains the ULARA Judgment and Sylmar Stipulation.

Groundwater Basin Management and Sustainability

The ULARA Judgment requires safe yield operations for each of the basins to ensure groundwater extractions over the long term do not create a condition of overdraft in any one of the basins. Basin management in the ULARA is achieved by collective efforts of a court-appointed Watermaster and ULARA Administrative Committee, which is comprised of representatives from five public water supply agencies overlying the ULARA Basins. The five public agencies are the City of Burbank, City of Glendale, City of Los Angeles, City of San Fernando, and Crescenta Valley Water District.

Reports furnished by the ULARA Administrative Committee members enable the Watermaster to publish annual reports. The annual reports monitor and account for actual and projected groundwater extractions, water imports and exports to and from each basin, natural and artificial groundwater recharge, generation and reuse of recycled water, changes in groundwater elevations and storage, and groundwater quality. The ULARA Administrative Committee members have made significant contributions toward ensuring sustainable management of ULARA basins. These efforts include operation of groundwater remediation systems, use of an extensive network of groundwater monitoring wells, routine reporting on groundwater elevations and water quality, management and mitigation of urban runoff water quality, and development of enhanced stormwater recharge and groundwater replenishment.

Federal and State regulatory agencies are also involved with managing water quality and are requiring potentially responsible parties to assist with remediation of groundwater contamination at sites within the ULARA watershed. These regulatory agencies include the Los Angeles Regional Water Quality Control Board (LARWQCB), State Water Resources Control Board—Division of Drinking Water (DDW), California Department of Toxic Substance Control (DTSC), and the United States Environmental Protection Agency (USEPA). The Watermaster and ULARA Administrative Committee members routinely meet and coordinate efforts with these agencies.

As required by the 2009 Statewide Recycled Water Policy, the Watermaster and ULARA Administrative Committee members are in the process of preparing a Salt and Nutrient Management Plan (SNMP) for the four basins within the ULARA watershed. The SNMP provides a process whereby management of salts and nutrients can effectively be carried out to reduce the degree of degradation of groundwater in the aquifer systems within the basins.

Historical Groundwater Production

On average over the past five years, about 95 percent (46,623 AFY) of the City's local groundwater supply was extracted from ULARA groundwater basins, while the Central Basin has provided the remaining 4 percent (3,804 AFY). LADWP Central Basin production facilities at the 99th Street and Manhattan Wellfields were taken out of service temporarily for wellfield improvement projects in May 2016 and in February 2017, respectively. Consequently, there has been a reduction in groundwater production from Central Basin. Exhibit 5C summarizes the City's local groundwater production by basin over the last five years.

Exhibit 5C
Local Groundwater Basin Supply
Fiscal Year (July 1 through June 30 in AF)

Groundwater Basin	2015/16	2016/17	2017/18	2018/19	2019/20	Average	Percentage
San Fernando	75,958	55,116	22,259	36,870	42,913	46,623	95
Sylmar	682	0.0*	0.0*	1*	3*	343	1
Central	8,395	3,005	1*	5*	11	3,804	4
Total	85,035	58,121	22,260	36,876	42,927	50,770	100

*Small quantities pumped from Sylmar and Central Basin were for water quality testing purposes, not water supply.

LADWP utilizes conjunctive use strategies to optimize available surface water and groundwater to balance supplies with demand. Through conjunctive use, the timing of groundwater pumping can be altered to meet varying demands. During previous successive dry-year periods, LADWP pumped groundwater at greater-than-average rates for the first few years of the dry period, then lowered its pumping rates and increased surface water use in subsequent years to facilitate groundwater basin replenishment. This strategic pumping serves to meet dry year needs while also preventing overdraft of a basin.

Groundwater contamination in the SFB has greatly limited LADWP's ability to strategically pump, replenish, and store groundwater. As the SFB is remediated and beneficial uses are restored to prior levels, LADWP will be able to more fully conjunctively use the basin to ensure water supply reliability, while at the same time protecting public health and the environment, and protecting the basin against overdraft conditions.

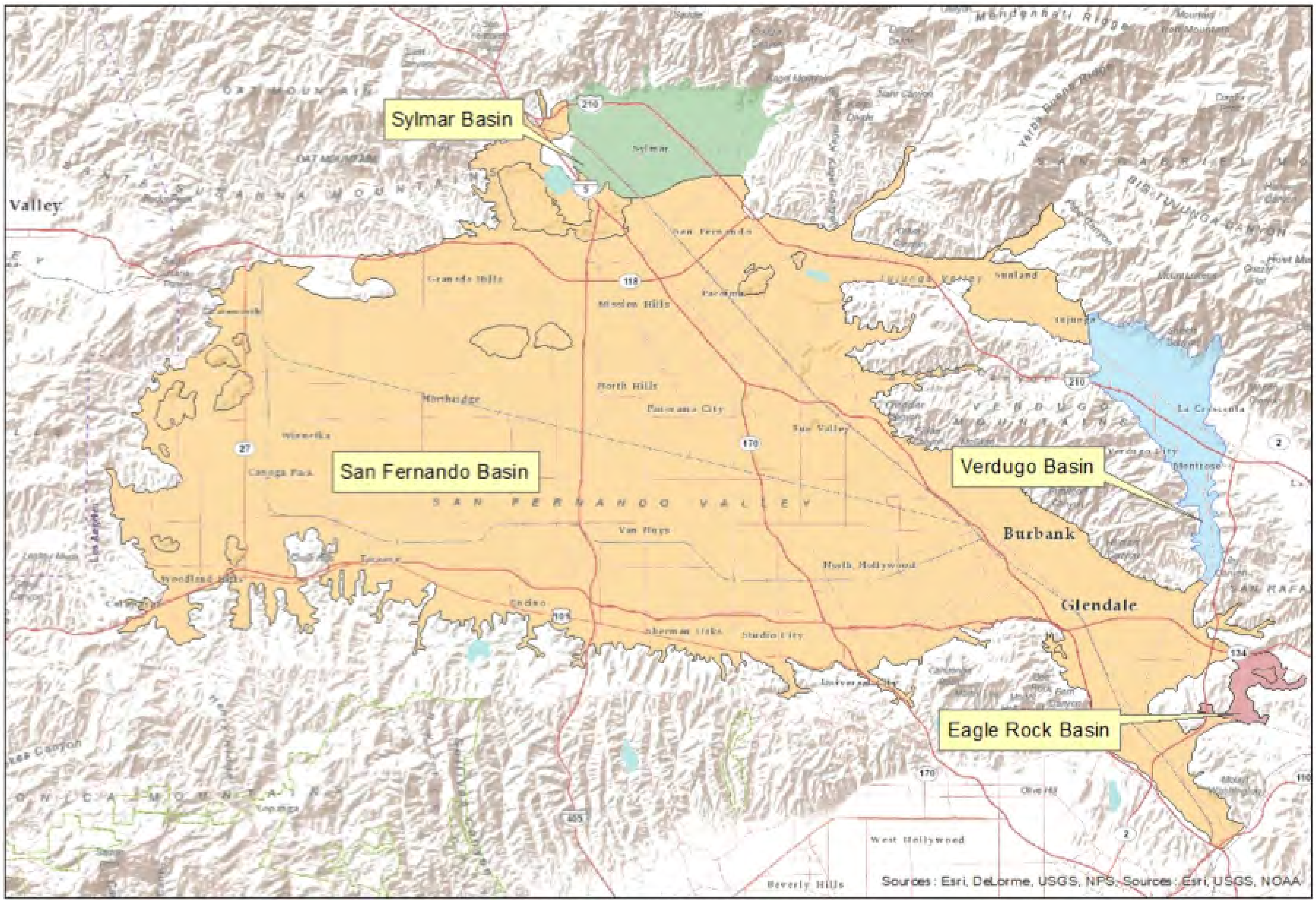
The need for effective management of groundwater supplies has never been greater, as demonstrated by the statewide water shortages resulting from the 2012-2015 dry period, coupled with the subsequent wide swings in hydrologic conditions throughout the State. LADWP responded to the most recent State declared drought by proactively increasing groundwater pumping from the SFB due to reduced SWP supplies. However, these increases were limited due to the presence of groundwater contaminant plumes in the vicinity of many LADWP production wells. LADWP closely monitored water quality conditions to ensure continued compliance with safe drinking water standards and protection of public health and the environment.

Following the wet winters of 2017 and 2019, LADWP temporarily reduced groundwater production to accommodate increased deliveries from the LAA and to help manage excess snowmelt runoff to protect lands and communities along the LAA from flooding. These events demonstrate the need for operational flexibility associated with the ability to increase or decrease groundwater pumping and use of the various basins for groundwater storage.

5.2 San Fernando Basin

The primary source of local groundwater for the City is the SFB, which has provided as much as 89 percent of the City's groundwater supply during the recent five-year period, ranging from 22,259 AFY to 75,958 AFY. The SFB is the largest of four groundwater basins in the ULARA, spanning 112,000 acres. This basin is bounded on the east by the Verdugo Mountains; on the north by the Little Tujunga Syncline and the San Gabriel and Santa Susana Mountains; on the west by the Simi Hills; and on the south by the Santa Monica Mountains. Exhibit 5D provides a map depicting the four groundwater basins of ULARA.

Exhibit 5D
San Fernando Basin



LADWP's SFB wellfields were generally installed over a 65-year period spanning from 1924 to 1991. The most recently constructed wellfields are Rinaldi-Toluca, established in 1988, and Tujunga, established in 1991. LADWP has 10 major wellfields within the SFB, comprising a total of 115 wells which, if fully operational, have a maximum pumping capacity of 533 cubic feet per second (cfs) (385,875 AFY). The actual pumping capacity is significantly lower due to the large number of wells that have become inoperable or restricted, mostly due to contamination. As of December 2020, the SFB has 41 operable wells (255 cfs), and once the first response actions become operational by 2023, there will be 59 operable wells (311 cfs). While LADWP has a relatively high pumping capacity, and even more so with treatment, sustained yearly pumping at full capacity may be limited by water rights, available stored water credits, and groundwater levels. Additional detail is provided in the Groundwater Rights section.

Collectively, nine wellfields (Tujunga, Rinaldi-Toluca, North Hollywood, Erwin, Verdugo, Whitnall, Pollock, Aeration) have a maximum active capacity to pump nearly 255 cfs of SFB groundwater.

- The Tujunga, Rinaldi-Toluca, North Hollywood East, and North Hollywood West Wellfields are LADWP's largest and primary wellfields providing a maximum combined pumping capacity of nearly 233 cfs. More specifically, the Tujunga and Rinaldi-Toluca Wellfields provide two-thirds (207 cfs) of the City's maximum active pumping capacity in the SFB.

- The Erwin and Verdugo Wellfields were put on standby in 2016 because they are not connected to the disinfection system. These wells can provide an additional operational flexibility of 13.5 cfs.

- Likewise, the Whitnall Wellfield was inactivated from service in 2016 because it is also not connected to the disinfection system and requires treatment due to contamination. As a result, two new wells will be installed here and connected to a groundwater treatment system in the near future.

- The Pollock Wellfield is located along the Los Angeles River Narrows and provides nearly 6 cfs of capacity.

- The Aeration Wellfield, also known as the North Hollywood Operable Unit (NHOU), is a USEPA Superfund facility that provides approximately 2 cfs of remediation capacity, and the treated product water is fed into the LADWP water distribution system. In coordination with USEPA, the Aeration Wellfield was shut down during the fourth quarter of 2017 in preparation for the construction of the North Hollywood Operable Unit Second Interim Remedy (the "NHOU-2IR") treatment facility.

Two remaining SFB wellfields, the Crystal Springs and Headworks Wellfields, have historically provided an additional 65 cfs of pumping capacity but are no longer in service. There are currently no plans to utilize the Crystal Springs Wellfield; however, early planning efforts are underway to revitalize and restore operations at the Headworks Wellfield through a Groundwater System Improvement Study for the southern portion of the SFB. The potential use of the Headworks Wellfield will be determined by the findings of the study.

Groundwater Rights

As recognized by the ULARA Judgment, the City has a prior and paramount right to utilize the surface waters of the Los Angeles River (LA River) and all native groundwater within the SFB, which represents the Pueblo Water Right of the City of Los Angeles. The City also has the right to recapture Import Return Water, i.e., groundwater derived from percolation attributable to delivered imported water. This Import Return Water is calculated each year by the ULARA Watermaster based on 20.8 percent of water LADWP delivered to customers overlying the SFB, including delivery of recycled water. Native safe yield has been determined as 43,660 AFY and Import Return Water averages approximately 43,000 AFY; therefore, the City's estimated water right in SFB is 87,000 AFY. The ULARA Judgment allows groundwater to be stored within the basin when the City pumps less than its annual water right, and stored water credits may be pumped in future years to supplement the City's water supply. The direct spreading of both imported surface water and recycled water by the City increases the water rights by an equal amount. As of October 1, 2018, the City had accrued 591,460 AF of stored water credits.

In September 2007, the cities of Los Angeles, Glendale, and Burbank entered into a 10-year Interim Agreement for the Preservation of the San Fernando Basin Water Supply (Interim Agreement). The Interim Agreement was intended to address reductions in stored groundwater within the basin and accumulation of stored water credits. The Interim Agreement acknowledged the need to construct projects to enhance stormwater recharge capacity, to limit pumping of stored water credits, and to begin to account for groundwater losses from the basin.

During the term of the Interim Agreement (September 2007 to 2017), LADWP invested approximately $120 million to enhance stormwater recharge initiatives in the San Fernando Valley. This investment has created stormwater capture projects that are expected to yield approximately 10,000 AFY of recharge water. In addition, LADWP continues to collaborate with the Los Angeles County Flood Control District (LACFCD), other neighboring local agencies, as well as non-local governmental organizations in developing and sponsoring projects that will enhance stormwater recharge capacity in the basin.

As groundwater levels increase within the basin due to natural infiltration and the completion of additional stormwater capture projects, LADWP's capacity to pump from the SFB will increase. This ensures stored water can be utilized in a sustainable manner that will not result in a condition of critical overdraft for the basin.

Groundwater Development

Los Angeles River Narrows: Groundwater in the SFB naturally flows across the basin in a general southeasterly direction toward the Los Angeles River Narrows where the LA River bends to a southward alignment as it flows toward river gaging station, Gage F-57C-R. Gage F-57-C-R is owned and operated by the LACFCD. Groundwater becomes shallow in this area, tending to rise into an unlined reach of the LA River where it can emerge as flow within the river channel. Subsurface groundwater also flows southward from this same locality leaving the SFB. This groundwater outflow is accounted for annually in the basin water budget provided with each ULARA Watermaster Report.

These annual losses are estimated using a methodology developed in the Report of Referee in 1962, utilizing readings from Gage F-57C-R and other nearby river gages. Average annual losses from 1971 through 2018 due to rising groundwater was estimated at 3,220 AFY; average annual losses due to subsurface outflow was estimated at 400 AFY. From 1915 until 1983, LADWP reduced basin outflows by diverting LA River surface water into Headworks Spreading Grounds and extracting the replenished groundwater from nearby Headworks Wellfield, until operations ceased due to discovery of contaminated groundwater at the wellheads. The Headworks Spreading Grounds has since been decommissioned and LADWP has repurposed the site for a recently constructed water storage reservoir. Pollock Wellfield, located upgradient of Gage F-57C-R, remains in operation and LADWP continues to extract groundwater intercepting much of the potential outflow losses.

Saugus Formation Exploration and Test Wells at Van Norman Complex: In 2015, two exploratory test wells were constructed at LADWP's Van Norman Complex to investigate hydrogeology, water quality, and potential yield for groundwater production from this region of the Saugus Formation. Laboratory tests indicated water produced from both test wells is of acceptable water quality, complying with all safe drinking water standards. Short-term aquifer tests performed in 2015 and later in 2017 yielded pumping in excess of 1,000 gallons per minute (gpm). To evaluate the potential for augmenting LADWP's potable groundwater supply, a 12-month long-term aquifer performance test is proposed under the Van Norman Exploratory Wells Project to determine sustainable yield to produce groundwater from this aquifer. The long-term aquifer testing is anticipated to occur in 2022.

Operation NEXT: In February 2019, LADWP initiated the Operation NEXT Water Supply Program, (see Chapter 8, *Operation NEXT Water Supply Program*), that includes delivering advanced treated recycled water from the Hyperion Water Reclamation Plant (Hyperion WRP) to local groundwater basins for indirect potable reuse. One component of Operation NEXT, which is a strategic priority, is a system of the Program that will convey advanced treated recycled water to the San Fernando Valley. This high-quality water will: a) replenish the SFB through infiltration at the various spreading grounds, and b) supplement purchased imported supplies at the Los Angeles Aqueduct Filtration Plant (LAAFP) through potable reuse by raw water augmentation. The SFB provides approximately 550,000 AF of available groundwater storage capacity. This component will allow for future increased extractions and help to make the SFB a sustainable local water supply.

Groundwater Quality

During the 1980s, testing of water supply wells in the SFB revealed elevated levels of the contaminants trichloroethylene (TCE), perchloroethylene (PCE), and other VOCs. The presence of these contaminants is due to past improper chemical handling and disposal practices of industries in the San Fernando Valley. Additionally, in the 1990s hexavalent chromium (chromium VI or Cr(VI)) and perchlorate were detected in various wells within the SFB. Nitrate concentrations have also been detected in an increasing trend since the 1990s, as a result of agricultural activities across the San Fernando Valley. Most recently, 1,4-dioxane has become an emerging chemical of concern with an increasing trend of concentration.

The presence of industrial contamination in groundwater has impeded LADWP's ability to fully exercise its groundwater rights in the SFB. Of the 115 LADWP production wells in the SFB, only 41 are currently in use with a capacity of 255 cfs. Once the North Hollywood West Wellhead response action and NHOU-2IR become operational, there will be 59 LADWP production wells in use with a capacity of 311 cfs. Various contaminants have been recorded in 47 wells at concentrations exceeding the Maximum Contaminant Level (MCL) or Notification Level (NL) established by State and Federal regulatory agencies. Among these contaminants of concern are VOCs (TCE, PCE, and carbon tetrachloride), nitrates, 1,4-dioxane, and perchlorate. Hexavalent chromium has also been detected in some of LADWP's wells. However, LADWP remediates groundwater and blends with other sources to remove or lower contaminants to concentrations below the MCL to ensure groundwater delivered to customers complies with State and Federal safe drinking water standards.

LADWP established its two largest wellfields, Rinaldi-Toluca and Tujunga, in areas that were at the time of their development believed to have been located away from known contamination areas. Since that time, these important wellfields have been significantly impacted by contamination. As discussed in the following sections, LADWP has developed various programs to restore the beneficial use of the groundwater basin. These include: the comprehensive Groundwater System Improvement Study and monitoring well installation program, response actions to address contamination in the vicinity of the Rinaldi-Toluca, Tujunga and North Hollywood West Wellfields, as well as LADWP cooperation with the USEPA response actions in the NHOU, and other collaborative efforts with State and Federal regulatory agencies to investigate sources of contamination and identify potentially responsible parties.

Agency Cooperation of SFB Remediation

LADWP actively coordinates with the State Water Resources Control Board, DDW, LARWQCB, DTSC, and USEPA to pursue protective and remedial measures for the SFB. DDW, LARWQCB, and DTSC are the three state regulatory agencies with enforcement responsibilities within the SFB. The LARWQCB and the DTSC issue enforcement directives for polluted sites and guide the development and implementation of remediation of groundwater sites. DDW oversees the quality of potable water from groundwater sources. USEPA administers the Superfund Program in the SFB.

In 1987, LADWP entered into a Cooperative Agreement with the USEPA to conduct the "Remedial Investigation of Groundwater Contamination in the San Fernando Valley." Under this agreement, LADWP received funds from the USEPA's Superfund Program to carry out: (1) construction, operation, and maintenance of the NHOU, consisting of a groundwater treatment facility and a system of eight production wells (construction completed in 1989); and (2) completion of the Remedial Investigation to characterize the SFB and the nature and extent of its groundwater contamination. The Remedial Investigation included: (a) 88 shallow and clustered monitoring wells to monitor contamination plumes of TCE, PCE, and nitrates in the SFB installed in 1992; (b) the development of a groundwater flow model (Flow Model) and the preparation of the Remedial Investigation report that was completed for the USEPA in 1992; and (c) on-going monitoring for TCE, PCE, nitrates, and emerging contaminants.

The Flow Model is a three-dimensional computer simulated model of the SFB based on the modular finite-difference flow model (MODFLOW) program code that was developed by the United States Geological Survey. It consists of four layers that represent the various depth zones of the SFB. Geologic and hydrogeologic data for the basin, generated through field investigations, were analyzed to develop the physical site characterization of the basin for the MODFLOW Flow Model. The Flow Model produces simulated groundwater levels, gradients, and their fluctuations as a function of time and is updated annually with actual extraction and recharge data. LADWP uses the Flow Model to prepare the Annual Watermaster Report, the Annual Pump and Spreading Report, and to evaluate all groundwater remediation projects and recycled water recharge projects that are ongoing or proposed in the SFB.

San Fernando Basin Groundwater Remediation

The remediation programs LADWP is planning and implementing in the SFB will help restore the capacity of SFB as a drinking water source and groundwater storage. Remediation of contamination present in the SFB is a prerequisite to being able to fully utilize LADWP's groundwater rights in the SFB and the storage capacity of the SFB. The remediation programs being pursued by LADWP are described next.

Groundwater System Improvement Study (GSIS)

LADWP completed the 6-year, $11.5-million study in February 2015 that provides the basis for a comprehensive remediation and cleanup program to address groundwater contamination in the SFB. One of the fundamental goals of the GSIS was to fill data gaps and provide a framework to collect data and assess overall groundwater quality in the eastern SFB. The GSIS was executed as an iterative study, whereby data gaps were identified, addressed, and then re-assessed. The two primary data gaps identified during initial evaluation of available data included:

- Identification of the chemicals of concern (COCs), including emerging and future contaminants, as identified by the DDW, as well as their distribution in groundwater in the eastern SFB.

- Increased characterization of the geophysics and hydrogeology of the eastern SFB, specifically in areas of North Hollywood, Rinaldi-Toluca, and Tujunga Wellfields. This information was required to update and refine the Hydrogeologic Conceptual Site Model (HCSM).

LADWP developed a monitoring well installation, sampling, and analysis program to fill these data gaps. Monitoring well installation included the collection of the following data to assist with the development of the HCSM:

- Lithologic and geophysical data (used to determine appropriate screen intervals for the multi-level monitoring wells).

- Geotechnical soil properties (e.g., soil bulk density, porosity and hydraulic conductivity).

- Water quality samples collected at discrete depths.

Water quality data was collected from existing monitoring wells and production wells (a total of 67 wells sampled in 2012/2013) and 26 newly-installed multi-level nested monitoring wells (a total of 75 locations in 2014). A comprehensive suite of more than 400 chemicals were analyzed as part of these sampling events.

Evaluation of the new data in combination with historical water quality data resulted in a total of 93 chemicals detected in the groundwater above a regulatory threshold at least once since water quality monitoring began in 1980. Only a portion of these chemicals pose a long-term risk to human health and/or the environment. To prioritize these COCs, each of the 93 chemicals was evaluated with respect to occurrence in the SFB and LADWP production wells, toxicity, and relation to regulatory thresholds and treatment requirements.

Using these criteria, a total of 12 COCs were identified as "high priority," as follows:

- Organic Chemicals
  1. TCE
  2. PCE
  3. Cis-1,2-Dichloroethene (cis-1,2-DCE)
  4. 1,1-Dichloroethene (1,1-DCE)
  5. 1,2-Dichloroethane (1,2-DCA)
  6. Carbon tetrachloride
  7. 1,2,3-Trichloropropane (1,2,3-TCP)
  8. 1,4-Dioxane
  9. NDMA
- Inorganic Chemicals
  10. Cr(VI)
  11. Perchlorate
  12. Nitrate

The remaining chemicals were reported at least once above established regulatory limits, but are considered lower priority.

The Remedial Investigation Update Report summarizes investigative results from the GSIS as well as other data sources and updates the conceptual understanding of the SFB. Specifically, it presents LADWP's updated understanding of the groundwater basin physical characteristics, nature and extent of contamination, fate and transport characteristics, and the contaminants' risk to human health and the environment. This report serves as an update to the 1992 Remedial Investigation Report for the San Fernando Valley because many of the findings from that report form the basis of the updated HCSM model.

After the completion of the Remedial Investigation Update Report in 2015, LADWP conducted individual investigations/studies for each of the three interim response actions described in the next section. Following public comment and other extensive outreach efforts, LADWP selected three interim remedial actions, described below. LADWP is now in the process of completing design, permitting, construction, and startup of these response actions. LADWP is completing these response actions in substantial compliance with the National Contingency Plan (NCP). The NCP provides the organizational structure and procedures for responding to releases and threatened releases of hazardous substances, pollutants, and contaminants. Complying with NCP is important as it ensures that the public is informed and engaged in the process and can lead to holding potentially responsible parties accountable for the contamination.

Groundwater Remediation Facilities

North Hollywood West Response Action: On July 2017, LADWP selected a response action for North Hollywood West following an extensive study and public outreach process, consistent with the NCP. On August 1, 2017, the selected response action for North Hollywood West was approved by the Board of Water and Power Commissioners and is the first of several projects that aims to respond to releases of hazardous substances and restore the beneficial use of the SFB in the vicinity of the North Hollywood West Wellfield. The treatment system will remove 1,4-dioxane—historically used as a solvent in industrial and laboratory applications—and other contaminants from the North Hollywood West Wellfield's groundwater. Implementation of this response action by LADWP will help protect public health and the environment and restore the beneficial use of groundwater by capturing groundwater contamination in the capture zone of the North Hollywood West Wellfield. This facility is expected to operate year-round and be capable of treating nearly 12,000 AFY at a maximum rate of 16.4 cfs. LADWP will operate three existing wells to capture the plume of 1,4-dioxane and treat the extracted water using an ultra violet advanced oxidation process and liquid phase granular activated carbon vessels for peroxide quenching. After contaminants are removed through this process, the water will be sent to the distribution system. This response action is scheduled to become operational in 2022. The facility will be permitted by DDW. The operation of the three remedial wells, together with other elements of the remedial program, is intended to enable other wells in the wellfield to be operated without the need for additional treatment. This response action is partially funded by the State's Proposition 1 Groundwater Grant. LADWP works in close coordination with DFA, DDW, EPA and the RWQCB on its implementation.

Temporary Tujunga Wellfield Treatment Project: Implemented in May 2010, LADWP in partnership with MWD installed wellhead treatment on two of the 12 Tujunga water supply wells to test the effectiveness of coconut-based media for removing VOCs from groundwater. The treatment system there now remediates contaminated groundwater using 10 liquid-phase GAC vessels, one for each wellhead. To date, coconut shell-based GAC has proven to operate effectively. This facility provides remediation of up to 12,000 AFY at a maximum rate of 17 cfs. This project, however, is temporary and will be removed from service when the Interim Remedial Action at Tujunga, as described below, becomes operational.

Tujunga Response Action: In December 2018, LADWP selected a response action for Tujunga Wellfield following an extensive study and public outreach process, consistent with the NCP. On January 22, 2019, LADWP's selected response action for the Tujunga Wellfield was approved by the Board. Studies have identified the presence and/or threat of 1,4-dioxane and VOC contamination in the vicinity of most of the Tujunga Wellfield. Due to groundwater contamination, pumping of some of the wells is currently restricted, and these wells are not used to produce drinking water. The goal of the Tujunga Wellfield Response Action Treatment Facility is to address the contamination present in groundwater at the wells by capturing the groundwater plume, protect public health and the environment, and restore the beneficial use of the groundwater and operation of the full wellfield. Among other things, the response action involves constructing and operating treatment equipment capable of removing the groundwater contamination. Similar to the North Hollywood West interim response action, treatment equipment includes the use of an advanced oxidation process and liquid phase granular activated carbon vessels for groundwater remediation. This treatment facility, with a capacity of 59 cfs, will be located on LADWP-owned property entirely within the Tujunga Spreading Grounds, and is scheduled to be completed in 2023.The facility will be permitted by DDW. The operation of the remedial wells, together with other elements of the remedial program, is intended to enable other wells in the wellfield to be operated without the need for additional treatment. This response action is partially funded by the State's Proposition 1 Groundwater Grant. LADWP coordinates closely with DFA, DDW, EPA and the RWQCB on its implementation.

North Hollywood Central Response Action: In December 2018, LADWP selected a response action for North Hollywood Central Wellfield, following an extensive study and public outreach process, consistent with the NCP. On December 11, 2018, LADWP's selected response action for the Rinaldi-Toluca Wellfield was approved by the Board of Water and Power Commissioners. The North Hollywood Central interim response action will address the releases of hazardous substances in the vicinity of the Rinaldi-Toluca Wellfield. Studies have identified the presence and/or threat of 1,4-dioxane and VOC contamination in the capture zone of the Rinaldi-Toluca Wellfield, and pumping of some of the wells is currently restricted. As a result, LADWP is not using these wells to produce drinking water. The goal of the response action is to address the contamination present in groundwater at the wells by capturing the groundwater plume, protecting public health and the environment, and restoring the beneficial use of the groundwater and operation of the full wellfield. This project involves constructing and operating treatment equipment capable of removing the groundwater contamination, including the use of an advanced oxidation process and liquid phase granular activated carbon vessels. The facility, to be located at the North Hollywood Pump Station Complex, will be completed in 2023 and have a capacity of 38 cfs. The operation of the remedial wells, together with other elements of the remedial program, is intended to enable other wells in the wellfield to be operated without the need for additional treatment. This response action is partially funded by the State's Proposition 1 Groundwater Grant. LADWP works in close coordination with DFA, DDW, EPA and the RWQCB on its implementation.

North Hollywood Operable Unit: The North Hollywood Operable Unit First Interim Remedy (the "NHOU-1IR"), located in the North Hollywood Wellfield, was completed in December 1989 to contain the contamination from various potentially responsible parties (the "PRPs"), including Honeywell International, Inc. ("Honeywell") and Lockheed Martin Corporation

(“Lockheed”). The NHOU-1IR was designed to extract up to 4.5 cfs of groundwater utilizing an Aeration Facility. The NHOU-1IR was designed to focus on the most concentrated part of the contamination plume. However, in 2005, it was determined by the USEPA that NHOU-1IR was not able to fully contain the contamination, and the plume continued to migrate towards LADWP production wells. In September 2009, USEPA issued a record of decision (ROD) for the NHOU-2IR, which expanded the response action for that area. USEPA issued an amendment to the ROD in January 2014, which would allow for reinjection of treated groundwater, rather than the serving of the treated water. In February 2018, USEPA issued an explanation of significant differences (ESD), which concludes that increased groundwater extraction would be more effective in attaining the NHOU-2IR remedial action objectives and protecting various LADWP production wells. That ESD allowed for the implementation of the NHOU-2IR in two components: one on the eastern side and another on the western side.

In October 2018, LADWP entered into a settlement with Lockheed (the “Lockheed Settlement Agreement”), which will enable Lockheed to implement the eastern portion of the NHOU 2IR. Pursuant to that agreement, Lockheed will cause two North Hollywood Extraction wells (NHE-7 and NHE-8), together with two new production wells to be installed by Lockheed, to be operated to remove contamination from the eastern portion of the NHOU. Pursuant to that agreement, Lockheed will cause 4,670 AFY of treated groundwater (meeting applicable drinking water standards) to be placed into the City’s distribution system, through a separate agreement with the City of Burbank. The City of Burbank will operate the treatment plant pursuant to obtaining a permit from DDW.

In December 2019, LADWP and Honeywell entered into a Settlement Agreement (the “Honeywell Settlement Agreement”), which will enable the implementation of the western portion of the NHOU 2IR. That settlement establishes a partnership to enhance and expedite remediation of contamination and support restoration of beneficial uses of groundwater within the NHOU through a program referred to as the cooperative containment concept (“CCC”). Under USEPA oversight, Honeywell will design the CCC to capture and treat various contaminants, including VOC’s, hexavalent chromium, and 1,4-dioxane. The first phase of the CCC is expected to be operational by 2022, which will pump and treat 1,500 AFY. The final phase of the CCC is expected to be operational by the fourth quarter of 2023, which together with the first phase will be designed to pump and treat 8,500 AFY. These systems will be permitted by DDW and will enable the treated water to be used for municipal use. Honeywell will construct and test the treatment and collection systems. LADWP will operate and maintain the CCC, with Honeywell paying the costs of such operation and maintenance.

Pollock Wells Treatment Plant: This facility was constructed with LADWP funds and placed into service in 1999. The plant treats groundwater pumped from two extraction wells using four liquid-phase GAC vessels at a total design flow of 6.7 cfs. The Pollock Wells Treatment Plant was designed to treat for TCE and PCE and restore a critical wellfield used to contain and reduce the loss of groundwater flowing out of SFB through the Los Angeles River Narrows.

Los Angeles-Burbank Interim Interconnection Pipeline: In 2015, the City of Los Angeles and the City of Burbank, through each of their respective Department of Water and Power agency, entered into an agreement to construct and operate the Los Angeles-Burbank Interim Interconnection (Interim Interconnection). The Interim Interconnection is a water service connection pipeline between the two cities’ water supply systems. The pipeline is capable of transferring up to 3,200 gallons per minute (GPM) of potable water to LADWP’s distribution system. In compliance with federal, state, and local laws and regulations concerning water quality, the potable water consists of an approximate 80/20 ratio blend of San Fernando Basin groundwater treated at the Burbank Operable Unit (BOU) and imported supply from the Metropolitan Water District of Southern California (MWD). Both agencies have agreed that water deliveries will be on a rolling basis with a minimum of 500 acre-feet transferred each Water Year (October 1-September 30) for five years from the project inception.

LADWP has been unable to fully produce its annual entitlement to groundwater from the San Fernando Basin due to groundwater contamination, which has impaired and restricted the use of many of LADWP’s groundwater production wells. The City of Burbank (Burbank) does not have the potable water demand year-round to utilize the maximum 9,000 GPM capacity of BOU groundwater production mandated by the EPA. LADWP and Burbank share the common goal of remediating the San Fernando Basin in order to maintain a healthy groundwater supply. The Interim Interconnection will therefore mutually benefit both cities by optimizing the use of the BOU, and maximizing the mass removal of contaminants from the San Fernando Basin. In August 2019, Burbank Water and Power (BWP) initiated conveyance of the blended water into LADWP's system via the new interconnecting pipeline and as of December 2020, 809 acre-feet has been transferred.

Separately, BWP will operate the eastern portion of the NHOU-2IR through an agreement with Lockheed, and will transfer 4,300 AFY of treated groundwater to LADWP via an agreement between LADWP and BWP. A new permanent intertie project is in development to convey flows memorialized in this Agreement. Once complete, this existing connection will cease operation.

Expanded San Fernando Basin Remediation Strategies

Pursuant to recommendations provided by the GSIS, LADWP is in the process of implementing separate response actions at its three primary wellfields in SFB: Tujunga, Rinaldi-Toluca, and North Hollywood. As a next step, LADWP intends to study and better characterize groundwater in the southeast region of SFB surrounding the Headworks, Pollock, Erwin, Whitnall, and Verdugo wellfields. In general, extraction in the southern portion of the SFB helps to soften the drawdown effect of localized pumping in LADWP's wells to the north and aids the capture of upwelling groundwater. Results of this study will provide the basis for implementation of additional basin remediation facilities.

5.3 Sylmar and Eagle Rock Basins

The Sylmar Basin has provided as much as 0.8 percent of the City's local groundwater during the recent five-year period, providing as much as 682 AF during FY 2015/16, see Exhibit 5C. The Sylmar Basin is located in the northern part of ULARA and spans 5,600 acres. This basin is bounded on the north and east by the San Gabriel Mountains; on the west by a topographic divide in the valley fill between the Mission Hills and the San Gabriel Mountains; and on the south by the Little Tujunga syncline, which separates it from the SFB.

Mission Wellfield, the only groundwater production facility LADWP operates in the Sylmar Basin, consists of two wells constructed before 1961, and five wells constructed between 1961 and 1977. Of these seven wells, only one remains operable today. However, as a result of high levels of contamination in the groundwater and deteriorated facilities, the wellfield was removed from service in June of 2016. In October 2009 LADWP, completed the first phase of the Mission Wellfield (MWF) Improvement Project. The MWF Improvement Project Phase II consists of constructing new production wells and other facility improvements. Two production wells are expected to be placed into service in 2021, which will increase LADWP's Sylmar Basin production capacity to 9 cfs.

The Eagle Rock Basin is the smallest of the four basins and located in the southeast corner of ULARA spanning only 800 acres. Eagle Rock Basin is bounded by the San Rafael Hills on the north and west, by the Repetto Hills on the east and south, and a small alluvial area to the southeast consisting of a topographic divide. The safe yield of Eagle Rock Basin is derived from imported water delivered by LADWP, which is approximately 500 AFY. LADWP has the right to produce the entire safe yield from the basin, but has not established groundwater production facilities there. Currently, one private party pumps groundwater and compensates the City for such pumping in accordance with the ULARA Judgment.

Groundwater Rights

Water rights in the Sylmar Basin were originally established by the 1979 ULARA Judgment, which recognized prior overlying rights of two private land owners and appropriative rights of the cities of San Fernando and Los Angeles. The Judgment also recognized the cities' rights to store water within the basin and recapture Import Return Water, calculated as 35.7 percent of imported water delivered.

On August 26, 1983, the ULARA Watermaster reported to the Los Angeles Superior Court that the Sylmar Basin was in a condition of overdraft. In response, in 1984, the Los Angeles Superior Court approved a stipulated agreement, limiting total pumping to 6,210 AFY, divided equally between the two cities. In 1996, the ULARA Watermaster recommended, and ULARA Administrative Committee approved, increasing the safe yield to 6,510 AFY for a 10-year period. In 2006, the ULARA Watermaster re-evaluated the safe yield and recommended a subsequent increase to 6,810 AFY, which the Los Angeles Superior Court approved, subject to various conditions. The conditions included requiring the two cities to install groundwater monitoring wells to assist in determining basin outflows and storage capacity. In 2012, the ULARA Watermaster completed an updated re-assessment of safe yield that resulted in a temporary and conditional increase in safe yield to 7,140 AFY, allowing each City the right to produce 3,570 AFY. The Court approved a new stipulated agreement in 2013, consistent with the ULARA Watermaster's assessment. The ULARA Watermaster issued a memo dated October 31, 2016, affirming the 3,570 AFY per party water right.

Stored water credits accumulated in the basin are determined by the Watermaster pursuant to the ULARA Judgment and subsequent stipulations. As of October 1, 2019, the City had accrued 9,014 AF of stored water credits in the Sylmar Basin.

Water Quality

Groundwater quality issues in the Sylmar Basin related to TCE contamination has impaired one of the two remaining production wells at LADWP's Mission Wellfield. TCE has also been detected at elevated levels in the second well. LADWP has removed the impaired well from service to ensure groundwater produced from the wellfield surpasses State and Federal safe drinking water standards. Recently installed replacement wells have shown the presence of hexavalent chromium, or Cr(VI), detected at trace levels, and TCE above the MCL in one of the three wells. LADWP is evaluating appropriate actions to address the release and threatened release of hazardous substances in this area. LADWP has also installed three off-site monitoring wells to evaluate water quality near the wellfield.

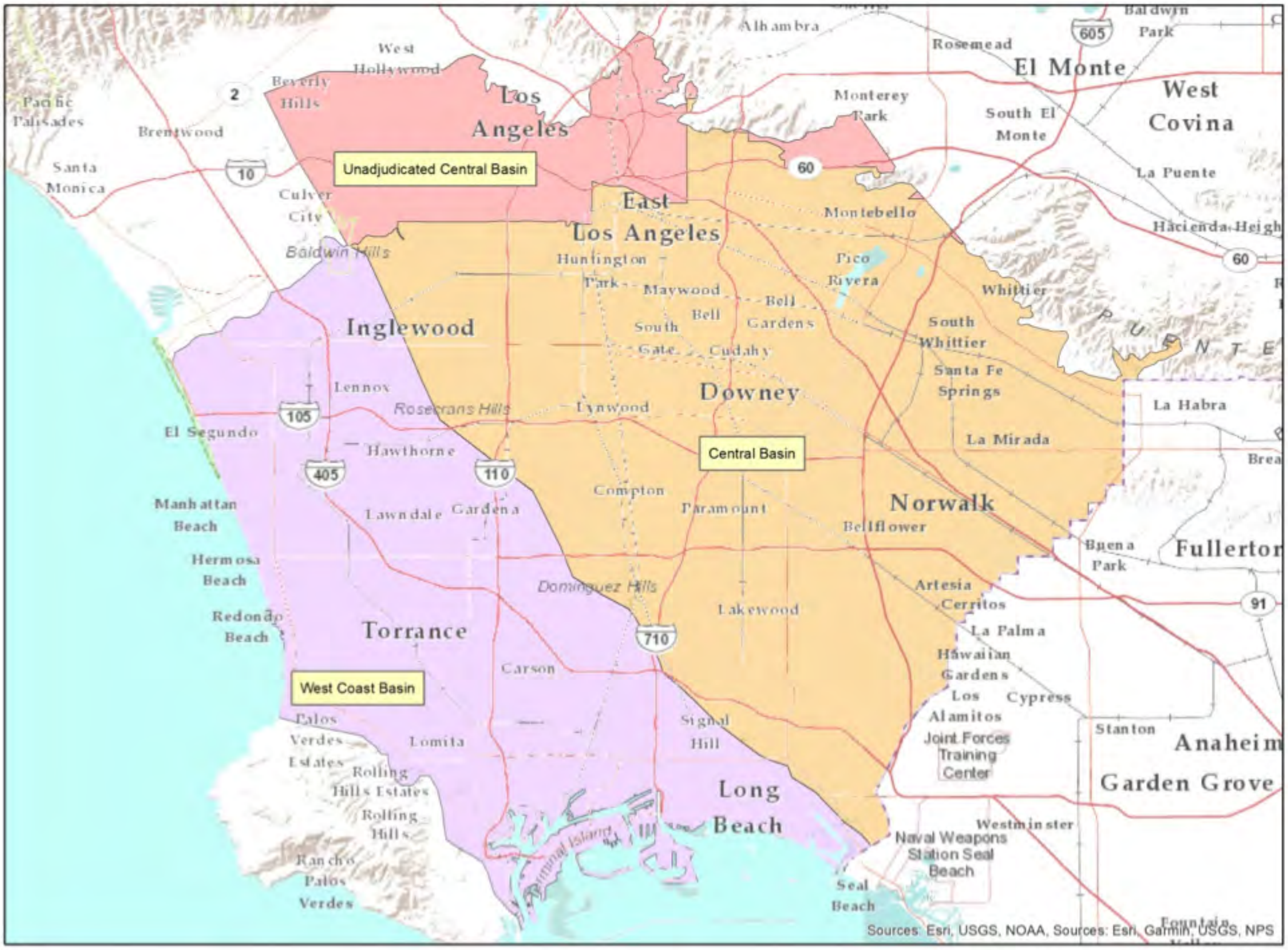
Mission Wells Facilities Improvement Project: The Mission Wellfield facility has been undergoing continued improvements since the early 2000's. In 2009, LADWP installed a new water storage tank, as part of Phase I. Phase II, which has been ongoing since 2014, involves LADWP constructing three new replacement production wells, replacing the existing pump station, upgrading the collector and discharge lines, upgrading the electrical system, installing a new flow meter, improving of the control system, and constructing three off-site monitoring wells to evaluate water quality near the wellfield. Future projects may include TCE groundwater remediation and chloramination facilities, which are currently in the planning and design phases, respectively.

5.4 Central Basin

Over the recent five-year period, the Central Basin has provided as much as 11 percent of the City's local groundwater supply, up to 8,395 AF through two wellfields, see Exhibit 5C. Known as sub-basin number 4-11.04 in DWR Bulletin 118, the Central Basin Watermaster service area overlies about 227 square miles of the Central Basin in the southeastern part of the Los Angeles Coastal Plain in Los Angeles County, as depicted in Exhibit 5E. The Central Basin Watermaster service area is bounded by the Newport-Inglewood Uplift on the southwest, the Los Angeles-Orange County line on the southeast, and an irregular line that approximately follows Stocker Street, Martin Luther King Boulevard, Alameda Street, Olympic Boulevard, the boundary between the City and unincorporated East Los Angeles, and the foot of the Merced and Puente Hills on the north. Twenty-three incorporated cities and several unincorporated areas are within the Central Basin Watermaster service area. Groundwater within the basin provides a large portion of the water supply needed by overlying residents and industries. The Central Basin Watermaster Service Report for FY 2017/18 indicates 130 parties with rights to groundwater in the Central Basin.

LADWP produces Central Basin groundwater from the Manhattan and 99th Street Wellfields. The 99th Street wells are newer, but three of them are under-producing and have been slated for destruction and replacement. The Manhattan wells are approaching the end of their useful life and have experienced water quality issues and mechanical deterioration, which has limited their capacity. To restore pumping capacity in the Central Basin, LADWP is implementing the Manhattan Wells Improvement Project and the 99th St. Wellfield Improvements, discussed in the following sections.

Exhibit 5E
Central Basin



Groundwater Rights

Prior to the creation of a formal governing organization in 1959, groundwater overdraft and declining water levels in the Central Basin threatened the area's groundwater supply and caused seawater intrusion in the southern part of the Central Basin. However, timely legal action and adjudication of the water rights halted the overdraft and prevented further damage to the Central Basin. Today, groundwater use in the Central Basin is restricted to Allowed Pumping Allocations set by the Superior Court Judgment and is monitored by a court-appointed Watermaster. The Central Basin Judgment was amended for the third time in December 2013, and major changes include new provisions to allow parties to augment and store groundwater, and to appoint a new Watermaster Panel. The Watermaster consists of three separate arms with different functions:

- The first arm is the Administrative Body, to administer the Watermaster accounting and reporting functions. This role is performed by the Water Replenishment District of Southern California (WRD).
- The second arm is the Central Basin Water Rights Panel (CBWRP), which enforces issues related to pumping rights defined in the adjudication. The CBWRP is made up of seven water rights holders who are selected through election.
- The third arm is the Storage Panel, which is comprised of the CBWRP and the WRD Board of Directors.

Annually, the Watermaster prepares a Watermaster Service Report indicating groundwater extractions, replenishment operations, imported water use, recycled water use, finances of Watermaster services, administration of the water exchange pool, and significant water-related events in the Central Basin.

The City's 15,000 AFY water right entitlement was established by judgment of the Superior Court of the State of California for the County of Los Angeles in Central and West Basin Water Replenishment District v. Adams (Case No. 786,656 – Third Amended Judgment). The City purchased an additional 46 AF and 1,500 AF of pumping rights through two separate transactions in 2014, and then 690 AF in a third transaction in 2015, bringing the total annual pumping right in the Central Basin to 17,236 AF. The City is also considering the purchase and lease of additional water rights to help augment its local groundwater supplies.

In addition to its annual entitlement, the Central Basin Judgment allows for carryover and storage of unused water rights, up to a maximum of 60 percent of a purveyor's pumping right, generally closer to 20 percent in subsequent years. The City has utilized these new storage provisions allowed under the judgment, accruing a total of 22,943 AF of stored water (Central Basin Watermaster Service Report, FY 2019/20). The Central Basin Judgment has an extraction limitation of no more than 140 percent of a purveyor's annual entitlement. This allows the City to effectively use its carryover storage right for operational flexibility and conjunctive use and underscores the benefit of acquiring additional water rights.

Water Quality

Although the Manhattan and 99th Street Wellfields are located approximately 4 miles apart, there is a significant variation in water quality between them. Two of the six Manhattan wells have been impaired by contamination exceeding the MCL of 5 ppb for TCE. Wellfield blending was not sufficient to allow continued operation of these impaired wells, which showed TCE concentrations as high as 20 ppb, requiring that these wells be removed from service. The two remaining wells have also shown TCE detected at trace levels below the MCL. The impaired wells, along with two other mechanically deteriorated wells, have been demolished. Four replacement production wells have been installed at the Manhattan Wellfield, and test results demonstrate that improved water quality can be produced from these wells. Water quality analysis has detected various levels of TCE, iron, and manganese, but not at levels requiring treatment at this time. LADWP will continue to manage and operate the wellfields in such a way that ensures groundwater quality complies with State and Federal safe drinking water standards.

Groundwater produced from the 99th Street Wellfield does not currently contain industrial contaminants above the MCLs. In addition to manganese, iron is another naturally occurring constituent found in the groundwater. While iron concentrations remain well under the secondary MCLs, they can cause water discoloration. These two constituents do not pose a risk to human health at existing concentrations; however, they do affect the aesthetic qualities of the groundwater such as taste, color, and odor. As a result, the wellfield has been taken out of operation.

Wellfield Improvement Projects

Manhattan Wellfield Improvement Project: The Manhattan Wellfield Improvement Project (MWIP) was initiated to restore the pumping capacity of the Manhattan Wellfield to produce the City's annual entitlement of groundwater in the Central Basin, plus any accumulated groundwater storage credits.

Wells and infrastructure at the Manhattan Wellfield date back to the 1920s. All older wells, with the exception of two wells, have been demolished largely due to age and corrosion, which has resulted in casing failures and sand intrusion. Contaminant plumes have also impacted local water quality. The MWIP has constructed one groundwater monitoring well, four production wells, and related facility infrastructure, including well collector and discharge lines, a purge water system, electrical upgrades, and system controls. The two older wells have a capacity of 6.9 cfs, and the four new wells recently installed have a capacity of 17 cfs. Together, these six wells will have a total capacity of 23.9 cfs. This wellfield is scheduled to be commissioned spring 2021.

99th St. Wellfield Improvements: The 99th Street wells have had a history of water quality issues, concerning levels of iron and manganese, and negative customer perception of well water. In 2016, residents of the Watts and Green Meadows Communities reported water discoloration at the Environmental Justice Town Hall Meeting, propelling the 99th Street Wellfield Improvements forward.

In the past, LADWP has used zinc orthophosphate and chlorine to treat the water. The application of zinc orthophosphate via corrosion control treatment acts as a sequestering agent. Application of sodium hypochlorite, which is used as part of the chlorination process, oxidizes iron and manganese, and provides effective water quality control for manganese and iron. Hydrogen sulfide is also present, but with chlorination, it does not pose an imminent threat to the reliability of this well supply.

The Filtration Plant System to be constructed uses an adsorptive, manganese dioxide, catalytic media to remove iron and manganese to ensure that optimal quality groundwater is produced from this wellfield. Construction of the 99th Street Wells Chloramination Station began in Fall 2016 and was completed in December 2019. Construction of the filtration plant will begin in Fall 2020 with an expected completion date of late 2021. In addition to the Filtration Plant, the 99th Street Wells Chloramination Station was constructed as a means of complying with the Federal Stage 2 Disinfectants and Disinfection Byproducts Rule and LADWP's system-wide conversion to chloramines. Working in conjunction with the Filtration Plant, the Chloramination Station will treat the groundwater produced by the 99th Street wells through the injection of chlorine in the form of sodium hypochlorite, upstream of the Filtration Plant. Chlorine, which serves as an oxidizing agent, results in an iron and manganese precipitate, which can thereby be filtered out of the water. Once the water is filtered and treated with chlorine, it is then treated with ammonia. Both the Filtration Plant and Chloramination Station are designed for treatment capacity of 10.9 cfs.

It is anticipated that additional water rights will be purchased or leased, and stored groundwater will continue to accumulate. While planned improvements at the Manhattan Wellfield will significantly increase production, additional capacity will be needed to utilize the City's entire annual water rights, including stored groundwater.

LADWP evaluated the feasibility of establishing additional extraction facilities in the Central Basin. The study assessed existing and forecasted groundwater supplies, potential environmental impacts of a new wellfield construction and operation, potential sites for wellfield development, and economic cost/benefit analysis. Additionally, LADWP constructed one monitoring well in 2015, with plans to construct three more to characterize geology, hydrogeology, and groundwater quality of the Central Basin.

Groundwater Development and Augmentation Plan

LADWP is taking a comprehensive approach towards development of the City's local groundwater assets. Concurrent with the pursuit of immediately beneficial groundwater projects, the Groundwater Development and Augmentation Plan (GDAP), published in July 2020, is intended to inform the use, storage, and augmentation of local groundwater supplies.

LADWP prepared the GDAP to evaluate means of benefiting from the opportunities provided by the Central Basin. Through the course of this study, it was recognized that a successful program would require the integration of many inter-related parts, each with the potential for alternative approaches that may evolve over time. Therefore, an approach was selected that emphasized the independent analysis and development of component parts, including wells, treatment, and conveyance. A resource allocation analysis that quantified the potential value of the Central Basin, without regard to specific locations, was combined with an independent analysis and development of component parts (e.g. well networks, treatment facilities, system connections). The results were used to generate five representative project concepts, covering a full range of beneficial resource development.

During the development of the GDAP, in February 2019, LADWP initiated the Operation NEXT Water Supply Program, see Chapter 8, Operation NEXT that includes delivering advanced treated recycled water from HWRP to groundwater basins for indirect potable reuse. One component of Operation NEXT is a system of Central Basin extraction and injection wellfields, including treatment and conveyance. The GDAP provides a planning framework for developing that system.

5.5 West Coast Basin

Due to localized groundwater contamination issues and deterioration of water quality, LADWP discontinued operating its West Coast Basin Lomita Wellfield and has been unable to pump its entitlement since 1980. Referred to as sub-basin number 4-11.03 by DWR Bulletin 118, the West Coast Basin underlies 160 square miles in the southwestern part of the Los Angeles Coastal Plain in Los Angeles County. The West Coast Basin is bounded on the west by Santa Monica Bay, on the north by Ballona Escarpment, on the east by the Newport-Inglewood Uplift, and on the south by San Pedro Bay and the Palos Verdes Hills. Twenty incorporated cities and several unincorporated areas overlie the West Coast Basin (West Coast Basin Watermaster Service Report, FY 2017/18).

Groundwater Rights

In 1945, when seawater intrusion caused by declining groundwater levels threatened the quality of the groundwater supply, legal action was taken to halt the overdraft and prevent further damage to the West Coast Basin. In 1955, the Superior Court of Los Angeles County appointed DWR as the Watermaster to administer an Interim Agreement. In 1961, the Court retained DWR as the Watermaster of the West Coast Basin Judgment entered in California Water Service Company v. City of Compton (Case No. 506,806 – Amended Judgment). Similar to the Central Basin, an annual Watermaster Service Report is prepared. The West Coast Basin Judgment affirmed the City's right to produce 1,503 AFY of groundwater from this basin. In 2014, the West Coast Basin Judgment was amended in a manner similar to the Central Basin Judgment. The Watermaster for the West Coast Basin consists of the Administrative Body (handled by WRD, as in the Central Basin), the West Coast Basin Water Rights Panel, and the Storage Panel. Parties will also be able to store specified quantities of water in the West Coast Basin, and certain parties (including the City) are able to pump up to 5,000 AFY of unused West Coast Basin rights out of the Central Basin, per the Central Basin Judgment.

Water Quality

Groundwater quality problems in the West Coast Basin were previously related to high levels of TDS, hydrocarbons, and chlorides. LADWP halted operations in the basin in September of 1980, with closure of the Lomita Wellfield, and intends to study the feasibility and cost of restoring groundwater pumping.

Brackish Desalter Feasibility Study

WRD is responsible for managing and replenishing both the West Coast and Central Basins. In the West Coast Basin, a significant plume of saline groundwater with elevated TDS is trapped in the Gage, Silverado, Lynwood, and Lower San Pedro aquifers because of historical seawater intrusion, which subsequently resulted in the development of two injection barriers. To fully utilize the West Coast Basin, WRD initiated a Regional Brackish Water Reclamation Program to evaluate ways to remediate the trapped saline plume.

A feasibility study expected to be completed in 2021 will evaluate the following components: where to extract the plume water, where and how to treat the plume water, how to convey the treated potable water to the Program Stakeholders, and how to manage the brine waste stream. Seven Program Stakeholders are participating in the feasibility study: WRD, LADWP, City of Torrance, City of Manhattan Beach, City of Lomita, Golden State Water Company, California Water Service Company, and West Basin Municipal Water District. The stakeholders either pump, hold water rights, or have other key roles in supporting basin operations. The Program Stakeholders have expressed interest in treating the saline plume, receiving the treated water, or both.

WRD determined that there is a potential to extract, treat, and distribute up to 20,000 AFY of the saline plume over thirty years. LADWP has not utilized its groundwater rights in the West Coast Basin since 1980. Participation in this Program could help further reduce the City's dependence on purchased imported water supplies by restoring the use of a local water resource. Additionally, advanced treated recycled water from Operation NEXT will be considered as a source of replenishment water for the basin.

5.6 Antelope Valley Groundwater Basin

The City has the right to pump 3,975 AF of native groundwater from the Antelope Valley Groundwater Basin (AVGB) and to store water it imports into the basin for future export. Utilization of the basin to meet City water demand will be limited to supplies imported and stored in the AVGB. Native safe yield entitlements may only be used locally within the basin. However, water imported and stored in the AVGB can be exported for use in the City. Identified in DWR Bulletin 118 as sub-basin number 6-44, the AVGB underlies 1,580 square miles of an extensive alluvial valley in the western Mojave Desert. The elevation of the valley floor ranges from 2,300 to 3,500 feet above sea level. The basin is bounded on the northwest by the Garlock Fault Zone at the base of the Tehachapi Mountains and on the southwest by the San Andreas Fault Zone at the base of the San Gabriel Mountains. The basin is bounded on the east by ridges, buttes, and low hills that form a surface and groundwater drainage divide and on the north by Fremont Valley Groundwater Basin at a groundwater divide approximated by a southeastward-trending line from the mouth of Oak Creek through Middle Butte to exposed bedrock near Gem Hill, and by the Rand Mountains farther east.

Total groundwater storage capacity is reported to be between 68 million acre-feet (MAF) (Planert and Williams 1995) and 70 MAF (DWR 1975). For the shallow section of the basin between 20 and 220 feet below ground surface, the storage capacity is reported to be 5.4 MAF (Bader 1969). However, the AVGB has a documented history of declining groundwater levels resulting in land subsidence and adverse effects to overlying land caused by excessive groundwater pumping. Much of the AVGB supported extensive agricultural production in the early part of the 20th Century followed by a shift towards rapid urbanization during the latter part of the century. The shift brought about renewed demand for groundwater, which resulted in a dramatic decrease in groundwater levels.

Groundwater Rights

Declining groundwater levels and concerns about the availability of groundwater became more pronounced as public water suppliers increased pumping for municipal supply. Litigation over Antelope Valley groundwater rights began in October 1999, with certain private land owners filing complaints and public water suppliers responding with cross complaints. In August 2005, the various actions were consolidated into the Antelope Valley Groundwater Cases, which continued under the Santa Clara County Superior Court supervised by the Honorable Jack Komar. Overlying landowners collectively have the paramount right to native groundwater, and public water suppliers have claimed prescriptive rights against the landowners. The City of Los Angeles had standing in this litigation as one of the overlying landowners in the basin.

During the 1960s and 1970s, the City, by and through the Los Angeles World Airports (LAWA), acquired approximately 27 square miles of land in Antelope Valley for the purpose of developing an international airport in Palmdale. LAWA has leased their properties to tenants using the land for agricultural production (supported by groundwater pumping), as well as for the use of treated effluent supplied by Los Angeles County Sanitation District No. 20.

After more than a decade of litigation, four trial phases, and various attempts to comprehensively adjudicate the water rights, litigation concluded on December 23, 2015, with Judge Komar entering the Antelope Valley Groundwater Adjudication settlement in the Antelope Valley Groundwater Cases (Los Angeles Superior Court Case No. JCCP4408, and Santa Clara Superior Court Case No, 1-05-CV-049053). The Court determined the native safe yield as 82,300 AFY and total safe yield inclusive of import return flows as 110,000 AFY.

The United States government asserted a paramount federal reserved right to 11,000 AFY for Edwards Air Force Base. The Court found the basin to be in overdraft since at least 1951, and has estimated current pumping to be between 130,000 and 150,000 AFY. The City's entitlement to pump 3,975 AFY may only be used on LAWA land in the Antelope Valley. Settlement provisions also allow parties to carryover and store unused annual entitlements in AVGB, and ability to transfer entitlements (purchase/sell) between parties in the Antelope Valley. The City's right to store imported water in AVGB allows for later recovery and export to the City, subject to any irretrievable losses that may be determined by the Watermaster.

The City's annual entitlement to native groundwater may be useful for LAWA's future development of an international airport in Palmdale since the native groundwater may be used only on overlying land. The right to store imported water is of broader interest to LADWP. This would allow LADWP to import water from various sources, temporarily store these supplies within the AVGB, and recover the water for export to Los Angeles at times when it is necessary to manage seasonal peak demand or augment supplies during dry periods, emergencies, or natural disaster. The LAA and State-owned California Aqueduct are facilities that may be used to convey imported supplies into the AVGB for storage. Additional facilities, such as percolation basins or injection wells, are necessary to physically place water into storage. Pumping facilities are also needed to recover stored water from AVGB for conveyance to the City. Agencies who own storage and extraction facilities may become potential partners to facilitate the City's use of underground storage in AVGB.

Water Quality

AVGB groundwater quality typically contains calcium bicarbonate where the basin approaches the surrounding mountains, and sodium bicarbonate or sodium sulfate near the central part of the basin (Duell 1987). In the eastern part of the basin, the upper aquifer contains sodium-calcium bicarbonate, while the lower aquifer contains sodium bicarbonate (Bader 1969). TDS averages 300 milligrams per liter (mg/L), ranging from 200 to 800 mg/L (KJC 1995). High levels of boron and nitrates have also been observed in the basin (KJC 1995). Based on water quality data reported to the State, concentrations detected in certain wells have exceeded the MCL for inorganics, radiological constituents, nitrates, and/or VOCs/SVOCs.

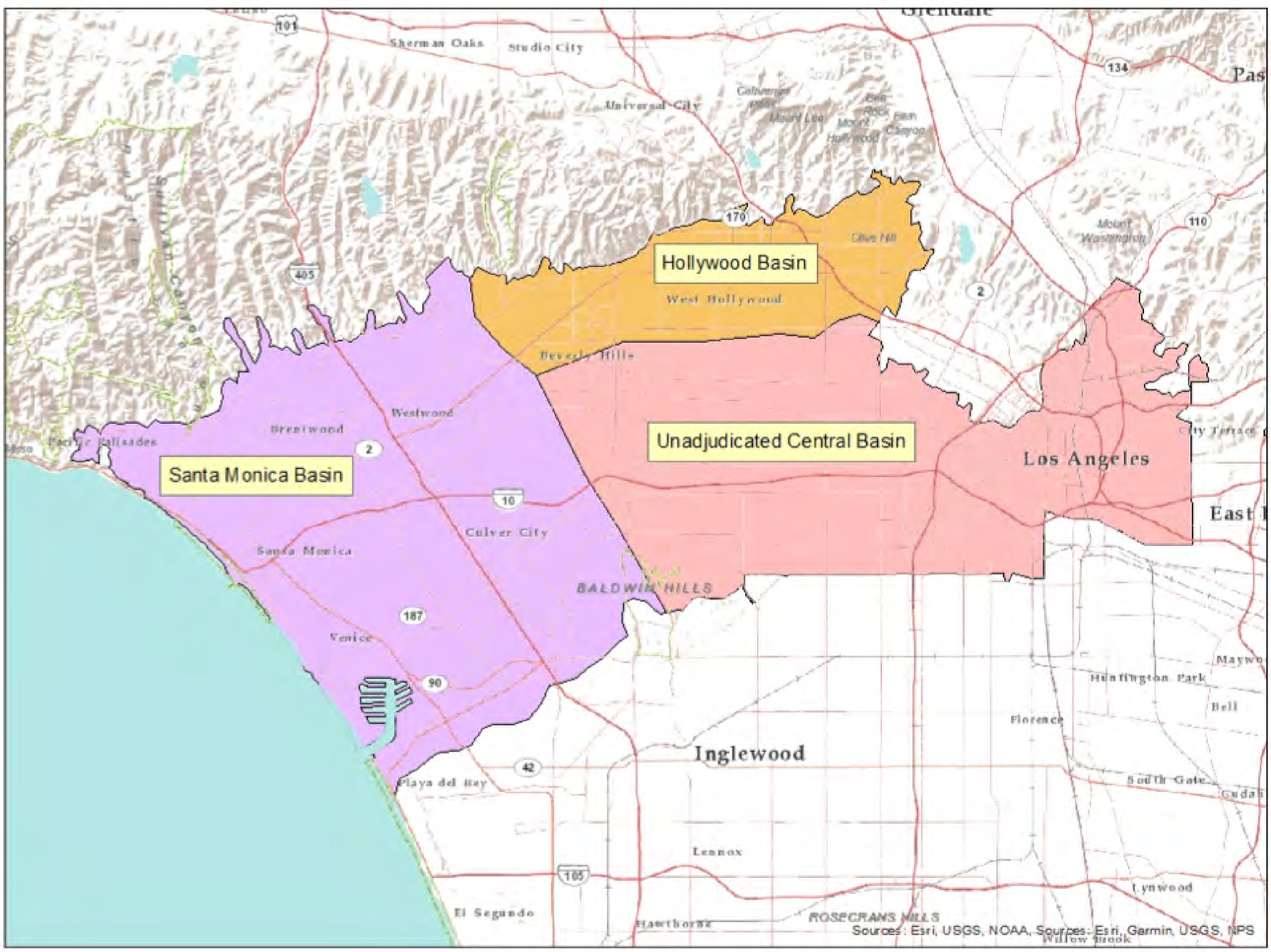
Groundwater Storage Opportunities

LADWP is exploring storage development opportunities to help improve the management of the City's supplies under hydrologic variability. The Antelope Valley contains characteristics, such as favorable soil conditions for infiltration, reasonable groundwater depths, and favorable water quality for potential storage development. Ongoing evaluations are being considered to determine the feasibility to pursue groundwater storage in the Antelope Valley. LADWP continues to evaluate opportunities for groundwater storage located near the LAA. Assessing banking opportunities includes an economic analysis in combination with the development of a water operations plan. This ongoing work will ensure that any future groundwater bank is well aligned with the City's long term sustainable and reliability goals.

5.7 Unadjudicated Basins

The Central and West Los Angeles areas of the City overlie the Hollywood Basin, Santa Monica Basin, and the northerly area of Central Basin located outside of the adjudicated basin boundary. The unadjudicated Hollywood, Santa Monica, and Central Basins are depicted in Exhibit 5F. Although the potential for utilizing these basins for groundwater supply may present certain challenges related to water quantity and quality, the call by City leaders to increase use of local resources has prompted a renewed focus toward all of the City's groundwater assets including potential supplies from these basins. As such, LADWP has considered and is exploring opportunities to develop groundwater resources in a manner that is locally sustainable, in cooperation with its regional partners in each of these basins.

Exhibit 5F
Hollywood and Santa Monica Basins



5.8 Sustainable Groundwater Management Act (SGMA)

The State Legislature enacted landmark groundwater management legislation known as SGMA, which took effect on January 1, 2015. With SGMA, the State focused upon equipping and empowering local agencies with tools needed to manage high- and medium-priority groundwater basins in a sustainable manner. Actions necessary to achieve sustainability vary by basin, but SGMA generally required local government and water agencies to form Groundwater Sustainability Agencies (GSAs) by January 30, 2017, and requires them to develop and implement Groundwater Sustainability Plans (GSPs), and monitor and report status of groundwater conditions of high- and medium-priority basins. GSPs for critically overdrafted high- and medium-priority basins were due to DWR by January 31, 2020. GSPs for the remaining high- and medium-priority basins are due to DWR by January 31, 2022. The State seeks to mitigate and prevent the occurrence of adverse effects caused by unreasonable use of groundwater, such as groundwater storage depletion, land subsidence, seawater intrusion, water quality degradation, critical overdraft basin conditions, and surface water depletions.

Throughout the development of SGMA there was broad public consensus that adjudicated basins are well managed, subject to Court jurisdiction, and should not be the primary focus for SGMA. The new law only requires managers of adjudicated basins to file a copy of their adjudications with DWR and provide annual reports that document basin conditions. However, the City overlies both adjudicated and unadjudicated basins. As such, LADWP has been working with regional partners towards implementing SGMA for the applicable unadjudicated basins, such as the Santa Monica Basin (SMB). The Hollywood Basin, also within the City boundary, was classified as low priority and not mandated to develop a GSA/GSP. Similarly, areas associated with adjudicated basins, like the northern area of Central Basin, were eventually characterized as lower priority and exempt by DWR.

In September 2017, DWR approved the formation of the SMBGSA as the exclusive GSA in the SMB. The GSA includes five agencies include LADWP, the City of Beverly Hills, the City of Santa Monica, the City of Culver City, and the County of Los Angeles. In November 2019, the SMBGSA initiated the development of a GSP for the SMB. The final GSP will be submitted to DWR by January 31, 2022.

5.9 Water Quality Goals and Management

The groundwater management efforts that LADWP has undertaken resulted in all groundwater delivered to LADWP customers meeting or exceeding all DDW water quality regulations. As part of its regulatory compliance efforts, LADWP works with the DDW to perform water quality testing on production and monitoring wells.

Groundwater Monitoring

Wells that are pumped to supply water to the City are monitored by LADWP, as required by DDW. LADWP's groundwater monitoring program is comprised of several distinct components. These components include the monitoring of metals, coliform bacteria, inorganics, VOCs, unregulated compounds, and disinfection by-products. The frequency and level of monitoring (i.e., annually, quarterly, or monthly) depends on the level of contamination found in each well. Monitoring for all contaminants is performed in close proximity to where the water is being pumped from the wells, typically the blend point. If water quality problems are detected, the well source is immediately isolated and retested. LADWP conducts extensive field and laboratory tests throughout the year for hundreds of different contaminants to ensure that they are well within safe levels before serving water to customers.

Operating Goals

LADWP has established operating goals for TCE, PCE, nitrates, perchlorate, and total chromium that are more stringent than the MCLs permitted by Federal or State regulations. These stricter operational goals provide an additional safety margin from these contaminants for City customers. Exhibit 5G summarizes these water quality goals and compares them with the State-regulated requirements, which are generally more stringent than Federal requirements.

Exhibit 5G
Operating Limits of Regulated Compounds

Compound	State of California Limit	LADWP Operational Triggers (ppb)	LADWP Added Factor of Safety
Trichloroethylene (TCE)	5 ppb	4 ppb	20%
Perchloroethylene (PCE)	5 ppb	4 ppb	20%
1,1-Dichloroethene (1,1 DCE)	6 ppb	4.2 ppb	20%
Nitrate (as N)	10 ppm	8 ppm	20%
Perchlorate (ClO4)	6 ppb	4.8 ppb	20%
Total Chromium	50 ppb	40 ppb	20%

TCE and PCE compounds are commonly used in industries requiring metal degreasing such as automotive, aerospace, and fabrication. PCE was commonly used in dry cleaning and automotive repair industries.

Nitrate is a concern because of its acute effect on infants, who are most sensitive to its effect of reducing the uptake of oxygen to the blood. The current standard for nitrate is 10 parts per million (ppm). A single exceedance of the nitrate standard is classified as an acute violation requiring immediate public notification. Treatment for nitrates may eventually become necessary for affected City groundwater supplies.

Perchlorate is an inorganic compound that is commonly used in the manufacture of rocket fuels, munitions, and fireworks. Perchlorate primarily affects the thyroid gland. The current standard for Perchlorate is 6 ppb.

Hexavalent Chromium (Chromium VI) is a carcinogenic compound widely used in electroplating, stainless steel production, leather tanning etc. There is currently no state or federal drinking water standards for Chromium VI. USEPA has set an MCL of 100 ppb for total chromium, which is the sum of trivalent Chromium (Chromium III) and Chromium VI, in drinking water. California established an MCL of 50 ppb for total chromium in drinking water.

Managing Emerging Contaminants of Concern

LADWP addresses emerging contaminants on many levels by:

1. Encouraging the development of standardized testing to enable early detection and supporting the regulatory framework by providing early occurrence data,

2. Advocating good science and a balanced approach to risk assessment,

3. Seeking to gain a risk perspective with other existing contaminants to manage the emerging contaminants in the absence of regulations,

4. Supporting early interpretation of emerging contaminants in collaboration with research and regulatory agencies, and

5. Supporting the research to develop cost-effective treatment for the removal and management of these emerging contaminants.

LADWP is currently engaged with other agencies and associations through workgroups and task forces to address emerging contaminants. As new research, science, and information becomes available, LADWP will develop monitoring technology and support programs to address emerging contaminants.

An increasing number of LADWP's North Hollywood wells have contamination of 1,4-dioxane above the 1 ppb NL set by the USEPA. Several of LADWP's North Hollywood wells were removed from service due to the increasingly compromised water quality and critical need for plume management. LADWP will continue to lose its use of these wells until the anticipated completion of the North Hollywood West/Central groundwater remediation projects.

A more recent contaminant of concern is per- and polyfluoroalkyl substances (PFAS). They are a group of manmade chemicals that have been manufactured in the United States since the 1940s. Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are the more extensively produced PFAS. Under an order issued by DDW in 2019, LADWP tested for PFOA and PFOS at the Rinaldi-Toluca and Erwin Wellfields and these chemicals were not detected in the samples. PFOA and PFOS have been detected at some of the wells in the Pollock Wellfield. The groundwater pumped from these wells is blended with other sources and the subsequent water samples showed no detection of PFAS.

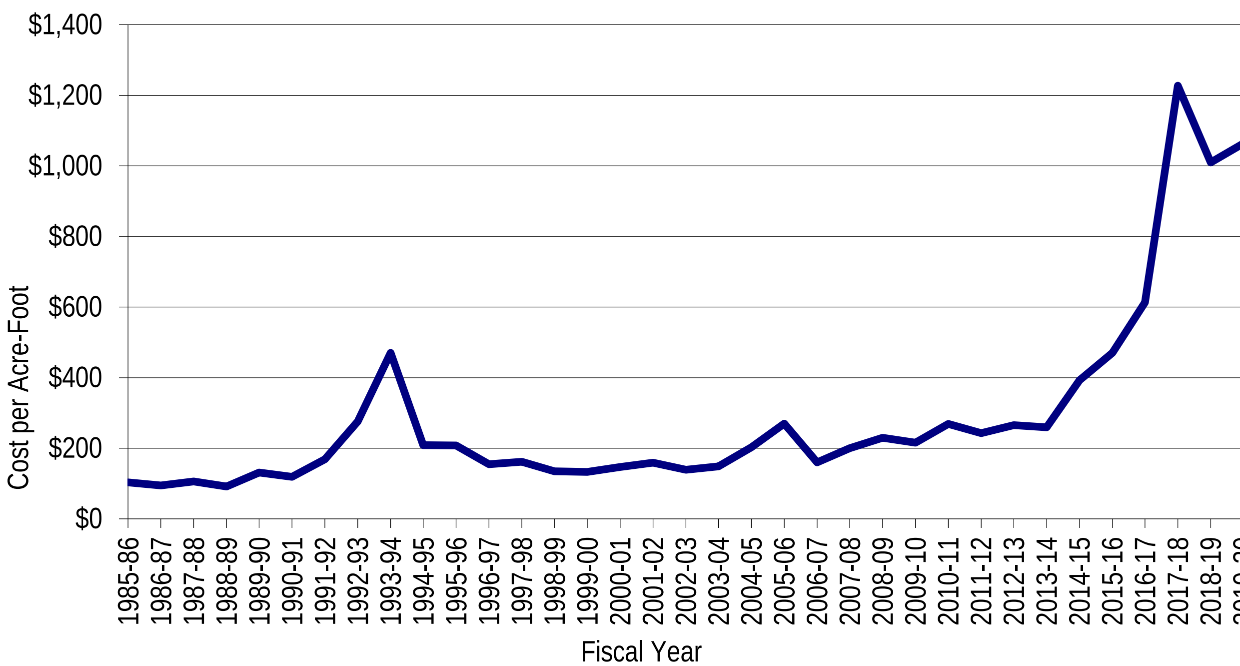
Another recent group of emerging contaminants are pharmaceutically active compounds and personal care products that are emerging in rivers, lakes, and waterways from urbanized areas. Concerns exist regarding the occurrence and effects of endocrine disrupters, hormone-shifting compounds, and pharmaceuticals. Technology now allows the detection of compounds down to the parts per trillion levels, thus some of these previously invisible compounds are now being detected in water supplies. The risk assessment sector is having difficulty keeping pace with rapid advances in analytical detection technology. The question of what health risks these contaminants pose at low levels needs more investigation. LADWP will continue to proactively address emerging contaminants through early monitoring and utilization of a balanced approach to risk management.

LADWP will be incorporating appropriate treatment processes into future groundwater treatment facilities. LADWP has and will continue to solicit input from stakeholders to carefully plan and develop processes for removal and treatment of emerging contaminants.

5.10 Groundwater Pumping Cost

Exhibit 5H graphically illustrates LADWP's annual unit cost to produce local groundwater for the City over the previous 34 years. The cost includes groundwater pumping and source facilities, payment to WRD for the Central Basin replenishment assessment, operation and maintenance, depreciation, and interest on investments. Exhibit 5I tabulates annual unit costs for the recent five-year period (FY 2015/16 through 2019/20). The five-year weighted average is $752 per acre-foot.

Exhibit 5H
Historical Cost of Groundwater Pumping



Groundwater costs increased in FYE 2015 due to remediation costs in the SFB, and in FYE 2018 unit costs increased due to the wet year impacts from the LAA resulting in low production.

Exhibit 5I
Annual Unit Cost ($/AF)*

Fiscal Year	2015/16	2016/17	2017/18	2018/19	2019/20
Unit Cost	$470	$614	$1,227*	$1,010	$1,064

*Cost increases in 2017/18 are due to: 1) substantially reducing pumping in response to the 2017 near-record LA Aqueduct water delivery to the City; 2) implementing improvement projects at some wellfields (Mission, Manhattan, 99th St); and 3) having wells out of service. While the volume of pumped water decreases, other associated costs are fixed, and the ongoing groundwater remediation projects incur additional costs as compared with previous years.

5.11 Groundwater Production Forecast

Exhibit 5J presents LADWP's forecast for groundwater production from each basin through FY ending June 30, 2045. The projection accounts for projects that restore capacity of LADWP's existing wellfields and the implementation of expanded basin remediation in SFB. Although excluded from the figures provided, LADWP anticipates pumping additional volumes in conjunction with enhanced groundwater recharge and replenishment using stormwater and purified recycled water as presented in Chapter 6, *Watershed Management*, and in Chapter 7, *Recycled Water*. Please see the respective chapters for water supply forecasts associated with these related activities.

Exhibit 5J
Groundwater Production 2019/20 to 2044/45 for Average Weather Conditions

Basin	2019/20 (Actual)	2024/25	2029/30	2034/35	2039/40	2044/45
	AFY					
San Fernando[1]	42,913	98,000	106,000	113,000	113,000	113,000
Sylmar[2]	3	4,170	4,170	4,170	3,570	3,570
Central[2]	11	18,245	18,245	18,245	18,245	18,245
Total	**42,927**	**128,415**	**128,415**	**135,415**	**134,815**	**134,815**

1. SFB remediation facilities are expected to be in operation in FY 2023. Use of groundwater storage credits and groundwater augmentation allows for increased pumping above the annual safe yield

2. Use of groundwater storage credits in Sylmar Basin and Central Basin allows for temporary increase in pumping above the annual safe yield until stored water credits have been expended.

5.12 Groundwater Management

LADWP utilizes various strategies to respond to hydrologic variability to maintain supply reliability for the benefit of its customers. One of these strategies, known as conjunctive use, is storing supplies when available to help minimize the impacts of water shortages during future dry periods. Since the 1930's, LADWP has recognized the greater operational flexibility provided by a storage program. LADWP has operated its groundwater resources conjunctively by reducing groundwater pumping and diverting water from the LAA into the Tujunga and Pacoima Spreading Grounds, which are owned and operated by the City and LACFCD, respectively. This strategy allows for greater replenishment to the local groundwater basins during wet and normal periods and prevents conditions of severe overdraft when groundwater pumping is increased during dry periods. The California Supreme Court has recognized the City's right to use the San Fernando Basin for temporary storage of its water by means of artificial recharge and subsequent recapture in The City of Los Angeles v. City of San Fernando,14 Cal.3d 199 (1975).

The San Fernando (storage capacity of 550,000 AF), Central (storage capacity of 330,000 AF), and West Coast storage capacity of 120,000 AF groundwater basins have a combined available storage capacity of approximately one million AF, representing a great opportunity for adding flexibility to the City's water supply. Various water rights judgments also enable conjunctive use strategies through provisions allowing water rights holders to pump less than their annual entitlements and accumulate groundwater storage credits. Parties may then produce this stored groundwater in subsequent years, such as during dry periods. Certain provisions of the water rights judgments also allow temporary increases in pumping while requiring equivalent reductions in pumping in subsequent years. This provides flexibility for parties who may have no accumulated groundwater in storage. LADWP utilizes these judgment provisions and has accumulated stored groundwater within each of its operating basins to provide supplemental water during dry periods, natural disasters, and emergencies.

The Operation NEXT Water Supply Program (Chapter 8, *Operation NEXT Water Supply Program*) will further develop and secure the long-term sustainability of our local groundwater resources by using advanced treated recycled water to replenish the San Fernando, Central, and West Coast groundwater basins. Through conjunctive use and sound groundwater management, LADWP can optimize the City's overall water supply portfolio and provide system resilience. The additional storage will provide a hedge against extended dry periods, changing hydrology, or an acute seismic event that disrupts imported supplies. Additional storage will also provide a safety net against regulatory or other threats to our imported supply.

In the future, as more extreme climate variability impacts the City's water resources, LADWP will continue to explore and develop storage opportunities to help improve the management of the City's supplies. In addition to increasing conjunctive use locally, LADWP is currently pursuing evaluation of groundwater storage programs during wet years in the Owens Valley and along the LAA, between South Haiwee Reservoir and LADWP's LAAFP. Additional storage through banking will help reduce the variability of imported water supply from Eastern Sierra, and allow excess supply to be stored in wet years and recovered to meet demands during dry years.

Blank Page

Hansen Spreading Grounds

Chapter Six

Watershed Management

6.0 Overview

Stormwater runoff from urban areas is an underutilized local water resource. Within the City of Los Angeles (City), the majority of stormwater runoff is directed to storm drains and ultimately channeled into the ocean. This unused stormwater carries many pollutants that are harmful to marine life and public health. In addition, local groundwater aquifers that could be replenished by stormwater are receiving less recharge than in past historical times due to increased urbanization. Urbanization has increased the City's hardscape, which has resulted in less infiltration of stormwater and contributed to a decline in groundwater elevations.

In response, LADWP's Watershed Management Group was created in January 2008 to develop and manage the water system's involvement in emerging issues associated with local and regional stormwater capture. The Watershed Management Group coordinates activities with other agencies, departments, stakeholders, and community groups for the purpose of planning and developing projects and initiatives to improve stormwater management within the City. The Group's primary goal is to increase stormwater capture by expanding centralized stormwater capture facilities and promoting distributed stormwater infiltration and reuse systems. Achieving this goal will help the City achieve its long-term strategy of enhancing local water supply and improved groundwater reliability through stormwater capture. Other watershed benefits of stormwater capture can include increased water conservation, improved water quality, open space enhancements, wildlife habitat, flood control, and social/economic benefits.

LADWP's Stormwater Capture Master Plan (SCMP), which was completed in August 2015, provides a comprehensive evaluation of stormwater capture potential within the City. Stormwater capture can be achieved by increasing infiltration into groundwater basins (i.e., groundwater recharge) and by onsite capture and reuse of stormwater for landscape irrigation (i.e., direct use).

Urbanization has encroached onto historical watershed floodplains resulting in channelization of these floodplains, which once recharged the San Fernando Basin (SFB) groundwater aquifers with large volumes of stormwater runoff. As these floodplains were undergoing rapid channelization and development, LADWP and Los Angeles County Flood Control District (LACFCD) reserved five parcels of land for use as stormwater spreading basins. These stormwater spreading basins are adjacent to some of the largest tributaries of the Los Angeles River (LA River), as well as the Pacoima and Tujunga Washes.

During average and below average years, these spreading facilities are very effective at capturing a large portion of the stormwater flowing down the tributaries. However, storm flows during wet and extremely wet years exceed the capacity of these facilities. Weather patterns in the City are highly variable, with periods of both dry years and wet years. Some climate studies predict that these patterns may become more extreme in the future. Since preparation of the SCMP, effective steps and measures were taken to develop additional stormwater capture potential. LADWP's existing capture capacity is approximately 75,000 acre-foot per year (AFY). LADWP identified future projects to capture up to an additional 80,000 AFY, bringing the total capture capacity up to 155,000 AFY by 2035.

Furthermore, a significant portion of the watershed is not located adjacent to large tributaries, and therefore cannot be served by existing spreading facilities. These areas are the urbanized low-lying flatlands where stormwater runoff typically accumulates. Therefore, the SCMP identified a strategy to develop and implement distributed stormwater infiltration solutions. These distributed solutions include widespread, smaller projects at the neighborhood scale and landscape changes at the individual parcel scale. The SCMP identified future distributed infiltration and direct use projects, programs, and policies to capture up to an additional 31,000 AFY to 56,000 AFY by 2035.

With ever-increasing attention being placed on stormwater capture, other challenging conditions beyond imperviousness and changing climate patterns have been identified. These challenges include aging spreading facilities, landfills adjacent to spreading facilities, continuing floodplain encroachment, substructure impacts, and other man-made conditions that limit the ability to capture stormwater for later use. Solutions exist for many of these challenges. For example, the aging delivery systems at the spreading facilities can be retrofitted with new gates and telemetry. Additionally, existing spreading basins can be deepened and consolidated to increase their capture capacity. Other conditions, such as the presence of large sanitary landfills adjacent to spreading facilities, are more difficult to rectify.

With increasing pressure on traditional water resources, LADWP is undertaking a significant effort to augment its local water supply portfolio with increased stormwater capture. This effort aligns with LADWP's mission of providing safe, reliable, and environmentally sensitive water supply for the City.

6.1 Importance of Watershed Management to Groundwater Supplies

Managing native stormwater is a necessary step towards maintaining a healthy groundwater basin. Urbanization and its associated increase in impervious surfaces have altered the natural ability of stormwater to replenish local groundwater aquifers. Stormwater systems in the City were designed primarily for flood control to convey stormwater runoff to the Pacific Ocean as quickly as possible, thereby minimizing the potential for flooding while maximizing the land area available for development. Within LADWP's service area, the SFB is the most receptive to regional stormwater capture and recharge through spreading basins because of its predominantly sandy soils. However, stormwater that once percolated into groundwater is now channeled across impervious surfaces and through concrete-lined channels for transport outside the San Fernando Valley. Several other groundwater basins within LADWP's service area may provide varying levels of opportunity for development of stormwater capture. These basins include: Central Basin, West Coast, Hollywood Basin, Santa Monica Basin, Main San Gabriel, Sylmar, Verdugo, and Eagle Rock. The Central and West Coast basins have clear legally adjudicated mechanisms in place that would allow for storage and recovery of additional stormwater in a manner beneficial to the City's local water supply goals.

An essential task of watershed management is to retain as much stormwater runoff as possible for groundwater recharge, which is the process of increasing an aquifer's water content through percolation of surface water. Groundwater recharge occurs in the SFB primarily through the infiltration of natural rainfall, captured local stormwater, and/or imported water. LADWP also utilizes imported water for spreading and recharge. Groundwater recharge supports the health of LADWP's SFB groundwater supplies by addressing the long-term reduction in stored groundwater within the SFB, protecting the safe yield of the groundwater basin, and ensuring the SFB's long-term water supply reliability.

During storm events, large volumes of stormwater are captured with existing centralized facilities for spreading purposes. Centralized stormwater capture facilities (i.e., spreading grounds, dams, reservoirs) are engineered features located in specific locations that capture large runoff flows when available, and subsequently deliver this runoff to spreading basins where it is infiltrated into underlying groundwater aquifers. These facilities on average have captured and infiltrated 24,660 AFY, with a historic high of 109,163 AFY. LADWP coordinates these activities with LACFCD to effectively recharge the SFB through the spreading of native stormwater. Flood control facilities are the primary means to divert native runoff into the spreading basin facilities listed on Exhibit 6A and mapped on Exhibit 6B. LACFCD oversees operations at the Branford, Hansen, Lopez, and Pacoima Spreading Grounds. The Tujunga Spreading Grounds are operated by LACFCD in partnership with LADWP.

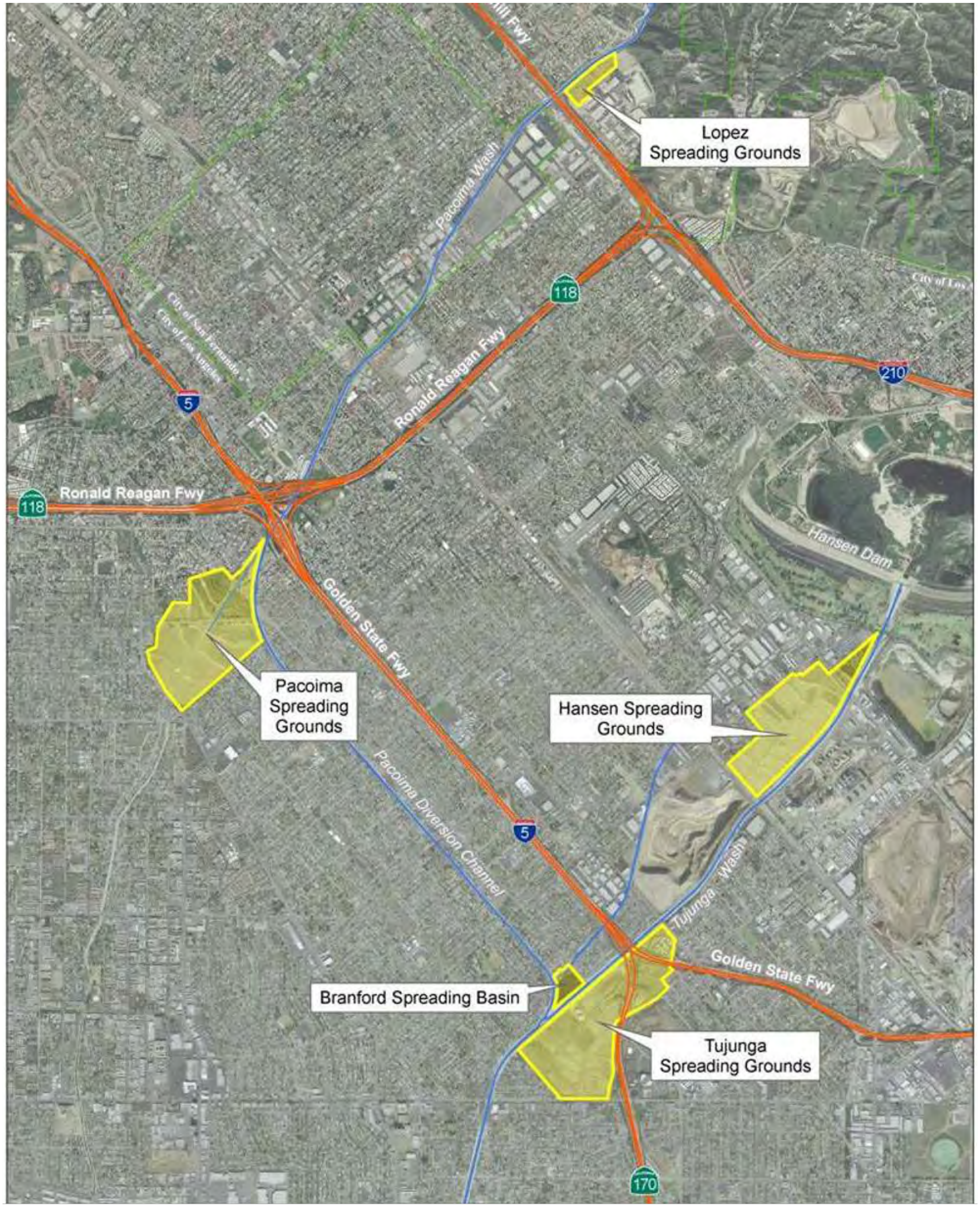
Exhibit 6A
SFB Spreading Grounds Operations Data

Facility	Location	Annual Spreading (AF)[3]	
		Average[1]	Historic High[2]
Branford	Sun Valley, CA	442	1,448
Hansen	Pacoima, CA	10,558	35,221
Lopez	Sylmar, CA	712	5,513
Pacoima	Arleta, CA	5,443	24,164
Tujunga	Arleta, CA	7,506	42,817
	Total	24,661	109,163

[1] Historic Water Year Average from first use through March 2020
[2] Historic high at each facility was determined independently
[3] Data for Water Year 2019-2020 (until March 2020) is preliminary

Rendering of Tujunga Spreading Grounds Enhancement Project

Exhibit 6B
Spreading Ground Facility Locations



6.2 Additional Benefits of Watershed Management

Watershed management provides additional important benefits to the City, including increased water conservation, improved water quality, open space enhancements, wildlife habitat, flood control, and social and economic benefits.

6.2.1 Water Quality

Water quality in local streams, rivers, and the Pacific Ocean is improved by reducing pollutants reaching downstream waterways. Stormwater runoff is a conveyance mechanism that transports pollutants from urban hardscape into various waterways, and ultimately the Pacific Ocean. Pollutants include, but are not limited to, bacteria, oils, grease, trash, and heavy metals. The City must comply with adopted Total Maximum Daily Loads (TMDLs) for certain pollutants. TMDLs set maximum limits for specific pollutants that can be discharged to a water body without causing the water body to become impaired or limiting certain uses, such as water body contact during recreation.

In 2009, the Los Angeles City Council adopted the Water Quality Compliance Master Plan for Urban Runoff. This 20-year plan provides a strategy for cleaning stormwater and runoff to protect the City's waterways and the Pacific Ocean. Capturing stormwater runoff for groundwater recharge removes a portion of the pollutant conveyance mechanism, which in turn reduces downstream pollution and thereby assists the City with water quality compliance and improving the overall health of its waterways.

The U.S. Environmental Protection Agency (USEPA) regulates discharges from large municipal separate storm sewer systems (MS4s) under the National Pollutant Discharge Elimination System (NPDES) program. MS4s are systems that serve a population of 250,000 or more. MS4 permits allow stormwater discharges into surface waters such as rivers, lakes, creeks, and the ocean under specified conditions. The Los Angeles Regional Water Quality Control Board (LARWQCB) initially issued NPDES MS4 Permit Order No. R4-2012-0175 (LA County MS4 Permit) on November 8, 2012, and it became effective on December 28, 2012. The purpose of the LA County MS4 Permit is to ensure the MS4s within Los Angeles County are not causing or contributing to exceedances of water quality objectives, which are set to protect the beneficial uses in the receiving waters in the Los Angeles region.

The LA County MS4 Permit allows permittees to customize their stormwater programs through the development and implementation of a Watershed Management Program (WMP) or an Enhanced Watershed Management Program (EWMP) to achieve compliance with receiving water limitations (RWL) and water quality-based effluent limits (WQBELs). The EWMP compliance path is designed to enable permittees to collaborate within specific Watershed Management areas to implement multi-benefit regional projects that, where feasible, retain all non-stormwater runoff and all stormwater runoff from the 85th percentile, 24-hour storm event. EWMPs were prepared and approved for the City, by watershed, as part of the City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment (LASAN)'s compliance with MS4 Permit in June 2015.

The State Water Resources Control Board State Water Board (SWRCB) amended the LA County MS4 Permit on June 16, 2015, by Order WQ 2015- 0075. The amendments included TMDL provisions designed to ensure that permittees achieve waste load allocations (WLAs) and meet other requirements of TMDLs covering receiving waters impacted by the permittees' MS4 discharges, specifically, the LA River and Ballona Creek Watershed trash TMDLs. Also, the amendments included applicable WQBELs for trash, compliance options that permittees may use to achieve compliance with the effluent limitations for trash, as well as monitoring and reporting requirements related to the effluent limitations for trash.

6.2.2 Water Conservation

Water conservation is achieved by enhancing the capture and management of localized runoff for uses that reduce potable demands. Distributed stormwater capture is the primary stormwater capture mechanism that results in water conservation. Distributed stormwater capture includes stormwater Best Management Practices (BMPs) that utilize vegetation, soils, and natural processes to manage stormwater runoff close to the source and capture localized dry and wet weather runoff. Distributed projects are smaller-scale projects that can provide water supply benefit at the neighborhood and even residential level, and can be placed throughout the City on any landscape, including parks, public and private development, public infrastructure and rights of way, and entire residential blocks. Distributed direct use projects aim to conserve water by capturing stormwater for uses that reduce potable water demand. Examples of distributed direct use projects that reduce potable demands include rain gardens, cisterns, and rain barrels. Refer to Chapter 3, Water Conservation for more information regarding rain gardens, cisterns, and rain barrels.

6.2.3 Open Space Enhancement

Open space enhancement can be an added benefit of some stormwater capture/groundwater recharge projects, which at times provide additional open space areas that may include passive recreation, educational opportunities, and habitat restoration. Most projects involve increasing vegetation and recreational amenities to create opportunities for wildlife habitat and a recreational/educational resource for the local community. Additionally, open space enhancements assist the City in improving the overall quality of life for residents and provide substantial aesthetic improvements to the urban landscape.

6.2.4 Wildlife Habitat

Wildlife habitat can be improved or augmented through stormwater capture projects that include restoration of native vegetation. For example, projects that include open space enhancements may also provide habitat for aquatic life, birds and insects, while helping to replenish groundwater supplies and improve water quality. Additionally, removal of invasive species increases native vegetation that provides food and habitat for wildlife.

6.2.5 Flood Control

Flood control benefits are achieved when demand on the conveyance capacity of the storm drain system is reduced. Groundwater recharge projects reduce potential flooding by diverting a portion of storm flows into recharge areas, thereby decreasing the demand on the overall capacity of the storm drain and flood control-channel systems.

6.2.6 Social/Economic

Social and economic benefits can be provided by stormwater capture projects. Specific benefits include: passive recreation, neighborhood revitalization, public health improvement, educational opportunities, and job creation.

6.3 Stormwater Capture Master Plan

The SCMP, completed in August 2015, investigated potential strategies for advancement of stormwater and watershed management throughout the City. The SCMP is a document that outlined LADWP's strategies from 2015 to 2035: (1) implement stormwater policies, programs and projects in the City, and (2) contribute to the development of more reliable and sustainable local water supplies, which ultimately reduce the City's purchase of imported water.

6.3.1 Goals and Benefits

The SCMP evaluates existing stormwater capture facilities and projects, quantifies the maximum stormwater capture potential, develops feasible stormwater capture alternatives (i.e., projects, programs, policies etc.), and proposes potential strategies to increase stormwater capture. The SCMP also evaluates the multi-beneficial aspects of increasing stormwater capture, including potential open space alternatives, improved downstream water quality, and peak flow attenuation in downstream channels, creeks, and streams such as the LA River.

The goals of the SCMP include:

- Quantification of the stormwater capture potential, including both long-term (2099) as well as a 20-year implementation timeline;
- Identification of new projects, programs, and policies to increase stormwater capture for water supply;
- Prioritization of opportunities based on water supply criteria;
- Development of costs and benefits for proposed projects, programs, and policies;
- Definition of timing and key milestones at 5-year intervals/implementation rates (2020, 2025, 2030, and 2035); and
- Identification of potential funding strategies that could be used for program and project implementation.

6.3.2 Key Stakeholders

Project partners and supporters included:

- City of Los Angeles Department of Water and Power
- City of Los Angeles Department of Public Works
- City of Los Angeles Department of Recreation and Parks
- Community-based organizations and stakeholders
- County of Los Angeles Department of Public Works
- Los Angeles County Flood Control District
- Metropolitan Water District of Southern California
- U.S. Army Corps of Engineers

The SCMP's target audiences were grouped into four categories:

1. The internal audience, which consisted of local and state elected officials, regulators, and entities involved in research or implementation programs related to stormwater capture. Groups included City, County, State, and Federal departments, such as the Mayor and City Council members, USEPA Region 9 Administrators, LARWQCB members, and the SWRCB.

2. The Technical Advisory Team, which consisted of internal LADWP and City staff, as well as representatives from other government agencies with planning-level interests and overlap with LADWP's master planning process.

3. Key regional stakeholders, which included critical opinion leaders and leaders of environmental, neighborhood, civic, and community organizations.

4. The general public, which included the citywide audience, constituents of key stakeholders, and the media.

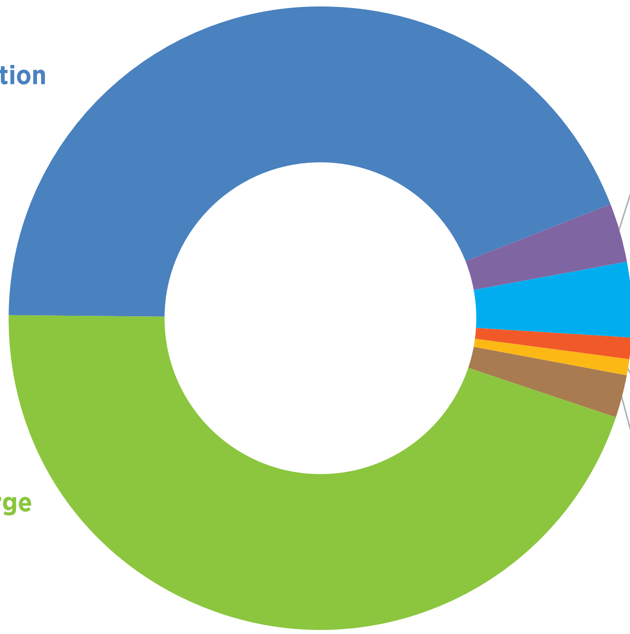
6.3.3 Existing Capture

The SCMP used two watershed models to estimate the existing stormwater capture occurring in the City, both in centralized facilities (e.g. spreading grounds) and as incidental distributed capture on pervious surfaces. The primary model was Los Angeles County's Load Simulation Program (LSPC) model because it is constructed with all of the major centralized facilities in place, calibrated to simulate runoff for the SCMP study area, and can simulate the routing, drainage networks, storage in dams, and infiltration in spreading grounds. The second model used to corroborate the LSPC results was the Ground Water Augmentation Model (GWAM) because it models evapotranspiration and recharge more robustly than LSPC, though it does not have the ability to simulate the routing and centralized facilities.

Results indicate that an average annual volume of 831,400 AF of water enters the City (volumes are based on the average annual volume for the period of record from 1988 to 2011) as precipitation, irrigation, or runoff from upstream areas and, as shown in Exhibit 6C, leaves either as evapotranspiration (45 percent), surface discharge (44 percent), capture/recharge in centralized facilities (three percent), or incidental capture on pervious surfaces and distributed recharge (eight percent).

Approximately 11 percent or 92,000 AF of the total incoming water currently goes to recharge aquifers, which is divided between 29,000 AF of centralized stormwater capture and 63,000 AF of incidental distributed stormwater capture. However, only 35,000 AF of the incidental distributed stormwater capture is recharged into groundwater supply aquifers. Combined, the total existing amount recharged into groundwater supply aquifers is 64,000 AF. The San Fernando Valley is where most of the incidental distributed recharge is occurring and where all the existing centralized facilities are located.

Exhibit 6C
Watershed Model Results



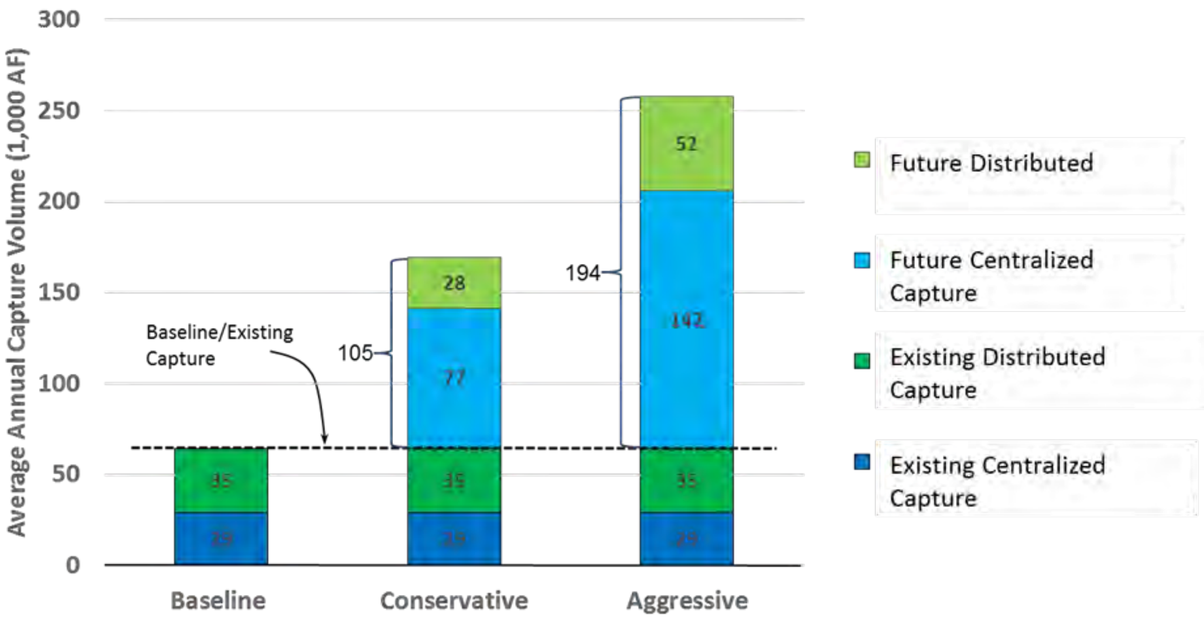
6.3.4 Potential Capture

The SCMP analyzed potential capture to determine how much of the inflow to the City could realistically be captured in centralized facilities (e.g. spreading grounds), distributed facilities/infiltration BMPs (e.g. rain gardens), incidental distributed capture/recharge on pervious land, and direct use storage facilities (e.g. cisterns). This analysis defined the Conservative and Aggressive implementation scenarios, and modeled those scenarios to determine how much capture is potentially attainable. The two scenarios create an "envelope" of the range of potential future outcomes and reflect broader conditions outside the direct control of LADWP that could impede or accelerate stormwater capture.

Man-made obstacles that could potentially be addressed in the future were mapped for the entire City area, including contaminant plumes, Superfund sites, dewatering permits, production wells influenced by untreated stormwater, and heavy industrial land uses. Under the Conservative Scenario these obstacles were assumed to remain, and those areas considered off limits. Under the Aggressive Scenario, it was assumed that these obstacles were removed so that these constraints did not impact opportunity.

The long-term (2099) stormwater capture potential is 169,000 AFY and 258,000 AFY under the Conservative and Aggressive scenarios, respectively. This capture potential is shown on Exhibit 6D and represents a long-term (2099) capture volume of approximately double and triple the existing volume.

Exhibit 6D
Existing and Long-Term (2099) Potential Stormwater Capture



The SCMP provides an implementation strategy for stormwater capture from 2015 to 2035, at 5-year increments, using centralized and distributed capture. Under the SCMP implementation strategy, LADWP could increase its stormwater capture by nearly 68,000 to 114,000 AF per year by 2035 for a total capture amount of 132,000 AF (Conservative) and 178,000 AF (Aggressive).

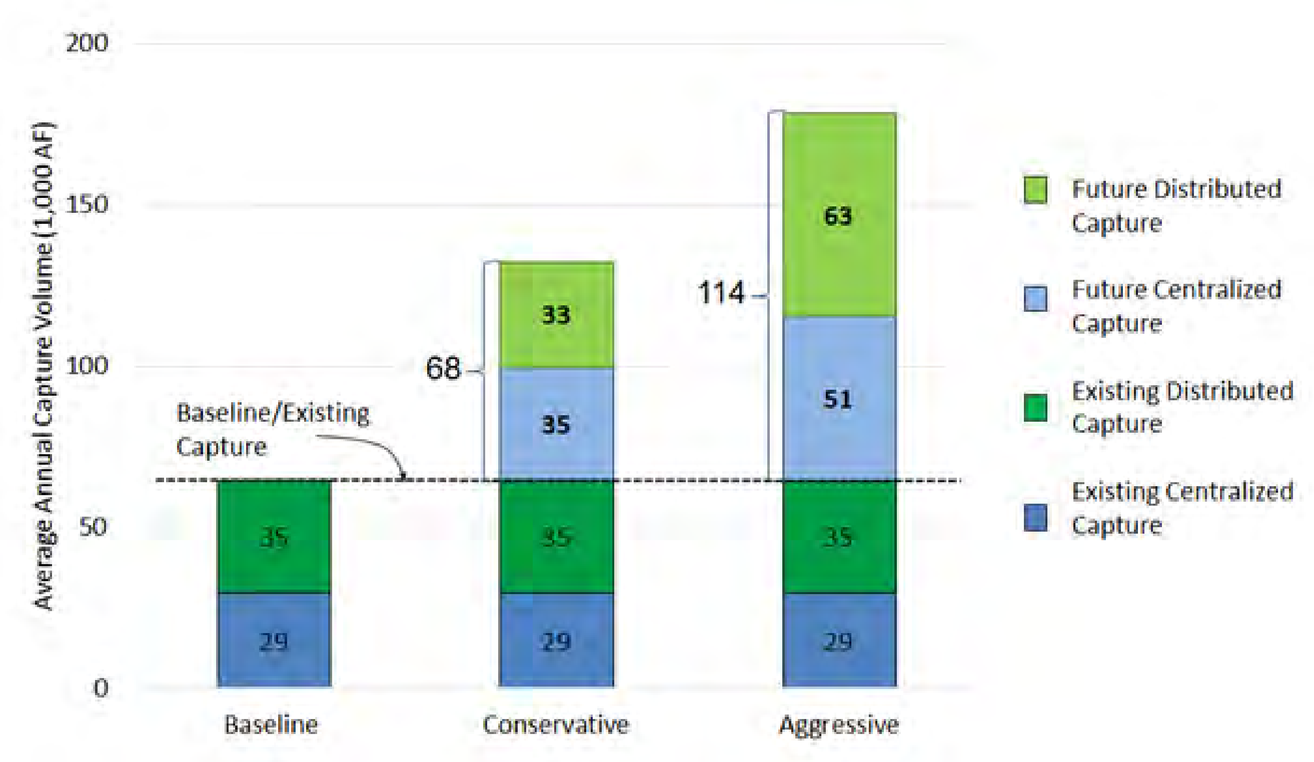
As in the existing condition, most of the increase in recharge will take place in the San Fernando Valley under both scenarios. Capture volumes are summarized in the Exhibits 6E and 6F for the 20-year implementation timeline ending in 2035.

Exhibit 6E
Potential Distributed and Centralized Stormwater Capture in 2035

Type of Stormwater Capture			Conservative Scenario (AF)	Aggressive Scenario (AF)
Existing/Baseline Capture	Baseline Recharge	Centralized Capture	29,000	29,000
		Incidental Distributed Capture	35,000	35,000
		Subtotal Existing/Baseline Capture	64,000	64,000
Future Capture	Recharge Potential	Centralized Facilities	35,000	51,000
		Distributed Facilities	31,000	56,000
		Subtotal Recharge	66,000	107,000
	Direct Use Potential	Distributed Direct Use	2,000	7,000
	Total Future Capture		68,000	114,000
Total Existing/Baseline + Future Capture			132,000	178,000

Source: LADWP, Stormwater Capture Master Plan, 2015.

Exhibit 6F
Distributed and Centralized Capture - 2035



6.3.5 Implementation

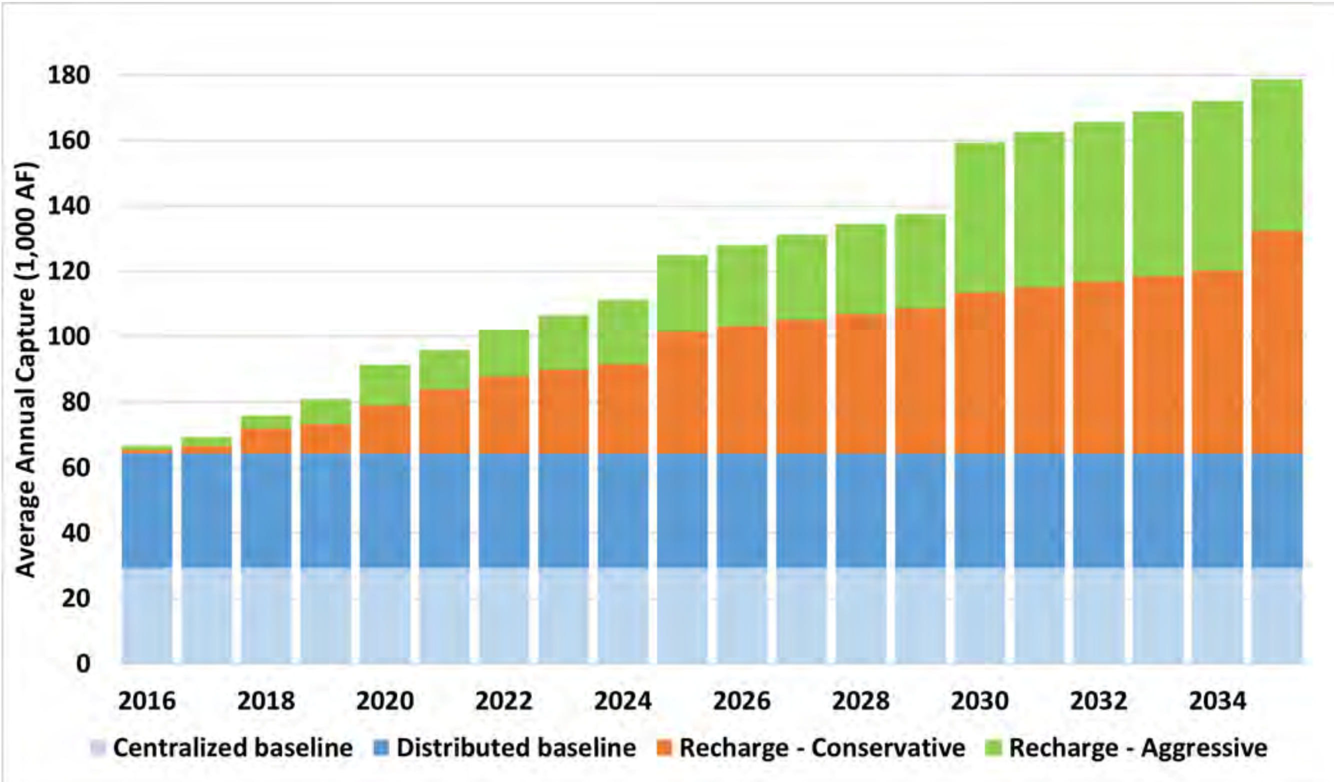
The SCMP defines five-year targets for stormwater capture from 2015 to 2035 and presents recommended avenues for implementation using a combination of centralized and distributed projects. The projected average annual capture through time is illustrated on Exhibit 6G.

For centralized projects, a comprehensive list of alternatives was compiled from review of previously-implemented stormwater capture studies, LADWP's current list of centralized projects, new project concepts, and stakeholder input. Implementation phasing was developed by analyzing the status of each project, understanding the technical complexity of each project, determining the level of permitting required, and assessing the individual project costs and partnership opportunities. These projects are described in Section 6.4.

For distributed capture, program type alternatives were developed by creating categories based on different combinations of project attributes, including tributary area (either projects capturing runoff from a single property or those that capture runoff from an entire neighborhood), land use type (private property land uses or streets in the public right of way), and ultimate use of captured water (aquifer recharge or direct use). This categorization includes (1) on-site infiltration, (2) on-site direct use, (3) green street programs, (4) subregional infiltration, and (5) subregional direct use. These programs are described in Section 6.5.

LADWP is committed to achieving its goal of 150,000 AFY of stormwater capture by 2035, which is between the conservative scenario of 132,000 AFY and the aggressive scenario of 178,000 AFY.

Exhibit 6G
Potential Average Annual Capture through Time



Lopez Spreading Grounds

6.4 Centralized Stormwater Capture Projects

Tujunga Spreading Grounds

Existing centralized stormwater capture facilities will require infrastructure improvements to maximize their capture capacity during extreme wet years. Weather patterns vary dramatically in the City with extreme wet years and extreme dry years. Therefore, new projects are necessary to expand the capability to capture a larger portion of stormwater flows during wet years. Multiple opportunities exist to develop new recharge projects and improve existing recharge projects in the SFB as identified in the SCMP. LADWP is proactively working in close partnership with LACFCD on multiple stormwater projects. LADWP, in collaboration with LACFCD has supported and contributed resources toward the design, construction, and implementation of a variety of projects to increase groundwater recharge of the SFB. Additionally, multiple agreements between LADWP and LACFCD have been approved to facilitate the completion of recharge studies, design work, and construction projects in the SFB for groundwater recharge, flood protection, and other benefits.

LADWP identifies future centralized stormwater capture projects, of which the most significant projects are summarized in Exhibit 6H and 6I. For prioritizing projects, LADWP developed evaluation criteria that were used to score each of the projects. The ranking criteria included items such as stormwater capture potential and cost, as well as ownership and partnership opportunities. LADWP identified future projects to capture up to 80,000 AFY by 2035, raising groundwater levels and ensuring future water supply reliability.

Exhibit 6H
Potential Improvements to Existing Spreading Grounds Projects

Project	Historical Annual Recharge (AFY)	Increased Annual Recharge (AFY)	Expected Annual Recharge (AFY)	Estimated Project Completion	Total Project Cost (Millions $)
Tujunga Spreading Grounds Upgrade	8,000	8,000	16,000	2021	51
Pacoima Spreading Grounds Upgrade	5,500	5,300	10,800	2024	70
Lopez Spreading Grounds Upgrade	700	480	1,180	2025	4

Exhibit 6I
Potential New Stormwater Capture Projects

Project	Expected Annual Recharge (AFY)	Estimated Project Completion	Total Project Cost (Millions $)
Penmar Water Quality Improvement Phase II	200	2022	2.83
Parks Program - Strathern Park North Stormwater Capture	282	2022	18.43[1]
Parks Program - Fernangeles Park Stormwater Capture	231	2022	16.46[1]
Silver Lake Stormwater Capture	159	2022	9.12[3]
Parks Program - Valley Village Park Stormwater Capture	99	2023	6.32[1]
San Fernando Regional Park	446	2023	14.28
Parks Program - Whitsett Fields Park North Stormwater Capture	123	2023	14.61[1]
Parks Program - Alexandria Park Stormwater Capture	93	2023	10.66[1]
Bull Creek Pipeline	3,000	2026	8.80
Parks Program - David M. Gonzales Stormwater Capture	489	2023	24.66[1]
Parks Program - North Hollywood Park Stormwater Capture	1,165	2023	95.72[1]
Parks Program - Valley Plaza Park North Stormwater Capture	470	2023	35.28[1]
Parks Program - Valley Plaza Park South Stormwater Capture	136	2023	8.00[1]
Pacoima Dam Sediment Removal	700	2025	85.00
Riviera Country Club	158	2025	3.00[3]
Big Tujunga Reservoir Restoration Project	500	2026	33.00
Rory M. Shaw Wetlands Park	590	2026	52.00
Big T & Pacoima Dam to LA Filtration Plant	5,000	2027	80.00[3]
Lakeside Debris Basin	238	2027	0.42
Van Norman Stormwater Capture	2,300	2027	45.00
Boulevard Pit Multiuse	9,760	2028	118.00[3]
Hansen Dam Water Conservation Project	3,400	2029	6.00[3]
North Hollywood Power Line Easement	750	2029	5.00[3]
Sepulveda Basin – Hansen SG Pipeline	3,000	2030	6.60[3]
Sheldon Pit Multiuse	4,500	2031	75.00[3]
Old Pacoima Wash Stormwater Capture	1,000	2031	44.22[3]
Whiteman Airport	174	2032	7.50[3]
Mid-Valley Water Facility	18	2032	TBD
BWP DS #80	34	2032	TBD
Hubert H Humphrey Memorial Recreation Center	49	2032	11.6
David M. Gonzales Pacoima Recreation Center	368	2032	19.73[1]
Ritchie Valens Park/Paxton Park	237	2032	TBD
Roger W Jessup Park	80	2032	TBD

Project	Expected Annual Recharge (AFY)	Estimated Project Completion	Total Project Cost (Millions $)
Stonehurst Recreation Center	31	2032	TBD
San Fernando Community Health Center	8	2032	TBD
JSTI	10	2032	TBD
Andres and Maria Cardenas Recreation Center	481	2032	TBD
Brandford Park	5,822	2032	TBD
Devonshire Arleta Park	4,755	2033	TBD
Devonwood Park	62	2034	TBD
El Dorado Avenue Park	2,154	2034	TBD
Marson Park	364	2034	TBD
North East Valley Multipurpose Center	144	2034	TBD
North Hills Community Park	913	2034	TBD
Panorama City Recreation Center	69	2034	TBD
Sepulveda Recreation Center	498	2034	TBD
Tobias Park	16	2035	TBD
Van Nuys Multipurpose Center	440	2035	TBD
Van Nuys Recreation Center	462	2035	TBD
Louise Park	873	2035	TBD
Vanalden Park	4,565	2035	TBD

Note: Total Project Cost is from LADWP supplied project flyers unless specified otherwise.
[1] City of LA Bureau of Engineering Stormwater Capture Parks Program, June 12, 2019
[2] LADWP Neighborhood Council MOU Oversight Committee, September 1, 2018
[3] One Water LA: 2040 Plan; Volume 3 – Stormwater & Urban Runoff Facilities Plan, 2018

Future projects listed in Exhibit 6H and 6I with an estimated project completion date of 2025 or sooner are described next.

Tujunga Spreading Grounds Upgrade. LADWP and LACFCD worked cooperatively to enhance the Tujunga Spreading Grounds. Enhancements include deepening and consolidating the existing basins into nine large spreading basins, installing two high flow intakes with inflatable rubber dams, and modifying the existing intake to improve water quality and remove sediments. Other equipment installed includes control houses, slide gates and spillways, as well as a remote-control telemetry system. The project plan incorporates community access and open space for passive recreation, limited to operational constraints. The City will maintain the open space attributes of the project, and LACFCD is going to continue to operate the recharge facilities. Project construction began in 2016 and is expected to be completed in summer of 2021. The project is expected to increase stormwater capture by 8,000 AFY.

Stormwater Capture Parks Program. LADWP's Stormwater Capture Parks Program (Parks Program) has identified nine LA City-owned parks suitable for stormwater capture projects. The primary objective of the Parks Program is to recharge the San Fernando Valley Groundwater Basin by capturing urban runoff and diverting stormwater from the Tujunga Wash Central Branch storm drain. The total Parks Program tributary area is 5,956 acres with an anticipated average stormwater capture capacity of 3,088 AFY. In addition, the Program will improve LA River water quality, reduce localized flooding, raise public awareness, and provide open space enhancements including active and passive recreation space.

LADWP applied for funding from the Los Angeles County's Safe Clean Water Program (SCWP) to help partially fund the implementation of the Parks Program. The Los Angeles County Board of Supervisors formally voted to approve the Round 1 funding awards to LADWP in the amount of $20,816,698. The SCWP provides dedicated funding to increase local and sustainable water supplies, improve water quality, protect public health and enhance open space, all of which are in alignment with LADWP's Parks Program.

Strathern Park North. Strathern Park North is one of nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The Parks Program proposed project consists of installing 11-foot-tall subsurface infiltration galleries and increasing the approximate capacity to capture 282 AFY of runoff from a 445-acre tributary area.

Fernangeles Park. Fernangeles Park is another location that the Parks Program has identified as suitable for stormwater capture projects. The proposed project consists of capturing runoff from approximately 318-acre tributary area, diverting it into a 1.6-acre underground infiltration gallery. The project is expected to capture 231 AFY of stormwater.

Valley Village Park. Valley Village Park is one of the parks in the Parks Program. The proposed project consists of capturing runoff from approximately 455-acre tributary area, diverting it into a 0.6-acre underground infiltration gallery, and increasing the approximate capacity to capture 99 AFY of runoff.

Whitsett Fields Park North. Whitsett Fields Park North is one of the nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The proposed project consists of capturing runoff from approximately 302-acre tributary area, diverting it into a 1.62-acre underground infiltration gallery, and capturing 123 AFY of runoff.

Alexandria Park. Alexandria Park is one of nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The project consists of installing 11-foot-tall subsurface infiltration galleries and increasing the approximate capacity to capture 93 AFY of runoff from a 175-acre tributary area.

David M. Gonzales Stormwater Capture. The David M. Gonzales Stormwater Capture project consists of capturing runoff from approximately 759-acre tributary area around the David M. Gonzales Recreational Center and diverting it into a 2.9-acre underground infiltration gallery. The gallery is sized to store approximately 1,250,000 cf. The project is expected to capture 489 AFY of stormwater.

North Hollywood Park. North Hollywood Park is one of nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The proposed project consists of capturing runoff from approximately 2,363-acre tributary area and diverting it into an 11-acre underground infiltration gallery and capture 1,165 AFY of runoff.

Valley Plaza Park North. Valley Plaza Park North is one of nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The Program will install 11-foot-tall subsurface infiltration galleries and increase the approximate capacity to capture 470 AFY of runoff from a 920-acre tributary area.

Valley Plaza Park South. Valley Plaza Park South is one of nine City-owned parks that the Parks Program has identified as suitable for stormwater capture projects. The proposed project consists of capturing runoff from approximately 229-acre tributary area and diverting it into a 0.7-acre underground infiltration gallery to capture 136 AFY of runoff.

Silver Lake Stormwater Capture. New storm drains are going to be constructed to divert stormwater from the surrounding residential neighborhood into the Silver Lake and Ivanhoe reservoirs. These two reservoirs have been removed from the potable water distribution system. On average, the Silver Lake and Ivanhoe reservoirs lose an estimated 460 to 585 AFY of water to evaporation and exfiltration. The Silver Lake Reservoir Stormwater Capture Project is expected to reduce groundwater demand at the Silver Lake Reservoir Complex by delivering an average of 159 AFY of stormwater.

Pacoima Spreading Grounds Upgrade. LADWP, in conjunction with LACFCD, is upgrading the Pacoima Spreading Grounds by improving the intake and stormwater storage capacity. Annual average stormwater capture is expected to increase by approximately 5,300 AFY with completion of the project. Other project benefits include flood protection, water quality improvements, and passive recreation.

San Fernando Regional Park. The San Fernando Regional Park is owned and operated by the City of San Fernando. The project aims to renovate these amenities and recharge stormwater runoff into the groundwater basin. This is going to be accomplished with the installation of an underground infiltration/retention BMP with a 25-acre-foot single event capacity. The BMP is going to be constructed beneath the open space and southwest baseball diamond. Anticipated benefits include: an average of 446 AFY of stormwater infiltrated into the SFB, improved LA River water quality, reduced localized flooding, removal of pollutants (trash, bacteria, metals, and nutrients), and open space enhancements (i.e., active and passive recreation).

Bull Creek Stormwater Capture. The Van Norman Complex has a 13-square mile tributary area and has large potential for stormwater capture. These flows exit the Van Norman Complex through Bull Creek and are eventually lost to the ocean via the LA River. This project proposes conserving a portion of the lost water by diverting flows from Bull Creek, using a six-foot high rubber dam, and conveying flows through a 60-inch pipeline to Pacoima Spreading Grounds, where it would spread and recharge the SFB. The project is expected to capture 3,000 AFY of stormwater.

Lopez Spreading Grounds Upgrade. The Lopez Spreading Grounds Upgrade involves deepening the existing Lopez Spreading Grounds and improving the intake and delivery system. LACFCD is the lead agency for the project. Additional stormwater capture in the amount of 480 AFY is expected from the project.

Pacoima Dam Sediment Removal. The Pacoima Dam Sediment Removal project involves removing sediment from behind the Pacoima Dam to increase storage volume. The sediment build-up behind the dam has decreased the capacity to about 3,300 AF. The project involves excavating five million cubic yards of sediment and increasing the storage volume by 3,000 AF. Increased storage would decrease the number of reservoir spill events and increase the available recharge flow for the Pacoima and Lopez Spreading Grounds. The excavation is going to extend over 7,000 feet upstream of the existing dam. The project is projected to produce an additional annual water recharge benefit of 700 AFY.

Riviera Country Club. The Riviera Country Club is located within the Santa Monica Canyon Watershed, which discharges into Santa Monica Bay where bacteria levels are monitored. Nearly half of this watershed (4,500 acres) drains to the project site. A new rubber dam diversion is going to route runoff from the Santa Monica Canyon Channel to a Continuous Deflective Separation (CDS) unit to trap sediment, trash, debris, and hydrocarbons. Flows from the CDS unit will lead to an existing 350,000- gallon tank. During wet weather, up to 12 cubic feet per second (CFS) of stormwater will be diverted to the 350,000-gallon tank and subsequently pumped to the barranca for infiltration. Drywells are going to be installed along the barranca to enhance infiltration capacity.

6.5 Distributed Stormwater Capture

Distributed stormwater/runoff capture refers to capturing localized dry and wet weather runoff; it is further categorized as groundwater recharge capturing less than 100 AF. Dry weather runoff is any runoff that occurs in the absence of rainfall from inefficient irrigation systems, overwatering, A/C condensate, or other wasteful outdoor water use practices. Wet weather runoff occurs as a direct result of rainfall. Wet weather runoff represents a significantly larger volume of water than dry weather runoff, but either weather runoff can be beneficially used.

Throughout the City there are opportunities to capture localized dry and wet weather runoff for local reuse. However, the City's storm drain systems have historically been designed to protect life and property from flood impacts by quickly redirecting rainfall and runoff from impervious surfaces into the City's storm drain and flood control channel systems and ultimately into the Pacific Ocean without regard to water supply or water quality impacts.

While centralized stormwater capture plays a key role in groundwater recharge in the City of Los Angeles, space constraints limit opportunities for new large centralized facilities and have changed the focus towards distributed stormwater capture. Distributed stormwater capture includes stormwater management BMPs that utilize vegetation, soils, and natural processes to manage stormwater runoff close to the source. Distributed facilities can be placed throughout the City on any landscape, including parks, public and private development, public infrastructure and rights of way, as well as entire residential blocks. They can therefore be installed at numerous locations within the highly developed landscape of the City. The SCMP identified potential future distributed projects to capture between 31,000 AFY to 56,000 AFY by 2035.

6.5.1 Program Alternatives

For distributed capture, the SCMP program type alternatives include:

- On-site infiltration;
- On-site direct use;
- Green streets;
- Sub-regional infiltration; and
- Sub-regional direct use.

6.5.1.1 On-Site Infiltration

On-site infiltration is the practice of collecting stormwater runoff from impervious or compacted areas on a property for infiltration within the same parcel. BMPs that can be implemented as part of on-site infiltration include permeable pavement, bio-infiltration, and subsurface infiltration. Bio-infiltration BMPs can take a variety of forms, but they all have the common elements of storage, bio-filter media, and plants adapted to tolerate periods of inundation and dryness. Specific bio-infiltration types are described below.

Rain Garden/Bio-Infiltration Basin. A rain garden is a depressed vegetated area underlain by porous soil media and sometimes open-graded gravel. The wide, shallow excavation allows runoff to collect and be used by the vegetation. Water, in excess of what the plants need to survive, can slowly seep into the surrounding soils. Large-scale rain gardens are often referred to as bio-retention or bio-infiltration basins. Not only do they provide for an attractive landscape, but they are also effective in treating and infiltrating stormwater for local groundwater recharge. Bio-infiltration basins typically have a deeper gravel layer to accommodate larger runoff volumes, and some form of pre-treatment is provided due to the higher amount of debris, trash, and sediment in the inflow due to the larger tributary area.

Tree Wells/Planters. Tree wells and planters are a type of bio-infiltration BMP that is most typically used in parking lots, highly-trafficked pedestrian corridors, as well as commercial or residential parkways and streetscapes. Storage is provided in the void space of the soil, and a gravel base is used to maximize infiltration. These BMPs have a small footprint, providing wide application to locations where space constraints exist. Planters are designed to treat roof runoff and runoff from small tributary areas, accepting runoff from roofs, walkways, sidewalks, or parking areas, then holding the runoff so that it can slowly be infiltrated into the ground.

Vegetated (Parkway) Swales. A vegetated swale is a shallow, vegetated hydraulic conveyance that collects runoff while slowing it down and allowing it to infiltrate. Infiltration capacity can be maximized through the use of check dams running perpendicular to flow. Vegetated swales are most commonly found along roadways.

Bump-Outs. A curb bump-out is traditionally a traffic calming measure in which the curb is extended into a crosswalk or roadway to reduce crossing distance for pedestrians, increase pedestrian safety, and create the visual effect of the roadway narrowing for drivers. Curb bump outs can act as bio-infiltration BMPs when runoff from the roadway, sidewalks, or the roofs of adjacent buildings is allowed to enter the bump out via a curb cut.

6.5.1.2 On-Site Direct Use

On-site direct use is the practice of collecting stormwater generated on-site for non-potable on-site uses (e.g. irrigation or toilet flushing). On-site direct use reduces potable demand (water conservation), therefore taking pressure off the municipal supply. Rain barrels and cisterns are the primary BMPs for on-site direct use.

Rain Barrels. Rain barrels are distributed stormwater capture devices used to store rainwater collected from roofs via roof rain gutter systems. Harvested water can be used for outdoor irrigation at a later time. If overflow infiltration is provided, and/or greater roof area is utilized, then annual rainfall volume captured can be significantly greater. Through participation in the SoCal Water$mart Program, LADWP customers are currently eligible to receive a rebate for a maximum of four rain barrels of up to $50 per rain barrel with a minimum size of 50 gallons. More information on this program is available in Chapter 3, Conservation.

Cisterns. Cisterns are larger than rain barrels and can range from 100 to 10,000 or more gallons. They store diverted runoff from roof areas and other impervious surfaces. Cisterns have applicability for nearly all land uses as they can be easily scaled up or down to fit size and water use demands of a site. Residential, commercial, institutional, industrial, and educational land uses can implement cisterns to capture stormwater and use it for irrigation, toilet flushing, or other non-potable uses (i.e., cooling towers, cleaning tools or equipment, concrete mixing, dust control, etc.). Because residential irrigation can account for up to 40 percent of domestic water consumption, water conservation measures such as cisterns can be utilized to reduce demands, especially during hot summer months. Through participation in the SoCal Water$mart Program, LADWP customers are currently eligible to receive a rebate for a maximum of one cistern of up to $500 per cistern with a minimum size of 200 gallons. More information on this program is available in Chapter 3, Conservation.

The Great Los Angeles Water Collaborative, formerly known as the Multi-Agency Collaborative Phase II, is a pilot project demonstrating the use of cisterns to further stormwater capture initiatives to increase water supply, improve water quality, and flood attenuation. In partnership with TreePeople, the project is equally funded by LADWP, LASAN, and LACFCD, to collaboratively plan, fund, implement, and monitor landscape transformation at six properties in the City of Los Angeles, including electronically monitored and remote-controlled cisterns. The project will seek to demonstrate the viability of increasing stormwater capture for groundwater recharge and on-site reuse in lieu of potable water. Cisterns installed range in size from 420 gallons to 1,981 gallons. Multiple tanks are installed per site and result in systems that range from 840 to 3,962 gallons. The project maintains an online "LA StormCatcher" dashboard that tracks the progress of the half dozen pilot systems and reports the total stormwater collected to date to be more than 26,000 gallons.

Exhibit 6J is an underground rain-harvesting cistern. This 216,000-gallon cistern is located at Coldwater Canyon Park, harvesting local rainwater. Stormwater is collected from structure rooftops, fire lane, parking lot, and the surrounding landscape. The water is filtered and then used throughout the year to irrigate landscape on the top level of the park. The underground tank is 70 feet in diameter and 8-feet deep.

Exhibit 6J
Construction of Underground Cistern for Stormwater Capture

Coldwater Canyon Park (Photo courtesy of TreePeople)

6.5.1.3 Green Street Programs

A green street is a right-of-way that maximizes stormwater capture through a combination of stormwater BMPs and design considerations. Practices could be placed in the street and sidewalk (permeable pavement, dry wells) or in the parkways (vegetated swales, bio-retention curb bump-outs, tree wells, and planters, and bio-retention basins). Green streets provide an alternative to traditional impervious roadways and streetscapes by incorporating one or more BMPs to manage stormwater runoff while still maintaining the roadway's primary function of accommodating vehicular traffic and safe pedestrian access. Stormwater BMPs capture and infiltrate runoff from both the street itself, as well as some percentage of adjacent properties. Green streets may be implemented in residential and commercial streets, at street-ends that dead end at major rivers (i.e. "Rio Vistas"), and in specially-zoned areas such as Pedestrian Oriented Districts and Business Improvement Districts.

6.5.1.4 Sub-Regional Infiltration

In sub-regional infiltration, stormwater runoff is collected from multiple parcels, city blocks, or entire neighborhoods into a single infiltration BMP within the public right-of-way or adjacent public/private lands. Sub-regional infiltration programs often divert water from a storm drain line; however, in some instances, they may be fed via surface flow. BMPs that could be used for a sub-regional infiltration program include underground infiltration galleries and bioretention.

6.5.1.5 Sub-Regional Direct Use

In sub-regional direct use, stormwater runoff is collected from multiple parcels, blocks, or an entire neighborhood for use in indoor or outdoor non-potable uses. Flows are routed into storage facilities, such as a cistern or pond, by diverting storm drain infrastructure from the public right-of-way onto a private or publicly-owned parcel with available space and adequate reuse purpose. Stored water is most often treated and pumped to its end purpose, which may include irrigation, toilet flushing, or cleaning vehicles and equipment.

6.5.2 Distributed Stormwater Capture Projects

An outgrowth of the 2006 City of Los Angeles Water Integrated Resources Plan (IRP) was the development of the SCMP with its increased emphasis on stormwater capture. Within the SCMP, neighborhood recharge concept efforts have evolved from the conceptual stage visualized in the IRP to actual identified projects in the City that infiltrate wet weather runoff as close as possible to the point of origin. Future projects with an estimated project completion date by 2025 are described below.

Great Street: Lankershim Boulevard (Chandler to Victory). The Lankershim Boulevard Stormwater Capture Project is designed to capture runoff from an 83-acre tributary area that currently has no storm drains. The project is in Council District 2 and could capture and recharge up to 51 AF per average rainfall year into the SFB. Potential BMPs that could be implemented include parking lot pavers, infiltration swales and chambers, parkway swales, as well as dry wells along curb and gutter.

Glenoaks & Filmore Stormwater Capture Project. The Glenoaks-Filmore Stormwater Capture Project is located in a sub-watershed that would benefit from the installation of stormwater capture BMPs. The project is located in Council District 7, near the intersection of CA-118 and I-210. The project is expected to capture and recharge an average of 86 AF per average rainfall year into the SFB through various stormwater BMPs.

Agnes Avenue: Vanowen to Kittridge Stormwater Capture Project. The Agnes Avenue Stormwater Capture Project is located in a sub-watershed that would benefit from the installation of stormwater capture BMPs. The project is located in Council District 2, near the intersection of CA-170 and Vanowen Street. The project is expected to capture runoff from a 56-acre tributary area that currently has no storm drains. The project could capture and recharge up to 60 AFY on average in the SFB through various stormwater BMPs.

Bradley Green Alley Project. The Bradley Green Alley Project involves the greening of a two-block section of Bradley Alley in Pacoima to capture and reuse stormwater, promote groundwater recharge, and sequester stormwater pollutants. The project is intended to capture 4.5 AFY and be completed in 2021.

Victory – Goodland Median Project. The Victory-Goodland Green Street Project has an approximate total area of 108 acres and has the potential to capture up to 97 AF of stormwater runoff per year. It is located in Council District 2 in the Valley Glen neighborhood and the drainage area is bounded by Vanowen St to the north, Whitsett Ave to the east, Victory Blvd to the south, and Coldwater Canyon Ave to the west. This project is a Green Stormwater Infrastructure (GSI) project that is designed to capture and infiltrate stormwater runoff using drywells and pre-treatment systems (i.e. bioretention planters). The project will recharge groundwater in the SFB, will capture pollutants prior to discharging to the downstream LA River, and may reduce runoff flow rates and volumes during certain storm events. This project is planned to be completed in 2021.

Ben & Victory Green Stormwater Infrastructure. The Ben & Victory Green Stormwater Infrastructure Project is located at Ben Avenue and Victory Boulevard, a site of intense flooding in the past. The project is expected to alleviate flooding that has not only affected the immediate intersection, but also surrounding neighborhoods. It will also enable the capture of 67 AFY of stormwater. Drywells will be used to treat and infiltrate excess runoff within the project areas. Pretreatment swales are proposed upstream of the drywell systems to remove sentiment, nutrients, and other pollutants. This project is expected to be completed in 2021.

Burbank Boulevard BMP Project. The Burbank Boulevard BMP Project includes widening 0.7 miles of Burbank Boulevard to 70-feet for traffic and commerce conveyance improvements. The project will also install 20 drywells for stormwater capture and infiltration. This project is expected to increase regional annual average stormwater capture by 53 AFY and be completed in 2022.

LAUSD Conserving for Our Kids Program. LADWP teamed up with the Los Angeles Unified School District (LAUSD) to support energy and water efficiency on campuses. That partnership continued the existing "Conserving for Our Kids" program, providing additional funding for measures that include the installation of efficient power and water fixtures as well as stormwater capture projects. This program is expected to increase annual stormwater capture by 25 AFY and was completed in 2020.

San Fernando Gardens. San Fernando Gardens is a public housing project owned by the Housing Authority of the City of Los Angeles, located in the Pacoima region of Los Angeles. The Project proposal includes capturing and infiltrating stormwater, from a 38-acre tributary area, using a combination of dry wells and underground infiltration galleries in conjunction with landscape retrofit of the 10.5 acres of grass cover for a California Friendly landscape. This project is expected to increase regional annual average stormwater capture capacity by 26 AFY and be completed by 2023.

Arundo Donax Eradication Implementation. The non-native invasive grass Arundo Donax (Arundo, giant cane) threatens the ecological integrity of the rivers and streams throughout the region by altering ecosystem processes and negatively affecting native species. This project represents a 10-year, ongoing maintenance effort design to save 1,600 AFY and will be completed in 2023.

Hansen Spreading Grounds

Case Study:
Laurel Canyon Boulevard Green Street Project

The Background

The Laurel Canyon Boulevard Green Street Project is a low-impact development evolving from the City of Los Angeles' Flood Control Project Prioritization List and through a partnership with LASAN. The project helps recharge the SFB, improves water quality, and alleviates local flooding during storm events, while providing residents improved curbs, gutters, and sidewalks.

The project exemplifies a distributed approach to watershed management and the multiple benefits associated with smaller-scale stormwater capture projects. The multi-benefit project united interested parties and stakeholders including LADWP and LASAN for project implementation, SWRCB for funding under Proposition 84, and the local Council Office 7 for outreach support.

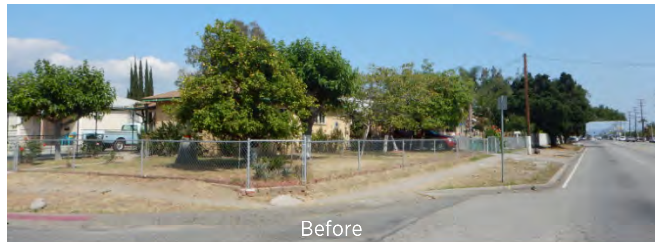
The Project

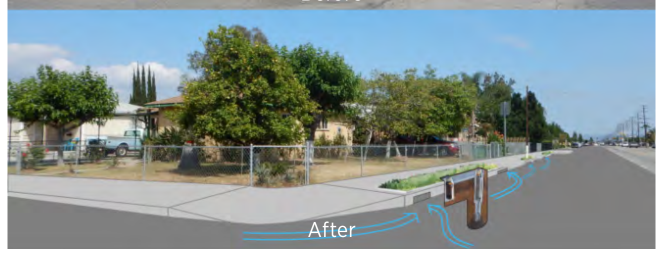
The project was completed in 2017, at a total cost of $3.0 million. Proposition 84 grant funding contributed $2.0 million towards the project cost. LADWP contributed to remaining capital costs, while LASAN is committed to operation and maintenance costs.

The project constructed Parkway infiltration swales that are located between the street curb and pedestrian sidewalks, measuring about 4 feet wide by 1 foot in depth. The project is collecting stormwater runoff from approximately 123 acres of residential area and infiltrates nearly 40 acre-feet of water per year, enough to provide water for 160 single-family homes. The project also replaced existing sidewalks in disrepair and installed several dry-well devices to achieve higher infiltration values. Any overflow drainage from the project flows into the existing storm drain system.

Public Right-of-Way Improvements

Parkway Infiltration Swales
Infiltration swales and dry-well filtration systems treat and reduce non-point source contaminants such as bacteria, nutrients, metals, total suspended solids, and organics in stormwater collected as runoff traveled through the streets. The Project aims to reestablish natural hydrologic patterns in the area and mitigate the impact of development on the LA River and its tributaries. Project monitoring will track measurable outcomes and provide replicable solutions for stormwater infiltration among other densely polluted Neighborhoods. The project is capable of contributing to sustained, long-term water quality benefits, consistent with the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties.


Before


After

The Benefits
The finished project incorporates a mixture of strategies to produce multiple levels of benefits, not only to the neighborhood, but also to the local and regional community that can take this work as encouragement:

- Capture stormwater and dry-weather runoff to prevent flooding and decrease pollution of local rivers and oceans
- Reduce impermeable surfaces and increase groundwater recharge
- Improve neighborhood aesthetics through increased green space and public right-of-way improvements
- Increase groundwater recharge by 40 AFY
- Encourage community awareness of water and associated environmental issues.


Groundbreaking

Case Study: Van Nuys Blvd Great Streets

The Background

The Van Nuys Blvd Great Streets Project was proposed as part of the San Fernando Valley Distributed Projects in partnership with LASAN. The project is located in the Pacoima region of San Fernando Valley near the intersection of CA-118 and I-5. The tributary area of the project is bounded by San Fernando Road, Filmore Street, Laurel Canyon Boulevard, and Van Nuys Boulevard.

The Project

The project was completed in spring of 2019, at a total cost was of $3.36 million. LADWP contributed $244,000. This Great Streets project captures runoff from a 100-acre tributary area that has no storm drains. The intersection between Van Nuys Boulevard and Laurel Canyon Boulevard is the confluence point for the 100-acre watershed. The project is has good soils for infiltration and overlies the SFB. The project captures and recharges up to 98 acre-feet per average rainfall year into the SFB.

Public Right-of-Way Improvements

Parkway Infiltration Swales

Infiltration swales and dry-well filtration systems treat and reduce non-point source contaminants, such as bacteria, nutrients, metals, total suspended solids, and organics in stormwater collected as runoff traveled through the streets. The project aims to reestablish natural hydrologic patterns in the area and mitigate the impact of development on the LA River and its tributaries. Project monitoring will track measurable outcomes and provide replicable solutions for stormwater infiltration among other densely polluted neighborhoods. The project is capable of contributing to sustained, long-term water quality benefits, consistent with the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties.

The Benefits

The finished project incorporates a mixture of strategies to produce multiple levels of benefits:

- Provide storage volume and treatment for a ¾" storm event
- Meet all standards for dry- and wet-weather runoff, as published in the Metals TMDL for the LA River
- Bacteria reduction to meet or reduce exceedance days on TMDL limits for the LA River
- Achieve 100% capture of trash from the upstream watershed in compliance with the LA River Trash TMDL.

Infiltration swales

Case Study: Tujunga Spreading Grounds Enhancement Project

The Background

LADWP and the LACFCD cooperatively worked to enhance the 150-acre Tujunga Spreading Grounds. The Tujunga Spreading Grounds, owned by LADWP, and operated by LACFCD, are located along the Tujunga Wash Channel at its confluence with the Pacoima Wash Channel. The unique location allows the Tujunga Spreading Grounds to be managed in conjunction with other LACFCD facilities along both waterways. The site is utilized for recharging the SFB.

The Project

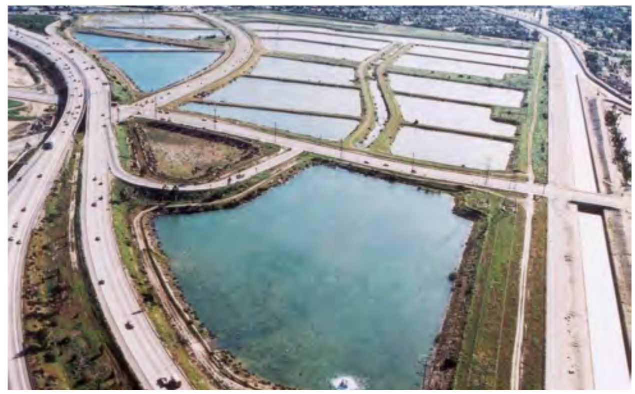
The project plan incorporates community access and open space for passive recreation, limited to operational constraints. LADWP is working with the City Department of Recreation and Parks to maintain the open space attributes of the project, and LACFCD will continue to operate and maintain the operating recharge facilities. This project was awarded a $3.2 million grant through Proposition 84's Integrated Regional Water Management Plan (IRWMP) and a $7 million grant through Proposition 1's Storm Water Grant Program.

Project enhancements included; deepening and consolidating the existing 20 basins into nine large spreading basins, installing two high flow intakes with inflatable rubber dams, and modifying the existing intake to improve water quality and remove sediments. The two intakes are 60' (along Tujunga wash) and 100' (at the confluence of Tujunga wash and Pacoima wash) respectively. Additionally, the second intake will eventually enable the facility to divert flows from the Pacoima Wash Channel into the facility. Other equipment to be installed includes; control houses, slide gates, and a remote control telemetry system.

LADWP contracted with LACFCD for design services. A second agreement between LADWP and LACFCD was executed to transfer Construction Management responsibilities from LADWP to LACFCD.

The Benefits

This project will increase storage capacity to 885 acre-feet from its current level of 100 AF and increase the intake capacity from 250 CFS to 450 CFS. An increase in recharge of 8,000 AFY is expected, totaling 16,000 AFY during normal precipitation years, enough to supply 64,000 average sized homes per year.



Tujunga Spreading Grounds

6.5.3 Best Management Practices

This section provides a short review of the regulatory environment that promotes distributed stormwater capture and implementation of BMPs.

6.5.3.1 LA County MS4 Permit

As described above, on November 8, 2012, the LARWQCB adopted NPDES MS4 Permit Order No. R4-2012-0175, which requires that large new development and redevelopment projects provide onsite or offsite BMP such as infiltration.

The MS4 Permit could impact BMP projects in two ways: (1) BMP projects with significant areas of disturbance could trigger the permit requirements and therefore have minimum sizing requirements for the BMPs set by the permit terms; or (2) development/redevelopment projects that would have otherwise not included BMPs, will now have to include stormwater BMPs capable of meeting permit requirements for onsite or offsite retention of stormwater. More information on the Los Angeles County MS4 Permit is available on the LARWQCB website at: http://www.waterboards.ca.gov/losangeles/.

6.5.3.2 Low Impact Development

LADWP, in conjunction with other City departments, is developing programs to highlight water conservation through Low Impact Development (LID) and installation of BMPs. LID is a stormwater management approach that is designed to reduce runoff of water and pollutants from the site(s) at which they are generated. BMPs consist of practices designed to infiltrate runoff for groundwater recharge, reduce runoff volume, and capture rainwater for reuse.

The City has taken significant strides towards promoting distributed capture and infiltration of runoff through development of a suite of distributed projects. A LID Ordinance was adopted in May 2012, which is a set of site design approaches and BMPs that are designed to address runoff and pollution at the source. The City's LID ordinance has significant benefits to stormwater capture because it requires that all development and redevelopment projects that create, add, or replace 500 square feet or more of impervious area to capture the three-quarter-inch rain event for infiltration or reuse on-site. Single-family residences can comply in a simpler way by installing rain barrels, permeable pavement, rainwater storage tanks, or infiltration swales.

In general, implementing integrated LID practices into new development and retrofit of existing facilities can result in enhanced environmental performance, while at the same time reducing development costs when compared to traditional stormwater management approaches. According to the USEPA, infrastructure costs associated with LID practices as compared to traditional stormwater treatment practices result in significant cost savings ranging between 15 percent and 80 percent less than traditional practices.

Retrofit of LADWP Facilities to Meet LID Standards. LADWP is assessing its existing facilities for potential retrofits using LID BMPs. LID BMPs under consideration include pervious pavement, stormwater capture, curb cuts, bioretention cells, and amended soils. Expected benefits include: increased groundwater recharge; decreased outdoor water use; increased compliance with stormwater regulations and Model Water Efficient Landscape Ordinance; improved environmental conditions for employees and the public; increased awareness of LID and examples for residents.

New LADWP Facility Development Using LID Standards. LADWP's Watershed Management Group developed a framework for implementation of LIDs and BMPs. Within the framework, LID and BMPs are considered during the planning, design, implementation, and maintenance processes associated with new LADWP facilities. Benefits include: reduced maintenance costs for stormwater infrastructure and landscape; reduced costs for grading by using natural drainage; reduced sidewalk cost by using narrower sidewalks; increased groundwater recharge; and reduced runoff volume and pollutant loading.

6.5.3.3 Incentive Programs that Promote Stormwater Capture

In addition to investing in centralized stormwater projects to recharge groundwater, LADWP has encouraged customers to participate in parcel-based stormwater capture incentive programs to promote stormwater infiltration. LADWP provides incentives for customers to install rain barrels and cisterns placed on their property. Through its partnership with MWD's SoCal Water$mart website, LADWP's Water Conservation Program offers rebates to offset the cost of rain barrels (minimum capacity of 50 gallons) and cisterns (minimum capacity of 200 gallons). Customers can request rebates for up to two rain barrels or one cistern through the SoCalWaterSmart.com website. Originally launched in October 2013, the program currently offers a $50 rebate for rain barrels. Rebates for cisterns are available up to $500 depending on size of the cistern.

LADWP also promotes stormwater capture as a mandatory requirement for LADWP Sustainable Landscaping program, as described in Chapter 3, Section XX. Additional incentive programs to advance conservation and stormwater capture initiatives are continually being studied by LADWP.

6.5.3.4 Permits, Mandates, Legislation, and Ordinances that Promote Stormwater Capture

Recently, several pieces of legislation that could promote stormwater capture and storage have been passed on a regional and state-wide level:

- As part of LASAN's compliance with the LA County MS4 Permit, LASAN has developed EWMP plans.
- County of Los Angeles LID ordinance, which became effective in October of 2008 and amended in November of 2013, requires the use of LID principles in all development projects except road and flood infrastructure projects.
- The State Recycled Water Policy mandates specific goals for stormwater use by 2020 and 2030.
- Assembly Bill No. 1881 and Senate Bill SBX7-7 specify water conservation measures that promote stormwater capture and storage as a means of compliance.
- City of Los Angeles Council Motion 14-0748, Development of draft ordinance that requires all public street construction and reconstruction projects to incorporate Stormwater Management Guidelines for Public Street Construction and Reconstruction (Sustainable Streets Ordinance).
- In November 2018, LA County voters passed Measure W to create the SCWP, which imposes a special parcel tax of 2.5 cents per square foot of impermeable surface area on private property within the LACFCD. The tax will generate up to $285 million per year, which will be used to improve water quality and supply, promote community investment benefits with a focus on disadvantaged communities, and implement nature-based solutions.

In addition, guidance documents such as Water LA's Homeowner's "How-To" Guides are becoming available to help individuals set up small-scale stormwater capture and use systems. And the U.S. Bureau of Reclamation/LACFCD Basin Study provides specific recommendations for basin management that can ultimately be applied to large-scale centralized stormwater storage programs. Furthermore, changes in basin management, such as the amendment of the Central Basin Judgment (Chapter 5- Groundwater) may help facilitate the use of groundwater basins for storage of stormwater and other "new" water supplies, and can serve as an example for regulators to develop stormwater storage policies in basins across LA County.

6.6 Integrated Regional Water Management Plan (IRWMP) Program

LADWP is a participating agency in the Greater Los Angeles County (GLAC) IRWMP which encompasses portions of 4 counties, 84 cities, and many local agencies and districts. The IRWMP aims to address water resources needs of the region in an integrated and collaborative manner to improve water supplies, enhance water supply reliability, improve surface water quality, preserve flood protection, conserve habitat, and expand recreational access in the region. An initial plan was adopted on December 16, 2006, and has been subsequently updated. An updated plan was completed in 2013 and adopted in February 2014 to comply with new requirements, improve content, and maintain eligibility for funding opportunities.

Objectives identified in the initial IRWMP were refined and updated resulting in six objectives for the IRWMP Update: improve water supply; improve surface water quality; enhance habitat; enhance open space and recreation; reduce flood risk; and adapt to and mitigate against climate change vulnerabilities.

The IRWMP objectives are consistent with the objective of the SCWP Regional Infrastructure Program which is to plan, build, and maintain multi-benefit watershed-based projects that improve water quality, increase water supply, and enhance communities through improved flood mitigation, restoration of parks, and enhanced recreational opportunities.

6.7 Stormwater Capture Master Plan Costs

Detailed costs for implementation of every aspect of the SCMP were not developed, except for centralized projects where project specifics are well defined. The SCMP is a planning-level document, not a programmatic document. The SCMP provides guidance for implementing cost effective distributed and centralized projects and determining whether outside funding and partnerships are necessary for implementing certain projects.

Exhibit 6K, below, compares the range of costs of the various watershed management opportunities LADWP is exploring.

Exhibit 6K
Cost Analysis

Water Source	Average Unit Cost ($/AF)
Centralized Stormwater Capture	$60 – $4,400
Distributed Stormwater Capture	
Subregional Infiltration	$600 – $1,300
Subregional Direct Use	$1,200 – $6,800
On-site Infiltration	$900 – $3,100
On-site Direct Use	$3,200 – $13,800
Green Streets	$600 – $2,400

The replenishment cost of recharge water is currently estimated at approximately $60 to $4,400 per AF, inclusive of the avoided cost of Tier 1 untreated imported water and the value assigned by MWD for participation in MWD's Local Resource Program. Direct use of stormwater without recharge has a cost of approximately $1,200 to $13,800 per AF, inclusive of the avoided cost of Tier 1 treated imported want and the value assigned by MWD for participation in MWD's Local Resource Program. The difference between the two values is related to the cost of untreated imported water for groundwater recharge versus treated imported water for direct use. The estimated values of recharge water and direct use are utilized to determine if a project is cost-effective.

Within the SCMP, a criteria was developed for evaluating projects based on cost. For infiltration projects with a cost range of less than $1,100 per AF and direct use projects with a cost range of less than $1,550 per AF LADWP may implement and/or fully fund the projects. For projects with a cost range greater than these amounts, LADWP may still pursue the projects by taking the following steps to bring LADWP's share of the cost into its target range:

- LADWP may seek outside funding and partnerships to implement the project itself, or
- LADWP may provide partial funding to partners that will implement the project, or
- LADWP may consider implementing projects it determines to be beneficial without additional funding or partners on a case by case basis, or

Within the SCMP, potential financing and funding sources are described. Financing includes local bonds and State Revolving Funds. Funding opportunities include grants and project partnerships. For private property owners potential financing mechanisms include on bill financing, credits, rebates, and implementation of a program similar to the LA County Property Assessed Clean Energy Program.

6.8 Summary

Watershed management involves retaining stormwater runoff for groundwater recharge. During storm events, large portions of stormwater are captured with existing centralized facilities for spreading purposes. However, increased urbanization has decreased natural infiltration, thereby contributing to declines in local groundwater levels. There is significant potential for increased stormwater capture in the City.

Groundwater recharge using captured stormwater is essential to maintaining groundwater supplies, addressing the overall long-term decrease in stored groundwater, protecting the safe yield of the groundwater basin, and ensuring the long-term water supply reliability of the SFB. Proposed centralized projects will enable the City to utilize its stored water credits in a sustainable manner and prevent conditions of overdraft in the basin. The UWMP projects that by 2045 there will be a minimum of 15,000 AFY of increased groundwater pumping in the SFB due to water supply augmentation through centralized stormwater infiltration. Anticipating that stored groundwater will rebound in response to enhanced groundwater replenishment, LADWP will work with the Upper Los Angeles River Area (ULARA) Watermaster to continue observing actual water levels and re-evaluate basin safe yield to protect against overdraft and to allow additional increases in groundwater production over time as SFB elevations rebound.

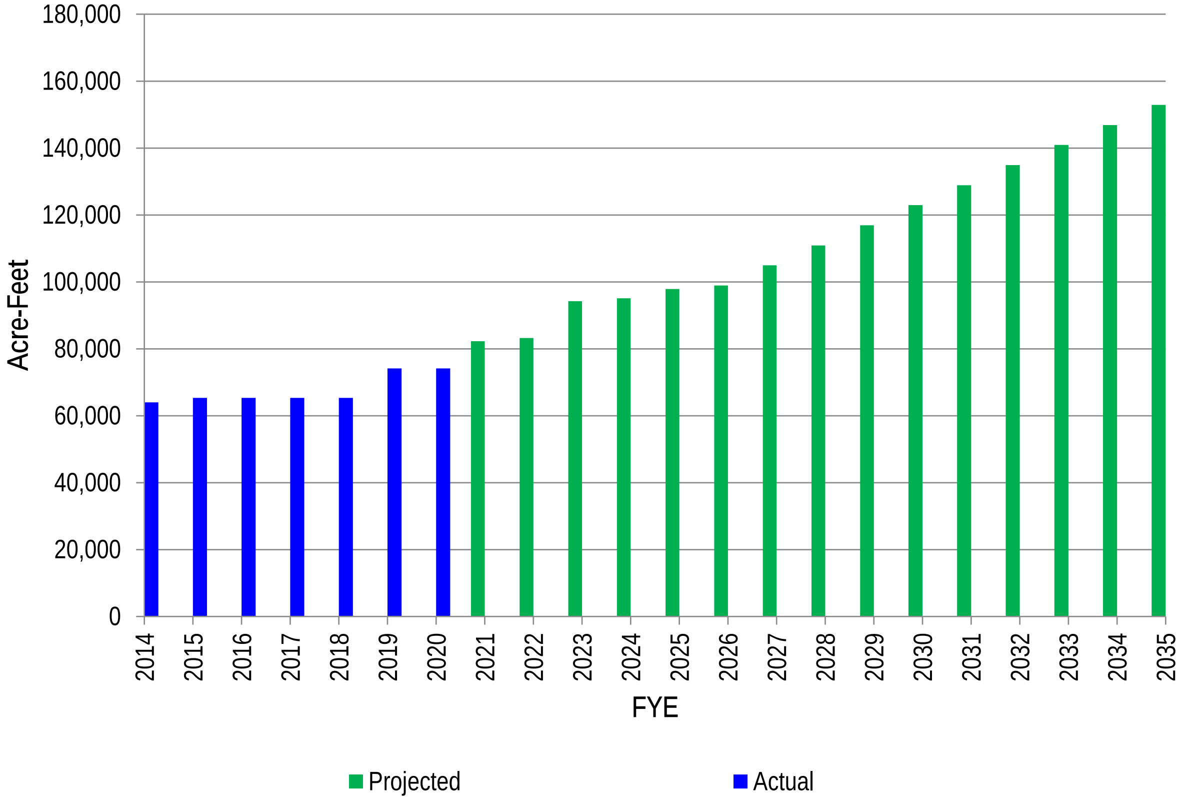
The SCMP investigated potential strategies for advancement of stormwater capture and watershed management in the City, and these numbers are used in the UWMP. The Plan outlines LADWP's strategies over the next 15 years to: (1) implement stormwater programs and projects in the City; and, (2) contribute to more reliable and sustainable local water supplies; and, (3) reduce purchases of imported water.

The SCMP analyzed potential capture to determine how much of the inflow to the City could realistically be captured in centralized facilities (e.g. spreading grounds), distributed facilities/infiltration BMPs (e.g. green streets), incidental distributed capture/recharge on pervious land, and direct use storage facilities (e.g. cisterns). This analysis defined two implementation scenarios (Conservative and Aggressive), creating an "envelope" of the range of potential future outcomes.

In 2015, the built stormwater capture capacity was 64,000 AFY; and increased to 84,200 AFY by 2020. Under the SCMP implementation strategy, LADWP could increase total stormwater capture to 132,000 AFY (Conservative) or 178,000 AFY (Aggressive) by 2035. Capture volumes are summarized in the Exhibit 6F.

Under LADWP's current implementation strategy, the total stormwater capture is projected at 155,000 AFY by 2035 as shown in Exhibit 6L, which is well in line with the 2015 SCMP implementation strategies.

Exhibit 6L
Historic and Projected Stormwater Capture Capacity



Recycled water pipes at Balboa Golf Course

Chapter Seven

Recycled Water

7.0 Overview

The City of Los Angeles (City's) water recycling program seeks to increase supply of recycled water to offset potable demands where infrastructure is available, and also plans to implement other potable reuse projects such as the Groundwater Replenishment Project and Operation NEXT Water Supply Program. In compliance with the California Water Code (CWC) Sections 13550-13557 recycled water served by LADWP meets or exceeds all the following conditions:

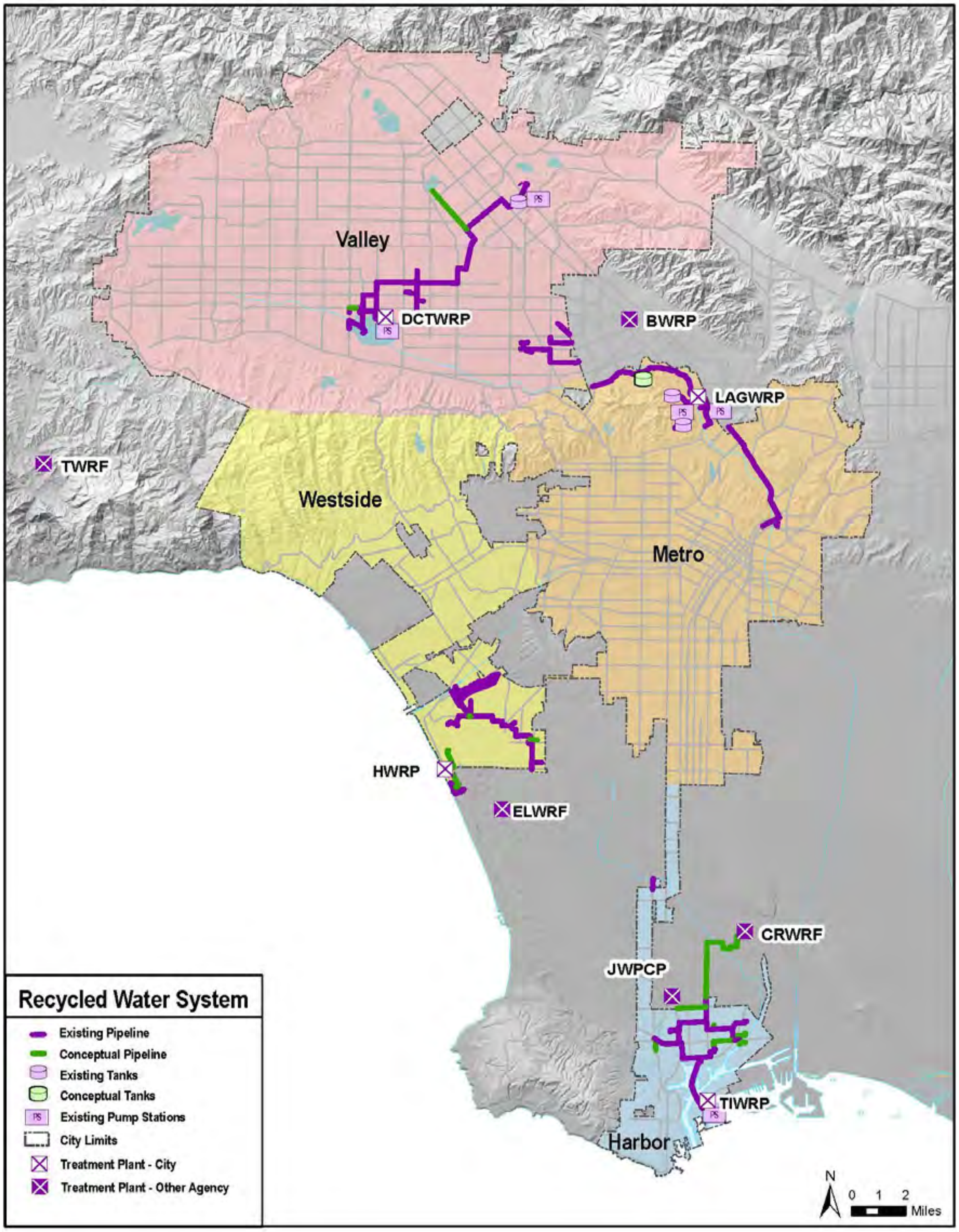
- The source of recycled water is of adequate quality for reuse.
- The recycled water may be furnished for these uses at a reasonable cost to the user.
- The use of recycled water from the proposed source will not be detrimental to public health.
- The use of recycled water will not adversely affect downstream water rights or degrade water quality.

In addition, the CWC mandates that public agencies serve recycled water for non-potable uses if suitable recycled water is available. Demand for recycled water has expanded as customer acceptance of recycled water as a safe and viable economical alternative to traditional potable supplies has increased. Outreach efforts designed to inform the public on the safety and viability of recycled water and its potential uses are an essential part of the process as the City's recycled water program expands.

Recycled water delivery in the City began in 1979 when LADWP delivered recycled water from the Los Angeles - Glendale Water Reclamation Plant (LAGWRP) to the City of Los Angeles Department of Recreation and Parks for irrigation of various areas in Griffith Park. This service was later expanded to include Griffith Park's golf courses and further expanded to serve freeway landscaping adjacent to the park in 1984. In 1992, LADWP began supplying recycled water to non-governmental customers with the completion of the Los Angeles Greenbelt Project, which supplied recycled water from LAGWRP to Universal Studios, Forest Lawn Memorial Park, Mount Sinai Memorial Park, and Lakeside Golf Club of Hollywood. LADWP continues to expand the use of recycled water to various customers. In 2009, Phase 1 of the Playa Vista development began receiving recycled water. Playa Vista is the first planned development in the City to utilize recycled water for all landscape needs. LADWP serves approximately 179 sites in the City with recycled water for irrigation and industrial uses. There are approximately 200 individual customer service accounts, with several projects containing multiple customer accounts at a single location. Future recycled water projects will continue to build on the successful implementation of these prior projects to expand recycled water use.

LADWP's water recycling program depends on the City's wastewater treatment infrastructure and wastewater treatment facilities located within and outside of the City's boundaries. Wastewater in the City is collected and transported through approximately 6,700 miles of major interceptors and mainline sewers, more than 11,000 miles of house sewer connections, 49 pumping plants, and four water reclamation plants: the Donald C. Tillman Water Reclamation Plant (DCTWRP), LAGWRP, Terminal Island Water Reclamation Plant (TIWRP), and Hyperion Water Reclamation Plant (HWRP). The City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment (LASAN) owns and is responsible for operating the City's wastewater treatment infrastructure and wastewater treatment facilities. The City's wastewater system serves 573 square miles, 456 square miles of which are within the City. Wastewater service is also provided to 29 non-City agencies through contract services. The treated effluent from the City's four water reclamation plants is utilized by LADWP to meet recycled water demands both inside and outside the City. As early as 1960, the City recognized the potential for water recycling and invested in infrastructure that produced water of tertiary quality, a high treatment standard for wastewater. These investments resulted in the construction of tertiary wastewater treatment plants DCTWRP and LAGWRP as an alternative to enlarging the two existing terminus treatment plant HWRP. These system enhancements facilitated the City's expanded use of recycled water.

Exhibit 7A
Sources of Recycled Water



LADWP's water recycling program also utilizes wastewater facilities located outside of the City. Currently, the HWRP serves a portion of its secondary treated wastewater to West Basin Municipal Water Disctrict (WBMWD's) Edward C. Little Water Recycling Facility (ECLWRF) where it undergoes further treatment to meet recycled water standards. A portion of the product water from the ECLWRF is returned to LADWP to meet the City's recycled water needs. Burbank Water Reclamation Plant (BWRP), operated by the City of Burbank Department of Public Works, supplies recycled water to parts of the City in the North Hollywood area.

LADWP is committed to maximizing use of recycled water in the City's water supply portfolio. LADWP is developing plans to maximize wastewater for beneficial use, including non-potable reuse and potable reuse. Recycled water goals include: producing 1.0 million gallons per day (mgd) of recycled water at HWRP by 2021 through expansion of the pilot membrane bioreactor (MBR) technology, recycling 7,000 acre-foot per year (AFY) of water at DCTWRP for groundwater recharge by 2025, and increasing non-potable reuse by an additional 8,000 AFY by 2035.

In addition to these efforts, LADWP is also collaborating with the LASAN, the Water Replenishment District of Southern California (WRD), and the Metropolitan Water District of Southern California (MWD) on the Operation NEXT Water Supply Program (Operation NEXT), one of the largest RW projects in the nation. The Operation NEXT Program, covered more in detail in Chapter 8, *Operation NEXT Water Supply Program*, aims to maximize water reuse of recyclable water originating from HWRP. When completed, advanced treated recycled water supplies (ATRW) from HWRP will further help to diversify the City's water supply portfolio by augmenting groundwater supplies, replenishing groundwater basins, and providing opportunities for other potential potable reuse applications. Key ongoing efforts within Operation NEXT include an MBR and Advanced Water Purification Facility (AWPF) Demonstration Project.

LADWP and LASAN are continuing to implement the Los Angeles Groundwater Replenishment (LA GWR) Project to convey recycled water from DCTWRP to the Hansen Spreading Grounds for percolation into the San Fernando Basin. The Initial Phase of the LA GWR Project will spread up to 3,500 AFY of recycled water, and includes a demonstration of ozone treatment technology. That will increase to 7,000 AFY by 2025, and future phases of the LA GWR Project are being planned to ultimately provide up to 30,000 AFY of recycled water for replenishment of the SFB.

Expansion of recycled water (non-potable reuse) to offset the use of potable water will help LADWP utilize the new recycled water sources and achieve the milestones. In Fiscal Year (FY) 2017/18, LADWP delivered 9,778 AFY of recycled water to offset potable demands (not including environmental uses). In FY 2019/20, LADWP's non-potable water demands and deliveries remained nearly constant at 9,641 AFY. LADWP plans to increase non-potable reuse to approximately 19,300 AFY in FY 2024/25 and to 29,800 AFY by FY 2039/40.

7.1 Regulatory Requirements

Recycled water use is governed by regulations at the State and local levels. These regulations are based on multiple factors, including the type of use and the quality of the recycled water. LADWP currently provides recycled water for non-potable uses and is pursuing potable reuse through various projects. Non-potable reuse projects are implemented in the City in compliance with existing recycled water regulations. There are currently a limited number of regulations for potable reuse. As of 2020, only regulations for indirect potable reuse (IPR) exist. IPR projects involve introducing recycled water into an environmental buffer such as an aquifer or reservoir and retaining for a required period of time before it enters the potable water system. Regulations for direct potable reuse (DPR) are expected to be available by December 31, 2023. The main distinction between DPR and IPR, is the presence of an environmental buffer for IPR. This section provides a summary of non-potable and potable reuse regulations.

7.1.1 Non-Potable Reuse Regulations

Non-potable reuse regulations in the City are governed by the State Water Resources Control Board (SWRCB), Los Angeles Regional Water Quality Control Board (LARWQCB), and the Los Angeles County Department of Public Health (LACDPH).

State Water Resources Control Board and Los Angeles Regional Water Quality Control Board

Criteria and guidelines for the production and use of recycled water were established by the SWRCB and can be found in the California Code of Regulations, Title 22, Division 4, Chapter 3 (Title 22). Title 22, also known as the Uniform Statewide Recycling Criteria, establishes required wastewater treatment levels and recycled water quality levels dependent upon the end use of the recycled water. Additionally, Title 22 also establishes recycled water reliability criteria to protect public health. Water recycling permits for each of the City's applicable wastewater treatment plants engaged in water recycling are issued by the LARWQCB. These requirements specify end-users of recycled water and enforce treatment and use area requirements.

A higher quality water will have a wider variety of applicable uses than a lower quality water. At a minimum, non-disinfected secondary treatment of wastewater is required for recycled water use. In the City, however, all recycled water used is treated, at a minimum, to tertiary levels with additional disinfection. The reliability of the treatment process and the quality of the product water must meet Title 22 requirements specified for each allowable treatment level. Wastewater treatment levels are discussed in detail in subsection 7.2, *Recycled Water Sources and Quality*. Exhibit 7B provides a summary of the currently approved non-potable recycled water uses.

Exhibit 7B
Allowable Title 22 Recycled Water Uses

Irrigation Uses
Food crops where recycled water contacts the edible portion of the crop, including all root crops
Parks and playgrounds
School yards
Residential landscaping
Unrestricted access golf courses
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations
Food crops, surface irrigated, above ground edible portion, and not contacted by recycled water
Cemeteries
Freeway landscaping
Restricted access golf course
Ornamental nursery stock and sod farms where no recycled water use occurs 14 days prior to harvesting, retail sale, or access by the public
Pasture for milk animals for human consumption
Non-edible vegetation with access control to prevent use as park, playground or school yard
Orchards with no contact between edible portion and recycled water
Vineyards with no contact between edible portion and recycled water
Non-food bearing trees, including Christmas trees not irrigated less than 14 days before harvest
Fodder and fiber crops and pasture for animals not producing milk for human consumption
Seed crops not eaten by humans
Food crops undergoing commercial pathogen destroying processing before consumption by humans

Supply for Impoundment Uses
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms in lieu of conventional treatment
Restricted recreational impoundments and publicly accessible fish hatcheries
Landscape impoundments without decorative fountains
Supply for cooling or air conditioning
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist
Industrial or commercial cooling or air conditioning not involving cooling tower, evaporative condenser, or spraying that creates a mist
Other Uses
Dual plumbing systems (flushing toilets and urinals)
Priming drain traps
Industrial process water that may contact workers
Structural fire fighting
Decorative fountains
Commercial laundries
Consolidation of backfill material around potable water pipelines
Artificial snow making for commercial outdoor uses
Commercial car washes, not heating the water, excluding the general public from washing process
Industrial process water that will not come into contact with workers
Industrial boiler feed
Nonstructural fire fighting
Backfill consolidation around non-potable piping
Soil compaction
Mixing concrete
Dust control on road and streets
Cleaning roads, sidewalks and outdoor work areas
Flushing sanitary sewer

North Hollywood Recreation Center

Sites where recycled water is used must also meet regulatory requirements. Title 22 stipulates use area requirements to protect public health. Use area regulations include requirements addressing recycled water application methods, and requirements addressing runoff near domestic water supply wells, drinking fountains, and residential areas. Dual-plumbed recycled water systems in buildings are also addressed. These systems must meet additional reporting and testing requirements. The SWRCB continues to develop regulations and guidance for recycled water for non-potable reuse.

Cross-connections between the potable and recycled water systems are not permitted. The California Code of Regulations, Title 17, Division 1, Chapter 5, Group 4 (Title 17), updated June 18, 2014, was developed to prohibit cross-connections between potable water supply systems and recycled water supply systems. Title 17 requires water suppliers to implement both cross-connection control programs and backflow prevention systems. Draft regulations for Cross Connection Control, first released in 2005, are now in the process of being further revised by the SWRCB.

Los Angeles County Department of Public Health

Title 22 and Title 17 water use regulations are enforced by the LACDPH, Environmental Health Division. LACDPH has published "A Guide to Safe Recycled Water Use, Pipeline Construction and Installation" requiring compliance with Title 22, SWRCB, and LARWQCB requirements. After SWRCB has approved the plans and specifications and the City has an agreement to serve the customer, LACDPH reviews and approves all plans and specifications prior to construction. After construction, LACDPH inspects the systems and conducts cross-connection, pressure, and backflow prevention device tests. Recycled water use must comply with the Los Angeles County Recycled Water Advisory Committee's "Recycled Water Urban Irrigation User's Manual". Each site must also have a site supervisor responsible for recycled water use.

City of Los Angeles

Recycled water responsibilities of the City include complying with all LARWQCB permits for the wastewater treatment plants and production of recycled water, approving recycled water use sites, conducting post-construction inspections, and periodically inspecting use areas and site supervisor records.

LADWP customers are permitted to use recycled water when service is available per LADWP Ordinance No. 170435 (subsequently amended by Ordinance No. 182047 in 2012). Customers expressing interest in recycled water deliveries must enter into an agreement with LADWP, subject to approval of the Board of Water and Power Commissioners. Users are responsible for the operation and maintenance of their recycled water systems up to the connection point with LADWP. Users are required to use recycled water in accordance with Titles 22 and 17 and the "Recycled Water Urban Irrigation User's Manual". If the users fail to follow these regulations, LADWP may cease delivery of recycled water.

7.1.2 Indirect Potable Reuse (IPR) Regulatory Requirements

The SWRCB Division of Drinking Water (DDW), which regulates public drinking systems, also regulates IPR projects under Title 22 regulations. Project sponsors work with DDW to obtain a recommendation for the


Japanese Gardens at DCT

Regional Water Quality Control Board (RWQCB) to issue a permit for the respective project. DDW, previously under the jurisdiction of the California Department of Public Health, (CDPH) was transferred to the SWRCB on July 1, 2014.

On June 18, 2014, the State adopted its first set of potable reuse regulations. The State adopted uniform criteria for Indirect Potable Reuse for groundwater recharge pursuant to CWC Section 13562. "Indirect potable reuse for groundwater recharge" is defined in the CWC as the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system. Most recently in October 2018, the State adopted regulations for Surface Water Augmentation (SWA), which is defined as the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply.

Groundwater Replenishment – Surface Application

Regulations for groundwater replenishment via surface application are located in Title 22 sections 60320 through 60320.130. Title 22 outlines general requirements, public hearing, lab analysis, response times, and monitoring, among other requirements. Permits for groundwater replenishment are issued by the RWQCB in coordination with DDW.

One of the key components of groundwater replenishment via surface application is the additional treatment that the soil provides. Soil Aquifer Treatment efficacy must be assessed through monitoring. At a minimum, recycled wastewater applied for spreading is required to be disinfected tertiary recycled water. Title 22 regulations should be referenced for specific requirements. The City is currently developing the LA GWR Project, which will replenish the City's groundwater supplies via surface application.

Groundwater Replenishment – Subsurface Application

Regulations for groundwater replenishment via subsurface application are located in Title 22 sections 60320.200 through 60320.230. Title 22 outlines general requirements, advanced treatment criteria, public hearing, lab analysis, response times, and monitoring, among other requirements. Permits for groundwater replenishment are issued by the RWQCB in coordination with the DDW.

Besides the point of application, one of main differences between surface and subsurface application is the treatment level of recycled water used. Subsurface application requires the use of full advanced treated water. The City's Operation NEXT Program is planned to also have a groundwater replenishment element via subsurface application and is described further in Chapter 8, *Operation NEXT Water Supply Program*.

Surface Water Augmentation

Regulations for SWA are located in Title 22 Sections 60320.300 through 60320.330. Although SWA is currently defined as the planned placement of recycled water into a surface water reservoir used as a source of domestic drinking water supply, California Assembly Bill (AB) 574 (2017) replaced the term "surface water augmentation" with "reservoir water augmentation" in the CWC and incorporated "[augmentation] into a constructed system conveying water to such a reservoir" to the definition. As of August 2019, the SWRCB has stated that changes are expected in the Title 22 regulations within one to two years.

SWA projects require full advanced treatment. The pathogen log reduction requirements vary depending on the dilution occurring at the reservoir and the retention time. There are currently no planned SWA projects in the City.

7.1.3 Direct Potable Reuse (DPR) Regulations

DPR is defined in CWC Section 13561 as the planned introduction of recycled water directly into a public water system (also known as treated water augmentation) or into a raw water supply immediately upstream of a water treatment plant (also known as raw water augmentation).

There are currently no uniform regulations for DPR in the United States. In 2016, pursuant to CWC Section

13563, the SWRCB submitted a report to the legislature assessing the feasibility of developing uniform water recycling criteria for direct potable reuse. Shortly thereafter, California Assembly Bill 574, as codified in CWC Section 13560 et seq., mandated that the SWRCB adopt uniform water recycling criteria for DPR through raw water augmentation by December 2023. In 2018, the SWRCB published A Proposed Framework for Regulating Direct Potable Reuse in California. The framework covered topics including potential DPR scenarios, risk management, and various criteria elements for further evaluation. A revised framework was completed in August 2019. A notable change in the revised framework was DDW's plan to prepare a single regulation package with criteria that encompasses not only raw water augmentation, but a full range of DPR scenarios. The City is currently working on several DPR project concepts that can augment the potable supplies once regulations are available.

7.2 Recycled Water Sources and Quality

Recycled water production relies on treated wastewater obtained from the City's wastewater treatment plants as well as wastewater treatment plants operated by neighboring agencies, as shown in Exhibit 7A above. City wastewater treatment consists of a series of processes that, at a minimum, remove solids to a level sufficient to meet regulatory water quality standards. During the preliminary, primary, secondary, and tertiary treatment processes, progressively finer solid particles are removed. Preliminary treatment removes grit and large particles through grit removal basins and screening. Primary treatment relies on sedimentation to remove smaller solids. With most of the grit, large particles, and solids already removed, secondary treatment converts organic matter into harmless by-products and removes more solids through biological treatment and further sedimentation. At the end of secondary treatment, most solids will have been removed from the water. Tertiary treatment follows secondary treatment to eliminate the remaining impurities through filtration and chemical disinfection.

All recycled water used within the City undergoes, at a minimum, tertiary treatment and disinfection to meet Title 22 standards for reuse. DCTWRP, LAGWRP, and BWRP treatment process includes tertiary treatment, nitrification-denitrification (NdN), and disinfection. TIWRP meets tertiary Title 22 standards by using advanced treatment process to remove high levels of fine particles: reverse osmosis (RO), microfiltration (MF), and advanced oxidation processes (AOP). In West Los Angeles, WBMWD's ECLWRF receives secondary treated wastewater from HWRP and produces recycled water through varying levels of treatment based on customer needs. A portion of ECLWRF's product water, treated through tertiary treatment, is provided back to the City for service in the West Los Angeles area. A portion of ECLWRF's tertiary treated effluent is also conveyed to the Carson WRF for MF/RO and nitrification.

Exhibit 7C summarizes the treatment levels, capacity, and FY 2019/20 wastewater flows at the four City plants and the four plants outside the City.

Exhibit 7C
Sources of Recycled Water Summary

Sources of Recycled Water	Wastewater Collection/ Treatment Agency	Treatment Type(s)	Wastewater Treatment Capacity (AF)	Treated Wastewater FY 19/20[6] (AF)	Recycled Water Served to LA FY 19/20[6] (AF)	Other Uses Other Uses FY 19/20 (AF)	Discharged Treated Wastewater FY 19/20 (AF)
Located within City of Los Angeles							
Donald C. Tillman Water Reclamation Plant (DCTWRP)[1]	LA Department of Public Works - LASAN	Tertiary with NdN	89,600	34,000	3,029	In-plant: 2,700 Environmental Use: 26,751	560
Los Angeles - Glendale Water Reclamation Plant (LAGWRP)[1]	LA Department of Public Works - LASAN	Tertiary with NdN	22,400	15,000	2,687	In-plant: 900 Outside LA: 1,570[2]	10,420
Terminal Island Water Reclamation Plant (TIWRP)[1]	LA Department of Public Works - LASAN	MF/RO/AOP	33,600	14,000	3,121	In-plant: 672	8,600
Hyperion Water Reclamation Plant (HWRP)[1]	LA Department of Public Works - LASAN	Secondary	504,000	288,000	0	In-plant: 40,800[7] Outside LA: 40,500[3]	232,200
Located Outside City of Los Angeles							
Edward C. Little Water Recycling Facility (ECLWRF)[1,5]	WBMWD	Tertiary; Nitrification; MF/RO; or MF with double-pass RO	N/A	N/A	1,433	29,456	N/A
Carson Regional Water Recycling Facility (Carson Facility)[1,4]	WBMWD	MF/RO/ Nitrification[5]	N/A	N/A	0	4,014	N/A
Burbank Water Reclamation Plant (BWRP)[1,4]	City of Burbank Department of Public Works	Tertiary with Nitrification/ De-nitrification	11,200	6,232	10	6,222	N/A
Joint Water Pollution Control Plant (JWPCP)[1,4]	Sanitation District of Los Angeles County	Secondary[6]	448,000	290,940	0	0	290,940

1. Sources: DCTWRP, LAG, TIWRP, and HWRP - Department of Public Works - Bureau of Sanitation Recycled Water Table FY 2019/20; ECLWRF and Carson Facility – West Basin staff; BWRP - Burbank Water and Power Staff; JWPCP – Sanitation District of LA County Staff; Recycled Water Served to LA – LADWP customer meters

2. In FY 19/20 1,570 AF of recycled water was delivered to City of Glendale from LAGWRP.

3. HWRP delivered 40,500 AF of secondary treated water to ECLWRF for treatment to Title 22 recycled water standards.

4. Recycled water deliveries to LADWP customers from Carson Facility, BWRP, JWPCP and TWRF are pending completion of current water recycling projects.

5. Tertiary treated recycled water from ECLWRF is advanced treated at Carson Facility. Amounts should not be double counted when totaled.

6. Sanitation Districts of Los Angeles County and the MWD have jointly proposed to increase the treatment level at the JWPCP to meet Title 22 standards, which will create a new source of recycled water.

7. Approximately 22.6 mgd of cooling water is uncontaminated and released into ocean as secondary effluent.

7.2.1 Recycled Water Facilities within Los Angeles

7.2.1.1 Donald C. Tillman Water Reclamation Plant

In service since 1985, DCTWRP has an average dry-weather flow capacity of 80 mgd, and currently treats approximately 45 mgd of wastewater to produce 32 mgd of recycled water. The current level of treatment to meet Title 22 standards is tertiary with NdN. To maximize wastewater reuse, DCTWRP provides recycled water for irrigation and industrial uses, in-plant uses, and environmental uses. Environmental uses include the Japanese Garden, the Wildlife Lake, and Lake Balboa, which were created as part of the environmental mitigation under CEQA for the implementation of DCTWRP, for recreational and environmental benefits. All recycled water produced from the facility is used within the LADWP service area. Irrigation uses in the area include golf courses, parks, churches, schools, and sports fields. Industrial uses include LADWP's Valley Generating Station, equipment washing at LADWP electrical distributing stations, and dust control at Hansen Spreading Grounds.

LADWP is partnering with LASAN to construct the LA GWR Project, which will replenish up to 30,000 AFY of recycled water to the SFB.

7.2.1.2 Los Angeles-Glendale Water Reclamation Plant

LAGWRP is a joint project of the City and City of Glendale. LAGWRP began treating wastewater in 1976. Its average dry-weather flow capacity is 20 mgd, and currently treats approximately 17 mgd to produce 14 mgd of recycled water. Each city is entitled to 50 percent of the plant's capacity. The City of Pasadena purchased rights to 60 percent of Glendale's capacity but has not yet exercised these rights. The current level of treatment to meet Title 22 standards is tertiary with NdN. All of LADWP's portion of the recycled water is used within its service area. To maximize wastewater reuse, recycled water from the LAGWRP provides landscape irrigation to multiple areas, including Griffith Park and the Los Angeles Greenbelt Project. In FY 2014/15 9.6 mgd of tertiary-treated water from LAGWRP was discharged into the Los Angeles River for environmental benefits.

7.2.1.3 Terminal Island Water Reclamation Plant

Originally built in 1935, TIWRP has been providing secondary treatment since the 1970s. Tertiary treatment systems were added in 1996. TIWRP has an average dry-weather flow capacity of 30 mgd. The plant's AWPF were added in 2002 and expanded in 2016 to meet updated State discharge requirements. The AWPF consists of MF, RO, and AOP and produces up to 12 mgd of highly purified recycled water. Recycled water is supplied to two users within the service area, the Water Replenishment District for the Dominguez Gap Seawater Intrusion Barrier to reduce seawater intrusion into drinking water aquifers, and to LADWP's Harbor Generating Station for landscape irrigation. The remaining TIWRP effluent, approximately 10 mgd, is discharged to the Los Angeles Harbor. To maximize wastewater reuse, additional recycled water will be provided to the Dominguez Gap Seawater Intrusion Barrier upon completion of a second supply connection, and additional sources of advanced treated recycled water supply are being considered to expand to other potential customers in the Harbor Area. DGBP was originally permitted to have a maximum of only 5 mgd or 50 percent of inflows provided by recycled water. In 2016, the LARWQCB authorized TIWRP to provide the barrier with 100 percent recycled water (up to 9.5.)

7.2.1.4 Hyperion Water Reclamation Plant

Operating since 1894, HWRP is the oldest and largest of the City's wastewater treatment plants. Its $1.2 billion construction upgrade, completed in 1999, allows for full secondary treatment. The average dry-weather flow capacity of HWRP is 450 mgd, with an average wastewater flow of 260 mgd. Most of the treated water is discharged through a five-mile outfall into the Santa Monica Bay. The remainder, approximately 70 mgd, is used at HWRP or sold to WBMWD for treatment at the ECLWRF to meet recycled water demands in the WBMWD service area and in parts of the City.

The Operation NEXT Program, covered more in detail in Chapter 8, *Operation NEXT Water Supply Program*, aims to maximize water reuse of recyclable water originating from HWRP. When completed, ATRW from HWRP will further help to diversify the City's water supply portfolio by augmenting groundwater supplies, replenishing groundwater basins, and providing opportunities for other potential potable reuse applications.

7.2.2 Recycled Water Facilities outside Los Angeles that serve the City

7.2.2.1 Edward C. Little Water Recycling Facility – West Basin Municipal Water District

WBMWD operates the ECLWRF, which has a capacity of 50 mgd. ECLWRF produces five different recycled water qualities: tertiary (Title 22 water) used for irrigation, nitrified water for cooling towers, pure RO water and ultra-pure RO water for refinery boiler feed water, and softened MF/RO water with disinfection (advanced treated water) used for groundwater injection into the West Coast Basin Groundwater Barrier to reduce seawater intrusion.

In 2015, a water purchase agreement between WBMWD and the City was executed, allowing WBMWD to purchase secondary treated effluent water from HWRP through 2021, with no limit for the volume of water that may be purchased. On average, WBMWD purchases approximately 35 mgd of secondary treated effluent from HWRP and treats this source water to Title 22 standards and above as necessary for reuse. WBMWD's ability to purchase water is limited by its pumping capacity and available effluent from HWRP. The existing pump station has a firm capacity of 60 mgd and total capacity of 130 mgd.

On average, over the period FY 2015/16 – FY 2019/20 ECLWRF produced 32 mgd of product water. The water is used to meet recycled water demands in WBMWD's service area, and a portion of this water is currently purchased by LADWP to serve customers in West Los Angeles. In FY 2019/20, approximately 1,433 AF was purchased and distributed in the LADWP service area. Customers in West Los Angeles include Loyola Marymount University, Playa Vista, multiple parks, street medians, LADWP's Scattergood Generating Station, and irrigation at Los Angeles International (LAX) Airport.

Per regulatory limits, ECLWRF can provide up to 17,000 AF of water to the West Coast Basin Groundwater Barrier, under the new Phase V construction improvements. An additional portion of the flows are routed to WBMWD's Carson Facility for further treatment to meet end-user requirements.

ECLWRF can treat up to 62.3 mgd of secondary-treated effluent received from HWRP to a tertiary level meeting Title 22 standards. Under an agreement between WBMWD and the City, WBMWD purchases secondary-treated effluent from HWRP, and LADWP has a right to purchase up to 25,000 AFY of recycled water produced by ECLWRF. Approximately 37,779 AF of secondary-treated effluent was purchased from HWRP in FY 2019/20. Recycled water not purchased by LADWP is sold to users within WBMWD's service area.

Through a joint partnership between LASAN, WBMWD and LADWP, a pilot MBR facility is currently under development at HWRP, as part of LADWP's Operation NEXT Program to maximize recycled water production out of HWRP. The long-term anticipated available effluent from HWRP to WBMWD will be contingent on the actual performance of the pilot facility and further interagency coordination to determine and establish regional demands.

7.2.2.2 Burbank Water Reclamation Plant – City of Burbank

The City of Burbank upgraded the BWRP to its current capacity of 9 mgd in 1971 and the plant has since been upgraded to remove ammonia. LADWP purchases water from BWRP to supply water to the North Hollywood area of the City.

7.2.3 City of Los Angeles Actual and Projected Wastewater Volume

Average dry-weather wastewater influent projections for the City's wastewater treatment plants are expected to increase by approximately 15 percent over the next 25 years. Projections include flows from 29 agencies outside of the City with contracts for wastewater treatment. Wastewater effluent that is not recycled is discharged to either the Pacific Ocean via the Los Angeles River, or to outfalls leading directly to the Pacific Ocean. Wastewater treatment projections of average dry-weather flows for 2019/20, and associated disposal methods, are provided in Exhibit 7D.

Exhibit 7D
City of Los Angeles Wastewater Treatment Plants Average Dry-Weather Flows, Reuse and Discharge Method

Wastewater Treatment Plants	Reuse and Discharge Method	Actual FY 19/20 (AF)
Donald C. Tillman Water Reclamation Plant (DCTWRP)	Recycling and Pacific Ocean via Los Angeles River	38,000
Los Angeles - Glendale Water Reclamation Plant (LAGWRP)	Recycling and Pacific Ocean via Los Angeles River	16,000
Terminal Island Water Reclamation Plant (TIWRP)	Recycling and Pacific Ocean via Outfall in Los Angeles Harbor	18,000
Hyperion Water Reclamation Plant (HWRP)	Conveyance to ECLWRF for Recycling and Pacific Ocean Outfall	294,000
Total		366,000

7.3 Existing Recycled Water Deliveries

The City has several recycled water projects that utilize water from the four treatment plants listed in Exhibit 7D as well as ECLWRF and BWRP outside the City Department of Public Works,. These projects currently provide recycled water for landscape irrigation, industrial, and commercial uses spread throughout the following four service areas:

- Harbor – located in the southern portion of the City and currently served by TIWRP and the WBMWD's ECLWRF.
- Central City (Metro) – located in the central/eastern portion of the City and served by LAGWRP.
- San Fernando Valley – located in the northern portion of the City and served by DCTWRP and BWRP.
- Westside – located in the central/western portion of the City and served by HWRP through the WBMWD's ECLWRF.

Locations of the service areas are depicted in Exhibits 7G, 7I, 7K and 7M provided with the discussion of each service area. Recycled water service areas coincide with potable water service areas. Recycled water produced for FY 2019/20 was 36,402 AFY, inclusive of municipal and industrial, and environmental reuse, as summarized in Exhibit 7E. The highest use was for environmental uses at 26,751 AF followed by irrigation at 5,574 AF. The latest recycled water production figures are updated annually and can be found in LADWP's *Recycled Water Annual Report*.

Exhibit 7E
Recycled Water Use FY 2019/20 by Service Area

Recycled Water Service Area	Existing Annual Demand (AFY)
Irrigation	
Harbor Area	58
Metro Area	2,689
Valley Area	2,091
Westside Area	736
Subtotal Irrigation	5,574
Industrial	
Valley Area	948
Westside Area	0
Subtotal Industrial	948
Dust Control	
Metro Area	7
Subtotal Dust Control	7
Environmental	
Valley Area	26,751
Subtotal Environmental	26,751
Seawater Barrier	
Harbor Area	3,121
Subtotal Seawater Barrier	3,121
Fill Station	
Valley Area	1
Subtotal Fill Station	1
Total	36,402

7.3.1 Harbor Area

Most recycled water supplied to the Los Angeles Harbor Area is currently produced at the TIWRP Advanced Water Treatment Facility (AWTF). The AWTF was developed jointly by LADWP, LASAN, and the City of Los Angeles Department of Public Works,Bureau of Engineering (BOE); operation and maintenance are provided by LASAN with funding from LADWP. The AWTF began operating in 2002, with first deliveries to the Dominguez Gap Seawater Barrier in 2006. The AWTF expansion was completed in 2016 and increased the treatment capacity (including MF and RO) to 12 mgd (13,440 AFY). As of FY 2019/20, the five-year average for water supplied to the Dominguez Gap Barrier to protect the West Coast Groundwater Basin from seawater intrusion was 2,413 AFY, and 10.4 AFY was supplied to LADWP Harbor Generating Station for irrigation. Excess recycled water is discharged into the Los Angeles Harbor.

Recycled water in the Los Angeles Harbor Area is also provided by WBMWD via the ECLWRF, located in the City of El Segundo, for irrigation demands at Roosevelt Memorial Park.

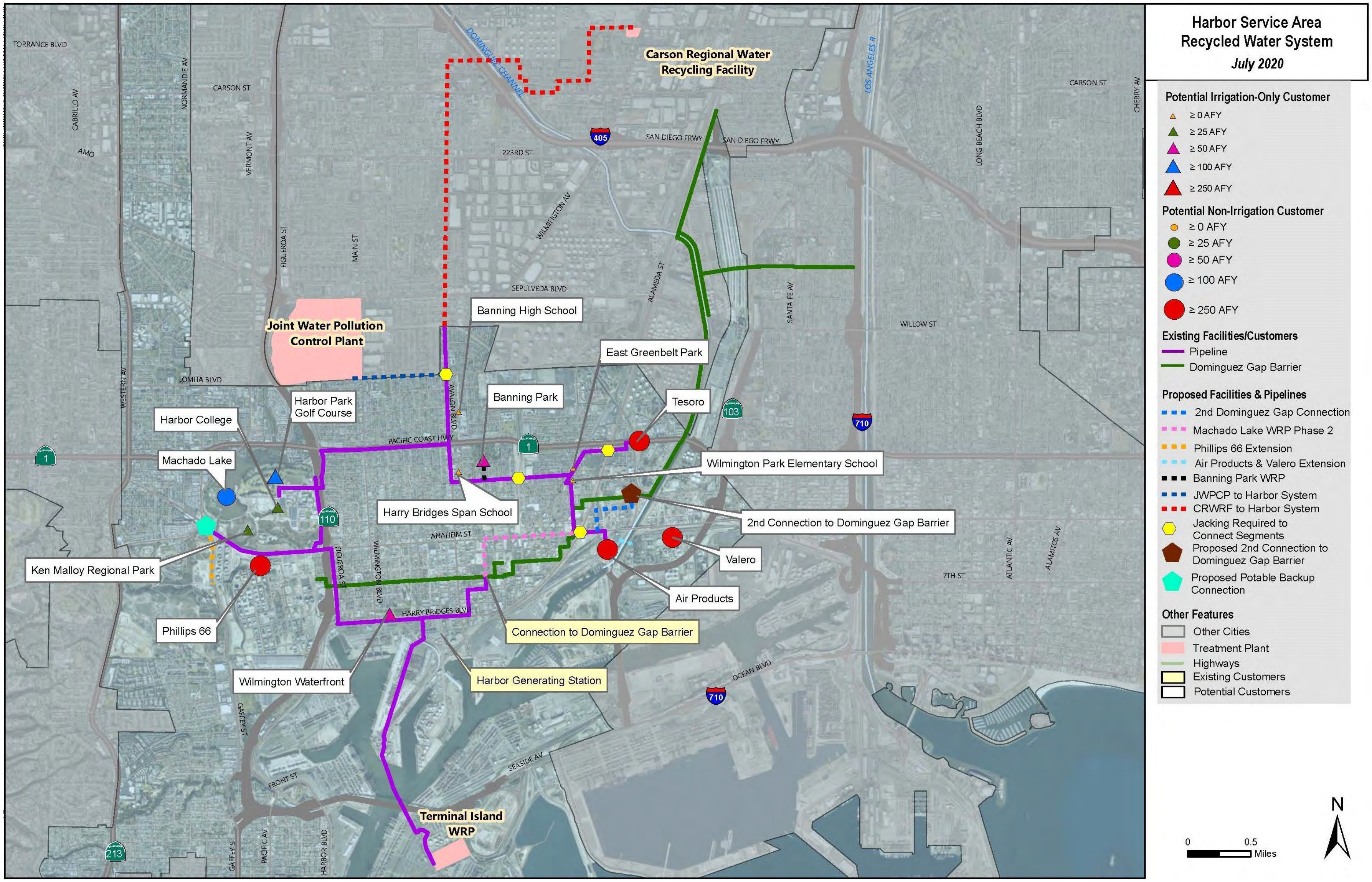
Exhibit 7F summarizes estimated annual demands in the Harbor Area based on FY 2019/20. Exhibit 7G illustrates the service area, existing users, potential users, and the location of the AWTF at TIWRP.

Exhibit 7F
Harbor Recycled Water Existing FY 2019/20 Annual Demand

Project	Existing Annual Demand (AFY)
Irrigation	
Roosevelt Memorial Park	58
Irrigation Subtotal	58
Seawater Barrier	
Dominguez Gap Barrier (Water Replenishment District)	3,121
Seawater Barrier Subtotal	3,121
Total Harbor Water Recycling Projects	3,179

In 2016, the LARWQCB authorized the TIWRP to provide the Dominguez Gap Seawater Intrusion Barrier with 100 percent recycled water, replacing a prior operation that utilized a blend of 50 percent recycled and 50 percent imported supplies. LADWP is currently working on expanding the use of recycled water to the Dominguez Gap and, in 2021, intends to construct a second connection to the Dominguez Gap. The connection is scheduled to come online in 2023 to provide up to a total of 9,500 AFY to the Dominguez Gap.

Exhibit 7G
Harbor Recycled Water Service Area



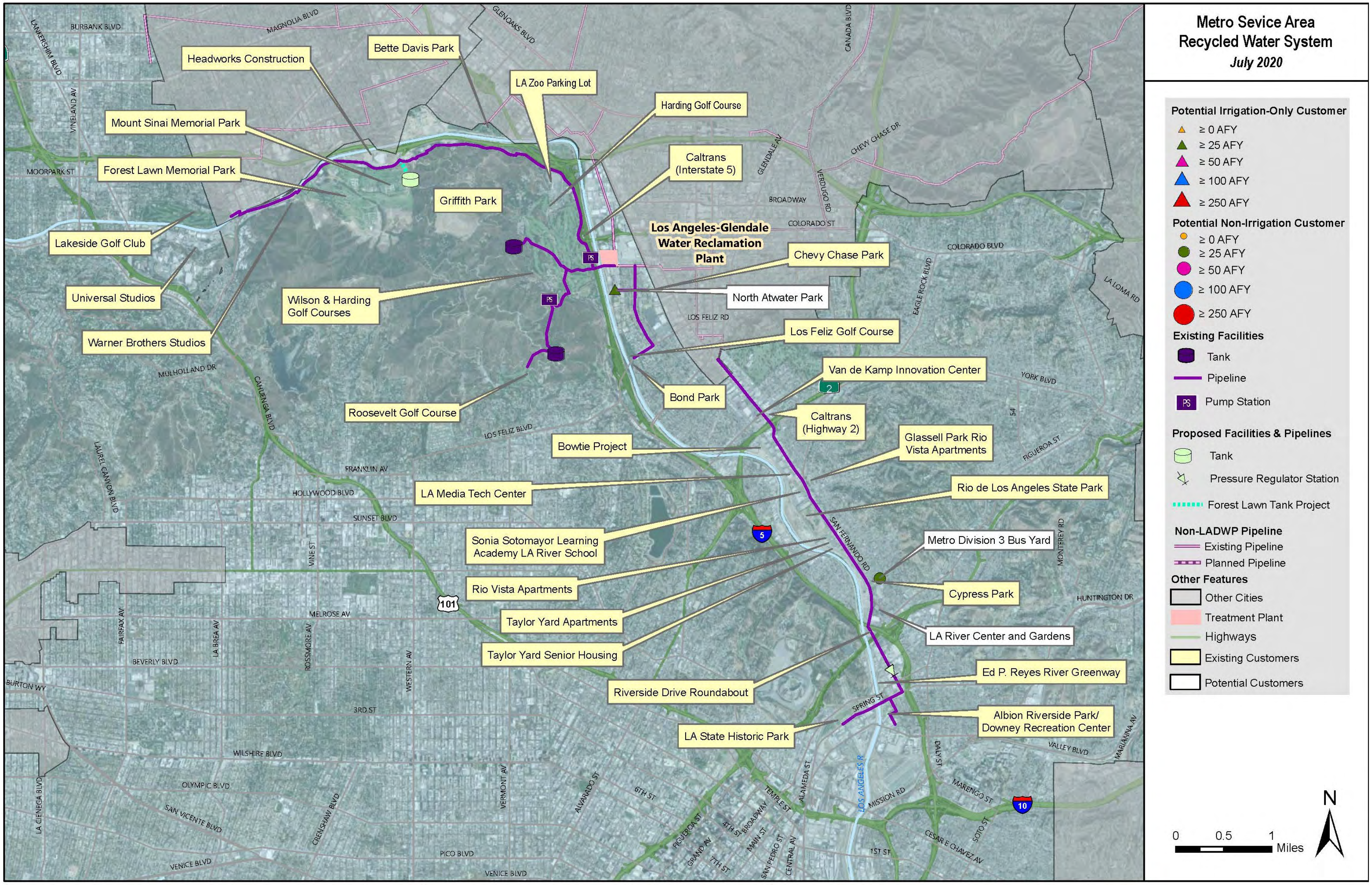
7.3.2 Metro Area

The Metro Recycled Water System has supplied the Metro Service Area with recycled water from LAGWRP since 1979. LAGWRP provides recycled water treated to a tertiary level meeting Title 22 standards with nitrogen removal. Any unused recycled water is discharged to the Los Angeles River. Griffith Park was the City's first recycled water project. In 1992, the Greenbelt project was the City's first recycled water project providing water to non-government entities. Recycled water service was established in the Taylor Yard area beginning in 2009 with service to Rio de Los Angeles State Park. Current recycled water demands (FY 2019/20) for the Metro Recycled Water System service area are 2,696 AFY. Almost all recycled water use in the Metro Service Area is used for irrigation with a small amount used for dust suppression at the Headworks Construction Project. As of FY 2019/20, there were 30 water recycling sites online. Exhibit 7H summarizes current demands on the Metro Recycled Water System. Exhibit 7I depicts the service area, existing users, potential users, and LAGWRP.

Exhibit 7H
Metro Recycled Water FY 2019/20 Annual Demand

Project	Existing Annual Demand (AFY)
Irrigation	
Caltrans (Highway 2)	1
Forest Lawn Memorial Park	645
Bond Park	4
Griffith Park	330
Harding and Wilson Golf Courses	697
Lakeside Golf Club	377
Mount Sinai Memorial Park	229
Universal Studios	124
Cypress Park	8
LA Zoo Parking Lot	16
Glassell Park Rio Vista Apartments	1
Rio de Los Angeles State Park	37
LA Media Center	11
Sonia Sotomayor Learning Academy LA River School	16
Van de Kamp Innovation Center	1
Ed P. Reyes River Greenway	2
Los Feliz Golf Course	7
Roosevelt Golf Course	48
LA State Historic Park	82
Albion Riverside Park/Downey Recreation Center	12
Bette Davis Park	14
Warner Brothers Studios	10
LADWP	6
Chevy Chase Park (LARAP)	3
Forest Lawn Gateway	3
Rio Vista Apartments	2
Taylor Yard Apartments	1
Taylor Yard Senior Housing	1
Riverside Drive Roundabout (City LA BOE, Public Works)	1
Subtotal Irrigation	2,689
Dust Control	
LADWP Headworks Construction	7
Subtotal Dust Control	7
Total Metro Water Recycling Projects	2,696

Exhibit 7I
Metro Recycled Water Service Area



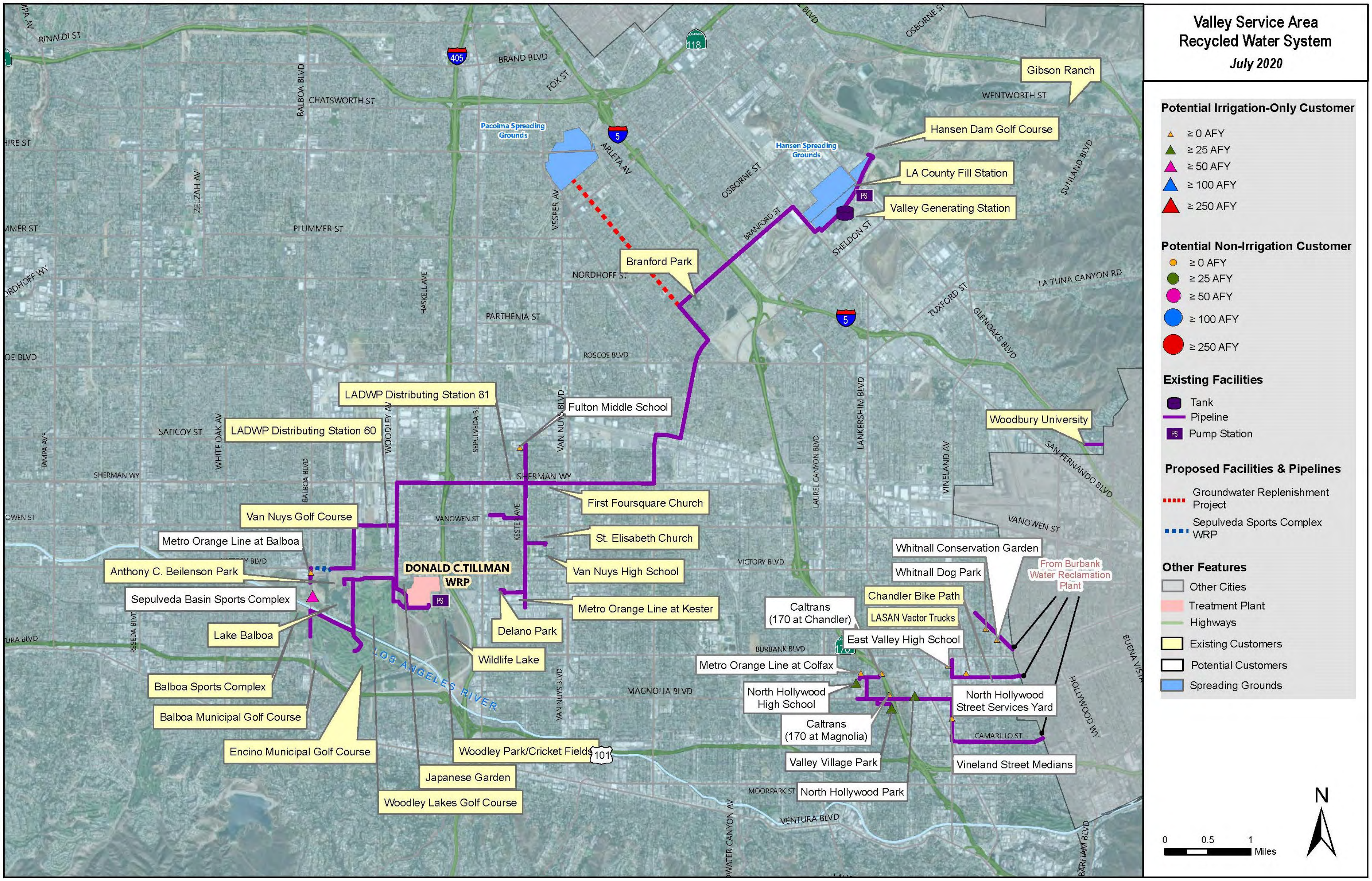
7.3.3 San Fernando Valley Area

The San Fernando Valley Area is serviced by two recycled water systems, which receive water from DCTWRP and BWRP to satisfy irrigation, environmental, and industrial demands. Recycled water is treated to a tertiary level meeting Title 22 standards with nitrogen removal at both plants. FY 2019/20 recycled water demands for the San Fernando Valley Area were 29,790 AFY. At DCTWRP, recycled water produced in excess of demand is discharged to the Los Angeles River. Exhibit 7J summarizes FY 2019/20 demands for the Valley Recycled Water System. The East Valley trunk line, a 54-inch-diameter pipeline, was previously constructed to replenish the SFB with recycled water. It is now the backbone of the Valley Recycled Water System's distribution system to deliver water throughout the San Fernando Valley for irrigation, commercial, and industrial use. As of FY 2019/20, 17 sites are served by the Valley Recycled Water Systems, excluding DCTWRP in-plant use and environmental uses. All users are served by DCTWRP except Woodbury University, Chandler Bike Path, and the Chandler Blvd fill station. Exhibit 7J summarizes current demands for Valley Recycled Water Systems. Exhibit 7K depicts the service area, existing users, potential users, and DCTWRP.

Exhibit 7J
Valley Recycled Water FY 2019/20 Annual Demand

Project	Existing Annual Demand (AFY)
Irrigation	
Hansen Dam Golf Course	480
Balboa Municipal Golf Course	319
Woodley Lakes Golf Course	452
Encino Municipal Golf Course	276
Woodley Park/Cricket Fields	121
Balboa Sports Complex	129
Van Nuys Golf Course	113
Anthony C. Beilenson Park	101
Metro Orange Line at Kester	13
Van Nuys High School	34
Branford Park	36
Woodbury University	8
Chandler Bike Path	2
Delano Park	6
Subtotal Irrigation	2,090
Industrial	
Valley Generating Station (Cooling Towers)	948
Subtotal Industrial	948
Environmental Use	
Japanese Garden	4,599
Wildlife Lake	4,876
Lake Balboa	17,276
Subtotal Environmental Use	26,751
Fill Station	
Gibson Ranch (via San Fernando/Branford fill station)	0.2
Hansen Spreading Grounds Above Fill Station (owned by LA County Public Works)	0
LASAN Vactor Trucks (via Chandler Blvd Fill Station)	0.3
Subtotal Fill Station	0.5
Total Valley Water Recycling Projects	29,790

Exhibit 7K
Valley Recycled Water Service Area



Irrigation

Recycled water from DCTWRP is used at 19 locations, while recycled water from BWRP is used at three locations. Irrigation users include golf courses, parks, churches, schools, sports fields, a ranch, and LADWP electrical distribution stations. LADWP Distribution stations 60 and 81 both use water for irrigation purposes and equipment washing. FY 2019/20 recycled water demands for irrigation, dust control, and equipment washing in the Valley was 2,088 AFY.

Industrial

Recycled water is used for industrial purposes at LADWP's Valley Generating Station. Recycled water service began in 2008 at the Valley Generating Station and demands in FY 2019/20 were approximately 948 AFY.

7.3.3.1 Environmental Uses

Recycled water from DCTWRP has provided recreational and environmental benefits since 1985, commencing with deliveries to the Japanese Garden and followed by deliveries to Lake Balboa in 1990 and the Wildlife Lake in 1991. In FY 2019/20, deliveries were estimated at 26,751 AFY. Overflows from the lakes and the garden are discharged to the Los Angeles River in conjunction with variable and intermittent direct discharges from DCTWRP for environmental benefits.

Japanese Garden

The 6.5-acre Japanese Garden is located at the Sepulveda Dam Recreation Area. The Japanese Garden receives more than 10,000 visitors per year. Historically, DCTWRP provides approximately 4,500 AFY of recycled water for the lake and landscaping at the Japanese Garden.

Wildlife Lake

Located in the Sepulveda Basin Wildlife Reserve, the Wildlife Lake uses approximately 5,100 AFY of recycled water from DCTWRP for wildlife habitat management.

Lake Balboa

Lake Balboa is the centerpiece of the Sepulveda Dam Recreation Area and is a popular recreational facility located in Anthony C. Beilenson Park. Approximately 17,000 AFY of recycled water is provided for this lake from DCTWRP.

7.3.4 Westside Area

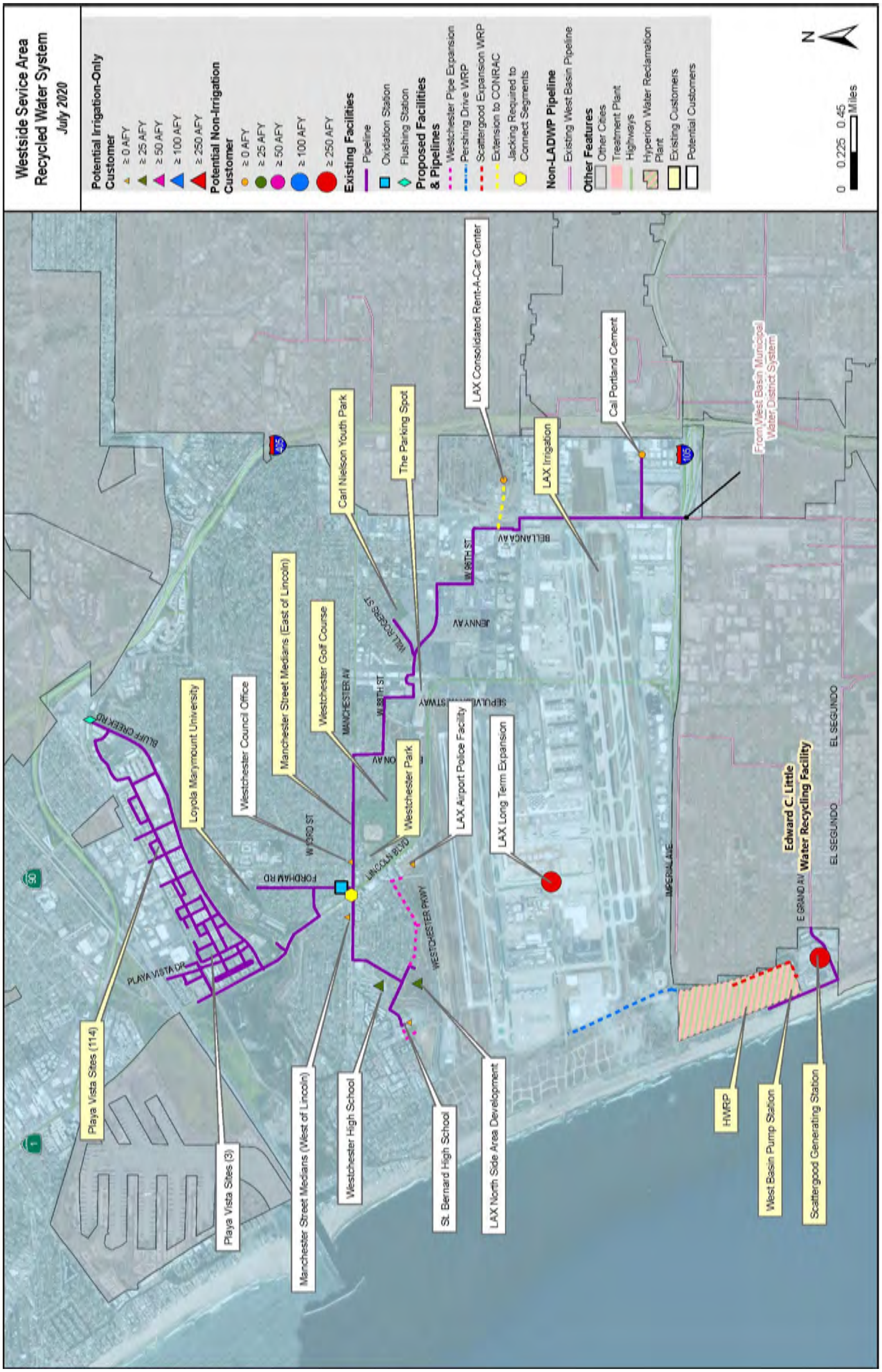
Recycled water supplied to the Westside Recycled Water System is provided by WBMWD via the ECLWRF, located in the City of El Segundo, for irrigation and commercial (toilet flushing) demands. Under an agreement between WBMWD and the City, WBMWD purchases secondary-treated effluent from HWRP, and LADWP has a right to purchase up to 25,000 AFY of recycled water from the ECLWRF. Approximately 37,800 AF of secondary-treated effluent was purchased from HWRP in FY 2019/20. Recycled water not purchased by LADWP is sold to users within WBMWD's service area.

Deliveries of recycled water from the Westside Recycled Water System first began in 1996. To increase the use of recycled water in West Los Angeles, LADWP has constructed more than five miles of distribution trunk lines to serve the Westchester, Los Angeles International Airport, and Playa Vista development areas. Recycled water demands in the Westside during FY 2019/20 were 736 AF as shown in Exhibit 7L. Exhibit 7M depicts the service area, existing users, potential users, and ECLWRP and HWRP.

Exhibit 7L
Westside Recycled Water FY 2019/20 Annual Demand

Project	Existing Annual Demand (AFY)
Irrigation	
LADWP Scattergood Generating Station	5
Los Angeles International Airport Irrigation	73
Loyola Marymount University	126
Carl Neilsen Youth Park	16
The Parking Spot	1
Westchester Park	31
Playa Vista Development, Phases 1 and 2	268
Westchester Golf Course	162
Hyperion Water Reclamation Plant	54
Subtotal Irrigation	736
Total Westside Water Recycling Projects	736

Exhibit 7M
Westside Recycled Water Service Area



Recycled water from ECLWRF is currently used at 124 sites to meet irrigation and toilet flushing demands, with 114 of these sites within the Playa Vista Development. Irrigation users include a golf course, parks, street medians, Los Angeles International Airport, LADWP Scattergood Generating Station, Loyola Marymount University, the Parking Spot, HWRP, and various users in Playa Vista. Recycled water is also used at HWRP and Playa Vista to flush toilets in dual plumbed commercial facilities. Playa Vista is the first planned development in the City to use recycled water for the irrigation of all its landscaping and for residential outdoor use. This project began receiving recycled water in 2009. Recycled water is required for outdoor use under the development's mitigation requirements established during the environmental review process.

7.3.5 Comparison of 2015 Projections Versus Actual Use

LADWP has made progress in increasing recycled water use. Between 2015 and 2020, over 35 additional sites have come online. Municipal and industrial recycled water use (including flows to Dominguez Gap Barrier) between FY 2015/16 and FY 2019/20 slightly increased from 10,421 AFY to 10,609 AFY. The 2015 Urban Water Management Plan (UWMP) projected municipal and industrial recycled water use in FY 2019/20 to be approximately 19,800 AF; however, actual use was lower than projected, as shown in Exhibit 7N. The lower than projected use of municipal and industrial use is a result of delays with signing up projected recycled water customers. Environmental use of recycled water fluctuates slightly year to year based on lake levels but the historical 10-year average is 26,600 AFY. For FY 2019/20 actual environmental use was 26,751 AF, and the overall total recycled water used in FY 2019/20 was 36,392 AFY.

Exhibit 7N
2015 UWMP Recycled Water Projections for FY 2019/20 versus Actual Use

Programs	2019-20 Actual Use (AFY)	Projected in 2015 UWMP (AFY)
Municipal and Industrial Uses[1]	6,529	19,800
Environmental Use[2]	26,751[3]	26,740
Seawater Intrusion Barrier (Dominguez Gap)[1]	3,121	7,500
Indirect Potable Reuse (Groundwater Replenishment)	0	0
Total	36,401	54,050

1. LADWP Fiscal Year 2019-20 Recycled Water Annual Report, does not include deliveries of 38,300 AFY to ELCWRF.

2. 5 Year Average water use is 26,600 AFY and is ultimately discharged to the Los Angeles River.

7.4 Recycled Water Planning Efforts

With the need to increase the reliability and sustainability of our water supply, along with the City initiatives to increase local water supplies, recycled water planning efforts have rapidly accelerated. The recycled water planning efforts described below are in addition to Operation NEXT, which as mentioned previously is one of the largest recycled water projects in the nation and is described further in Chapter 8, *Operation NEXT Water Supply Program*.

Recycled water projections in five-year increments beginning in FY 2019/20 through 2044/45 (projection period) are presented in Exhibit 7O. LADWP recycled water use is projected to reach 50,900 AFY by FY 2024/25 by adding 8,000 AFY of planned municipal/industrial use and 7,000 AFY of indirect potable reuse (groundwater replenishment), and further increase to 67,600 AFY through the remainder of the projection period. Environmental reuse is expected to remain relatively constant at approximately 26,600 AFY.

Exhibit 7O
Recycled Water Use Projections

Category	Projected Use (AFY)				
	FY 24/25	FY 29/30	FY 34/35	FY 39/40	FY 44/45
Municipal and Industrial Uses	17,300	29,200	29,700	29,800	30,000
Indirect Potable Reuse (Groundwater Replenishment)	7,000	11,000	11,000	11,000	11,000
Subtotal	24,300	40,200	40,700	40,800	41,000
Environmental Use	26,600	26,600	26,600	26,600	26,600
Total	50,900	66,800	67,300	67,400	67,600

Estimates of projected use and implementation timelines in the tables above, as well as the annual demands and service dates for individual customers in the following sections, may be affected by varying usage patterns of potential customers, timelines to reach agreements, potential financial constraints, and changing regulatory requirements.

7.4.1 Recycled Water by Service Area

Recycled water availability varies by service area. Additional supplies may be required to meet expected demands requiring a combination of existing facilities expansion, service connections to neighboring agencies outside the City, new facilities, and satellite treatment plants.

Harbor Area

LADWP is currently expanding recycled water infrastructure in the Harbor Area to serve large industrial and irrigation customers and Machado Lake. Nineteen projects are planned to increase recycled water usage by almost 16,000 AFY by FY 2030/31. Exhibit 7P summarizes projects, additional demands, estimated service dates, and the current status of projects in the Harbor Area.

Exhibit 7P
Harbor Area Estimated Demands

Project Site	Estimated Annual Demand (when fully online) (AFY)	Estimated initial Service Date (FYE)	Estimated Service Fully Online Date (FYE)	Current Phase
WRD Dominguez Gap Barrier 2nd Connection	3,500	2022	2027	Design
Valero	1,000	2023	2024	Construction
Harbor Generating Station Expansion - Cooling Towers	80	2023	2023	Design
Gardena High School	15	2022	2022	Design
Marathon Refinery	3,500	2029	2029	Planning
Air Products	2,500	2025	2026	Planning
Banning High School	13	2027	2027	Planning
Banning Park	51	2028	2028	Planning
East Greenbelt Park	6	2027	2027	Planning
Harbor Generating Station Expansion - Boilers	80	2026	2026	Design
Harbor Regional Park Golf Course	140	2028	2028	Planning
Harry Bridges Span School	4	2028	2028	Planning
Ken Malloy Regional Park	45	2028	2028	Planning
LA Harbor College	45	2028	2028	Planning
Machado Lake	140	2031	2031	Planning
Wilmington Park Elementary School	0.4	2028	2028	Planning
Wilmington Waterfront	57	2025	2025	Planning
Phillips 66	4,500	2028	2028	Planning
Total	15,676			

LADWP and LASAN are currently exploring concepts to treat and deliver additional recycled water to the Harbor Area to meet projected demands. Potential sources of recycled water are the Carson Water Reclamation Facility (Carson WRF) and the Joint Water Pollution Control Plant (JWPCP), as shown in Exhibit 7A.

Carson WRF further treats approximately 3.5 mgd of tertiary recycled water from ECLWRF to provide advanced treated recycled water for refinery boiler feed and cooling towers. Carson WRF could be expanded and connected to the Harbor System to increase the volume and reliability of the recycled water supply. The JWPCP is the central component of the Regional Recycled Water Program (RRWP), which would produce and deliver up to 150 mgd of purified recycled water. A new AWTF would be constructed at the JWPCP and a new conveyance system, over 60 miles long, would deliver water to groundwater basins within MWD's service area for IPR and potentially, as regulations are developed to facilitate this, to two MWD water treatment plants for DPR. The JWPCP is in close proximity to the Harbor System and could potentially be connected to create an additional source of advanced treated recycled water, increasing the volume and reliability of the recycled water supply. The RRWP also has the opportunity to join with the LADWP's Operation NEXT program, a regional recycled water program for the City, to create a truly regional recycled water system for Southern California.

Exhibit 7Q
Metro Area Near-Term Estimated Demands

Project Site	Estimated Annual Demand (Fully Operational)	Estimated Initial Service	Estimated Service Fully Online	Current Phase
	(AFY)	Date (FYE)	Date (FYE)	
Metro Division 3 Bus Wash/ Yard	30	2022	2022	Planning
Griffith Park Area Expansions	2	2022	2022	Planning
Forest Lawn Expansion (Irrigation)	450	2021	2041	Construction
Forest Lawn Expansion (4.5 million Tank) - Project but no consumption	500	2026	2041	Design
Griffith Park Nursery	13	2026	2026	Planning
North Atwater Park	40	2026	2026	Planning
Total	1,035			

Metro Area

Six water recycling projects and three customer connections are planned in the Metro Area to add annual demands of approximately 1,035 AFY. Almost all recycled water use is proposed for irrigation. LAGWRP will continue to meet all recycled water demands in the Metro Area. Exhibit 7Q summarizes near-term demands for the Metro Area.

Exhibit 7R
Valley Area Near-Term Estimated Demands

Project Site	Estimated Annual Demand (Fully Operational)	Initial Service Date	Estimated Service Fully Online	Current Phase
	(AFY)	Date (FYE)	Date (FYE)	
LA GWR Project (Initial and Second Phase)	11,000	2022	2027	Construction
Sepulveda Basin Sports Complex	54	2022	2022	Construction
North Hollywood Park	43	2023	2023	Design
North Hollywood High School	39	2022	2023	Design
Metro Orange Line at Colfax	22	2022	2022	Design
Whitnall Conservation Garden	21	2023	2023	Design
Valley Village Park	20	2023	2023	Design
North Hollywood Street Services Yard	14	2023	2023	Design
East Valley High School	13	2022	2023	Design
Caltrans (170 at Magnolia) Freeway	6	2023	2023	Design
Fulton Middle School	5	2022	2023	Design
Caltrans (170 at Chandler) Freeway	5	2023	2023	Design
Whitnall Dog Park	4	2023	2023	Design
Metro Orange Line at Balboa	2	2022	2022	Design
Vineland Street Medians	2	2026	2026	Planning
Total	11,250			

Valley Area

In the Valley Area, DCTWRP, in conjunction with recycled water obtained from BWRP, will provide recycled water for 15 potential projects and sites. These new uses are expected to increase recycled water use by an additional 30,250 AFY by FY 2044/45, with the majority of the new use associated with the LA GWR Project. These users are all located within close proximity to the existing recycled water systems. Exhibit 7R summarizes the potential demands for the Valley Area.

Exhibit 7S
Westside Area Near-Term Estimated Demands

Project Site	Estimated Annual Demand (fully online)	Initial Service Date	Estimated Service Fully Online	Current Phase
	(AFY)	Date (FYE)	Date (FYE)	
LAX CTA - Long Term Expansion	750	2023	2031	Design
Westchester High School	35	2022	2023	Design
LAX Northside Area 1	11	2024	2024	Planning
St. Bernard High School	10	2023	2023	Planning
Loyola Marymount University Expansion	20	2021	2028	Construction
LAX Airport Police Facility	3	2022	2022	Design
Manchester Street Medians (West of Lincoln)	2	2023	2023	Planning
LAX Northside Area 2	25	2024	2024	Planning
LAX Consolidated Rent-A-Car Center	10	2024	2024	Planning
LAX Midfield Satellite Concourse	2	2022	2023	Construction
Scattergood Generating Station Boilers	200	2025	2025	Planning
Scattergood Generating Station Towers	400	2025	2025	Planning
Westchester Golf Course Expansion (Phase 3)	1	2021	2021	Design
Cal Portland Cement	15	2026	2026	Planning
Hyperion Irrigation Expansion Phases 3 & 4	10	2024	2024	Planning
Westchester Council Office	1	2026	2026	Planning
Total	1,495			

Westside Area

LADWP will continue to serve new sites with projected use of approximately 1,495 AFY in the Westside Area. Planned demands include five projects and two customer connections. Most of the additional recycled water demands are attributed to industrial use at LAX for cooling towers. Exhibit 7S summarizes planned demands for the Westside Area.

LADWP, LASAN, and Los Angeles World Airports are collaborating to construct a 1.5 mgd Hyperion Advanced Water Purification Facility (HAWPF). The HAWPF will include MBR, RO, and advanced oxidation. Purified water from the HAWPF will be used for cooling towers at the LAX Airport Central Utility Plan, as well as dual plumbing in the Tom Bradley International Terminal and the Midfield Satellite Concourse.

7.4.2 Groundwater Replenishment

LADWP and LASAN are continuing to implement the LA GWR Project at DCTWRP. For the first part of the Initial Phase, up to 3,500 AFY will be conveyed to the Hansen Spreading Grounds for percolation into the SFB. Future phases of the LA GWR Project will ultimately provide up to 30,000 AFY of recycled water to replenish the SFB.

The Initial Phase of the LA GWR Project will spread recycled water at Hansen Spreading Grounds. Infrastructure required to implement the LA GWR Initial

Phase include additional treatment and facilities to convey product water to the spreading basins. The 54-inch recycled water trunk line already connects to the Hansen Spreading Grounds, having been constructed as a part of the previous recycled water spreading initiative under the East Valley Water Recycling Project. Existing facilities for spreading will be repaired and upgraded. As part of the Initial Phase, an Ozone Demonstration Project is being constructed at DCTWRP to demonstrate the efficacy of ozone treatment for future phases. For the next part of the Initial Phase, a 6.7-million-gallon equalization tank will be constructed at DCTWRP, to increase the supply of recycled water available for spreading to up to 7,000 AFY.

Future phases of the LA GWR Project of the LA GWR Project will include advanced treatment to meet or exceed evolving regulatory requirements, and may include increasing the supply of recycled water by recapturing flows of recycled water that flow through nearby lakes. Future phases may include the construction of injection wells and connecting to additional spreading grounds, such as Pacoima Spreading Grounds or Tujunga Spreading Grounds, which would require additional pipeline infrastructure.

Native stormwater recharge will continue to occur at the spreading grounds in conjunction with the project. Use of the spreading grounds could be potentially restricted for recycled water spreading during wet-weather events. Currently, LADWP and the Los Angeles County Public Works use multiple spreading grounds located in the eastern portion of the SFB to recharge the underlying SFB with stormwater. A detailed discussion of the San Fernando Basin and existing recharge operations is provided in Chapter 5, *Local Groundwater*, and Chapter 6, *Watershed Management*.

Independent Advisory Panel

IPR projects, such as LA GWR, typically require an independent third party with scientific and technical expertise to provide expert peer review of key aspects of the project. This review can further ensure the technical viability of the LA GWR Project and facilitate the regulatory process. To accomplish this, LADWP awarded a contract to the National Water Research Institute (NWRI) to form an Independent Advisory Panel (IAP) to provide expert peer review of the technical, scientific, regulatory, and policy aspects of the proposed LA GWR Project, pilot project testing, and other potential groundwater replenishment projects to maximize reuse as part of the City's Recycled Water Master Plan. The IAP process has provided a consistent, thorough, and transparent review of the proposed LA GWR Project and pilot testing during its development, as well as during the long-term implementation phase. Today the IAP continues to provide input on the LA GWR Project and the potential for direct potable reuse.

NWRI has vast experience in the organization and administration of the IAP processes for other agencies such as Orange County Water District's Groundwater Replenishment System. NWRI assists the IAP process by assembling the IAP members, developing a detailed scope and approach for the IAP's review, coordinating and facilitating meetings, and preparing IAP reports.

The "Independent Advisory Panel for the City of Los Angeles Groundwater Replenishment Project" consists of 12 members with scientific and/or professional expertise in issues related to the implementation of groundwater replenishment projects. The selection of members with different areas of expertise was based on the requirements of the CDPH Draft Groundwater Replenishment Reuse Regulations dated August 2008, as well as the composition of panels used by the Orange County Water District and the City of San Diego for the implementation of similar groundwater replenishment projects.

NWRI convened the Independent Advisory Panel for the first time in October 2010 to receive introductory information about the recycled water program and groundwater replenishment project. The most recent meeting was in August 2018 to discuss implementation of the Initial Phase of the LA GWR Project, and concepts for future phases. The IAP is involved throughout the planning, permitting, design, environmental documentation, and implementation of the LA GWR Project.

Some of the activities addressed by the IAP have included, but are not limited to, review of the following:

- General approach for Recycled Water Master Planning;
- Hydrogeology (response-retention time and in-basin groundwater blending);
- Treatment (barriers to replace the fifty-percent blend criteria and to meet evolving regulations);
- Source Control Evaluation for LA GWR;
- Draft Engineering Report for LA GWR; and
- Response to technical concerns raised by regulators and the public.

7.4.3 Cost and Funding

The capital cost of expanding the recycled water system to achieve the goal of 67,600 AFY by 2045 of recycled water through the construction of planned projects and the LA GWR project is estimated at $1.2 – 1.4 billion. Capital costs to construct the LA GWR project are estimated at approximately $520 million in 2020 dollars. The project annual operations and maintenance costs are estimated at $25.5 million per year in 2020 dollars.

Unit Cost

Non-potable reuse and IPR projects are diverse and result in a wide range of costs to implement and sustain. Non-potable reuse projects present numerous challenges, including distance from treatment plant and the associated transmission pipeline construction costs. This is weighed against customer size and recycled water adaptability to a specific commercial site or process. The approximate range of cost for the planned non-potable reuse projects is estimated to be from $500 to $2,000 per acre-foot. This approximation includes capital, operation, and maintenance costs. Unit costs for the LA GWR project, including capital, operation, and maintenance costs, are estimated to be $1,055 per acre-foot in 2020 dollars.

Funding

Capital costs for recycled water projects will be covered by the funding sources identified below, as well as other sources as they become available.

- Water Rates – LADWP water rates are the primary funding source for the recycled water program.

- Federal Funding – LADWP will pursue Federal funding as it becomes available. In the past LADWP has received funding for recycled water projects from the Federal Water Project Authorization and Adjustment Act of 1992, Public Law 102-575 (HR429), and the United States Bureau of Reclamation Title XVI Program.

- State Funding – LADWP will pursue State funding for recycled water projects through the SWRCB and California Department of Water Resources (DWR), as it becomes available. Proposition 1, Chapter 9 contains $625 million for grants and loans for water recycling projects. This funding is being administered through the SWRCB's Water Recycling Funding Program, which also provides low-interest loans from the Clean Water State Revolving Fund. Proposition 1, Chapter 7 contains $98 million for Integrated Regional Water Management implementation projects in the Los Angeles subregion (includes Ventura), including recycled water projects. IRWM funding is administered by DWR.

- MWD Local Resources Program Incentive – The Local Resources Program (LRP) provides funding for water recycling and groundwater recovery projects that prevent a new demand on MWD or displace an existing demand on MWD. Financial incentives vary based upon the incentive payment structures selected by the applicant. In 2018, MWD adopted three incentive structures with incentives ranging from $305 per AF to $475 per AF based upon the incentive terms. As of FY 2019/20, LADWP has 11 executed LRP agreements with MWD for recycled water projects, and another four that are in the application development process.

7.4.4 Outreach and Agency Coordination

Outreach with key stakeholders and the public, and coordination with agencies is necessary for the success of the City's recycled water program. LADWP and LASAN initiated an extensive outreach process in 2009 with the formation of the Recycled Water Advisory Group (RWAG). The efforts of the RWAG are continued today through the Water System Stakeholder Engagement Group which held its first workshop in 2020.

Stakeholder Process

Through the combined outreach efforts of the LADWP and LASAN, the City continues to promote the advantages and safety of recycled water use. Outreach strategies include briefing key influential stakeholders and elected officials as well as presentations to Neighborhood Councils and community groups. Water recycling staff participates in multiple community events and responds to public inquiries regarding the City's goals and water supply challenges.

In addition, LADWP staffs continue to reach out to K-12 schools and the community about developing the local water supplies with recycled water, storm water capture, and water conservation and use efficiency.

At the center of the City's outreach efforts is continued dialog with stakeholders. The original RWAG of approximately 70 stakeholder organizations with varied perspectives was integrated with One Water LA stakeholder outreach in 2016, and after the completion of the One Water 2040 Plan LADWP founded the Water System Stakeholder Engagement Group in 2020 to continue dialog with stakeholders. Maintaining an open dialog is a key strategy in understanding the needs of stakeholders and keeping them substantively informed of policies impacting their lives.

Agency Coordination

To maximize recycled water, use and to move forward with recycled water efforts, LADWP has closely coordinated and continues to coordinate with agencies at the local and state levels. Coordination is necessary to ensure adequate funding, identification of end-users, adequate availability of supplies, permitting and regulatory approvals, and regional cooperation. If Federal funding opportunities become available, LADWP will also coordinate with the applicable Federal agencies. Exhibit 7T provides a summary list of agencies that LADWP either coordinated with or is currently coordinating with to maximize recycled water use.

Exhibit 7T
Recycled Water Agency Coordination

Burbank Water and Power[1]	Los Angeles County Public Works[1]
Central Basin Municipal Water District[1]	Metropolitan Water District of Southern California[1]
Glendale Water and Power[1]	Pasadena Water and Power[1]
Los Angeles County Sanitation Districts[1]	Water Replenishment District of Southern California[1]
Long Beach Water Department[1]	West Basin Municipal Water District[1]
Las Virgenes Municipal Water District[1]	Los Angeles Regional Water Quality Control Board
State Water Resources Control Board	Los Angeles County Department of Public Health
City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment	City of Los Angeles Department of Public Works, Bureau of Engineering

1. Met with agencies individually to discuss potential regional recycled water use.

Financial Incentives

LADWP also coordinates recycled water end use with potential customers by assisting with facility retrofits and public education. Recycled water is provided to customers at a cost less than potable water. LADWP implemented a new incentive program on July 11, 2012, designed to assist with onsite retrofits to convert customers to the use of recycled water.

7.4.5 Recycled Water Quality

All recycled water provided by LADWP meets, at minimum, Title 22 standards. Title 22, Chapter 4, of the California Code of Regulations establishes water quality standards and treatment reliability criteria for water recycling to ensure public safety as discussed in Section 7.1. Title 22 standards are achieved with tertiary treatment and disinfection. For additional information regarding water quality produced at each source, refer to Section 7.2.

Blank Page

Chapter Eight

Operation NEXT Water Supply Program

8.0 Overview

Through the Operation NEXT Water Supply Program (Program), LADWP seeks to strengthen the City's long-term resiliency and sustainability by maximizing water reuse from the Hyperion Water Reclamation Plant (HWRP) in conjunction with similar efforts at other reclamation plants in the city. When completed, advanced treated purified recycled water supplies (ATRW) from HWRP will further help to diversify the City's water supply portfolio by augmenting groundwater supplies, replenishing groundwater basins, and providing opportunities for other potential potable reuse applications.

Partnerships are in place with the City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment (LASAN), the Water Replenishment District of Southern California (WRD), and the Metropolitan Water District of Southern California (MWD) to coordinate, develop, and evaluate a comprehensive list of collaborative opportunities for potential system interconnections and maximizing beneficial reuse. Ongoing planning efforts are underway and include a specialized technical study, stakeholder outreach, regulatory engagement and support, and the development of a governance and funding structure.

The Program aims to support LADWP's goal to increase development of local supplies and maximize water reuse, as detailed in Chapter 1, *Introduction*.

8.1 Background

LADWP anticipates continued challenges in managing the water system with impending seismic risks, increased environmental responsibilities, frequent extreme dry conditions, and variable hydrology. These challenges require a new approach in managing the water system and have encouraged the City to reduce its dependence on purchased imported water to improve local resiliency and sustainability.

Faced with this collection of challenges, the City seeks to hedge these impacts by maximizing water reuse through expanded groundwater production and potential potable reuse. Over the past several years, multiple studies have evaluated various scenarios on how to effectively use recycled water from HWRP. These studies include:

- City of Los Angeles Recycled Water Master Plan (2012)
- Hyperion Reuse Feasibility Study (2016)
- WRD Groundwater Master Plan (2016)
- One Water L.A. Plan (2018)
- LADWP Groundwater Development and Augmentation Plan (GDAP) (2020)

These studies have helped set the framework for LADWP's recycling program, and identified strategies for increasing recycled water supply through indirect potable reuse (IPR) and non-potable reuse (NPR) applications. In particular the feasibility of developing advanced treatment processes at HWRP were considered, and the use of recycled water from HWRP as a means of replenishing local groundwater basins were evaluated. Concepts were developed upon the feasibility studies that involved conveying recycled water from HWRP to local groundwater basins, LADWP's distribution system, and the Los Angeles Aqueduct Filtration Plant (LAAFP). Methods were also identified for developing local groundwater basins using HWRP as the source water for augmentation.

The Program builds upon these earlier studies and efforts to help develop a holistic strategy to maximize recycled water use for the City of Los Angeles from HWRP. Current efforts include two Advanced Treatment Pilot Projects at HWRP (Chapter 7, *Recycled Water*) and the LADWP/WRD Joint Los Angeles Basin Replenishment and Extraction Master Plan (Joint Master Plan). The Advanced Treatment Pilot Projects will help inform final treatment technology and design recommendations to convert HWRP to an Advanced Water Purification Facility (AWPF).

The second of these efforts is a partnership with WRD, the regional entity responsible for management and enhancement of groundwater basins in southern Los Angeles County (refer to Chapter 5, *Local Groundwater* for additional information regarding WRD). In order to advance shared sustainability goals, LADWP and WRD determined it was necessary to create the Joint Master Plan to evaluate projects for replenishment and extraction of the West Coast and Central Groundwater Basins with the underlying goal to improve the resilience and sustainability of the City's local water supplies.

8.2 Program Objectives

The Program encompasses four key objectives that set the framework in accomplishing the Program's goal of maximizing the beneficial reuse of this new local water supply to help improve long-term sustainability, resiliency, and reliability. Achieving this goal will provide LADWP with an additional tool to add to its already diverse water supply portfolio as part of the UWMP's integrated strategy to ensure water supply reliability. These four objectives include the following:

Maximize Recycled Water Production at HWRP

Currently, HWRP recycles only a fraction of its total influent; approximately 25 percent of its available supply. Once the wastewater is treated to meet permit requirements, all unclaimed water is then discharged to the ocean. In FY 2019/20, HWRP discharged approximately 247,000 AF of treated wastewater to the ocean. LADWP and LASAN have collaborated since 1979 to increase the City's recycled water production and are currently studying methods to convert the HWRP secondary treatment process to an AWPF, which includes membrane bioreactor, reverse osmosis (RO), and advanced oxidation technologies. These technologies allow recycled water to be treated to exceed drinking water quality standards and increase the City's beneficial reuse of this vital local resource. HWRP will provide the source water for the Program and is a critical piece in accomplishing the remaining objectives.

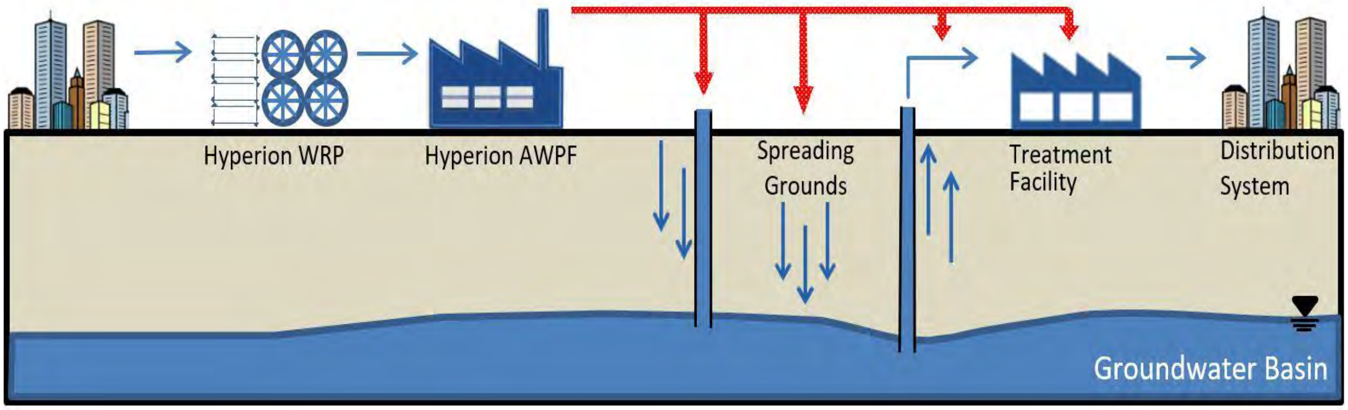
Build Local Groundwater Storage

Conveying ATRW to local groundwater basins provides a resilient storage supply that adds operational flexibility and increased redundancy to LADWP's water system. This supply can be used as-needed to supplement demand, or remain in the aquifer as storage for emergency use or other operational needs. Within the West Coast, Central, and San Fernando Valley Groundwater Basins, there exists approximately one million acre-feet of available storage capacity. The Program may utilize this storage potential by conveying ATRW to the West Coast Seawater Barrier (WCSB) to aid in the remediation of an existing saline plume, to new injection wells located throughout the Central Basin, and to the San Fernando Valley where existing spreading ground capacity can be used to replenish the San Fernando Valley Groundwater Basin. Each basin will serve an essential role in maximizing local groundwater storage. This will allow LADWP to maintain a reliable water supply in the event of emergency scenarios or disruptions in imported supplies.

Increase Local Water Supplies

As outlined in the previous objective, ATRW from HWRP may be stored in local groundwater basins for current and/or future needs. Existing regulations allow for ATRW to be recharged into groundwater aquifers that serve as a source of water supply for a public water system. This new source of groundwater may then be extracted and conveyed directly to the potable water distribution system. ATRW may also be conveyed directly to the LAAFP, or other parts of the system, where potable reuse applications may allow for ATRW to be integrated with existing water supplies as a supplemental source water (see Chapter 7, Recycled Water). While there are currently no regulations in place for this potable reuse application, Assembly Bill 574, as codified in Water Code Section 13560 et seq., requires the State Water Resources Control Board to adopt uniform regulations by December 2023. Once materialized, these regulations may allow for recycled water to be placed directly at the beginning of the City's water distribution system, providing a new local water supply that can serve a vast majority of the City. These potable reuse applications increase local water supplies and the overall reliability of this new local resource (Exhibit 8A).

Exhibit 8A
Operation NEXT Potential Potable Reuse Applications



Collaborate with Regional Partners

MWD is currently developing their Regional Recycled Water Program (RRWP) in partnership with the Los Angeles County Sanitation Districts (LACSD) at the Joint Water Pollution Control Plant (JWPCP) in Carson, California. Similar to LADWP's partnership with LASAN at HWRP, the RRWP will advance treat wastewater at JWPCP for use in the region's groundwater basins and industrial facilities, with potential future potable reuse applications.

On July 16, 2019, LADWP and MWD entered into a Letter of Intent (LOI) to collaborate in the development and utilization of ATRW produced from their respective facilities. The LOI represents an opportunity for a potential water exchange between the water sources produced by each program, either along MWD's planned conveyance system or at the Jensen Water Filtration Plant immediately adjacent to LAAFP. This potential for a water exchange would add flexibility and redundancy to both agency's programs and could benefit the region holistically.

8.3 Program Strategy

The magnitude of the Program presents many unique challenges, as well as innovative collaboration strategies and opportunities for successful implementation. These challenges are categorized as phasing, regulatory, technical, financial, political, and institutional.

Phasing

Challenge: Estimating the timeframe for full conversion to advanced treatment at HWRP, including the amount of recycled water available and associated infrastructure necessary to convey it.

Strategy: Continue to work in partnership and closely collaborate with LASAN to ensure that Program phasing will be consistent with the upgrades at HWRP, and that the conveyance infrastructure is built and ready to begin taking water from HWRP once it's available.

Regulatory

Challenge: Uncertainty that uniform potable reuse regulations, set to be adopted by December 31, 2023, will cover all potable reuse applications.

Strategy: Work closely with the State Water Resources Control Board, Division of Drinking Water in developing potable reuse regulations and use the current Pilot Projects at HWRP to demonstrate and inform the effectiveness of new innovative technology.

Technical

Challenge: Complexities of integrating this new supply source into the existing distribution system, identifying alignments for conveyance pipelines, and constructability considerations for Program infrastructure. These challenges apply to all Program components, including those associated with the conversion at HWRP and will require ongoing technical analysis to resolve.


Los Angeles Aqueduct Filtration Plant

Strategy: Continued engineering analysis and implementation of new technologies throughout Program infrastructure will allow further development and utilization of local groundwater basins. New operating plans and standards will help integrate this new water supply into the existing distribution system.

Financial, Political, and Institutional

Challenge: The Program will also require an extensive financial support framework and involve partnerships with local agencies for cost sharing wherever applicable, with considerations to impacts on the LADWP Rate Payer. This may lead to political and institutional challenges, which also requires extensive outreach and stakeholder engagement to align local water supply goals with other City agencies. As such, LADWP continues to collaborate with local municipalities and agencies to establish and maintain regional collaboration.

Strategy: Develop a financial support framework to work closely with the Program's phasing strategy and ensure appropriate integration into LADWP's rate structure. Establish and strengthen regional relationships, as well as potential funding partnerships. Continue to work closely with all stakeholders, local City agencies and municipalities, and the various neighborhood Council Groups and City Council Districts.

8.4 Program Implementation

Given the magnitude of the Program, thoroughly analyzing alternatives and scheduling of distinct, but interrelated projects, will be critical for successful implementation. These efforts will allow for parallel delivery of key Program components and will require close coordination among all Program partners to ensure consistent completion of all Program components.

Alternatives Analysis

A set of Program alternatives tool was developed to objectively evaluate critical components of the Program including consideration of cost per acre-foot, operational flexibility, wet-year flexibility and building storage, institutional arrangement/regional benefit, public support, permitting and regulatory pathway, and potential project phasing. Each category serves as a building block in providing a reliable, sustainable, and resilient water supply.

Component Implementation

Scheduling of Program components considers:

- HWRP's conversion to an AWPF, while continuing to provide required wastewater treatment and meet discharge requirements.
- Conveyance to deliver ATRW to the several areas within and adjacent to LADWP's service area including WCSB, Central Basin, and San Fernando Valley for replenishment and includes routing to LAAFP for potable reuse applications.
- Infrastructure to extract replenished groundwater and convey it into LADWP's existing potable distribution system.
- Interconnection with MWD at its Jensen Water Filtration Plant in Sylmar and/or RRWP Backbone System.

Additional analysis will be conducted to determine optimal phasing of these components.

8.5 Environmental Considerations

Programmatic environmental studies to comply with CEQA are currently being conducted and are required prior to the start of construction. The Programmatic Environmental Impact Report (PEIR) was initiated in February 2020 and is anticipated to be completed by 2022. Consideration will be given to approval for spreading and injection facilities, groundwater extraction facilities, pipeline construction, and potable reuse applications. The PEIR will require close coordination with LASAN regarding the conversion at HWRP, identification of regulatory agencies, and development of strategies for engagement with regulators. This approach will help to facilitate permitting of the various aspects of the Program.

8.6 Funding Opportunities

Generally, the funding strategy includes the acquisition of State and Federal grants, loans, and collaboration with other agencies to leverage existing infrastructure. Additionally, securitization will play a role.

Potential funding programs include:

- Clean Water State Revolving Fund Program
- Infrastructure State Revolving Fund (ISRF) Program
- Title XVI Reclamation and Reuse Program
- Water Infrastructure Finance and Innovation Act (WIFIA)
- Integrated Regional Water Management (IRWM) Program
- California Governor's Office of Emergency Services/ Federal Emergency Management Agency (OES/ FEMA) Hazard Mitigation Assistance (HMA) Program
- MWD Local Resource Program (LRP)
- Future unidentified Water Bond Measures

Where feasible, efforts will be made to leverage other City programs. Examples include potential partnerships with the Department of Recreation and Park's 50 Parks Initiative and the Economic and Workforce Development Department for new or existing co-located facilities. If deemed necessary, cost recovery associated with National Contingency Plan (NCP) groundwater remediation could also provide a potential funding source. Program costs will be incorporated into LADWP's Capital Improvement Program (CIP) and prioritized along with other large projects and programs in the coming years. All remaining costs will likely be covered by the Water Revenue Fund through a rate action, with consideration to the financial impacts on LADWP customers.

8.7 Communications Plan

A robust communications and outreach plan will be necessary to define communication needs and engage the public and all stakeholders on the Program goals and benefits to the community. This will be an opportunity to incorporate public education throughout every aspect of the Program and develop grassroots advocacy within the community. The plan will include distribution of all public Program information and thorough management of the stakeholder process by communicating relevant information and resolving issues in an appropriate manner. Outreach will be consistent with the CEQA process to establish the communication needs of all stakeholders.

8.8 Next Steps

Moving forward, there are a number of recommendations for next steps to further this Program, including continued collaboration with Program partners and development of associated agreements. A more in-depth internal hydraulic analysis will be conducted to better understand system demands, particularly in the Central, West Coast, and San Fernando Groundwater Basins. Implementation of a pilot or demonstration scale injection well(s) study will be required to better characterize injection and extraction potential in the Central Basin and surrounding areas. To support injection/extraction well, treatment, and conveyance infrastructure, subsequent to the PEIR, LADWP will investigate and seek real estate to accommodate construction and development of all Program components. Furthermore, as the Program nears the end of the planning stage, in fiscal year 2024-25, a more refined cost-estimate will be developed.

The Operation NEXT Water Supply Program will help to secure the long-term sustainability of the City's local groundwater resources by helping to replenish the Central, West Coast, and San Fernando Groundwater Basins, while supplementing potable supplies. Through this program, LADWP can optimize the City's overall water supply portfolio, enhance system resilience, and utilize up to an additional one million AF of local storage.

Chapter Nine

Metropolitan Water District Supplies

9.0 Overview

As a member agency of the Metropolitan Water District of Southern California (MWD), the City of Los Angeles (City) through LADWP purchases water to supplement its supplies from local groundwater, the Los Angeles Aqueduct (LAA), and recycled water. LADWP has historically purchased supplemental supplies from MWD to help meet the City's demands. Between fiscal year ending (FYE) 2016 and 2020, MWD purchased water accounted for approximately 42 percent of the City's total water supply. While the City plans to improve its water supply reliability through investments in additional local supply development and conservation, it has made significant investments in MWD and will continue to rely on the wholesaler to meet current and future supplemental water needs. Additional detail of MWD's water supplies can be found in MWD's 2020 Urban Water Management Plan (UWMP) which can be found at http://www.mwdh2o.com/AboutYourWater/Planning/Planning-Documents.

MWD is the largest water wholesaler for domestic and municipal uses in California, providing over 19.2 million people with an average of 1.7 billion gallons of water per day to a service area of approximately 5,200 square miles. MWD was formed by the MWD Act and exists pursuant to this statute, which was enacted by the California Legislature in 1927. MWD's purpose is to develop, store, and distribute water to meet the current and future supplemental water needs of Southern California. In 1928, MWD was incorporated as a public agency following a vote by residents in 13 cities in Southern California. Operating solely as a wholesaler, MWD owns and operates the Colorado River Aqueduct (CRA), is a contractor for water from the California State Water Project (SWP), manages and owns in-basin surface storage facilities, stores groundwater within the basin via contracts, engages in groundwater storage outside the basin, and conducts water transfers to provide additional supplies for its member agencies. Today, MWD has 26 member agencies consisting of 11 municipal water districts, one county water authority, and 14 cities, including the City.

9.0.1 History

Initially formed to import water into the Southern California region, MWD's first project was to build the CRA to import water from the Colorado River. The City provided the capital dollars to initiate and complete land surveys of all proposed alignments for the CRA. Construction was financed through $220 million in bond sales during the Great Depression. Ten years after initiating construction, Colorado River water reached Southern California in 1941. To meet further water demands in the Southern California region, MWD contracted with the California Department of Water Resources (DWR) in 1960 for almost half of the SWP's water supplies, which are delivered from the San Francisco Bay and Sacramento-San Joaquin River Delta (Bay-Delta) region into Southern California via the California Aqueduct. Construction of the California Aqueduct was financed as part of the $1.75 billion bond measure passed by the Burns-Porter Act in 1960. Deliveries of SWP water were first received in 1972.

9.0.2 Governance

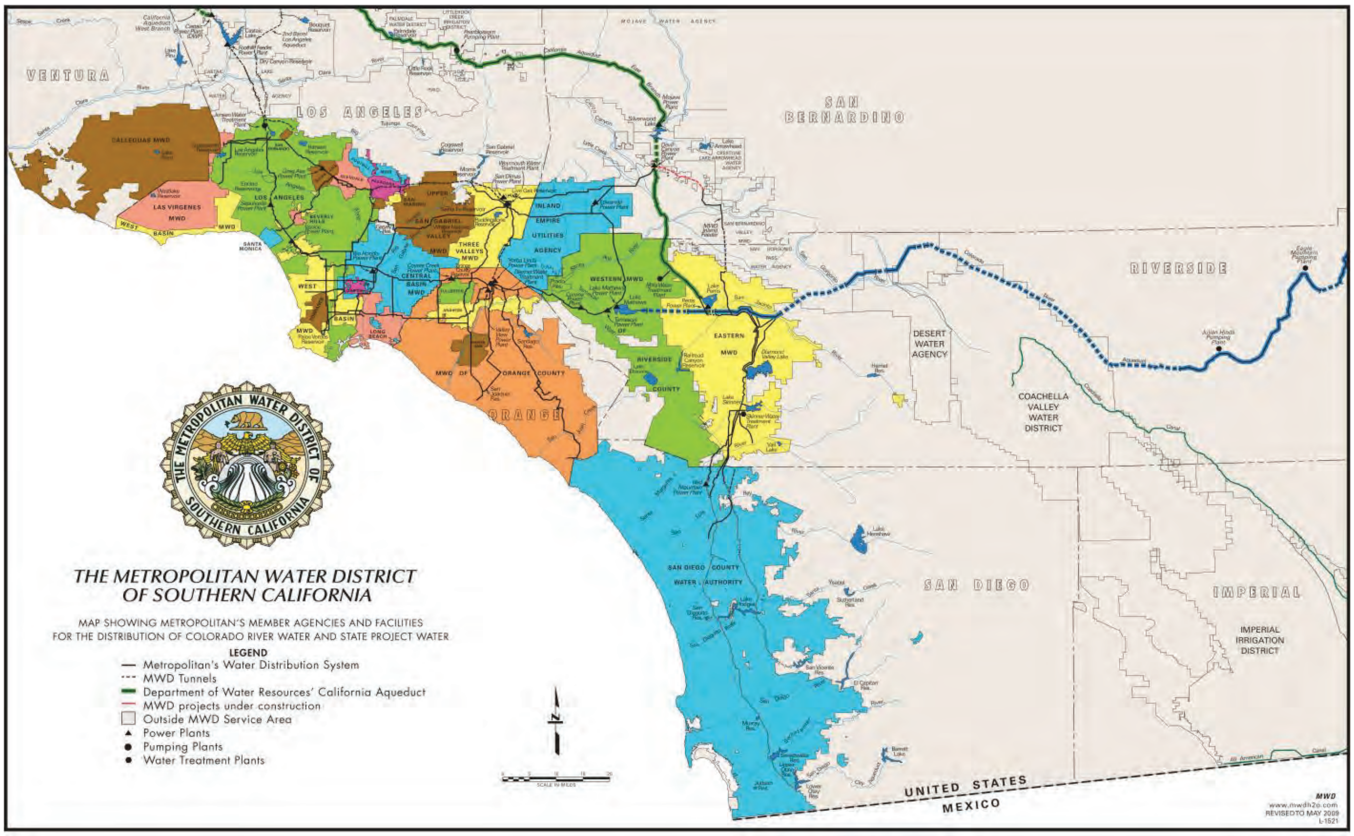
MWD is governed by a Board of Directors composed of 38 individuals with a minimum of one representative from each of MWD's 26 member agencies. The allocation of the directors and voting rights are determined by each agency's assessed valuation. As of August 2020, the City has five Directors on MWD's Board and a 20.93 percent of the voting weight. MWD's

Administrative Code defines various tasks which the MWD Board has delegated to MWD staff. A General Manager oversees MWD staff. The General Manager, General Auditor, General Counsel, and Ethics Officer serve under direction and authority given directly by the MWD Board.

9.0.3 Service Area

Originally serving an area of approximately 625 square miles in 1941 when water service began, MWD's service area has grown to approximately 5,200 square miles serving over 19 million people through its 26 member agencies. MWD's service area covers portions of Los Angeles, Ventura, Orange, Riverside, San Bernardino, and San Diego counties as depicted in Exhibit 9A. MWD member agencies serve 152 cities and 89 unincorporated communities. Member agencies provide wholesale, retail, or a combination of wholesale and retail water sales in their individual service territories.

Exhibit 9A
MWD Service Area



Courtesy of the Metropolitan Water District of Southern California

9.0.4 Major Infrastructure

MWD delivers approximately 4,300 AF per day of treated and untreated water to its member agencies through its vast infrastructure network. Major facilities include the CRA, pumping plants, pipelines, treatment plants, reservoirs, and hydroelectric recovery power plants. A summary of the major facilities and capacities are provided in Exhibit 9B. Exhibit 9C illustrates the geographic locations of the facilities.

Exhibit 9B
Major MWD Facilities Summary

Facility	Units	Capacity
Colorado River Aqueduct		
Aqueduct	242 miles	1.3 million AFY
Pumping Plants	5 plants	1,617 feet of total lift
Distribution Pipelines		
Distribution Pipelines/Tunnels	830 miles	
Water Treatment Plants		
Joseph Jensen		750 mgd
Robert A. Skinner		350 mgd
F.E. Weymouth		520 mgd
Robert B. Diemer		520 mgd
Henry J. Mills		220 mgd
Total Treatment Capacity		2,360 mgd
Reservoirs		
Diamond Valley Lake		810,000 AF
Lake Matthews		182,000 AF
Lake Skinner		44,000 AF
Copper Basin		24,200 AF
Gene Wash		6,300 AF
Live Oak		2,500 AF
Garvey		1,600 AF
Palos Verdes		1,100 AF
Orange County		212 AF
Total Reservoir Capacity		1,072,000 AF
Hydro Plants		
Hydroelectric Recovery Plants	16 plants	131 megawatts

Exhibit 9C
Major MWD Facilities

Courtesy of the Metropolitan Water District of Southern California

9.1 Supply Sources

Colorado River supplies, State Water Project supplies, water transfers, and storage and exchange programs together comprise MWD's total system water supply sources. These sources provide supplemental water to meet the demands in Ventura, Los Angeles, Riverside, Orange, San Bernardino, and San Diego Counties.

9.1.1 Colorado River

The Colorado River forms California's border with Arizona to the east. The drainage area in California that contributes water to the Colorado River is relatively small and has an arid climate. Accordingly, California has no major tributaries contributing water to the Colorado River.

The Colorado River Board of California (CRB) is the California state agency given authority to protect the interests and rights of the state and its residents in matters pertaining to the Colorado River. The CRB is comprised of 10 gubernatorial appointees representing the LADWP, MWD, San Diego County Water Authority, Palo Verde Irrigation District, Coachella Valley Water District, Imperial Irrigation District, California Department of Water Resources, California Department of Fish and Wildlife (CDFW), and two public members.

9.1.1.1 The Law of the River

As Watermaster, the Secretary of the Interior is vested with the responsibility to manage the mainstream waters of the Colorado River pursuant to applicable federal law. This responsibility is carried out consistent with a body of documents referred to as the "Law of the River". Water rights to Colorado River water are governed by a complex collection of federal laws, state laws, a treaty with Mexico, other agreements with Mexico, Supreme Court decrees, contracts with the Secretary of the Interior, interstate compacts, and administrative actions at the federal and state levels. Collectively, these documents and associated interpretations are commonly referred to as the "Law of the River" and govern water rights and operations on the Colorado River. Particularly notable among these documents include: The Colorado River Compact of 1922, The Boulder Canyon Project Act of 1928, The California Seven Party Agreement of 1931, The 1944

Hoover Dam in Nevada

Treaty, The 1963 United States Supreme Court Decision in *Arizona v. California*, The 1964 United States Supreme Court Decree in *Arizona v. California*, The Colorado River Basin Project Act of 1968, and the 2019 Colorado River Basin Drought Contingency Plans.

The Colorado River Compact of 1922 apportioned 7.5 million acre-feet (MAF) each to both the Lower Basin and Upper Basin annually. California is within the Lower Basin along with Arizona and Nevada. The Boulder Canyon Project Act of 1928 stipulates that California is required to limit Colorado River water use to 4.4 MAF annually plus one half of the excess water unapportioned. The 2019 Colorado River Basin Drought Contingency Plans reduce risks from ongoing drought and require states to contribute defined volumes of water when lake elevations drop below certain levels. Through the plans, the Lower Basin states commit to reducing amount of water withdrawals from Lake Mead during times of shortage.

9.1.1.2 Colorado Supply Reliability

In 2000-2004, the Colorado River Basin experienced severe dry conditions. These dry conditions have continued throughout the past two decades, with precipitation slightly below average and runoff below average in two out of every three years. The long-term outlook of Lake Mead is for continued decline of the reservoir level, which could reduce the amount of Colorado River water currently available to MWD. In accordance with the Drought Contingency Plan, a shortage will be triggered if Lake Mead elevation drops below 1,075 feet.

The reliability of CRA water for MWD has decreased over time due to dry conditions and other factors. Historically, California had used up to 5.4 million AFY of water as Arizona and Nevada were not using their normal apportionments of Colorado River water and surplus water was made available by the Secretary of the Interior. The 1964 Decree and the 2006 Consolidated Decree of the US Supreme Court in *Arizona v. California* confirmed California's allocation was limited to 4.4 MAF annually. As a result, MWD can now only rely on its fourth priority allocation of 550 thousand acre-feet (TAF) annually. Prior to this, MWD was able to satisfy its fifth priority allocation with Nevada and Arizona's unused water. However, in 1985, Arizona began increasing deliveries to its Central Arizona Project, reducing the availability of unused apportionment to fill MWD's fifth priority.

Because of extended dry conditions on the Colorado River system and Arizona and Nevada using their full apportionment, the U.S. Secretary of the Interior asserted that California must come up with a plan to live within its 4.4 MAF apportionment, plus any available surplus water. Therefore, users from California developed California's Colorado River Water Use Plan (California Plan). The users included: MWD, Palo Verde Irrigation District (PVID), Imperial Irrigation District (IID), and Coachella Valley Water District (CVWD). This plan identifies actions that California will take to operate within its 4.4 million acre-foot entitlement.

A component of the California Plan was completion of the Quantification Settlement Agreement (QSA) in 2003, which established baseline water use for each California party with Colorado River water rights. Key to the agreement is the quantification of IID at 3.1 MAF and CVWD at 330 TAF. Completion of the QSA facilitates the transfer of water from agricultural agencies to urban water suppliers by allowing water conserved on farm land to be made available for urban use. On November 5, 2003, IID filed a validation action in Imperial County Superior Court, seeking a judicial determination that the thirteen agreements associated with the QSA are valid, legal, and binding. Other lawsuits were also filed challenging the execution, approval, and subsequent implementation of the QSA on various grounds. All of the QSA cases were coordinated in the Sacramento County Superior Court. After more than a decade of litigation, the final challenges to the QSA were dismissed, and the agreements were upheld. MWD's existing conservation, land fallowing, and transfer programs for Colorado River supplies are independent of the QSA.

9.1.1.3 Water Quality Issues

Water quality issues for Colorado River supplies cover high salinity levels, perchlorate, nutrients, uranium, and hexavalent chromium (chromium-6). High salinity levels present the most significant issue and the only foreseeable water quality constraint for the Colorado River supply. MWD expects its source control programs for the CRA to adequately address other water quality issues, including constituents of emerging concern such as N-Nitrosodimethylamine, pharmaceuticals and personal care products, microplastics, per- and polyfluoroalkyl substances (PFAS), and 1,4-Dioxane. MWD has also bolstered its water security measures across all of its operations since 2001, including an increase in water quality tests.

9.1.2 State Water Project

MWD began receiving water from the SWP in 1972. MWD is the largest of the 29 SWP contractors, holding a contract for 1.912 MAF per year, or 46 percent of the total contracted amount of the project's 4.173 MAF ultimate delivery capacity. Variable hydrology, environmental issues, and regulatory restrictions in the San Francisco Bay and Sacramento-San Joaquin River Delta (Bay-Delta) have periodically reduced the quantity of water that the SWP delivers to MWD.

9.1.2.1 Major State Water Project Facilities

The SWP is owned by DWR, delivering water to two-thirds of the population of California and 750,000 acres of farmland. The SWP system consists of over 700 miles of aqueduct, 36 storage facilities including reservoirs and lakes, and 26 power and pumping plants. Exhibit 9D illustrates the location of major SWP facilities. SWP facilities originate in Northern California at Lake Oroville on the Feather River. Water released from Lake Oroville flows into the Feather River, goes downstream to its confluence with the Sacramento River, and then travels into the Bay-Delta. Water is pumped from the Bay-Delta region to contractors in areas north and south of the San Francisco Bay and south of the Bay-Delta. SWP deliveries consist solely of untreated water. In addition to delivering water to its contractors, the SWP is operated to improve water quality in the Bay-Delta region, control flood waters, and provide recreation, power generation, and environmental enhancement.

MWD receives SWP water at three locations: Castaic Lake in Los Angeles County, Devil Canyon Afterbay in San Bernardino County, and Box Springs Turnout at Lake Perris in Riverside County. In addition, MWD has flexible storage rights at Lake Perris at the terminus of the East Branch of the SWP and at Castaic Lake at the terminus of the West Branch.

Exhibit 9D
Current and Projected Facilities of the State Water Project

Courtesy of the Metropolitan Water District of Southern California

Los Angeles Metropolitan Water District Headquarters

9.1.2.2 Contract Allocations

Contract allocations, also known as entitlements, for SWP contractors are provided by DWR in a table commonly referred to as "Table A". Allocations are based on the original projected SWP maximum yield of 4.173 MAF. Table A is a tool used by DWR to allocate fixed and variable SWP costs and yearly water entitlements to the contractors. Table A contract amounts do not reflect actual deliveries a contractor should expect to receive. MWD has a Table A contract amount of 1.912 MAF. MWD's full Table A contract amount was last made available to MWD in 2006.

DWR annually approves the amount of contract allocations SWP contractors will receive. The contract allocation amount received by contractors varies based on contractor demands and projected available water supplies. Contractors' requests for portions of their entitlements cannot always be met. Variables impacting projected water supplies include snowpack in the Sierra Nevada, capacity available in reservoirs, operational constraints, and demands of other water users. Operational constraints include pumping restrictions related to fish species listed as either threatened or endangered under the federal or state Endangered Species Acts. In some years there are shortages, and in other years, surpluses. In 2014, SWP contractors received only five percent of their SWP contract allocations, a historic low. In 2017, SWP contractors received 85 percent of their SWP contract allocations, the highest since 2006. Most recently, DWR reduced SWP contract allocations from ten percent to five percent in March 2021.

DWR bi-annually prepares the State Water Project Delivery Reliability Report to provide contractors with current and projected water supply availability for the SWP. In August 2019, DWR released the 2019 State Water Project Delivery Capability Report. The 2019 Delivery Capability Report provides State Water Project delivery capabilities factoring in climate change, sea level rise, current regulations, and water use assumptions upstream of the Delta.

In addition to MWD's Table A amount, MWD has long-term agreements in place to obtain additional SWP supplies through five other programs listed below:

- Article 21
- Turnback Pool
- Yuba River Accord
- San Luis Carryover Storage
- Desert Water Agency (DWA) and Coachella Valley Water District (CVWD) Table A Transfer

MWD also engages in short-term transfer agreements using SWP facilities to bolster supplies as opportunities become available, as discussed in the Groundwater Storage and Transfers sub-section. Historically, MWD has obtained transfers through the Governor's Water Bank, Dry-Year Purchase Programs, and the State Water Contractors Water Transfer Program.

MWD projects their supply capability to be 1.761 MAF through its SWP supplies in 2045 under average conditions (1922 – 2017 hydrology). This projection includes SWP-related groundwater storage and water transfer programs. Excluding SWP-related groundwater storage and water transfer programs, current programs are expected to result in 1.521 MAF under average conditions; while under multi-year dry conditions (1988 – 1992 hydrology) and single-dry year conditions (1977 hydrology), MWD expects to receive only 628 TAF and 416 TAF, respectively.

9.1.2.3 Water Quality Issues

Water quality issues for SWP supplies include disinfection byproduct precursors such as total organic carbon (TOC), bromide, low alkalinity arsenic, and nutrient levels. Other constituents of emerging concern include N-Nitrosodimethylamine, pharmaceuticals personal care products, microplastics, PFAS, and 1,4-Dioxane. TOC and bromide in SWP water present the greatest water quality issues and have restricted MWD's ability to use SWP water at various times, as the contaminants form disinfection byproducts during water treatment processes. MWD has upgraded treatment processes to ozone disinfection at four of MWD's treatment plants to reduce formation of disinfection byproducts and lift potential restrictions on SWP water usage. MWD requires low salinity levels of SWP water to meet blending requirements for CRA water, and therefore, any increase in salinity levels in SWP supplies is a concern to MWD.

MWD has supported the expansion of DWR's Municipal Water Quality Investigations Program beyond its Bay-Delta core water quality monitoring and studies to include enhanced water quality monitoring and forecasting of the Delta and SWP.

MWD is utilizing its water supply portfolio options to conduct water quality exchanges to reduce TOC and bromide. MWD has stored SWP water during periods of high water quality in groundwater storage basins for later use when SWP is at a lower water quality. These storage programs were initially designed to provide water during dry SWP conditions, but a few of these programs are now operated for dual-purposes.

TOC and bromide in high concentrations lead to the formation of disinfection byproducts when source water is treated with disinfectants, such as chlorine. Agricultural drainage to the Bay-Delta and seawater commingling with Bay-Delta supplies increases these contaminants. Ozone disinfection combined with pH control and chloramines is a very effective treatment to control for bromate. MWD has completed upgrades to use ozone as the primary disinfectant at all five of MWD's treatment plants. Additionally, LADWP purchases untreated SWP water for treatment at its Los Angeles Aqueduct Filtration Plant (LAAFP) which uses chloramine and ultraviolet light disinfection to control bromate formation.

9.1.2.4 Bay-Delta Issues

The Bay-Delta is a major waterway at the confluence of the Sacramento and San Joaquin rivers, serving multiple and at times conflicting purposes, exacerbated during dry years when water to meet the needs of both people and the environment is in short supply. Approximately two-thirds of Californians receive at least a portion of their water from the Bay-Delta. Almost all water delivered via the SWP to Southern California must pass through the Bay-Delta. Runoff from more than 40 percent of the state is also conveyed through the Bay-Delta forming the eastern edge of the San Francisco Bay's estuary. A large portion of the Bay-Delta region lies below sea level and is protected by more than 1,100 miles of levees to prevent flooding. Deterioration of the Bay-Delta ecosystem coupled with infrastructure concerns, hydrologic variability, climate change, litigation, regulatory restrictions, and previously discussed water quality issues have resulted in supply reliability challenges for SWP contractors who depend upon the Bay-Delta for water supplies.

Former California Governor Arnold Schwarzenegger established the Delta Vision process in 2006 to address ongoing Bay-Delta conflicts through long-term solutions. As a result of legislation following the Delta Vision, a Delta Plan was adopted in 2013. The Delta Plan includes binding regulations as well as nonbinding recommendations intended to ensure progress in areas such as water supply reliability, ecosystem restoration, water quality, flooding, and the economic health of the Bay-Delta. The Bay Delta Conservation Plan (BDCP) was also developed as a joint effort of state and federal fish agencies; state, federal, and local water agencies; environmental organizations; and other parties with the goal of providing for both improvements in water reliability through securing long-term permits to operate the SWP and species/habitat protection in the Delta. In 2015, two projects, the California WaterFix and California EcoRestore, were proposed to replace the existing BDCP. The Delta Conveyance Design and Construction Authority (DCA) was formed in 2018 to help design and develop the proposed WaterFix project.

In February 2019, Governor Gavin Newsom announced his support of a one-tunnel approach to water conveyance in the Delta, the Delta Conveyance Project (DCP). The DCP replaced the WaterFix project, the previous two-tunnel approach to water conveyance in the Delta. The DCP will develop new diversion and conveyance facilities in the Delta to protect the reliability of the State Water Project. The DCP is also listed as a priority in the Governor's Water Resiliency Portfolio. The DCA, along with the Department of Water Resources, is conducting engineering and design planning activities for the DCP.

9.1.3 In-Basin Storage

In-basin storage facilities play a key role in maintaining MWD's reliability during droughts or other imported water curtailments and emergency outages. In-basin storage facilities consist of surface reservoirs and contracted groundwater basin storage. Conjunctive use of surface reservoirs and groundwater basins was first initiated by MWD in the 1950s. Long-term storage goals for in-basin storage facilities were established in MWD's Water Surplus and Drought Management (WSDM) Plan. The WSDM Plan allows storage for hydrology variances, water quality, and SWP and CRA issues.

MWD has established emergency in-basin storage requirements based on a major earthquake that could potentially cut off all supplies for six months from all aqueducts serving the region: the CRA, both SWP branches, and LADWP's LAA. Under this scenario, MWD would maintain deliveries by suspending interruptible deliveries, implementing mandatory water use reductions of 25 percent of normal-year demands, making available water from surface reservoir and groundwater supplies stored as part of MWD's interruptible supply program, and implementing full local groundwater production. MWD's emergency storage requirement is a function of projected demands and varies with time.

9.1.3.1 Surface Reservoirs

MWD owns and operates seven in-basin surface storage reservoirs. Four of the reservoirs, Live Oak, Garvey, Palos Verdes, and Orange County, are used for regulatory purposes and do not provide drought or emergency storage. Additionally, MWD owns and operates two reservoirs, Copper Basin and Gene Wash, along the CRA outside of the basin for system regulation purposes. Outside its basin, MWD has 1.5 MAF of storage rights in Lake Mead on the Colorado River pursuant to its intentionally created surplus agreement with the USRB. MWD also has storage rights in DWR's SWP terminal reservoirs, Lake Perris and Castaic Lake, as previously discussed. The total capacity of all in-basin surface reservoirs, inclusive of the rights in the terminal reservoirs, is 1.26 MAF, as itemized in Exhibit 9E.

Exhibit 9E
MWD's In-basin Surface Reservoir Capacity

Reservoir	Capacity (AF)
Dry Year/Emergency/Seasonal Storage Purposes	
Diamond Valley Lake	810,000
Lake Mathews	182,000
Lake Skinner	44,000
Lake Perris (Storage Rights)[1]	65,000
Castaic Lake (Storage Rights)[1]	153,940
Subtotal	1,254,940
Regulatory Purposes	
Live Oak, Garvey, Palos Verdes, and Orange County	3,500
Total Reservoir Capacity	**1,258,440**

1. MWD holds storage rights for flexible use in DWR terminal storage facilities, Lake Perris and Castaic Lake. In addition, MWD has emergency storage of 381 TAF in DWR's reservoirs.

MWD operates its three main storage reservoirs, Diamond Valley Lake, Lake Skinner and Lake Mathews, for dry-year, emergency, and seasonal storage. Under an average-year scenario for 2045 (1922-2017 hydrology), 804 TAF per year of in-basin surface storage is projected to be available, exclusive of emergency supplies, as shown in Exhibit 9F.

Exhibit 9F
MWD Forecast Supplies of In-Basin Surface Storage Supplies in 2045, Average Year (1922 – 2017 Hydrology)

Program	Supply (Thousands of AF)/Year
In-Basin Surface Storage (Diamond Valley Lake, Lake Skinner, Lake Mathews)	588
Lake Perris and Castaic Lake MWD Storage Rights	216
Maximum MWD Supply Capability	**804**

Source: 2020 Urban Water Management Plan, Metropolitan Water District of Southern California, April 2021 Draft

MWD has a total surface storage of 1,630 TAF. It reserves a portion of its in-basin surface reservoir storage capacity for emergencies. MWD's emergency surface reservoir storage portfolio is split between storage in its three main reservoirs and DWR reservoirs. MWD's emergency storage capacity, based on demands for 2045, is forecast to be approximately 817 TAF. Approximately 436 TAF is projected to be stored in MWD's facilities and the balance of 381 TAF in DWR's facilities. The balance of available storage capacity, 812 TAF, is for dry-year and seasonal storage.

Any additional reservoir capacity is used for seasonal storage and system operations. Seasonal storage is required to meet peak demands. MWD incorporates reserves of five percent into reservoir operations to account for imported water transmission infrastructure maintenance that would restrict or temporarily halt imported water flows.

9.1.3.2 Contracted Groundwater Basin Storage

To improve reliability, MWD engages in contracted groundwater basin storage within the basin area. MWD has worked with local water agencies to increase groundwater storage and has implemented conjunctive water use through various programs. Groundwater storage occurs using the following methods:

- Direct delivery – Water is delivered directly by MWD to local groundwater storage facilities through the use of injection wells and spreading basins.
- In-lieu delivery – Water is delivered directly to a member agency's distribution system and the member agency uses the delivered water and forgoes pumping, allowing water to remain in storage.

MWD engages in two main types of storage programs: cyclical and conjunctive use. These programs are designed to deliver water to agencies prior to the actual need for the demands, allowing MWD to store supplies for use in dry years. Since 2007, MWD has used these programs to address SWP shortages. MWD provides financial incentives and funding to assist agencies with developing storage programs.

In November 2015, MWD Board of Directors approved a joint study with Sanitation Districts of Los Angeles County on the feasibility of a regional recycled water project to purify and reuse wastewater for the recharge of groundwater basins and to augment water supplies within the Southern California region. The study included a demonstration plant completed in October 2019 to verify treatment design parameters for a full-scale project, a feasibility study to determine the parameters of the delivery system, and a comprehensive finance plan. In November 2020, MWD Board of Directors approved an amendment to the original agreement to continue to partner with Sanitation Districts of Los Angeles County on the environmental planning phase of the Regional Recycled Water Program. The environmental planning phase will include preparation of environmental documentation and technical studies, as well as public outreach activities. At full build-out, this project could provide up to 150 million gallons per day of purified water for the region. Exhibit 9G provides a summary of forecast groundwater storage supplies available in 2045 under an average year (1922 -2017 hydrology). Approximately 68 TAF per year is projected to be available.

Exhibit 9G
MWD Forecast Supplies of In-Basin Groundwater Storage in 2045, Average Year (1922 – 2017 Hydrology)

Program	Current Supply (Thousands of AF/Year)
Conjunctive Use	68
Maximum MWD Supply Capability	**68**

Source: Draft 2020 Urban Water Management Plan, Metropolitan Water District of Southern California, April 2021 Draft

9.1.4 Groundwater Storage and Water Transfers

MWD engages in groundwater storage outside of the basin and water transfers to increase the reliability of SWP dry-year supplies. Groundwater storage and water transfers were initiated by MWD in response to concerns that MWD's supply reliability objectives could not be met by the SWP. Groundwater storage and transfer programs were developed to allow MWD to reach its SWP reliability goal. All groundwater storage and water transfer programs designed to bolster SWP reliability are located within the vicinity of the SWP or Central Valley Project (CVP) facilities to facilitate the ultimate delivery of water to MWD. Groundwater storage programs involve agreements allowing MWD to store its SWP contract Table A water in excess of MWD demands and to purchase water for storage. MWD calls for delivery of the stored water during dry years. Transfers involve purchases by MWD from willing sellers when necessary.

9.2 MWD Supply Reliability

MWD is in the process of completing its 2020 Integrated Water Resources Plan (IRP) and UWMP updates. MWD's forecasted supplies and demands are provided below in Exhibit 9H. The projected LADWP supplemental water purchase from MWD is further discussed in Chapter 11, *Water Service Reliability and Financial Integrity*, under various weather scenarios.

Exhibit 9H
MWD System Forecast Supplies and Demands, Average Year (1922 – 2017 Hydrology)

Forecast year	Supply (Thousands of AF per Year)				
	2025	**2030**	**2035**	**2040**	**2045**
Current Programs					
In-Region Supplies and Programs	875	876	875	875	872
State Water Project[1]	1,774	1,766	1,763	1,762	1,761
Colorado River Aqueduct					
Colorado River Aqueduct Supply[2]	1,214	1,290	1,283	1,230	1,250
Aqueduct Capacity Limit[3]	1,250	1,250	1,250	1,250	1,250
Colorado Aqueduct Capability	1,214	1,250	1,250	1,230	1,250
Capability of Current Programs	**3,863**	**3,892**	**3,888**	**3,867**	**3,883**
Demands					
Total Demands on MWD	1,191	1,142	1,101	1,116	1,140
Exchange with SDCWA	278	278	278	278	278
Total Demands on MWD[4]	**1,469**	**1,420**	**1,379**	**1,394**	**1,418**
Surplus	**2,394**	**2,472**	**2,509**	**2,473**	**2,465**
Programs Under Development					
In-Region Supplies and Programs	0	0	0	0	0
California Aqueduct	13	13	13	13	13
Colorado River Aqueduct					
Colorado River Aqueduct Supply	0	0	0	0	0
Aqueduct Capacity Limit[2]	36	0	0	20	0
Colorado River Aqueduct Capability	0	0	0	0	0
Capability of Programs Under Development	**13**	**13**	**13**	**13**	**13**
Potential Surplus	**2,407**	**2,485**	**2,522**	**2,486**	**2,478**

1. California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.

2. Colorado River Aqueduct includes programs, IID-SDCWA transfer and exchange, and canal lining water conveyed by the aqueduct.

3. Maximum CRA deliveries limited to 1.25 MAF including IID-SDCWA transfer and exchange and canal lining water.

4. Total demands are adjusted to include IID-SDCWA transfer and exchange and canal lining water. These supplies are calculated as local supply, but need to be shown for the purposes of CRA capacity limit calculations without double counting.

Source: 2020 Urban Water Management Plan, Metropolitan Water District of Southern California, April 2021 Draft

9.3 LADWP's Costs for Purchased Water

9.3.1 MWD Rate Structure

Until the 1960s, MWD primarily financed its capital projects through property taxes and annexation fees. Because of this, original member agencies such as Los Angeles contributed to 75 percent of the Colorado River Aqueduct costs while drawing only 8 percent of total deliveries from 1929-1996. MWD shifted its primary revenue source to water sales by 1970, and adopted new fixed charges such as the Readiness-to-Serve Charge, Standby Charge, and Demand Charge in 1995. In 2003, MWD partially unbundled water rates using a tiered rate structure for greater financial transparency.

Since 2003, MWD's rates have been structured on a two-tier system. Eight major elements determine the actual price a member agency will pay for deliveries. All of the elements are volumetric-based except for two fixed rates, the Readiness-to-Serve Charge and the Capacity Charge. For additional information, please see http://www.mwdh2o.com/WhoWeAre/Management/Financial-Information/Pages/default.aspx.

Exhibit 9I summarizes the rates and charges for member agencies effective January 1 of 2019, 2020, and 2021. These rates are adopted by the MWD Board every two calendar years.

Exhibit 9I
MWD Rates and Charges

Rates and Charges	Effective Rate January 1		
	2019	2020	2021
Tier 1 Supply Rate ($/AF)	209	208	243
Tier 2 Supply Rate ($/AF)	295	295	285
System Access Rate ($/AF)	326	346	373
Water Stewardship Rate ($/AF)	69	65	-
System Power Rate ($/AF)	127	136	161
Full Service Untreated Volumetric Cost ($/AF)			
Tier 1	731	755	777
Tier 2	817	842	819
Treatment Surcharge ($/AF)	319	323	327
Full Service Treated Volumetric Cost ($/AF)			
Tier 1	1,050	1,078	1,104
Tier 2	1,136	1,165	1,146
Treated Replenishment Water ($/AF)	-	-	-
Treated Interim Agricultural Water Program ($/AF)	-	-	-
Readiness-to-Serve Charge ($M)	133	136	130
Capacity Charge ($/cfs)	8,600	8,800	10,700

Source: Metropolitan Water District of Southern California

9.3.2 LADWP's Purchased Water Costs

MWD's water rates vary from $777 per AF of Tier 1 untreated water to $1,146 per AF of Tier 2 treated water in 2021. The average unit cost of MWD water supply depends on the proportions of treated water and untreated water, Tier 1 water, and Tier 2 water purchased in a given period.

The Readiness-to-Serve Charge and Capacity Charge are predetermined fixed charges for each member agency and are not affected by the quantity of MWD water purchased. However, these fixed charges are added to the unit cost of the City's MWD water purchase. The City's share of the Readiness-to-Serve Charge is approximately 19 percent, or $24.95 million in 2021. The Capacity Charge is calculated based on the maximum three-year peak day demand placed by a member agency on MWD's distribution system between May 1 and September 30 and is applied with a one-year lag. The City's 2021 Capacity Charge is $3.05 million based on the daily peak flow of 284.6 cfs in summer 2018. Both charges will add $28.0 million to LADWP's MWD water purchase in 2021.

Blank Page

Chapter Ten
Other Water Supplies

10.0 Overview

LADWP continually investigates potential water supplies to diversify and expand the City of Los Angeles' (City's) water supply portfolio for improved reliability. LADWP has pursued and/or investigated various alternative water supply options, including water transfers, groundwater banking, brackish groundwater recovery, and seawater desalination. Evaluating the viability of these and other water supply options is a key element to ensuring the City's future water supply reliability, sustainability, and cost-effectiveness. Such options, with proper planning, can help to contribute toward fulfilling future water demand under various conditions. Future water resource challenges, including population and economic growth, seismic risk, and climate change, as well as continuing legal, regulatory, and environmental constraints, may create an increased demand on other supplies, thereby warranting thoughtful consideration of alternate feasible water supply options.

Other water resource options, as mentioned above, are discussed next, highlighting LADWP's efforts with regard to each alternative source. Factors that affect feasibility and influence potential implementation are described, as well as advances that facilitate development of each water resource option.

10.1 Water Transfers and Groundwater Banking

Water transfers involve the lease or sale of water or water rights between consenting parties. Water Code Section 470 (The Costa-Isenberg Water Transfer Act of 1986) states that voluntary water transfers between water users can result in a more efficient use of water, benefiting both the buyer and the seller. The State Legislature further declared that transfers of surplus water on an intermittent basis can help alleviate water shortages, save capital outlay development costs, and conserve water and energy. This section of the Water Code also obligates the California Department of Water Resources (DWR) to facilitate voluntary exchanges and transfers of water, when there is available capacity along the State Water Project (SWP).

DWR is required to establish an ongoing program to facilitate the voluntary exchange or transfer of water and implement the various State laws that pertain to water transfers. In response to this mandate, DWR established an internal office dedicated specifically to water transfers in June 2001 and has developed various definitions and policies for transfers. Of particular importance are the rules protecting existing water rights. Water rights cannot be lost when they are transferred to another user if the transferor has an underlying right to the transferred water. DWR also developed three fundamental rules specifically regarding water transfers:

- There can be no injury to any legal user of water.
- There can be no unreasonable effect on fish and wildlife.
- There can be no unreasonable economic effects to the economy in the county of origin.

Voluntary exchanges and transfers of water may or may not require approvals from state agencies dependent on the supply sources and facilities utilized for conveyance. Water transfers involving SWP or Central Valley Project (CVP) facilities, or State Water contractors require DWR's approval. Also, the State Water Resources Control Board (SWRCB) manages water transfers involving surface waters that the state has jurisdiction over.

Executive Orders issued on January 17, 2014, April 25, 2014, and December 22, 2014, known as the Drought Proclamation, expedited the processing of water transfers through DWR and SWRCB. Through the Executive Orders, certain California Environmental Quality Act (CEQA) requirements for actions by DWR and SWRCB related to water transfers were suspended, but CEQA compliance on behalf of local agencies is still required to facilitate transfers. Furthermore, on July 28, 2020, Governor Newsom released the final California Water Resilience Portfolio, Executive Order N-10-19, that identified several actions to improve the state's water conveyance systems to enhance water transfers and also develop a system to increase participation in the water transfer market.

Groundwater banking, a form of conjunctive use, is the storage of water in groundwater basins for future use. Water is stored or banked within groundwater basins, typically during wet periods, for potential extraction during dry periods. Groundwater banking includes establishing accounts to track the volumes of water recharged and extracted per terms of contract agreements between the water agency and the groundwater bank operator. Groundwater banking may occur outside of a water agency's service area. If the water agency's own conveyance facilities are not directly adjacent to the water bank, then stored water can be extracted and transferred through wheeling and exchange via other conveyance and storage facilities. Such movements of water involve institutional transfer agreements among water users and agencies. LADWP currently utilizes the San Fernando Basin for conjunctive use. Additional information regarding conjunctive use strategies can be found in Chapter 5, *Local Groundwater,* Section 5.12, *Groundwater Management*.

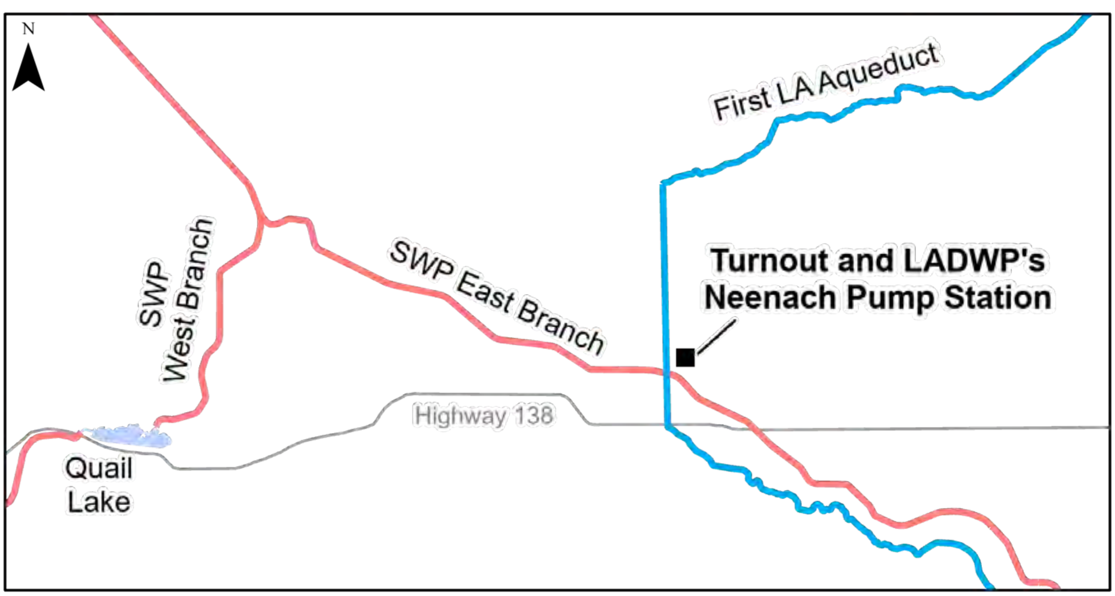
10.1.1 LADWP Opportunities

MWD holds an exclusive contractual right to deliver SWP entitlement water into its service territory, which includes the City. Therefore, the City can only purchase non-SWP supplies to ensure compliance with MWD's SWP contract with DWR. As such, LADWP plans to acquire non-SWP water through water transfers to compensate for a portion of the Los Angeles Aqueduct (LAA) water used for LADWP's Eastern Sierra environmental obligations. When it is economical and feasible, the City would purchase non-SWP water from an available seller and either store the water in a groundwater bank or deliver it to LADWP's water system.

To facilitate water transfers, LADWP completed construction of the Antelope Valley-East Kern water agency's (AVEK) LADWP turnout (turnout) between LADWP's First LAA and the East Branch of DWR's SWP located where the two aqueducts intersect in the Antelope Valley within the AVEK Service Area (see Exhibit 10A). In September 2017, DWR accepted the construction of the permanent turnout. The turnout provides an opportunity for LADWP to purchase non-SWP water that is conveyed from the East Branch of the SWP through the turnout, and then pumped by LADWP's Neenach Pump Station into the LAA system. It also provides operational flexibility to receive other water supplies to meet the City's water demand in the event of a disruption of flows along the LAA System.

The turnout provides LADWP with the ability to offset some of the LAA supplies being used to meet

Exhibit 10A
AVEK's LADWP Turnout and Neenach Pump Station Location



environmental obligations in the Mono Basin and Owens Valley and replace it with non-SWP water in order to meet the City's water demand. The turnout not only provides increased operational flexibility for LADWP to receive water, but it also increases the City's resiliency to interruptions and ability to participate in the water supply transfer market when other water supplies are not available.

To supplement water transfers, LADWP is also evaluating the feasibility of groundwater banking to store valuable wet year supplies and supplies from water transfers to meet water demand during dry years. For additional information on the groundwater basins of interest, refer to Chapter 5, *Local Groundwater*, Section 5.6 *Antelope Valley Groundwater Basin*.

The City supports statewide policies, plans, and legislation that promote water transfers to ensure the efficient use of the state's limited water resources and provide safeguards for the environment, public facilities, water conservation efforts, and local economies. LADWP will continue to develop a responsible water transfer program that can assist in offsetting City supplies that have been reallocated along with the advancements of the City's local supply program.

10.2 Brackish Groundwater Recovery

Brackish groundwater recovery is the process of pumping and treating lower salinity groundwater for water supply. The main advantage of brackish groundwater recovery over seawater desalination is the energy savings associated with pushing lower salt concentration water through reverse osmosis (RO) membranes, resulting in a more cost-beneficial supply. In 2018, LADWP initiated a Groundwater Development and Augmentation Plan and committed to partnering with the Water Replenishment District of Southern California (WRD) on the Regional Brackish Water Reclamation Program Feasibility Study. In 2019, LADWP and WRD agreed to create the Joint Los Angeles Basin Replenishment and Extraction Master Plan to evaluate projects for replenishment and extraction of the West and Central Groundwater Basins. For additional information on LADWP's ongoing efforts, refer to Chapter 5, *Local Groundwater*, Section 5.5 *West Coast Basin*.

10.3 Seawater Desalination

Seawater desalination, the process of removing salts and other impurities from seawater, is an established water supply technology across the world. LADWP's current water resource strategy does not include seawater desalination as a water supply due to its high cost and potential challenging environmental impacts. LADWP is primarily focused on enhancing local supplies, including conservation, recycling, stormwater, and Operation NEXT (see Chapter 3, *Water Conservation*, Chapter 7, *Recycled Water*, Chapter 6, *Watershed Management*, and Chapter 8, *Operation NEXT Water Supply Program* respectively), which are lower cost alternatives. Seawater desalination may be further explored in the future as technologies evolve and lower cost supplies are exhausted.

10.3.1 LADWP Seawater Desalination Efforts

LADWP initiated efforts in 2002 to evaluate seawater desalination as a potential water supply source with the goals of improving reliability and increasing diversity in its water supply portfolio. These efforts led to the selection of Scattergood Generating Station as a potential site for a seawater desalination plant. Although no fatal flaws were uncovered for the potential project, LADWP decided in May 2008 to shift focus towards other, lower cost local water resources, including conservation, water use efficiency, and water recycling, as part of its primary strategy to create a more sustainable and locally based water supply for the City.

Blank Page

Los Angeles Aqueduct Filtration Plant

Chapter Eleven

Water Supply Reliability and Financial Integrity

11.0 Overview

LADWP is addressing the challenge of providing a reliable water supply for a growing population in a semi-arid climate by expanding its local water supply programs and reducing demands on purchased imported water. Currently, LADWP relies on imported water from the Los Angeles Aqueduct (LAA) and Metropolitan Water District of Southern California (MWD) that make up a significant portion of its total water supply portfolio. Imported surface water supplies are highly impacted due to variability in climate and hydrology, and are also subject to environmental regulatory restrictions. In response to these challenges and impacts to its imported supplies, LADWP plans to further diversify its water supply portfolio by continuing to make substantial investments in local groundwater, recycled water, stormwater capture, and water conservation and use efficiency. Local water supplies tend to be more reliable than imported water because they have less variability due to climate, weather, and environmental restrictions. Additionally, by investing in these local supplies, the City of Los Angeles' (City) urban environment can be protected and enhanced.

11.1 Unit Cost and Funding of Supplies

11.1.1 Unit Cost Summary of Supplies

Unit costs play an important role and consideration in planning future water supply development and in determining which supply investments provide the greatest benefits to our customers. Unit costs of production can vary dramatically by water supply source. Exhibit 11A summarizes the average unit cost for each of LADWP's water supply sources.

Among the City's existing and planned water supplies, unit costs range from a high of $2,000/acre-foot (AF) for certain recycled water projects to a low of $877/AF for locally produced groundwater. LAA supply requires operation and maintenance costs regardless of the amount of water the LAA delivers to the City. Therefore, hydrology and increased water for environmental enhancement efforts in the Eastern Sierras result in LAA unit costs fluctuating from year to year. Local groundwater supply is the least expensive source. However, its production is currently limited by groundwater basin contamination. Unit costs for MWD purchased water vary based on tier allocations. MWD's treated water rates for CY 2021 are $1,104/AF for Tier 1 and $1,146/AF for Tier 2.

Water conservation and user efficiency costs to LADWP have historically been minimal as the majority of incentives provided to LADWP's customers for installation of water-efficient fixtures and turf removal are partially funded by outside sources including MWD's Conservation Credits Program, Outside Agency Co-Funding and Grant Funding. However, future costs for water savings that will be required to achieve LADWP's targets will likely increase as MWD reduces funding for the program and demand-hardening increases. Recycled water costs are project specific and vary widely depending on the infrastructure requirements of each project.

Unit costs for local water supplies such as stormwater capture and reuse are highly variable based on a variety of factors, including the size of the overall program and project location. The Stormwater Capture Master Plan presents estimated costs for reuse and recharge projects ranging from $1,100/AF to $1,550/AF. As described in Chapter 6, *Watershed Management*, the estimated costs are inclusive of the avoided cost of MWD Tier 1 untreated imported water and the value assigned by MWD for participation in MWD's Local

Resource Program (LRP). Projects in excess of these amounts will be considered if partnerships or outside funding can reduce the unit cost to these specified levels. Projects in excess of the specified not to exceed levels may be considered by LADWP on a case by case basis.

Exhibit 11A
Unit Costs of Supplies for LADWP

Water Source	Chapter Reference	Average Unit Cost ($/AF)
Conservation[1,2]	Chapter 3 - Water Conservation	$60 - $1,200
Los Angeles Aqueduct[3]	Chapter 4 - Los Angeles Aqueduct System	$859
Groundwater[3]	Chapter 5 - Local Groundwater	$752
Stormwater Capture[4]	Chapter 6 - Watershed Management	$1,100 - $1,550
Recycled Water	Chapter 7 - Recycled Water	$500 - $2,000
Metropolitan Water District[5]	Chapter 9 - Metropolitan Water District Supplies	$1,104 - $1,146

1. Determined from LADWP's Water Conservation Potential Study.

2. MWD Funds conservation at $195/AF, our share is estimated at 15 percent of MWD's cost.

3. Los Angeles Aqueduct supply and groundwater supply are based on FY2015/16 – 2019/20 five-year average.

4. Costs presented are not to exceed costs for infiltration and direct use in 2025, respectively. Projects with higher per unit costs may be implemented if outside funding is obtained or partnerships are implemented. Additionally, LADWP may implement higher per unit cost projects on a case by case basis.

5. MWD water rates for treated water, tier 1 and tier 2, effective on January 1, 2021.

11.1.2 Funding of Supplies

Funding for water resource programs and projects are primarily provided through LADWP water rates, with supplemental funding provided by MWD, and local, state, and federal grants. LADWP will also seek reimbursement from potential responsible parties to assist with groundwater remediation program costs.

Funding for water resources projects consists of the following:

- Water Rates – The revenue collected through water rates is the primary funding source for LADWP's water resource programs, which includes supporting the following Local Supply programs: conservation, water use efficiency, water recycling, stormwater capture, and remediation of contamination in the San Fernando Basin (SFB).

- MWD's Local Resource Program – Currently MWD provides funding through its LRP for the development of water recycling, groundwater recovery, and seawater desalination. The LRP incentive structure offers three options: sliding scale incentives up to $340/AF over 25 years, sliding scale incentives up to $475/AF over 15 years, or fixed incentives up to $305/AF over 25 years. MWD also promotes conservation through its Conservation Credits Program, which includes rebates and incentives.

- Local Funds - In November 2018, LA County voters passed Measure W to create the Safe, Clean Water Program, which supports funding for stormwater capture. The Safe, Clean Water Program imposes a special parcel tax of 2.5 cents per square foot of impermeable surface area on private property within the Los Angeles County Flood Control District (LACFCD). The tax will generate up to $285 million per year, which will be used to improve water quality and supply, promote community investment benefits with a focus on disadvantaged communities, and implement nature-based solutions.

- State Funds – Funds for water recycling, groundwater, water conservation and use efficiency, and stormwater capture have been available on a competitive basis though voter approved initiatives, such as Propositions 50, 84 and 1. Proposition 1 allocates $900 million to prevent or clean up contaminated groundwater. Occasionally low or zero-interest loans are also available through State Revolving Fund programs.

- Federal Funds – Federal funding for water recycling is available through the U.S. Army Corps of Engineers via periodic Water Resource Development Act legislation and the U.S. Bureau of Reclamation's Title XVI program.

- Potentially Responsible Parties – LADWP may be able to recover some costs for groundwater cleanup from potentially responsible parties.

11.2 Reliability Assessment Under Different Hydrologic Conditions

11.2.1 Los Angeles Aqueducts

Water deliveries to the City from the LAA is dependent on snowfall in the Eastern Sierra Nevada. The average annual long-term LAA delivery is based on the 30-year median hydrology from FY 1985/86 to 2014/15, which projects average deliveries to the City totaling approximately 192,000 AFY. Under average year weather conditions, the long-term average LAA supply of 192,000 AFY is projected to slightly decrease to 190,400 AFY in 2025, and to 184,200 AFY in 2045 as a result of forecasted modeling results from hydrologic impacts of approximately 0.1652 percent annual decrease. The forecasted hydrologic impacts are based on LADWP's 2011 Climate Change Study on the Eastern Sierra Nevada region and its impacts to the imported water supply to the City. In a single dry year, defined as a repeat of FY 1989/90 hydrology, deliveries are forecasted to be as low as 68,500 AFY.

Since 1992, environmental concerns have required the City to reallocate approximately one-half of the LAA water supply to other uses within the Owens Valley and Mono Basin. Reduced water deliveries to the City from the LAA has resulted in an increased dependence on purchased imported water supply from MWD to make up the difference. For additional information on the LAA supplies, please refer to Chapter 4, *Los Angeles Aqueduct*.

11.2.2 Groundwater

Groundwater is also affected by local hydrologic variability. LADWP utilizes conjunctive use strategies to optimize available surface water and groundwater to balance supplies with demand. During wet periods,

LADWP reduces production to increase the storage of water in the groundwater basins; and during dry periods, LADWP increases production to draw from available storage to help meet demands. Under average weather conditions through FY 2044/45, LADWP projects that on a safe yield basis it may extract between 108,800 AFY and 109,400 AFY of groundwater, excluding increased allowable pumping from stormwater recharge and groundwater replenishment supplies. These projections are based on multiple assumptions: (1) groundwater basin elevations can support this level of pumping on a safe yield basis (2) LADWP's planned groundwater treatment facilities will be operational by FY 2022/23; and (3) Sylmar Basin production will increase to 4,170 AFY from now until FY 2038/39 to avoid expiration of stored water credits and then return to the entitlement of 3,570 AFY in 2039/40. Although in dry years LADWP can extract greater quantities of groundwater, a more conservative approach was adopted by assuming the same level of projected groundwater production for both single dry year and multi-dry year analysis.

The presence of industrial contamination, including volatile organic compounds (VOCs) and other hazardous substances, has impeded the City's ability to fully exercise its groundwater rights. The remediation of the SFB will facilitate groundwater replenishment utilizing advanced treated recycled water and stormwater recharge for future extraction, which are critical to ensuring and maintaining the future reliability of the City's groundwater supplies. Groundwater treatment facilities will remediate the SFB and help restore LADWP's ability to fully utilize its local groundwater rights, and will facilitate additional storage and extraction programs. For additional information on the groundwater supplies, please refer to Chapter 5, *Local Groundwater.*

11.2.3 Conservation

LADWP aims to continue to further reduce per capita potable water use by 22.5 percent by 2025 and 25 percent by 2035, compared to FY 2013/14 average per capita consumption. These targets were developed based on the results from the Water Conservation Potential Study, which showed that LADWP has a maximum cost-effective savings potential of approximately 140,000 AF of additional savings compared to the FY 2013/14 baseline. LADWP plans to achieve these goals through the development and implementation of additional active and passive conservation programs.

Conservation and water use efficiency is viewed by LADWP to be both a demand management measure and a source of local supply. Additional planned conservation targets are a significant contributor towards helping to further reduce purchases of imported supplies from MWD and augmenting local supply development. Conservation is a foundational component of LADWP's water resource planning efforts and will continue to be central to the City's water use efficiency goals over the long term. For additional information on water conservation, please refer to Chapter 3, *Water Conservation*.

11.2.4 Recycled Water

Recycled water is derived from wastewater effluent flows, which do not vary significantly due to hydrology. Therefore, recycled water use is mainly limited by system capacities and potable water demands. These facts make recycled water a more reliable supply than imported water. As outlined in Chapter 7, *Recycled Water,* LADWP is planning extensive expansion of its recycled water system not only to include expansion of irrigation and industrial uses, but also to include groundwater replenishment. Under average weather conditions, recycled water supply for non-potable reuses, including irrigation and industrial purposes, is projected to increase from 17,300 AFY in 2025 to 30,000 AFY by 2045. Indirect potable reuse through the Los Angeles Groundwater Replenishment Project is projected to increase from 7,000 in 2025 to 11,000 AFY in 2027. During dry year scenarios, forecasted available recycled water supplies would not change.

11.2.5 Stormwater Capture

Capturing stormwater for groundwater recharge is essential to maintaining groundwater supplies, addressing the overall long-term decrease in stored groundwater, protecting the safe yield of the groundwater basin, and ensuring the long-term water supply reliability of the SFB. Proposed stormwater capture projects will increase stormwater capture capacity by approximately 80,000 AFY by 2035 and enable the City to utilize its stored water credits in a sustainable manner and prevent conditions of overdraft in the SFB under variable hydrology. LADWP projects up to 15,000 AFY of increased groundwater pumping in the SFB due to increased stormwater capture recharge from completed projects. Anticipating that groundwater basin elevations will also respond to enhanced groundwater replenishment, LADWP will work with the ULARA Watermaster to continue observing actual water levels and re-evaluate basin safe yield to allow additional increases in groundwater production over time as SFB groundwater elevations rebound. For additional information on stormwater capture, please refer to Chapter 6, *Watershed Management*.

11.2.6 MWD Imported Supplies

LADWP has historically purchased supplemental MWD supplies to meet demands and maintain reliability. LADWP has relied on MWD supplies to a greater extent as LAA supplies have been reduced due to increased environmental mitigation and enhancement requirements. Through continued investments in local supplies, LADWP plans to reduce its purchases of imported supplies from MWD.

Historically, MWD's water supplies from the Colorado River and State Water Project (SWP) have been subject to shortages due to hydrologic variability (e.g., 1976/77, 1987-1992, 2007-2010, and 2012-2016). Restricted pumping to protect fish species in the San Francisco Bay and Sacramento-San Joaquin River Delta (Bay-Delta) further limits SWP supplies available to MWD. After the 1987-1992 dry period, MWD began to diversify its water supply portfolio. Partnering with its member agencies, MWD launched its first Integrated Resource Plan (IRP) in 1996 and is currently developing the 2020 IRP for adoption in September 2021.

MWD's 2020 Urban Water Management Plan indicates that MWD will continue to provide 100 percent supply capability through 2045 for its member agencies during average (1922 – 2017 hydrology), single dry (1977 hydrology), and multiple dry years (1988 - 1992 hydrology). For each of these scenarios, there is a projected surplus of supply capability in every forecast year (see Exhibit 11B). The projected surpluses are based on the capability of current supplies and range from 34 percent to 215 percent. When including supplies under development for all scenarios, the potential surplus ranges from 33 percent to 183 percent of projected demand. For additional information on MWD supplies, please refer to Chapter 9, *Metropolitan Water District Supplies*.

Exhibit 11B
MWD Supply Capability and Projected Demands (in AFY)

Single Dry Year MWD Supply Capability and Projected Demands (1977 Hydrology)					
Fiscal Year	2025	2030	2035	2040	2045
Capability of Current Supplies	2,696,000	2,760,000	2,435,500	2,759,000	2,479,500
Projected Demands[1]	1,597,000	1,548,000	1,505,000	1,524,000	1,551,000
Projected Surplus	1,099,000	1,212,000	930,500	1,235,000	928,500
Projected Surplus % (Proj. Surplus/Proj. Demands)	69%	78%	62%	81%	60%
Supplies under Development	0	0	0	0	0
Potential Surplus	1,099,000	1,212,000	930,500	1,235,000	928,500
Potential Surplus % (Potential Surplus/Proj. Demands)	69%	78%	62%	81%	60%
Multiple Dry Year MWD Supply Capability and Projected Demands (1988-1992 Hydrology)					
Fiscal Year	2025	2030	2035	2040	2045
Capability of Current Supplies	2,161,800	2,214,000	2,236,000	2,259,000	2,239,000
Projected Demands[1]	1,629,000	1,610,000	1,575,000	1,568,000	1,591,000
Projected Surplus	532,800	604,000	661,000	691,000	648,000
Projected Surplus % (Proj. Surplus/Proj. Demands)	33%	38%	42%	44%	41%
Supplies under Development	0	0	0	0	0
Potential Surplus	532,800	604,000	661,000	691,000	648,000
Potential Surplus % (Potential Surplus/Proj. Demands)	33%	38%	42%	44%	41%
Average Year MWD Supply Capability and Projected Demands (1922 - 2017 Hydrology)					
Fiscal Year	2025	2030	2035	2040	2045
Capability of Current Supplies	3,863,000	3,892,000	3,888,000	3,867,000	3,883,000
Projected Demands[1]	1,469,000	1,420,000	1,379,000	1,394,000	1,418,000
Projected Surplus	2,394,000	2,472,000	2,509,000	2,473,000	2,465,000
Projected Surplus % (Proj. Surplus/Proj. Demands)	163%	174%	182%	177%	174%
Supplies under Development	13,000	13,000	13,000	13,000	13,000
Potential Surplus	2,407,000	2,485,000	2,522,000	2,506,000	2,478,000
Potential Surplus % (Potential Surplus/ Demands)	164%	175%	183%	178%	175%

Source: Draft MWD 2020 Urban Water Management Plan, Tables 2-4 to 2-6, April 2021.

[1] Total demands Imperial Irrigation District and San Diego County Water Authority Transfers and canal linings

11.2.7 Service Area Reliability Assessment

To determine the overall service area reliability in compliance with California Water Code (CWC) Section 10635(a), LADWP defined three hydrologic conditions based on historic Eastern Sierra Nevada conditions: average year (30-year median hydrology from FY 1985/86 to 2014/15); single-dry year (repeat of the 1989/90 hydrology); and multi-dry year (repeat of FY 1987/88 to FY 1991/92 hydrology). These defined conditions are used to forecast the corresponding level of LAA water supply availability. The corresponding demand under each hydrologic condition is also determined. The average year demand is based on the forecasted median demand as shown below in Exhibit 11E. Weather patterns and water demands were further studied to determine single dry year demand and multi-dry year demands. The single dry and multi-dry year demands are estimated to be approximately five percent higher than the forecasted median demand.

The water supply reliability summaries are shown in Exhibit 11C and 11D. Exhibit 11C illustrates the average year conditions for FY 2044/45 and Exhibit 11D illustrates single dry year/multiple-dry year (year 3) for FY 2044/45. The projected supply portfolio under multiple dry year conditions is similar to that under single dry year conditions. New water conservation includes additional active and passive savings achieved since FY 2013/14 and retained passive savings from the most recent dry period ending in 2017. Local supplies are resilient to hydrologic variability and become the cornerstone of the City's future water supplies, comprising 43 percent and 48 percent of LADWP's portfolio in average and dry years, respectively. By FY 2044/45, LAA deliveries are projected at nine percent in dry years and 26 percent in average years, and MWD will make up the remaining 43 percent in dry years or 31 percent in average years to meet LADWP's projected demands.

Exhibit 11C
LADWP Supply Reliability Under Average Year Conditions in Fiscal Year 2044-45

Fiscal Year 2044-45 Average Hydrology
Total Supply: 710,500 AF

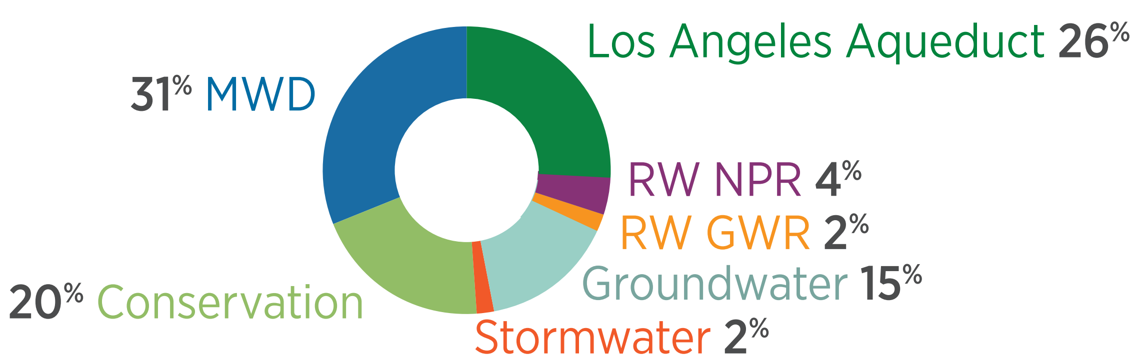
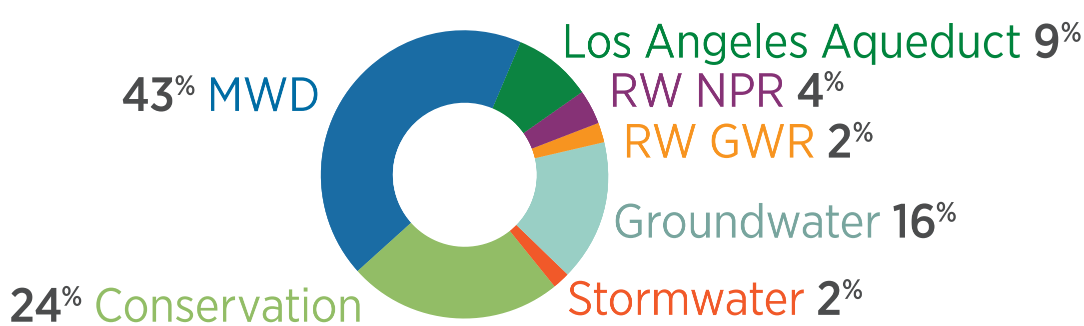


Exhibit 11D
LADWP Supply Reliability Under Single Dry Year/Multiple Dry Year (Year 3) Conditions in Fiscal Year 2044-45

Fiscal Year 2044-45 Dry Hydrology
Total Supply: 746,000 AF



Exhibits 11E, 11F, and 11G tabulate the service reliability assessment for average year, single dry year, and multiple dry year conditions, respectively. For these reliability tables, existing water conservation prior to FY 2013/14 has already been subtracted from projected demands, but new water conservation savings achieved is included as a supply source. No water shortages are anticipated as demands are met by the available supplies under all hydrologic scenarios. In addition to the total water demand, Exhibits 11E through 11G provide projected water demands aligned with LADWP demand targets. Under five consecutive dry-year conditions, similar to the driest five-year historical period (fiscal year ending (FYE) 1988 to 1992), LADWP plans to utilize conjunctive use strategies to increase groundwater production and purchases from MWD to meet water demands. This particular sequence is quantified in Exhibit 11G, including relevant assumptions.

Exhibit 11E
Service Area Reliability Assessment for Average Year

Demand and Supply Projections (in acre-feet)	Average Year Fiscal Year Ending on June 30				
	2025	**2030**	**2035**	**2040**	**2045**
Total Water Demand[1]	**642,600**	**660,200**	**678,800**	**697,800**	**710,500**
Post-Conservation Demand	**509,500**	**526,700**	**536,100**	**554,500**	**565,800**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	133,100	133,500	142,700	143,300	144,700
Los Angeles Aqueduct[4]	190,400	188,900	187,300	185,800	184,200
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	461,200	480,000	495,100	493,700	493,700
MWD Water Purchases With Existing/Planned Supplies	181,400	180,200	183,700	204,100	216,800
Total Supplies	**642,600**	**660,200**	**678,800**	**697,800**	**710,500**

1. Total Demand with existing passive conservation prior to FYE 14.

2. Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

3. Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

4. Los Angeles Aqueduct supply is estimated to decrease 0.1652 percent due to climate impacts.

5. LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Exhibit 11F
Service Area Reliability Assessment for Single Dry Year

Demand and Supply Projections (in acre-feet)	Dry Year Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**674,700**	**693,200**	**712,700**	**732,700**	**746,000**
Post-Conservation Demand	**509,500**	**526,700**	**536,100**	**554,500**	**565,800**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	165,200	166,500	176,600	178,200	180,200
Los Angeles Aqueduct[4]	70,800	70,200	69,600	69,000	68,500
Groundwater					
- Entitlements[5]	121,300	121,300	121,300	120,700	120,700
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	385,600	406,200	423,200	423,700	425,400
MWD Water Purchases With Existing/Planned Supplies	289,100	287,000	289,500	309,000	320,600
Total Supplies	**674,700**	**693,200**	**712,700**	**732,700**	**746,000**

1. Total Demand with existing passive conservation prior to FYE 14.

2. Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

3. Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

4. Los Angeles Aqueduct supply is estimated to decrease 0.1652 percent due to climate impacts.

5. LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

Exhibit 11G
Service Area Reliability Assessment for Multiple Dry Years

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year One (1988) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand	**657,900**	**675,800**	**694,900**	**714,400**	**727,400**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	150,300	149,200	158,800	160,000	161,700
Los Angeles Aqueduct[4]	133,700	132,600	131,500	130,400	129,300
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	421,700	439,400	455,400	455,000	455,800
MWD Water Purchases With Existing/Planned Supplies	236,200	236,400	239,500	259,400	271,600
Total Supplies	**657,900**	**675,800**	**694,900**	**714,400**	**727,400**

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year Two (1989) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand	**661,700**	**679,700**	**698,900**	**718,500**	**731,500**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	154,100	153,100	162,800	164,100	165,800
Los Angeles Aqueduct[4]	119,500	118,600	117,600	116,600	115,700
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
_- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	531,700	557,700	580,900	580,100	581,100
MWD Water Purchases With Existing/Planned Supplies	130,000	122,000	118,000	138,400	150,400
Total Supplies	**661,700**	**679,700**	**698,900**	**718,500**	**731,500**

Exhibit 11G (Continued)

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year Three (1990) Fiscal Year Ending on June 30				
	2025	**2030**	**2035**	**2040**	**2045**
Total Water Demand	**674,800**	**693,200**	**712,800**	**732,700**	**746,000**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	167,200	166,600	176,700	178,300	180,300
Los Angeles Aqueduct[4]	70,800	70,200	69,600	69,000	68,500
Groundwater					
- Entitlements[5]	121,309	121,309	121,309	120,709	120,709
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	387,609	406,309	423,309	423,809	425,509
MWD Water Purchases With Existing/Planned Supplies	287,191	286,891	289,491	308,891	320,491
Total Supplies	**674,800**	**693,200**	**712,800**	**732,700**	**746,000**

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year Four (1991) Fiscal Year Ending on June 30				
	2025	**2030**	**2035**	**2040**	**2045**
Total Water Demand	**661,600**	**679,600**	**698,900**	**718,400**	**731,500**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	154,000	153,000	162,800	164,000	165,800
Los Angeles Aqueduct[4]	119,700	118,800	117,800	116,800	115,800
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	411,400	429,400	445,700	445,400	446,400
MWD Water Purchases With Existing/Planned Supplies	250,200	250,200	253,200	273,000	285,100
Total Supplies	**661,600**	**679,600**	**698,900**	**718,400**	**731,500**

Exhibit 11G (Continued)

Demand and Supply Projections (in acre-feet)	Multi-Dry Year: Year Five (1992) Fiscal Year Ending on June 30				
	2025	2030	2035	2040	2045
Total Water Demand[1]	**655,700**	**673,600**	**692,600**	**712,000**	**724,900**
Post-Conservation Demand	**507,600**	**526,600**	**536,100**	**554,400**	**565,700**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	148,100	147,000	156,500	157,600	159,200
Los Angeles Aqueduct[4]	141,900	140,700	139,500	138,400	137,300
Groundwater					
- Entitlements[5]	109,400	109,400	109,400	108,800	108,800
- Groundwater Replenishment	7,000	11,000	11,000	11,000	11,000
- Stormwater Recharge (Increased Pumping)	4,000	8,000	15,000	15,000	15,000
Recycled Water- Irrigation and Industrial Use	17,300	29,200	29,700	29,800	30,000
Subtotal	427,700	445,300	461,100	460,600	461,300
MWD Water Purchases With Existing/Planned Supplies	228,000	228,300	231,500	251,400	263,600
Total Supplies	**655,700**	**673,600**	**692,600**	**712,000**	**724,900**

1. Total Demand with existing passive conservation prior to FYE 14.

2. Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

3. Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

4. Los Angeles Aqueduct supply is estimated to decrease 0.1652 percent due to climate impacts.

5. LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

11.3 Drought Risk Assessment

This section summarizes the development of a drought risk assessment in compliance with CWC Section 10635(b), which includes a summary of the anticipated LADWP's water demands and supplies over a five-year dry period assumed to start in FY 2021. The water demand and supply summary is presented in Exhibit 11H over the five-year period from 2021 to 2025 simulating LAA hydrology from LADWP's driest five consecutive year sequence from FYE 1988-1992.

11.3.1 Drought Risk Assessment Water Source Reliability

Near-term supply reliability by LADWP is dependent on the hydrologic impact and stress on each supply as described in Section 11.2, Reliability Assessment Under Different Hydrologic Conditions. The forecasted availability for each of LADWP's supplies from 2021-2025 is summarized below.

- Recycled Water: Water supply derived from treated wastewater is considered hydrologically independent. This supply is assumed to grow over time based on the projections in Chapter 7, *Recycled Water*, over the five-year drought risk assessment period. This supply is assumed to be reliable within this time frame.

- LAA Supply: Supplies from the LAA is based on a repeat of the driest five consecutive year hydrology in the Eastern Sierra Nevada which occurred from 1988 to 1992, with additional consideration for climate impacts. The same historic sequence was also used in the multi-year drought reliability assessment in Section 11.2.7.

- Groundwater: LADWP's groundwater supply makes up a significant percentage of the water supply portfolio and may also be affected by the reduced rainfall and corresponding runoff anticipated during a five-year dry period. LADWP utilizes conjunctive use strategies to optimize available surface water and groundwater to balance supplies with demand. During wet periods, LADWP reduces production to increase the storage of water in the groundwater basins; and during dry period, LADWP increases production to greater-than-average rates, as used in the multi-year drought reliability assessment in Section 11.2.7.

- Stormwater Capture: The City's stormwater capture is a supply that also contributes to supporting the recharge of the groundwater basin and groundwater storage over time; concurrently protecting the safe yield of the groundwater basin and ensuring long-term water supply reliability. The availability of groundwater is assumed to be equal to a small amount of increased groundwater pumping that could be brought online in the case of a multi-year drought. In year three of the multi-dry year scenario, pumping could be increased to access more stored groundwater and maintained if the drought lasts longer than five years.

- Supplies from MWD: Similar to the conditions described in section 11.2.6, MWD's 2020 Urban Water Management Plan indicates that MWD will continue to provide 100 percent supply capability over the next five years under a consecutive five-dry year condition starting in 2021.

- The demands used in this analysis were assumed to increase starting from the 2020 gross water use and are modified with weather factors that increase projected demand up to five percent during dry years. The drought risk assessment shows no anticipated shortages over the five-year drought starting in 2021.

Exhibit 11H
Service Area Drought Risk Assessment

Demand and Supply Projections (in acre-feet)	Drought Risk Assessment (1988-1992) Fiscal Year Ending on June 30				
	2021	2022	2023	2024	2025
Total Water Demand	**645,900**	**652,600**	**668,600**	**658,600**	**655,700**
Post-Conservation Demand	**494,200**	**497,100**	**500,600**	**504,700**	**507,600**
Existing / Planned Supplies					
Conservation (Additional Active[2] and Passive[3] after FYE 14)	151,700	155,500	168,000	153,900	148,100
Los Angeles Aqueduct[4]	134,600	120,100	71,000	119,900	141,900
Groundwater					
- Entitlements	100,500	104,800	119,300	107,400	109,400
- Groundwater Replenishment	0	1,750	3,500	3,500	7,000
- Stormwater Recharge (Increased Pumping)	2,000	2,000	2,000	2,000	4,000
Recycled Water- Irrigation and Industrial Use	11,400	12,500	14,300	15,400	17,300
Subtotal	400,200	396,700	378,100	402,100	427,700
MWD Water Purchases With Existing/Planned Supplies	245,700	255,900	290,500	256,500	228,000
Total Supplies	**645,900**	**652,600**	**668,600**	**658,600**	**655,700**

1. Total Demand with existing passive conservation prior to FYE 14.

2. Cumulative hardware savings since late 1980s reached 110,822 AFY by FYE 14.

3. Additional non-hardware conservation inclusive of retained passive savings from the dry period ending in 2017

4. Los Angeles Aqueduct supply is estimated to decrease 0.1652 percent due to climate impacts.

5. LADWP Groundwater Remediation projects in the San Fernando Basin are expected to be in operation by FYE 2023. Sylmar Basin production will increase to 4,170 AFY from FYE 2021 to 2036 to avoid the expiration of stored water credits, then revert to entitlement amounts of 3,570 AFY in 2037.

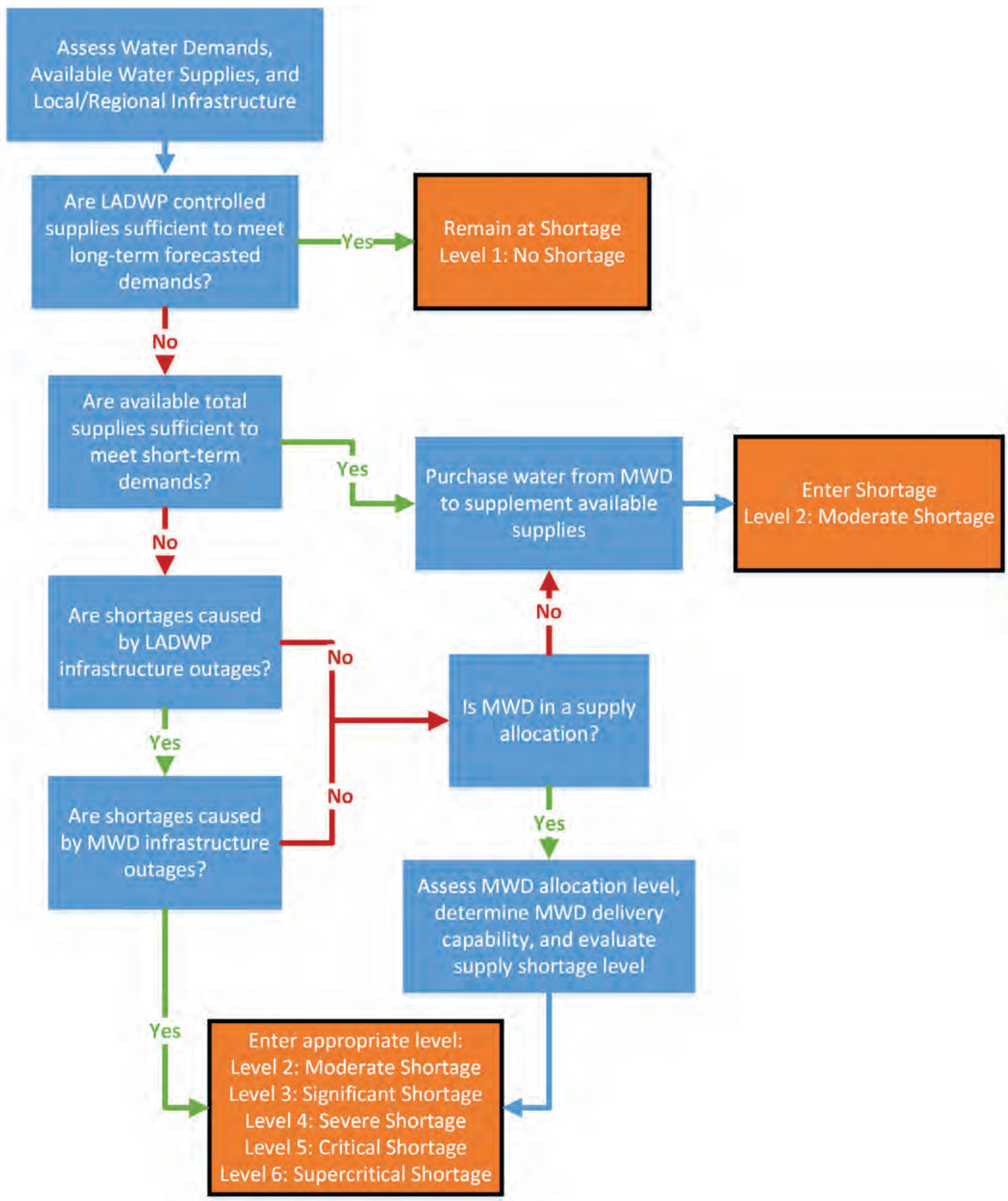
11.4 Water Shortage Contingency Plan (WSCP)

As required by CWC Section 10632, LADWP has developed a WSCP, which is included as Appendix I. The WSCP establishes six standard water supply shortage levels and corresponding shortage response actions as reflected in Exhibit 11I and outlines the decision-making process LADWP utilizes each year to determine shortage conditions (Exhibit J).

Exhibit 11I
LADWP Standard Water Shortage Levels

Water Shortage Level	Percent Reduction in Full Service Water Demand
Level 1: No Shortage	Up to 10%
Level 2: Moderate Shortage	Up to 20%
Level 3: Significant Shortage	Up to 30%
Level 4: Severe Shortage	Up to 40%
Level 5: Critical Shortage	Up to 50%
Level 6: Supercritical Shortage	Greater than 50%

Exhibit 11J
LADWP Water Shortage Level Evaluation Process



LADWP is currently in a Level 2 shortage condition which is considered a condition where LADWP controlled supplies alone are insufficient to meet long term forecasted demands. To determine the appropriate shortage level in the future, LADWP will assess water supply conditions per the procedures illustrated in Exhibit J. For example, if the Annual Assessment determines a water supply shortage of 25 percent, LADWP would be in a Significant Shortage, or Water Shortage Level 3. Once the condition is determined by LADWP, shortage response actions including demand reduction and supply augmentation measures would be placed into effect with the goal of reducing demands and utilizing emergency supplies to bridge the anticipated supply and demand gap.

A summary of shortage response actions is provided in Exhibit K. Additional details on shortage response actions can be found in Appendix I. LADWP's shortage response actions include a mix of prohibitions on end use, demand reduction methods, and supply augmentation. The City's Emergency Water Conservation Plan (Conservation Ordinance) describes prohibitions on end use and demand reduction methods that will be employed by LADWP in the event of a shortage. Supply augmentation actions will include withdrawing from available emergency supplies along the LAA system and/or local groundwater basins.

Exhibit 11K
Summary of LADWP Water Shortage Level Response Actions

Water Shortage Level	Demand Reduction Response Actions	Supply Augmentation Response Actions
Level 1: No Shortage	Conservation Ordinance Phase 1	N/A
Level 2: Moderate Shortage	Conservation Ordinance Phase 2	
Level 3: Significant Shortage	Conservation Ordinance Phase 3	
Level 4: Severe Shortage	Conservation Ordinance Phase 4	Withdraw from available emergency storage along the Los Angeles Aqueduct System and local groundwater basins
Level 5: Critical Shortage	Conservation Ordinance Phase 5	
Level 6: Supercritical Shortage	Conservation Ordinance Phase 6	

The WSCP also lists re-evaluation and improvement procedures LADWP will use to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed. The WSCP will be re-evaluated at least every five years in coordination with the Urban Water Management Plan (UWMP) update or at the discretion of LADWP.

In addition to shortage planning, the WSCP describes how LADWP is planning for a catastrophic supply interruption, including a large seismic event at the regional and local scale, which is also summarized below in Section 11.4.1. LADWP and MWD have developed plans for catastrophic supply interruptions that include regional power outages, earthquakes, or other disasters. Additionally, LADWP maintains several emergency connections to and from neighboring water agencies to provide mutual aid during times of catastrophic supply interruptions.

In the event of severe dry periods, MWD may implement its WSCP. MWD's WSCP incorporates substantial input from its member agencies and establishes priorities for the use of MWD's water supplies to achieve retail reliability under shortage conditions.

11.4.1 Catastrophic Supply Interruption Plan

11.4.1.1 Seismic Assessment of Major Imported Supplies

Numerous faults throughout California pose a major seismic risk to disrupting deliveries of Southern California's imported supplies. Portions of the conveyance systems on LADWP's LAA, DWR's SWP California Aqueduct, and MWD's Colorado River Aqueduct (CRA) all traverse the San Andreas Fault. A major seismic event on this fault could damage the conveyance systems and temporarily cut off deliveries of imported supplies to the Southern California region until repairs are completed.

MWD may limit supplies to member agencies in the event of disruptions after a large seismic event. LADWP and MWD have evaluated potential damage scenarios to the LAA, SWP, and CRA from a major (M 7.8) seismic event on the San Andreas Fault, as follows:

- Los Angeles, California, and Colorado River Aqueduct outage: The shakeout produces up to an 18-month outage of the LAA, a 12 to 24-month outage of the East Branch of the California Aqueduct, a 6 to 12-month outage of the West Branch of the California Aqueduct, and a 6-month outage of the CRA until 80 percent of CRA capacity could be recovered. Repairs to bring the CRA back to 100 percent capacity would last three to five years.

- Potential maximum reductions in member agency retail water demand: MWD estimates that 30 percent of all retail demand is directed toward outdoor uses. MWD combined this estimate with a Public Policy Institute of California (PPIC) report (Building Drought Resilience in California's Cities and Suburbs, June 2017) to resolve that its member agencies would be able to reduce retail demands by 25 to 35 percent following a seismic event. LADWP will evaluate projected shortages in accordance with its WSCP to determine necessary conservation actions following a major seismic event.

- Reductions to member agency local supplies: MWD estimated a 6 and 12-month aggregated loss of 10 to 20 percent of local production following a seismic event. This includes full outage of the LAA, and that local LADWP supplies would include groundwater and recycled supplies only.

MWD re-evaluated its Emergency Storage Objectives and in response to the above scenario, increased its emergency storage objective from 630,000 AF to 750,000 AF based on the anticipated performance of three water system components during the shakeout scenario. The MWD evaluation indicates that member agencies should be prepared to reduce their demands by 25 to 35 percent. A mandatory demand reduction proposed by MWD would mimic the impacts of water use reduction (MWD Water Supply Allocation) due to a dry period.

11.4.1.2 Emergency Response Plan

LADWP has Emergency Response Plans (ERPs, revised January 2021) in place to restore water service for essential use in LADWP's service area if a disaster, such as earthquakes and power outages, should result in the temporary interruption of water supply. LADWP personnel responsible for water transportation, distribution, and treatment have established ERPs to guide the assessment, prioritization, and repair of facilities that have incurred damage during a disaster.

An Emergency Operations Center (EOC) serves as a centralized point for citywide management of information about disasters and for coordination of all available resources. The EOC supports the City's Emergency Operations Organization to achieve its mission of saving lives, protecting property, and returning the City to normal operations in the event of a disaster. LADWP coordinates its efforts with the EOC and will utilize the EOC to resume water supply service after a catastrophic event.

Earthquakes

In the event of a major earthquake, LADWP has a Disaster Response Plan dedicated for the LAA in addition to its overall ERP. The Disaster Response Plan details procedures for operating the LAA following an earthquake in order to prevent further damage of the LAA. If the LAA is severed by seismic activity on the San Andreas Fault and is temporarily unable to provide water to the City, LADWP will be able to use its water storage in Bouquet Reservoir to provide water supply to the City while repairs are made. In addition to this resource, if the California Aqueduct is intact south of the Neenach Pump Station (First Los Angeles Aqueduct – State Water Project Connection), arrangements may be made to transfer LAA water through this connection into the California Aqueduct for delivery to MWD. Arrangements can then be made to deliver water to the City through one of MWD's connections.

Power Outages

Most of LADWP's pump stations are equipped with diesel-powered backup pumps in the event a major power outage disrupts the primary energy system. The diesel-powered backups are capable of running for extended periods of time with reliable refueling available from LADWP's Fleet Services. In the event of a major power outage, backup pumps can be automatically switch on, started remotely, or activated manually. In addition, LADWP maintains adequate storage supply to maintain water distribution system operability until power is restored.

11.5 Water Supply Assessments

Background

In 1994, the California Legislature enacted Water Code Section 10910 (Senate Bill 901), which requires cities and counties, as part of California Environmental Quality Act (CEQA) review, to request the applicable public water system to assess whether the system's projected water supplies were sufficient to meet a proposed development's anticipated water demand. The intent was to link the land use and water supply planning processes to ensure that developers and water supply agencies communicate early in the planning process. However, a study of projects approved by local planning agencies revealed that numerous projects were exempt due to loopholes in the statute, and that the intent of the legislation had largely gone unfulfilled.

Subsequently, California Senate Bill (SB) 610 and SB 221, modeled after SB 901, amended State law effective January 1, 2002, to ensure that the original intent of the legislation is fulfilled. SB 610 and 221 are companion measures, which seek to promote more collaborative planning between local water suppliers and cities and counties. These bills improve the link between information on water supply availability and certain land use decisions made by cities and counties. Both statutes require detailed information regarding water availability to be provided to the city and county decision-makers prior to approval of specified large development projects. Both statutes also require this detailed information be included in the administrative record that serves as the evidentiary basis for an approval action by the city or county on such projects. Both measures recognize local control and decision making regarding the availability of water for projects and the approval of projects.

Under SB 610, a water supply assessment (WSA) must be furnished to local governments for inclusion in any environmental documentation for specified types of development projects subject to CEQA. Specifically, SB 610 requires that for certain projects, as defined in California Water Code Section 10912, the CEQA lead agency must identify a public water system that may supply water to the proposed project and request the public water system to determine whether the water demand associated with the proposed projects included as part of the public water system's most recently adopted UWMP. If the projected water demand associated with the proposed project is accounted for in the most recently adopted UWMP, the public water system may incorporate the supporting information from the UWMP, including water supply entitlements, water rights, and water service contracts, in preparing the elements of the assessment. If the proposed project's water demand is not accounted for in the most recently adopted UWMP, the WSA for the project shall include a discussion with regard to whether the public water system's total projected water supplies available in normal, single-dry, and multiple-dry water years (WYs) during a 20-year projection will meet the proposed project's water demand, in addition to the public water system's existing and planned future uses. If the WSA concludes that water supplies will be insufficient, plans for acquiring additional water supplies would need to be presented. Under SB 221, approval by a city or county of new large development projects requires an affirmative written verification of sufficient water supply; which is a "fail safe" mechanism to ensure that collaboration on finding the needed water supplies to serve a new large development occurs before construction begins.

Methodology

Each WSA performed by LADWP is carefully evaluated within the context of the currently adopted UWMP and current conditions, such as restrictions on SWP pumping from the Sacramento-San Joaquin Delta imposed by a federal court and dry conditions. MWD, from whom the City purchases its SWP and Colorado

River water supplies, has also been actively developing plans and making efforts to provide additional water supply reliability for the entire Southern California region. LADWP coordinates closely with MWD to ensure implementation of MWD's water resource development plans and supplemental water reliability report prepared by MWD.

As described in Chapter 2, *Water Demand*, LADWP's UWMP uses a service area-wide method in developing the City's water demand projections. This methodology does not rely on individual development water demands to determine area-wide growth. Rather, the growth in water use for the entire service area was considered in developing long-term water projections for the City to the year 2045. The anticipated growth in the LADWP service areas' customer class sectors is provided by MWD, who received projected demographic data from the Southern California Association of Governments (SCAG). The data used was based on SCAG's 2020 Regional Transportation Plan (RTP) growth forecast. LADWP's demand projections are based on its entire service area, which also includes services for customers outside of the City. City Charter 673 and 677 permits LADWP to serve surplus water supplies to areas outside of the City boundary. The combined annual water use of customers outside of the City is less than one percent of all water delivered.

The water supply projections for LADWP's service area in the 2020 UWMP support future anticipated SCAG RTP demographics and growth projections, including projects consistent with such growth projections, during normal, single-dry, and multiple-dry water years, as well as existing and planned future uses of the LADWP's water system. Therefore, WSAs are a continuous integral part of LADWP's long-term water supply planning efforts to ensure adequate water supplies for its service area.

WSA Procedure

The City of Los Angeles Department of City Planning (City Planning) is the CEQA lead agency for most projects within the LADWP service area, although other City departments or even the County of Los Angeles may perform this role. The CEQA lead agency must evaluate proposed projects against the requirements for a WSA, in accordance with the Water Code. If a proposed project falls within CEQA requirements for a WSA, the lead agency will request LADWP to perform a WSA and determine whether the City's total projected water supplies will meet the projected water demand associated with the proposed project, during normal, single-dry, and multiple-dry WYs, in addition to existing and planned future uses of LADWP's water system.

The projected water demand is determined from the proposed project's scope of work associated water use, existing water demand associated with the project's demolition, and the water amount from the installation of voluntary water conservation features. The existing water demand associated with the project's demolition, as well as the project's proposed voluntary water conservation, are subtracted from the gross proposed project demand to arrive at the project's net additional water demand. WSAs include a discussion of the impacts of the annual net additional water demand of the project on the City's potable water supply. Elements of the water demand calculation are briefly described below.

Proposed Water Demand

Proposed water demand includes proposed indoor and outdoor water uses. For indoor uses, the base demand is determined by applying sewer generation factors (SGFs), published by City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment, to elements of the project scope such as square footage and use type (restaurant, office, etc.). Because SGFs, water conservation and use efficiency, codes, and ordinances are updated at different times, the latest SGFs may not account for water savings from the current ordinances. Required water savings are due to the Water Efficiency Requirements Ordinance No. 180822, No. 184248, No. 186488, and any other current City and State water conservation and use efficiency requirements. Much of the required water savings are achieved through the use of high-efficiency plumbing fixtures in the project. To account for water savings from codes and ordinances, required water savings are subtracted from the indoor base demand to arrive at the indoor proposed water demand.

A type of outdoor water use comes from the landscaping. This water demand is estimated by using California Code of Regulations Title 23, Division 2, Chapter 2.7. Model Water Efficient Landscape Ordinance (MWELO). MWELO sets the maximum water allotment through the Maximum Applied Water Allowance (MAWA) calculation.

Voluntary Water Conservation

LADWP encourages project applicants to incorporate additional and voluntary water conservation measures into the project. Indoor voluntary measures might comprise plumbing fixtures with flow rates below those required by current codes.

Voluntary water conservation through efficient landscaping is estimated by subtracting the Estimated Total Water Use (ETWU) from MAWA. ETWU represents water needs for specific plant types while considering the efficiency of proposed irrigation systems. Applicants may achieve additional water conservation by proposing California Friendly® plants and efficient irrigation systems that bring ETWU below MAWA.

Basis for Approval

The proposed project's net additional water demand is the increase in water demand compared to the existing water demand at the project site. This quantity is not compared directly to the City's water demand projection to conclude whether the City has sufficient water supplies for the development. Rather, the basis for approving WSAs lies in the demographic projections used to determine the City's overall projected water demand in the UWMP. In most cases, the CEQA lead agency is responsible for determining if a development conforms to the use and intensity of development permitted by the City's General Plan or if it otherwise requires General Plan amendments, using SCAG's 2020 RTP. The General Plan framework establishes the "Policy" growth level, based on SCAG's population growth forecasts, as the basis for the planning of land use, transportation, infrastructure, and public services, so if a proposed development is consistent with the General Plan, it is also consistent with the most recent SCAG projections. Projects under CEQA lead agencies such as the County of Los Angeles are exempt from City Planning requirements and General Plan conformance, but all CEQA lead agencies representing projects within the LADWP service area should ensure that a proposed development is consistent with the demographic growth projection by SCAG's 2020 RTP.

WSAs are required to include a discussion on whether projected water supplies available during a 20-year projection will meet a proposed development's water demand. SCAG utilizes a land use-based planning tool that allocates its projected demographic data into water service areas for MWD's member agencies, which was adopted for water demand projections in the UWMP. Because LADWP has performed an analysis of future City water demands and supplies based on SCAG demographic projections, and plans for adequate water supplies to 2045 with the projected growth considered, developments that are consistent with SCAG's 2020 RTP demographic projections also have adequate future water supply. This is the basis of approval for projects requiring WSAs.

All WSAs are subject to approval by the Board of Water and Power Commissioners. Upon approval, LADWP requests the CEQA lead agency to include the implementation of the additional water conservation plans, identified in the water conservation commitment letter, as part of the approval process for the proposed project.

Chapter Twelve

Climate Change and Water and Energy Nexus

12.0 Overview

Climate change is a global-scale concern but is particularly impactful in the Western United States where water supplies are already limited. Water supply availability for the City of Los Angeles (City) is impacted by many factors, including temperature and precipitation conditions, hydrologic patterns, and water demands. To better understand these impacts, LADWP actively monitors climate risks to the LADWP service area locally and to the watersheds of LADWP's imported supplies. These watersheds span across the Western United States and include the Eastern Sierra Nevada, Northern Sierra Nevada, and the Colorado River Basin where water supplies from the Los Angeles Aqueduct (LAA), State Water Project (SWP), and Colorado River Aqueduct (CRA) originate, respectively.

Water supplies that are dependent on natural hydrology, such as LADWP's imported supplies and local groundwater, are susceptible to climate risks. Imported sources that originate from mountain snowpack are particularly sensitive to changes in temperatures as small increases in temperature can significantly influence the melting of snowpack. LADWP continues to monitor the latest developments to advance the accuracy of hydrologic forecasts and projections to improve resources planning efforts that better respond to natural hydrologic variability and other potential future climate risks.

LADWP also continues to proactively track greenhouse gas (GHG) emissions associated with its Water System operations through its energy use and associated GHG emissions in the production, conveyance, extraction, pumping, treatment, and distribution of water. LADWP continues to analyze the nexus between water and energy consumption and to evaluate the associated carbon footprint of its water system in order to identify opportunities to improve system efficiency.

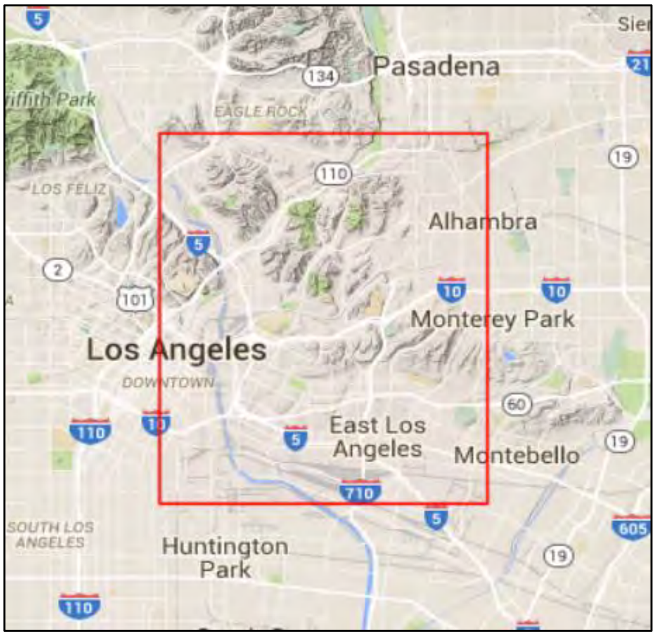
12.1 Potential Impacts of Climate Change on Water Supply Reliability

LADWP has conducted several studies to evaluate the potential impacts of climate risk on local and LAA water and City demands. These studies utilized global climate models (GCMs) to simulate climate systems up through the end of the 21st century in order to assess the potential range of climate impacts. The common trend among the GCMs forecast is increasing temperatures, however, all modeling results carry an inherent degree of uncertainty. This uncertainty is especially evident in models of predicted precipitation which do not demonstrate a single clear trend. Different scenarios that span across multiple GCMs are developed to better plan for this uncertainly and to account for the range of possible climate futures. This range of possible futures provides valuable insight for LADWP to assess climate risk and to develop plans to improve water supply reliability.

12.1.1 Water Demand and Local Impacts

As discussed in Chapter 2, *Water Demand*, shifts in weather conditions can influence water demands by approximately five percent when compared to average conditions. LADWP evaluated the potential effects of climate impacts on water demands by utilizing future projections of precipitation and temperature obtained from all available GCMs from the Lawrence Livermore National Laboratory through the World Climate Research Program's Coupled Model Intercomparison Project Phase 5 (CMIP5) dataset for representative concentration pathways (RCP). RCPs represent a set of four potential climate change scenarios that were adopted by the Intergovernmental Panel on Climate Change in 2014. Global coarse-scale climate projections were then downscaled to a regional level incorporating local weather and topography for the area indicated in Exhibit 12A to represent the City.

Exhibit 12A
Downscaled Global Climate Change Model Data Area for Los Angeles



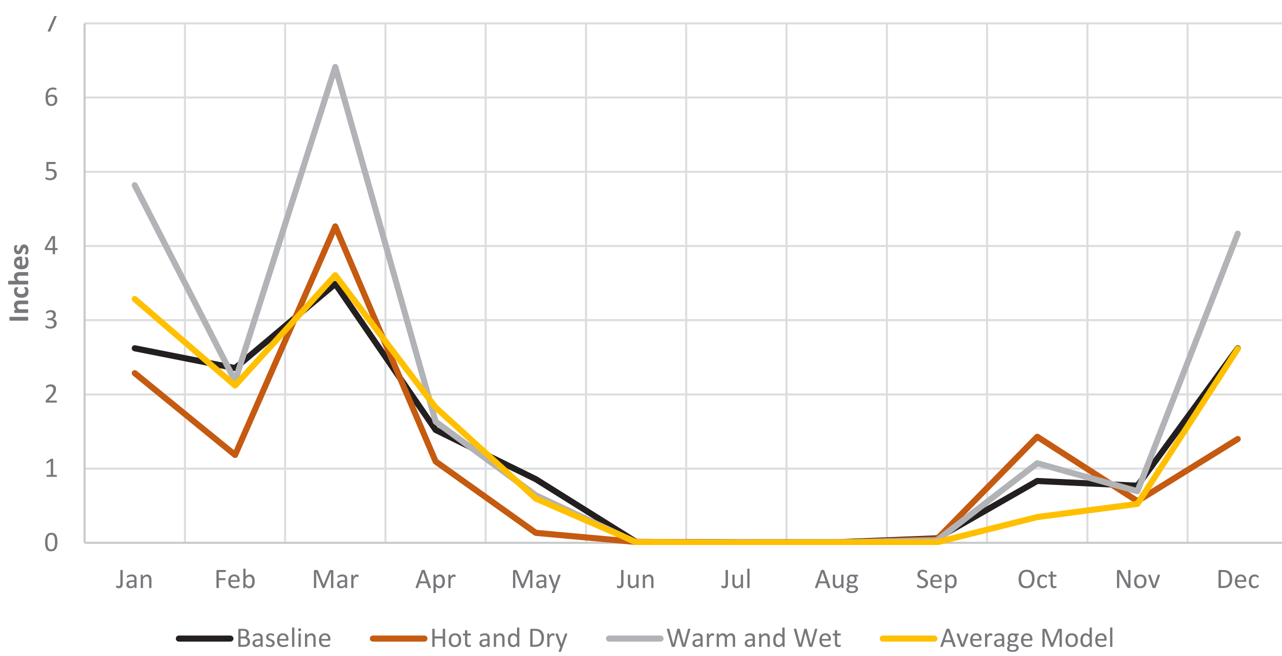
The CMIP5 dataset contains 34 GCMs of which three were selected to provide temperature and precipitation inputs into the demand forecast model to determine the range of uncertainty associated with future projections. The following models were selected as three models representative of potential future climate scenarios in the City:

- Hot and Dry – Micro-ESM-Chem.1 for an RCP of 8.5, model developed by the Japan Agency for Marine Earth Science and Technology, Atmosphere and Ocean Research at the University of Tokyo, and the National Institute for Environmental Studies;
- Warm and Wet – GISS-E2.R.1 for an RCP of 4.5, model developed by the NASA Goddard Institute for Space Studies; and
- Average (or central tendency of all 34 models and RCP variations) – IPSL-CM5B-LR.1 for an RCP of 4.5, model developed by the Institute Pierre Simon Laplace.

The hot and dry and warm and wet models represent high and low forecasts and are used to determine corresponding ranges of effects the City's demands. The average model represents the central tendency of all 34 GCMs to provide an approximate average forecast.

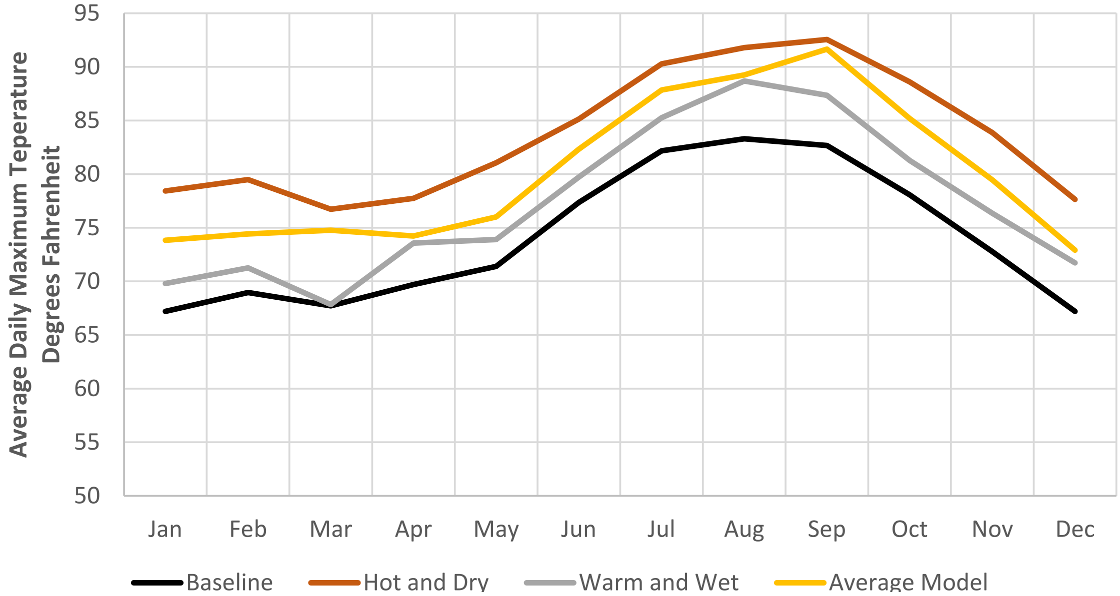
A comparison of average monthly precipitation projected for the three models for the period 2030 to 2050 and the historical long-term average baseline of 1950 to 1999 are provided in Exhibit 12B. Average annual precipitation for the warm and wet model is projected to increase by approximately 6.5 inches over the baseline period. In contrast, precipitation for the hot and dry model is expected to decrease by approximately 2.7 inches in relation to the baseline period. The average model projects annual precipitation will remain relatively unchanged in comparison to the baseline period. Overall, there is a 9.2 inch differential between hot and dry and wet and warm models. The changes in rainfall correspond to the rainy season illustrated by the baseline with little or no rain expected to occur during the dry season.

Exhibit 12B
Climate Change Impacts to Monthly Precipitation for GCM Models 2030 – 2050 vs. Baseline 1950-1999



A comparison of the City's average daily maximum temperature for the three models for the period 2030 to 2050 and historical long-term average of 1950 to 1999 is provided in Exhibit 12C. The average daily maximum temperature for the hot and dry model is projected to increase over the baseline ranging from 7.77 to 11.234 °F, depending on the month. The greatest increase is projected for January and the lowest increase for June. The warm and wet model has an increased range of 0.12 to 5.39 °F over the baseline. Even the average model shows an increase ranging between 4.53 and 8.99 °F.

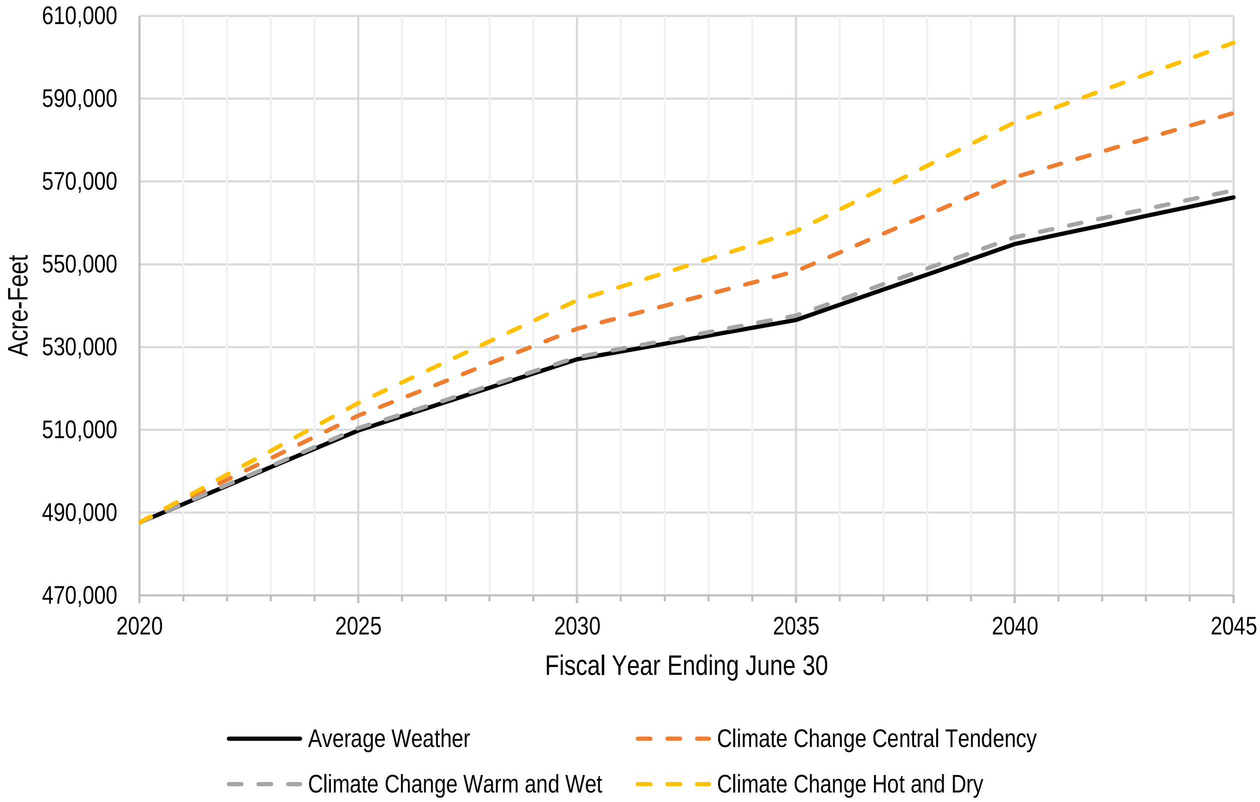
Exhibit 12C
Climate Change Impacts to Local Average Daily Maximum Temperature 2030 – 2050 vs. Baseline 1950-1999



The impact of these climate effects will likely impact projected water demands. Exhibit 12D illustrates projected demands through 2045 under the current forecast (baseline) and the application of the three selected GCM models. Demands are shown with passive conservation for average weather without climate change, hot and dry climate change, warm and wet climate change, and the most representative central tendency of all 34 GCMs. Impacts vary by the GCM. In general, the three climate change scenarios will result in an increase in demands over the current baseline forecast. The greatest increase in demands over the baseline in 2045 with passive conservation is associated with the hot and dry scenario, resulting in an increase in demands of 37,400 acre feet per year (AFY) (7 percent increase), followed by the central tendency scenario at 20,400 AFY (4 percent increase), and the warm and wet scenario at 1,700 AFY (less than 1 percent increase).

Lake Crowley, California

Exhibit 12D[1]
Baseline and Climate Change Demand Scenarios with Additional Conservation



[1]Exhibit 12D was generated using the Demand Forecast Model

Additionally, in partnership with the Bureau of Reclamation and local agencies, the Los Angeles County Flood Control District (LACFCD) completed the Los Angeles Basin Study (LA Basin Study) in 2016. The study evaluates the capacity of existing LACFCD flood control dams, reservoirs, spreading grounds, and other interrelated facilities that help store excess stormwater, recharge groundwater basins, and augment local supply. The LACFCD works in partnership with LADWP on stormwater capture projects like these which help to accommodate projected future climate and population changes in the Los Angeles Basin. (see Chapter 6, *Watershed Management*). As part of the LA Basin Study, climate-adjusted precipitation and evaporation inputs were developed for use in its Watershed Management Modeling System (WMMS). Three sets of downscaled climate change projections from the World Climate Research Programme's Coupled Model Intercomparison Project Phase 3 (CMIP3) and CMIP5 were selected and used in WMMS to model stormwater runoff, recharge, and peak flood flows. In general, it was found that there would be little to no change in annual average precipitation for the region and this was also reflected in the stormwater runoff projections. The climate projections and hydrologic modeling results were then used to analyze the response of the existing facilities and to assess the potential for changes in stormwater capture. It was found that there is a wide range of overall efficiency and resiliency within the existing system and that certain facilities are more readily adaptable to future changes than others, e.g. could maintain or improve the efficiency under future climate. Next, a large number of potential concepts were developed and modeled to determine which could provide the largest future stormwater conservation benefit. Finally, the project concepts were evaluated in a trade-off analysis to identify which could benefit the region the most, taking into consideration water conservation benefits and environmental, social, and economic measures. For the future opportunities highlighted in the LA Basin Study, implementing widespread, low-impact development, enhancing or constructing new centralized facilities, and improving policies could boost the region's existing stormwater capture potential. These concepts can help the region adapt to the effects of climate change and improve the overall resiliency of the local water supply portfolio.

12.1.2 Los Angeles Aqueduct Impacts

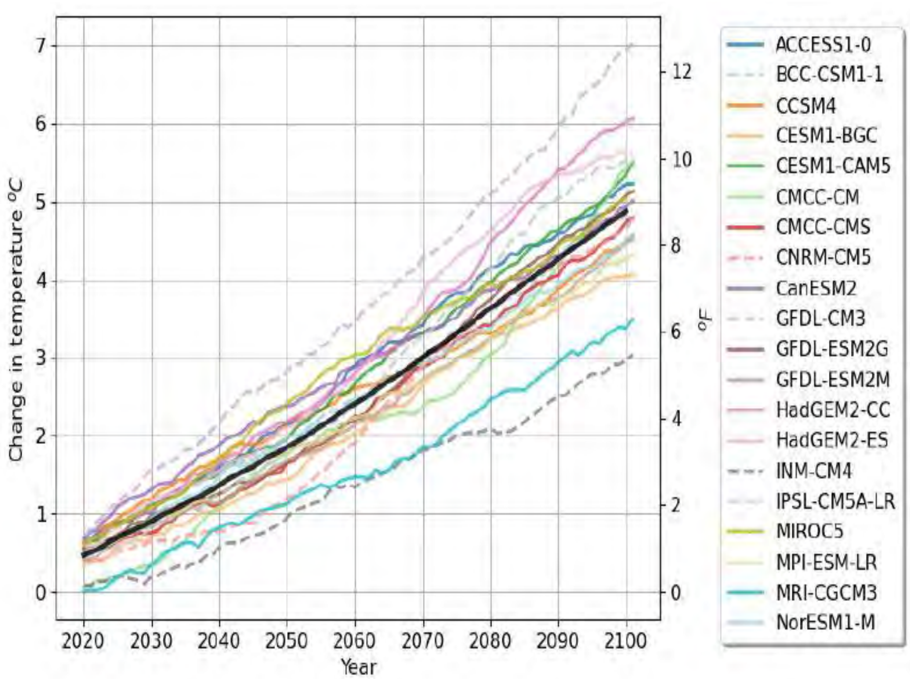
The LAA has experienced recent extreme hydrologic variability through an extended near historic dry period from 2012 to 2016 and subsequent extreme wet year that followed in 2017. While extreme hydrologic variability is naturally present and historically observed in the Eastern Sierra Nevada, impacts to supplies from the LAA from these climate risks will likely continue to potentially increase in frequency and duration of extreme events. LADWP continues to proactively monitor the latest research on climate risks to the Eastern Sierra Nevada and is developing mitigation strategies in its long term planning efforts.

LADWP has conducted several studies in recent years to further evaluate potential climate impacts in the Eastern Sierra Nevada watershed and deliveries from the LAA system. In 2011, LADWP completed a climate study (2011 Climate Study) that utilized a set of 16 GCMs and two GHG emission scenarios to model climate impacts in the Eastern Sierra Nevada region through the end of the 21st century. 2011 Climate Study results suggested an expected increase in temperature of 8 °F, reduction in precipitation of 10 percent, and reduction of snowpack. The resulting climate risks from these projected changes in temperature and precipitation include reduced snowpack volume, shifts in snowmelt timing, increased ratios of precipitation as rain to snow, alterations to evapotranspiration patterns, and ultimately, an estimated 0.1652 percent reduction in annual runoff per year.

In 2020, LADWP worked with the University of California, Los Angeles to complete a Climate Study Update (2020 Climate Study) to analyze potential changes since the 2011 Climate Study was completed by implementing advances in global climate modeling that have been achieved since 2011. The 2020 Climate Study utilized a set of 20 CMIP5 GCMs under the current GHG emission scenario, RCP 8.5, which represents no reduction to emissions levels associated with current energy sources. Results of the 2020 Climate Study show steady temperature increases throughout the remainder of the 21st century and are similar to the 2011 Climate Study. Exhibit 12E shows the temperature results of the 20 GCMs throughout the simulation period. The average projected temperature among the GCMs suggest an expected temperature increase of 9 °F at the end of the 21st century from the average historical baseline period of 1980 to 2005.

Of the 20 GCMS, five GCMs that were able to represent

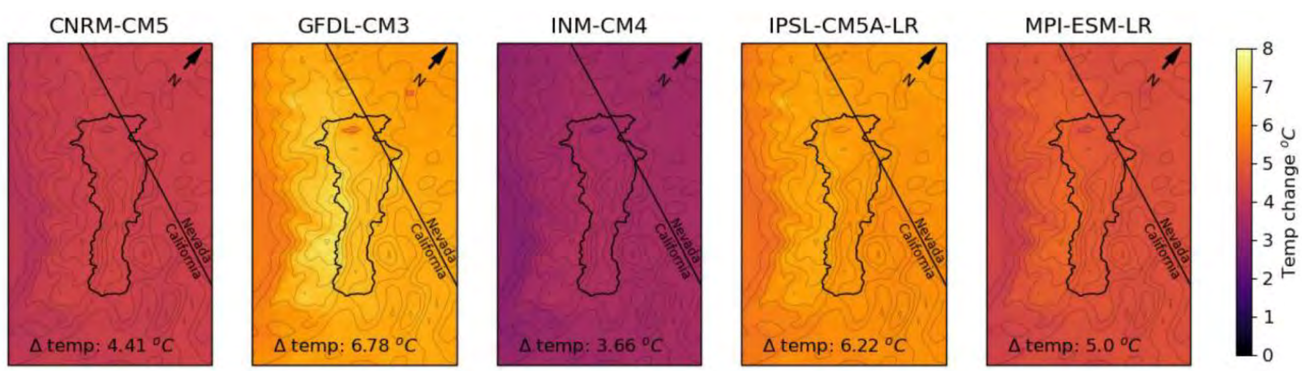
Exhibit 12E
30-Year Running Mean of the Change in Average Annual Daily Maximum Temperature in the Eastern Sierra Watershed under RCP 8.5



the extremes of modeled changes were selected to be dynamically downscaled in order to produce a range of localized information about the Eastern Sierra watershed. Exhibit 12F shows the temperature results of the five dynamically downscaled GCMs. The dynamically downscaled results show a uniform range of temperature increase that range from 3.66 °C to 6.78 °C (6.6 °F to 12.2 °F) by the end of the 21st century, in contrast to the larger range of temperatures shown in Exhibit 12E.

Projected precipitation results from the 2020 Climate

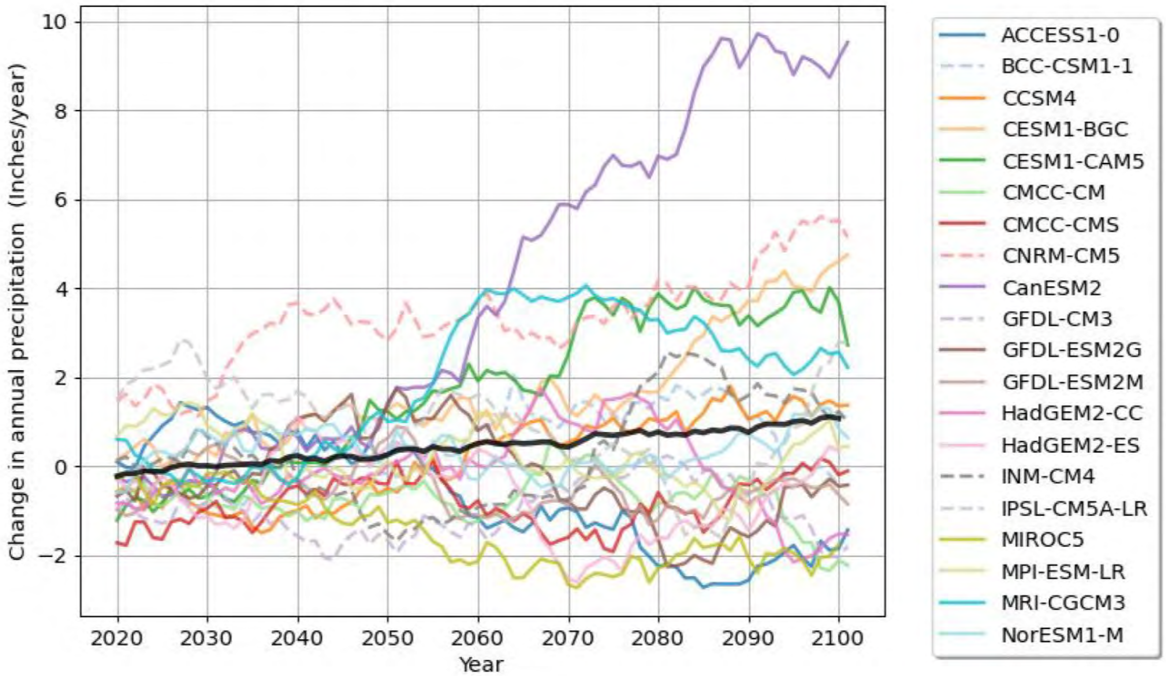
Exhibit 12F
Change in Average Temperature Over the Eastern Sierra at the End of the Century (2091-2100) Under RCP 8.5



Study, shown in Exhibit 12G for the 20 GCMs, differ widely under the same simulation period and GHG emission scenario. The precipitation pattern begins to differ dramatically around mid-century as half of the GCMs project increases in precipitation and the remaining half project decreases. The overall average over the 80-year period indicates little change to precipitation.

A closer look at the same dynamically downscaled

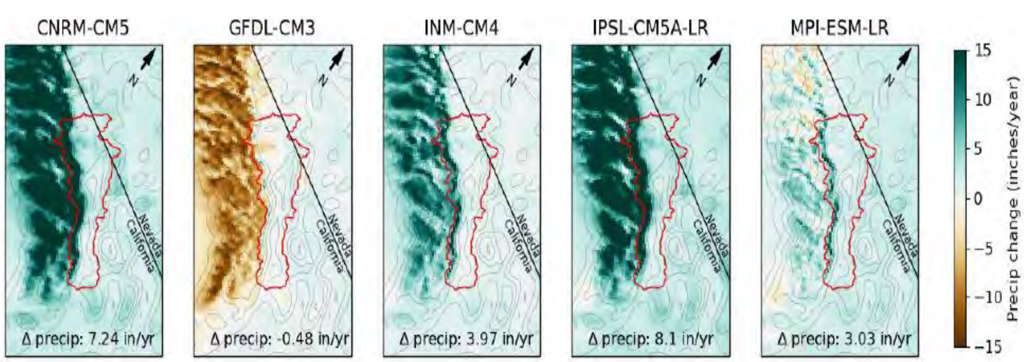
Exhibit 12G
30-Year Running Mean of Average Annual Precipitation in the Eastern Sierra Watershed Under RCP 8.5, Relative to Historical Baseline (1980-2005)



GCMs shown above in Exhibit 12F shows that the modeled average annual precipitation increases slightly when compared to the historical baseline (Exhibit 12H). Although the modeled changes in precipitation are not as dramatic as temperature changes, potential climate risks include less frequent but more intense storm events and longer dry periods. It should be noted that the 2020 Climate Study only considered the highest GHG emission scenario (RCP 8.5) which provides a conservative estimate of potential climate impacts to the Eastern Sierra Nevada. Overall, the 2020 Climate Study was able to reaffirm many of the findings of the 2011 Climate Study. In summary, by the end of the 21st century, these findings indicate temperature increase, snowpack reduction and shift in peak runoff to earlier in the spring.

Results from the 2020 Climate Study provide inputs to the hydrologic runoff models to estimate changes in deliveries into the LAA system. The projected runoff findings help better inform operational decisions and assist in developing strategies for improved management of supplies along the LAA system.

Exhibit 12H
Change in Average Annual Precipitation Between the Historical Period (1980-2005) and End of Century (2091-2100) Under RCP 8.5.



LADWP operates its local groundwater resources conjunctively by reducing groundwater pumping and diverting LAA water into local spreading grounds during normal and wet years. This strategy allows for replenishment to the local groundwater basins during wet and normal periods and prevents conditions of severe overdraft when groundwater pumping is increased during dry periods to meet consumptive demands. LADWP is also exploring opportunities to further enhance conjunctive use capabilities to better help improve LADWP's management and response to climate risks during more intense wet periods and prolonged dry periods.

12.1.3 MWD Imported Water Supply Impacts

The City receives purchased imported water supplies from the Sacramento-San Joaquin Delta, through the SWP, and from the Colorado River, through the CRA, from MWD. These water supplies are subjected to hydrologic variability and may affect its delivery to the City. Please refer to MWD's 2020 Urban Water Management Plan (UWMP) update for additional information on SWP and CRA water supplies.

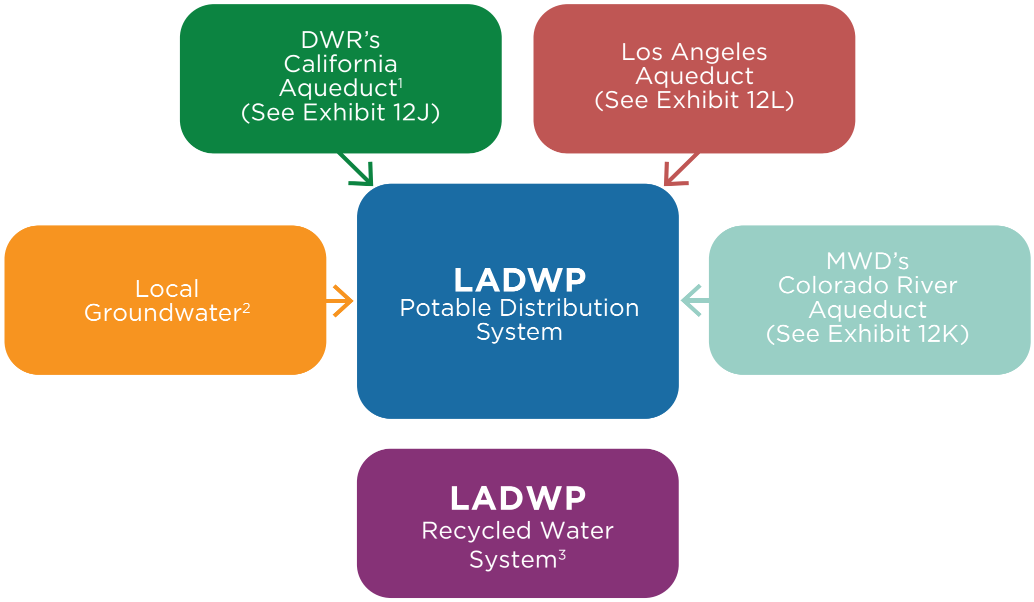
12.2 Water and Energy Nexus

A new California Water Code (CWC) requirement for the 2020 UWMP is to include any readily obtainable information or an estimate of the amount of energy used to process water supplies, such as energy used to extract, divert, convey, treat, store, and distribute water. Energy intensity reporting can be beneficial for water utilities because it not only compares various water supplies' associated energy and GHG emissions, it also identifies the energy savings and GHG reduction opportunities from water conservation programs. This, in turn, provides potential funding opportunities for these programs.

To comply with CWC Section 10631.2(a), and to identify opportunities mentioned above, LADWP has been studying the nexus between water and energy consumption and evaluating the associated carbon footprint of its water system. The most energy intensive source of water for LADWP is water purchased from MWD, which imports SWP supplies via the California Aqueduct and Colorado River supplies via the CRA. LADWP also supplies water via the LAA, which is a net producer of energy. The next most energy intensive sources are local sources of water for LADWP, which include groundwater and recycled water. Exhibit 12I outlines LADWP's water supply sources as well as the water system facilities that either consume or generate energy to extract, convey, and treat water for distribution throughout LADWP's service area. In the following sections, further information and values are provided and discussed for energy intensity or energy generation rate for each of LADWP's water supplies. The energy intensity or generation rates have been computed by dividing the total energy consumed or generated, by the total water conveyed or processed by that source. Both values are expressed in kilowatt hours per acre foot (kWh/AF).


Los Angeles Aqueduct Cascades

Exhibit 12I
Sources and Facilities of LADWP's Water Supply Portfolio



1. Source: Wilkinson, Robert, Ph.D. *Methodology for Analysis of the Energy Intensity of California's Water Systems, and an Assessment of Multiple Potential Benefits Through Integrated Water-Energy Efficiency Measures*, University of California, Santa Barbara, 2000, p. 27

2. See Chapter 5, *Local Groundwater* for the Local Groundwater map.

3. See Chapter 7, *Recycled Water* for the Recycled Water map.

12.2.1 MWD Imported Water Supplies

LADWP's purchases of imported supplies from MWD come from hundreds of miles away from the San Francisco Bay and Sacramento-San Joaquin River Delta (Bay-Delta) in Northern California, through the State Water Project, and Colorado River, through the CRA. Because of the conveyance path, a considerable amount of energy is required to convey the SWP and CRA supplies to LADWP.

SWP supplies originate from Northern California and the Delta and is conveyed along the 443-mile long California Aqueduct to Southern California. The SWP system is owned and operated by the California Department of Water Resources (DWR) and consists of pump stations that lift the water along its path to provide water to the City. Exhibit 12J shows the SWP facilities, including the 443-mile-long aqueduct that carries water from the Delta through the San Joaquin Valley to Southern California. At the Tehachapi Mountains, sizeable pumps lift the water from the California Aqueduct approximately 2,000 feet over the mountains and into southern California. The water MWD supplies from the SWP is the most energy intensive source of water available to LADWP when excluding embedded energy from hydropower generation. However, DWR operates the SWP and plans to reduce the SWP's energy and GHG emissions, which are identified in the DWR's Climate Action Plan Phase 1, Greenhouse Gas Emissions Reduction Plan Update 2020, found at https://water.ca.gov/Programs/All-Programs/Climate-Change-Program/Climate-Action-Plan.

Although a large amount of electricity is required to pump water along the SWP, it also includes hydroelectric plants that offset the conveyance energy. One of the plants is the Castaic Power Plant. This hydroelectric powerplant was developed in 1966 when DWR and LADWP entered into a contract for joint development of the West Branch of the California Aqueduct. The Castaic Power Plant is owned and operated by LADWP and provides energy storage in the form of water pumped and stored in Pyramid Lake Reservoir on the West Branch of the California Aqueduct. It has energy storage and generation capacity of 1,265 megawatt (MW). This power plant contributes to LADWP's total hydropower generation and is a vital component of LADWP's energy source to help meet the state's renewable energy targets.

Exhibit 12J
State Water Project Facility Elevations

Source: *California's Water-Energy Nexus: Pathways to Implementation*, written by GEI Consultants, Inc. on behalf of the Water-Energy Team of the Governor's Climate Action Team (September 12, 2012), Figure 2 on page 15

Colorado River supply is conveyed to the City through the CRA, which is owned and operated by MWD. The 242-mile-long CRA system begins at the Whitsett Intake Pumping Plant at Lake Havasu. Five pumping plants then lift the water to Hinds Pumping Plant, which then flows 116 miles by gravity and terminates in MWD's service area at Lake Mathews in Riverside County as shown in Exhibit 12K. CRA water is the second most energy intensive water source for the City, after the SWP when excluding embedded energy from hydropower generation. The energy source for the CRA conveyance is a combination of hydropower from Hoover Dam and Parker Dam along with wholesale energy supplies. MWD has plans to improve the CRA's energy efficiency. Additional details on improvements to the CRA can be found in MWD's Energy Sustainability Plan and Climate Action Plan.

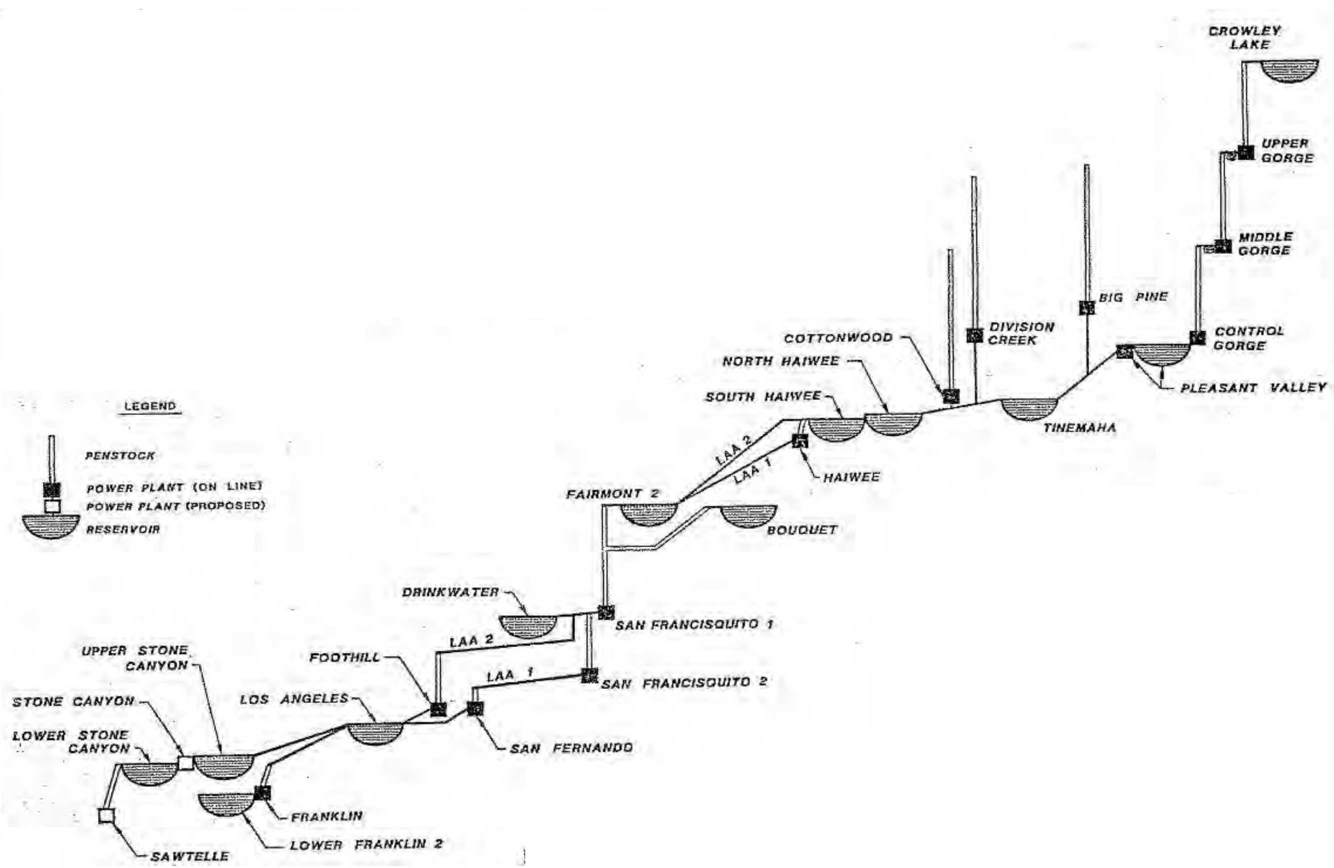
Exhibit 12K
MWD CRA Pumping Plants

Source: Metropolitan Water District of Southern California's Board of Directors Engineering and Operations Committee Board Action, June 11, 2013, Attachment 3

12.2.2 Los Angeles Aqueduct Supplies

The LAA is a gravity-fed water conveyance system that provides water from the Eastern Sierra Nevada watersheds. It also produces hydropower for the City, making it the most desirable source of water in terms of energy intensity. There are 12 power generation facilities along the LAA system (upstream of the Los Angeles Aqueduct Filtration Plant) as shown in Exhibit 12L. On average, from fiscal year ending (FYE) 2016 to 2020, the total unit energy generated by water flows through the hydroelectric generation plants was approximately 3,945 kWh/AF. The amount of hydroelectric generation varies annually and is dependent on the amount of water flowing through the power plants, environmental considerations, and planned power plant outages. The energy generated along the LAA is not included in LADWP's total energy intensity of its water system because the energy generated along the LAA is not directly used in providing the City's other sources of water supply. However, the LAA water does offset the more energy intensive sources of water, reducing the overall energy intensity of LADWP's water supplies.

Exhibit 12L
LADWP's LAA Powerplant Schematic



12.2.3 Local Groundwater Supplies

Groundwater accounts for approximately eight percent of LADWP's water supply from FYE 2016 to FYE 2020. The energy required for groundwater production consists of groundwater well extraction, treatment, and/or blending with other treated water supplies. The average groundwater energy intensity from FYE 2016 to FYE 2020 was approximately 604 kWh/AF. The groundwater energy intensity is expected to increase following the completion of the San Fernando Basin Groundwater Remediation facilities. However, future groundwater energy intensity is expected to remain lower than the energy intensity of imported water supplies from MWD.

12.2.4 Recycled Water Supplies

Recycled water is currently the smallest component of LADWP's water supply portfolio, with municipal and industrial uses accounting for approximately two percent of total supplies from FYE 2016 to FYE 2020. Currently, LADWP receives recycled water directly from three wastewater treatment plants operated by the City of Los Angeles Department of Public Works, Bureau of Sanitation and Environment (LASAN), two of which provide recycled water treated to a tertiary level: Los Angeles - Glendale Water Reclamation Plant (LAGWRP) and Donald C. Tillman Water Reclamation Plant (DCTWRP). Terminal Island Water Reclamation Plant (TIWRP) performs advanced treatment of recycled water in addition to tertiary treatment. LADWP receives a small portion of tertiary treated recycled water directly from the West Basin Municipal Water District (WBMWD), which takes secondary treated wastewater from LASAN's Hyperion Water Reclamation Plant (HWRP) in El Segundo and provides additional treatment of wastewater. LADWP also receives recycled water from the City of Burbank's Water Reclamation Plant to directly supply LADWP's customers adjacent to the Valley service area. Additional information about LADWP's recycled water sources can be found in Chapter 7, *Recycled Water*.

The average weighted FYE 2016 to FYE 2020 energy intensity associated with all the recycled water facilities is approximately 2,010 kWh/AF, accounting for energy to treat wastewater to tertiary and advanced levels and pump the recycled water to customers. The recycled water treatment plants are operated by West Basin Municipal Water District, Burbank Water and Power, Glendale Water and Power, and LASAN. Recycled water energy intensity is dependent on several factors including wastewater treatment, the amount of recycled water being pumped to a higher elevation, amount of advanced treated recycled water being used, extension of recycled water distribution system resulting in additional head loss, and pump efficiencies.

12.2.5 Treatment Energy for LAA and MWD Water Supplies

Another factor in determining the energy intensity of LADWP's water supply is the energy required to treat water for potable purposes. All LAA water and nearly all SWP West Branch water supplies purchased by LADWP are treated at Los Angeles Aqueduct Filtration Plant (LAAFP). A small percentage (approximately five percent) of SWP West Branch water purchased by LADWP is treated by MWD at their Jensen Treatment Plant located in Sylmar, adjacent to LAAFP. For LAAFP, the treatment energy intensity has averaged approximately 39 kWh/AF, from FYE 2016 to FYE 2020. The treatment energy intensity also includes the treatment energy used at the Dr. Pankaj Parekh Ultraviolet (UV) Disinfection Facility. In 2016, the facility went online to disinfect potable water leaving LAAFP to minimize potentially harmful disinfection by-products in compliance with new water quality regulations. The UV treatment process has increased the over-all energy intensity of water treated at LAAFP by approximately 7 kWh/AF.

The treatment energy from purchased treated imported MWD water supplies comes primarily from the East Branch of the SWP and CRA. MWD treats water supplied to LADWP at both MWD's Weymouth Treatment Plant in the San Gabriel Valley, and MWD's Diemer Treatment Plant in Orange County. Weymouth Treatment Plant supplies water to the East Los Angeles community, and Diemer Treatment Plant supplies water to the Harbor community.

12.2.6 Distribution Energy

LADWP's potable water distribution infrastructure is comprised of 85 pump stations, 115 tanks and reservoirs, 329 regulator and relief stations, and 7,340 miles of distribution mains and trunk lines. With major sources of LADWP's water entering the service area at higher elevations than most other parts of the City, the distribution system benefits from the topography of its service area in that much of the hydraulic head required for water distribution is provided by gravity. Distribution energy intensity is influenced by various factors including amount of water being pumped to a higher elevation, head loss in the pipe network, source water elevation, and pump efficiencies. FYE 2016 to FYE 2020 average energy intensity for LADWP's water distribution system is approximately 166 kWh/AF.

LADWP continuously explores means to improve energy efficiency throughout the water distribution system. First, LADWP replaces or upgrades selected aging motors with premium efficiency motors. Second, LADWP has installed and is in the process of evaluating the installation of a variable frequency drive in existing pump stations to increase the energy efficiency. Lastly, in an effort to increase the water distribution system's energy efficiency, LADWP has been participating in the Demand Response (DR) program since 2016. The DR program's objective is to reduce and/or shift electricity usage during peak energy demand periods. One of the ways LADWP achieves this is by reducing the water pumps' operating time during the peak energy demand periods. This energy efficient approach to operate the water pump stations helps to keep the Power System's peak energy demand lower on hot summer days in order to prevent power outages.

12.2.7 Carbon Footprint

All of LADWP's water supply sources have an associated carbon footprint related to the energy sources supporting conveyance, treatment and distribution systems required to pump and/or process the water. The carbon intensity factor depends on the energy source of each water supply. For water supplies that use energy not generated by LADWP, the calendar years (CYs) 2016 and 2018 Emissions & Generation Resource Integrated Database (eGRID) carbon intensity factors from the CAMX (California/Mexico) sub-region designated by the Western Electricity Coordinating Council, 527.9 and 496.5 lbs. CO2/MWh, respectively, were used to estimate the amount of carbon emissions produced per AF of water. For water supplies that use energy generated by LADWP, available LADWP Power System CO_2 intensity factors from CYs 2017 and 2018 were used to estimate the carbon emissions released in the production of this water. LAA is a net producer of energy and produces only green hydro-electric energy. No carbon emissions are associated with water imported through the LAA.

12.2.8 LADWP Water System Energy Intensity

Exhibit 12M shows the volume for all water supplies supplied by LADWP for FYE 2018, as well as the energy intensity, total energy, and associated carbon emissions. Data from FYE 2018 was selected because it is the most recent complete data set that most closely represents average water supply conditions. The "All Water Supplies" column includes energy and carbon emissions associated with all water supplies delivered by LADWP, including embedded energy related to water purchased from MWD. The "Excluding Embedded Energy" column only includes energy and carbon emissions associated with potable water directly produced by LADWP and recycled water produced by LASAN. This column also includes the energy LADWP uses to treat raw SWP West Branch water at LAAFP. A summary of each water supply's energy intensity is represented in Exhibit 12N.

Exhibit 12M
LADWP Water Energy Intensity and Carbon Footprint for FYE 2018*

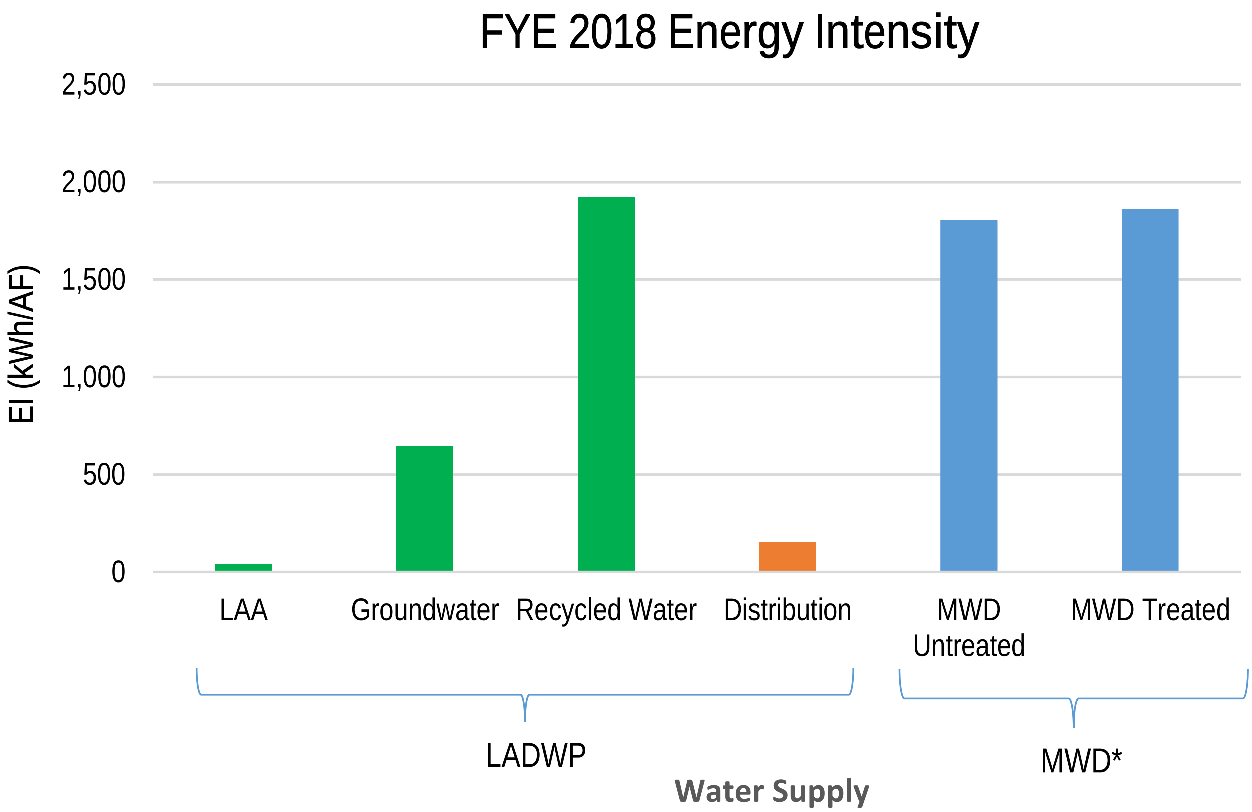
					All Water Supplies	Excluding Embedded Energy
Water Supplies	Local	LADWP	**Recycled Water**	Volume (AF)[1]	9,778	9,778
				EI (kWh/AF)[2]	1,925	1,925
				Energy (MWh)	18,827	18,827
				Carbon Footprint (tons CO_2)[3]	7,160	7,160
			Local Groundwater	Volume (AF)	21,760	21,760
				EI (kWh/AF)	645	645
				Energy (MWh)	14,042	14,042
				Carbon Footprint (tons CO_2)[3]	5,340	5,340
	Imported		**Los Angeles Aqueduct**	Volume (AF)	307,671	307,671
				Conveyance EI (kWh/AF)	0	0
				Treatment EI (kWh/AF)[4]	39	39
				Energy (MWh)	11,959	11,959
				Carbon Footprint (tons CO_2)[3]	4,548	4,548
		MWD	**MWD Untreated: SWP West Branch**	Volume (AF)	102,256	102,256
				MWD Untreated EI (kWh/AF)[5]	1,806	
				Treatment at LAAFP EI (kWh/AF)[6]	39	39
				Energy (MWh)	188,649	3,975
				Carbon Footprint (tons CO_2)[3,7]	48,805	1,510
			MWD Treated: SWP West Branch, SWP East Branch, CRA	Volume (AF)	80,450	80,450
				MWD Treated EI (kWh/AF)[8]	1,863	
				Energy (MWh)	149,878	
				Carbon Footprint (tons CO_2)[7]	38,384	
Potable Water Distribution				Volume (AF)	512,338	512,338
				EI (kWh/AF)	152	152
				Energy (MWh)	77,814	77,814
				Carbon Footprint (tons CO_2)[3]	29,593	29,593
				Spread, Spill and Storage Change (AF)[9]	-200	-200
				Total Water Volume Delivered (AF)	522,115	522,115
				Total Estimated Energy Intensity (kWh/AF)	883	243
				Total Energy (MWh)	461,168	126,616
				Total Carbon Footprint (tons CO_2)	133,829	48,150
				Total Carbon Intensity (tons CO_2/AF)	0.26	0.09

*Energy intensity values shown may differ from values presented in Sections 12.2.2-12.2.6 due to differing time periods and adjustments for hydrogeneration

1. Recycled water volume is based on use for municipal and industrial uses, not on all beneficial uses.
2. Recycled water energy intensity is a weighted average of energy used for treating wastewater and pumping recycled water to customers.
3. Historical LADWP power generation CO_2 emission factors were applied to energy used at City's water facilities.
4. Los Angeles Aqueduct supplies are treated at Los Angeles Aqueduct Filtration Plant.
5. MWD untreated water energy intensity is the 2013-2018 average including MWD conveyance and distribution energy intensities from the 2020 UWMP. Values presented accounts for additional hydropower generation that is not included in calculations for other supplies.
6. Untreated State Water Project supplies purchased from MWD are treated at Los Angeles Aqueduct Filtration Plant.
7. eGRID 2016 and 2018 CAMX (California/Mexico) values were applied to embedded energy for upstream water supplies.
8. MWD treated water energy intensity is the 2013-2018 average including MWD conveyance, treatment, and distribution energy intensities. MWD Treated water from SWP West Branch is treated at Jensen Treatment Plant, owned and operated by MWD. SWP East Branch and CRA supplies are treated at Weymouth and Diemer Filtration Plants, owned and operated by MWD. Values presented accounts for additional hydropower generation that is not included in calculations for other supplies.
9. The Spread, Spill, and Storage category is not included in energy intensity or total energy calculations. Negative values indicate net volumes of potable water taken out of storage within City or otherwise added to the Total Potable Water Volume Delivered.

AF= acre feet, CRA = Colorado River Aqueduct, EI = energy intensity, kWh = kilowatt hour, MWD = Metropolitan Water District of Southern California, MWh = megawatt hour, SWP = State Water Project

Exhibit 12N
LADWP's Water System Energy Intensity by Source for FYE 2018



*Includes embedded energy from hydropower generation.