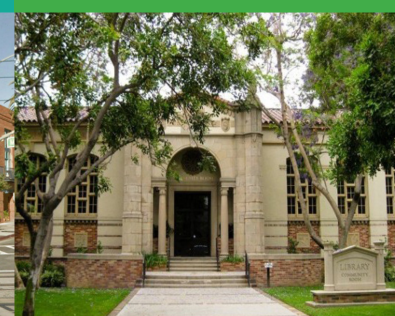
CITY OF

SOUTH PASADENA



ONE WATER 2050 PLAN

DRAFT REPORT | NOVEMBER 2021

City of South Pasadena

ONE WATER 2050 PLAN

FINAL DRAFT | November 2021

This document is released for the purpose of information exchange review and planning only under the authority of
Inge Wiersema,
November 30, 2021
California C-66123.

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Abbreviations

$/af	dollar per acre-foot
1,2,3 TCP	1,2,3-trichloropropane
AACE	Advancement of Cost Engineering
AB	Assembly Bill
ADD	average day demand
ADWF	average dry weather flow
af	acre-feet
afy	acre-feet per year
AWWA	American Water Works Association
BMPs	best management practices
Carollo	Carollo Engineers
CBC	California Building Standard Code
CC	concrete cylindrical pipe
CEQA	California Environmental Quality Act
CECs	contaminants of emergency concern
Central Basin MWD	Central Basin Municipal Water District
CIP	Capital Improvements Plan
CIMIS	California Irrigation Management Information System
CIPP	Cured-in-place pipe
City	City of South Pasadena
CI	cast Iron
ClO4	perchlorate
CRA	Colorado River Aqueduct
d/DSS	flow depth-to-pipe diameter ratio
DDW	State Department of Drinking Water
DI	ductile iron
DIP	ductile iron pipe
DPR	direct potable reuse
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency
ETo	Evapotranspiration
ENR CCI	*Engineering News Record* Construction Cost Index
EWMP	Enhanced Watershed Management Plan
fps	feet per second
ft	feet
FY	fiscal year

GIS	geographical information system
gpcd	gallons per capita day
HDR	High Density Residential
in	inches
IPR	indirect potable reuse
LACSD	Los Angeles County Sanitation District
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles Glendale Water Reclamation Plant
LARWQCB	Los Angeles Regional Water Quality Control Board
LDR	Low Density Residential
LID	low impact development
LFD	low flow diversion
LRS	Load Reduction Strategy
Main Basin	Main San Gabriel Basin
MCL	maximum contaminant levels
MDD	maximum day demand
MDD+FF	maximum day demand plus fire flow
MDR	Medium Density Residential
mg/L	milligrams per liter
mgd	million gallons per day
mi	mile
MinDD	minimum day demand
MMD	maximum month demand
MS4	Municipal Separate Storm Sewer System
MWD	Metropolitan Water District of Southern California
NO3	nitrate
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
Pasadena	City of Pasadena
PCE	tetrachloroethylene
PDWF	peak dry weather flow
PF	peaking factor
PHD	peak hour demand
PO	Professional Office
PRV	Pressure Reducing Valve
PS	pump station

psi	pounds per square inch
PVC	polyvinyl chloride
PWP	Pasadena Water and Power
PWWF	peak wet weather flow
R&R	rehabilitation and replacement
RHNA	Regional Housing Needs Assessment
ROW	right-of-way
RWQCB	Regional Water Quality Control Board
SAT	soil aquifer stormdrain
SB	Senate Bill
SCAG	Southern California Association of Government
SCWP	Safe, Clean Water Program
SJCWRP	San Jose Creek Water Reclamation Plant
SPUSD	South Pasadena Unified School District
sq. ft.	square feet
SSMP	Sewer System Management Plan
SSOs	sanitary sewer overflows
STL	steel
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCE	trichloroethylene
TMDL	total maximum daily load
ULAR	Upper Los Angeles River
USGVMWD or Upper District	Upper San Gabriel Valley Municipal Water District
VCP	Vitrified Clay Pipe
VLDR	Very Low Density Residential
Watermaster	Main San Gabriel Basin Watermaster
WDR	Water Discharge Department
WNWRP	Whittier Narrows Water Reclamation Plant
WQBELs	Water Quality Based Effluent Limitations
WRP	water reclamation plant
WTP	water treatment plant

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Executive Summary

EXECUTIVE SUMMARY

ES.1 Introduction and Background

This One Water 2050 Plan is the City of South Pasadena (City's) first integrated master plan that takes a holistic look at the City's potable water, wastewater, stormwater, potential recycled water, and water resources system. The One Water 2050 Plan will provide strategic guidance and justification for system improvements for both capital projects and system operations of the City's potable water, wastewater, and stormwater systems, as well as the potential for a future recycled water system.

ES.1.1 Purpose and Objectives

The goal of this One Water 2050 Plan is to guide the City with making the right investments at the right time for its potable water distribution, wastewater collection, stormwater drainage systems, as well as the potential for using recycled water. To achieve this goal, a number of key objectives can be identified that define the major tasks of this Plan. These objectives are:

- Develop projections for the near-term (year 2025) and long-term (year 2050) potable water demands, wastewater flows, and potential recycled water demands.
- Define planning and evaluation criteria for the City's potable water, wastewater, and recycled water systems.
- Update the City's water, wastewater, and stormwater GIS to accurately reflect existing conditions, along with base maps for the City's use.
- Develop/Update hydraulic models for the City's potable water and wastewater collection systems to identify system deficiencies and size system improvement needs.
- Identify necessary recycled water system facilities to serve the City's potential recycled water customers.
- Describe stormwater management opportunities, both within City limits and regionally, to advance implementation of Enhanced Watershed Management Plan (EWMP) recommendations, meet MS4 regulations, and realize the potential regional project and funding opportunity from the Safe, Clean Water Program (SCWP).
- Prepare an integrated capital improvement plan (CIP) with phasing of recommended improvements for the City's water, wastewater, stormwater, and recycled water systems.

ES.2 Land Use and Population

Located just 6 miles northeast of downtown Los Angeles and directly south from the City, the 3.5 square mile City is now home to approximately 26,000 residents. The City's service area for the potable water and wastewater collection generally coincides with City boundary. The City's General Plan guides development within the City's planning boundary and establishes long-range development policies. Land use information is an integral component in determining the amount of future water use and wastewater generation within the City. The type of land use in an area will affect the volume and timing of water use as well as the volume, timing, and water quality characteristics of the wastewater generation.

Growth has recently slowed as the City is approaching build out conditions. The 2020 General Plan accommodates the addition of 589 new residential units over the next 20 years, primarily located in Downtown along Mission Street and Fair Oaks Avenue, the Ostrich Farm, and along Huntington Drive.

However, additional residential development may be required per the Regional Housing Needs Assessment (RHNA), a requirement of State housing law that determines projected housing needs for all jurisdictions in California and requires that each jurisdiction plan for its allocation of future housing. The State has allocated 1.3 million housing units to Southern California Association of Government (SCAG). SCAG has made a draft allocation of 2,062 housing units to South Pasadena for the period between 2021 and 2029. South Pasadena will plan for these additional housing units in its 2021 Housing Element Update. Demand projections were developed for both the General Plan growth of 589 new residential units and the RHNA requirement of 2,063 units.

Figure ES.1 shows the historical City population as well as the population projections for two different growth scenarios: one extrapolated from SCAG population projections and that includes the additional population served under the RHNA requirement. In the year 2050, the SCAG-based projection estimates a City population of 27,500 and the RHNA-based projection estimates a population of 32,400.

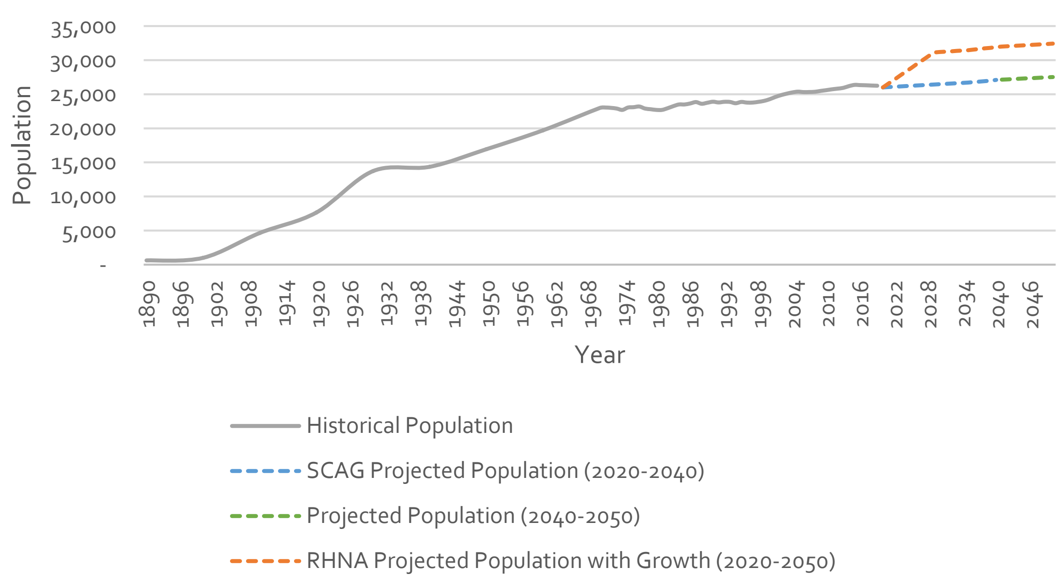

Figure ES.1 Historical and Projected City Population

ES.3 Water Demand and Wastewater Flow Forecasts

ES.3.1 Potable Water Demand

Water demand consists of water that leaves the distribution system through metered and unmetered connections (such as fire hydrants). The City's historical water use is summarized in acre-feet per year (afy) by billing classification in Table ES.1. Single-family residential demands account for the majority (56 percent) of the City's demands. Together with multi-family residential demands (31 percent), the residential water use comprises of 87 percent of the City's total water demand. In addition to the water uses shown in Table ES.1, approximately 8 percent of the total water supplied is lost as unaccounted-for water, which is within the generally accepted range of water loss for a well-operated system.

Table ES.1 Historical Annual Consumption by Customer Class

Customer Class	Percent of Total[(1)]	Demand (afy) [(2)]
Single Family Residential	56%	1,805
Multi-Family Residential	31%	1,036
Commercial	10%	377
Government	3%	73
Irrigation/Landscape	<1%	6
Private Fire/Hydrant	<1%	2
Total	**-**	**3,299**

Notes:
(1) Customer class percentage is an average of two time periods: fiscal year 2015/2016 and calendar year 2019.
(2) Demand by customer class has applied the customer class average percentage to average total demand from 2014 to 2019 to find average demand by customer class.

Both population-based and land-use based methods were used to forecast water demand through 2050. Population-based demand forecasting utilizes a calculated per-capita water use and population projections. Land-use-based demand forecasting is based on water use by customer class and build-out plans for residential, commercial, and other demands. Since there are two possible growth scenarios for the City, one from the General Plan and one that incorporates RHNA requirements, both demand projection methodologies were considered for both scenarios. Additionally, the impacts of conservation were considered for all demand projections.

For the purposes of this Plan, the General Plan and RHNA growth scenarios that use land use-based demand projections including conservation are recommended as a basis for future system analysis and sizing of recommendations. These projections incorporate the expected growth in commercial demand, as described in the City's General Plan, and also includes mandatory, state-wide conservation measures for indoor residential water use. These projections are shown in Table ES.2 and Figure ES.2 and form the foundation of the future water demand scenarios that were modeled as part of the One Water 2050 Plan.

Table ES.2 Recommended Demand Forecasts

Year	General Plan Forecast	RHNA Forecast
Existing(1)	3,590	3,590
2020	3,566	3,550
2025	3,498	3,743
2030	3,413	3,894
2035	3,481	3,961
2040	**3,549**	**4,028**
2045	3,617	4,095
2050	**3,685**	**4,163**

Note:
(1) 2014-2018 Average.

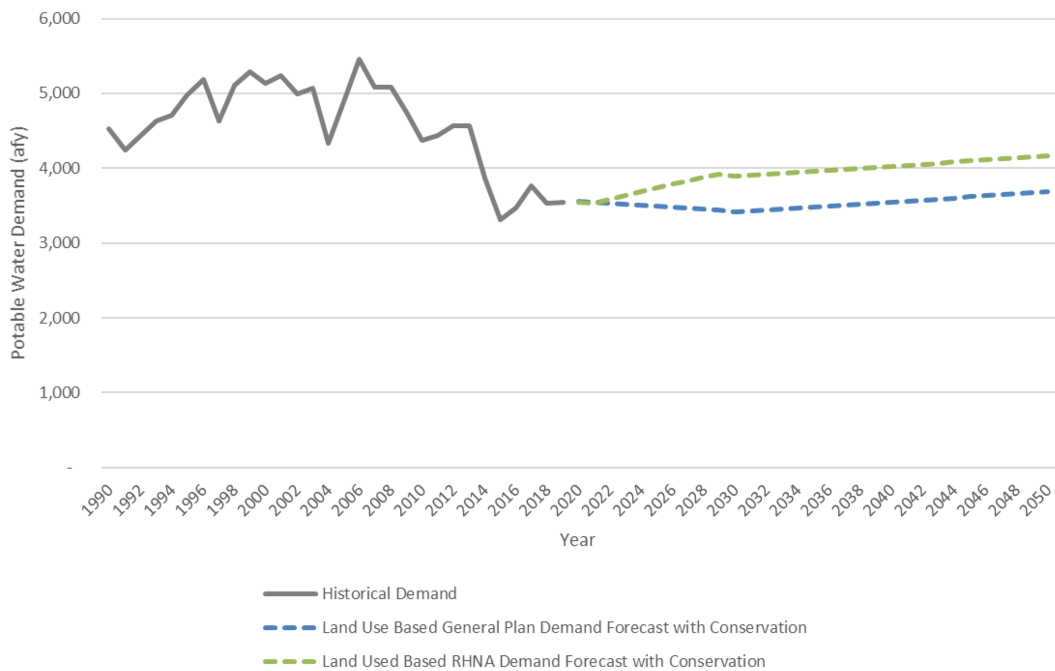

Figure ES.2 Recommended Demand Forecasts

Peaking Factors (PF) are typically used to determine the water demands for conditions other than average day demand (ADD) conditions. PFs account for fluctuations in demands on a seasonal or hourly basis. For example, during hot summer days, water use is typically higher than on a colder winter day due to increased irrigation demands. Based on historical data, the monthly PF was determined to be 1.3 and the daily PF 1.5. Applying these PFs to the demand projections shown in Table ES.2 result in the ADD, maximum month demand (MMD), and maximum day demand (MDD) shown in Table ES.3.

Table ES.3 Existing and Future Potable Water Demands

Phase	ADD (mgd)	MMD[1] (mgd)	MDD[2] (mgd)
Existing (2014-2019 Average)	3.20	3.88	4.65
Near-Term (year 2025) General Plan Growth Scenario	3.12	4.06	4.68
Long-Term (year 2050) General Plan Growth Scenario	3.29	4.28	4.93
Near-Term (year 2025) RHNA Growth Scenario	3.34	4.34	5.01
Long-Term (year 2050) RHNA Growth Scenario	3.72	4.83	5.57

Notes:
(1) MMD PF for future planning years is assumed to be 1.3 per Table 3.8.
(2) MDD PF for future planning years is assumed to be 1.5.

ES.3.2 Recycled Water

The City currently does not have a recycled water system. However, future potential recycled water customers have been identified as current large water users that have a significant amount of outdoor water use that could be converted to recycled water. These customers include parks, schools, transit authorities, a golf course, and an equestrian center. Future potential recycled water demands have been developed by identifying these users' historical potable water use and estimating the portion of that use that could be converted to recycled water. The total potential recycled water demand is estimated to be 176 afy. The largest potential recycled water user is the Arroyo Seco Golf Course, which has an estimated demand of 112 afy.

Similar to potable water, PFs are used to estimate recycled water demands for conditions other than average annual demand conditions. PFs are used to account for fluctuations in demands on a seasonal and hourly basis. Using historical billing data, a MMD peaking factor of 1.7 was calculated using the ratio of maximum month demand (September) to average annual demand. To account for the difference between MMD and MDD, this peaking factor was increased by 20 percent to 2.0. For future system sizing, the MDD peaking factor needs to be multiplied by a Peak Hour Demand (PHD) peaking factor, which was calculated using the assumption that recycled water would be used over an 8-hour period in a day. Applying these peaking factors to the total potential recycled water demand results in the values shown in Table ES.4.

Table ES.4 Total Potential Recycled Water Demand Including Peaking Factors

Total Demand (afy)	ADD (mgd)	MMD (mgd)	MDD (mgd)	PHD (mgd)
176	0.16	0.27	0.31	0.94

ES.3.3 Wastewater

The City discharges its wastewater into LA County Sanitation District's (LACSD's) trunk sewers at multiple locations. There are no flow meters that record this flow nor are there other records that can be used to calculate the City's wastewater flow. Thus, existing wastewater flow has been estimated as a proportion of the City's water use based on water use type. The combined estimated average dry weather flow (ADWF) is 1.9 mgd. Applying a wet weather peaking factor of 2.5 to this ADWF yields a peak wet weather flow (PWWF) of 4.7 mgd.

Wastewater flow projections were developed based on water use type and the growth scenarios developed for potable water projections. Commercial wastewater flow is expected to steadily increase under both growth scenarios while residential wastewater demand is expected to decrease through 2030 as indoor residential use decreases to meet conservation standards and then increase between 2030 and 2050 as population grows under the General Plan growth scenario. Under the RHNA growth scenario, residential wastewater flow is expected to stay constant through 2050 as growth and conservation balance out. Government wastewater demand is expected to stay constant through 2050 under both growth scenarios.

Projections for ADWF and PWWF are shown in Figure ES.3.

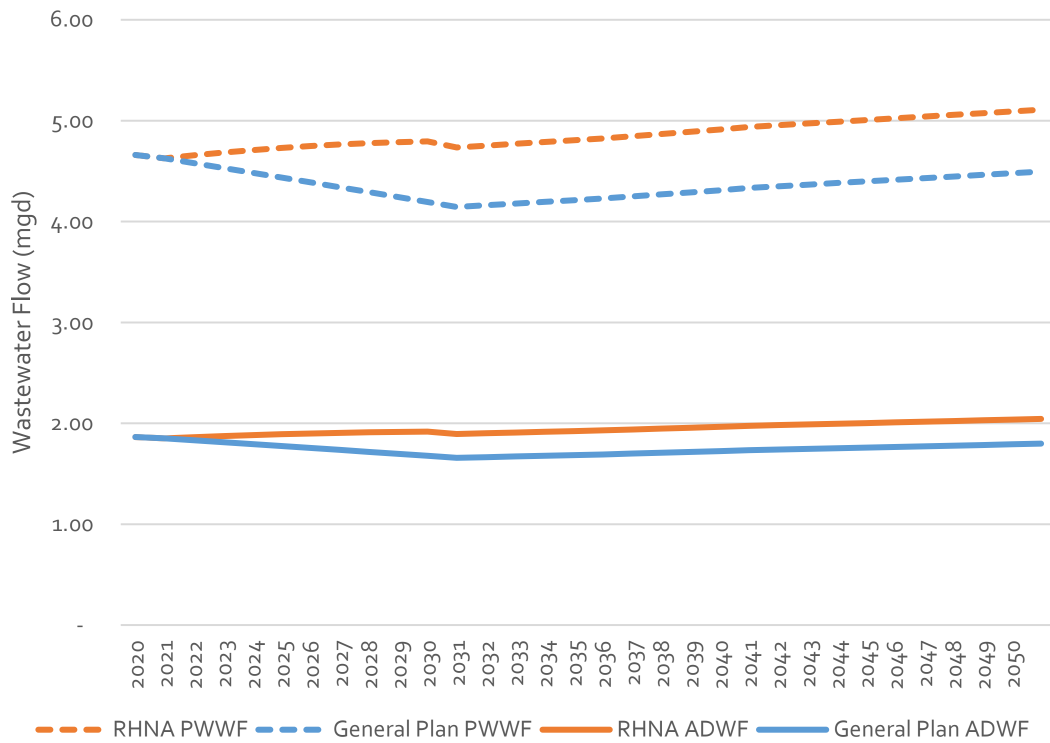

Figure ES.3 Projected Wastewater Flows

ES.4 System Evaluation Criteria

ES.4.1 Potable Water System Evaluation Criteria

Distribution system evaluation criteria are required to determine the performance of the City's water system under a range of operating conditions and to identify system deficiencies and improvement projects. Under each operating condition, the capacities and performance of the water system are compared to the evaluation criteria to determine which pipelines or water facilities need to be upgraded or replaced.

The evaluation criteria used for the evaluation of the City's potable water system are summarized in Table ES.5.

Table ES.5 Potable Water System Evaluation Criteria

Description	Value(1)	Units
Maximum Pressure		
Without Individual Pressure Regulator at Meter	80	psi
With Individual Pressure Regulator at Meter	150	psi
Minimum Pressure		
Peak Hour Demand (PHD)	40	psi
Maximum Day Demand (MDD) + Fire Flow	20	psi
Pipeline Criteria		
Maximum Velocity With ADD	5	fps
Maximum Velocity With PHD	8	fps
Maximum Velocity With MDD + Fire Flow	10	fps
Hazen-Williams C-Factor		
Pipelines Greater Than 50 Years in Age	120	N/A
Pipelines Between 20 to 50 Years in Age	130	N/A
Pipelines Less Than 20 Years in Age	140	N/A
Minimum Size for Pipeline Replacement	8	inches
Fire Flow Requirements(2)		
Very Low Density Residential (VLDR)	1,000	gpm for 2 hours
Low Density Residential (LDR)	1,000	gpm for 2 hours
Medium Density Residential (MDR)	2,000	gpm for 2 hours
High Density Residential (HDR)	2,500	gpm for 3 hours
Professional Office (PO)	2,500	gpm for 4 hours
Commercial/Retail/Office/Mixed Use	2,500	gpm for 4 hours
Civic or Public Facilities	2,500	gpm for 4 hours
Parks and Open Space	1,000	gpm for 1 hour
Conservation	0	N/A
Storage Volume		
Operational	30% of MDD	MG
Fire Fighting Storage	Maximum fire flow in zone	MG
Emergency Storage	100% MDD	MG
Pump Station Capacity		
Zones With Gravity Storage	Meet MDD with the largest pump unit out of service	gpm
Zones Without Gravity Storage	Meet MDD + FF with all pumps	gpm
Pressure Reducing Valve Capacity		
Zones Without Gravity Storage	Meet MDD + FF with largest valve in the pressure zone out of service	gpm

Notes:
(1) Use for planning purposes only. Values may be reduced with the use of fire sprinklers.
(2) Fire flow volumes are approximated by land use type.

ES.4.2 Recycled Water System Evaluation Criteria

A list of recommended criteria used in the evaluation of the City's potential future recycled water system is presented in Table ES.6.

Table ES.6 Recycled Water System Evaluation Criteria

Description	Value	Units
Pipeline Criteria		
Maximum Pressure	150	psi
Minimum Pressure Under Static Conditions	40	psi
Maximum Velocity With MDD	8	fps
Hazen Williams C-Factor for Pipelines 12 Inches in Diameter or Less	120	n/a
Hazen Williams C-Factor for Pipelines Greater Than 12 Inches in Diameter	130	n/a
Minimum Size for Pipelines	6	inches
Storage Volume		
Operational	Difference between PHD and MDD	MG
Pump Station Capacity		
Normal Conditions	Meet PHD with largest unit out of service	gpm

ES.4.3 Wastewater System Evaluation Criteria

The capacity of the City's sanitary sewer collection system was evaluated based on the planning criteria summarized in Table ES.7.

Table ES.7 Wastewater System Evaluation Criteria

Minimum Slopes for New Circular Pipes	
Pipe Size (in)	**Minimum Slope(1) (ft/ft)**
8	0.004
10	0.003
12	0.0024
15	0.0017
18	0.0014
21	0.0011
24	0.0010

Flow Depth, d/D	
Maximum Flow Depth for Existing Sewers	
Pipe Diameter	**Maximum d/D Ratio under PWWF(2)**
8 Inches and Smaller	3 feet below manhole rim
12 Inches and Larger	3 feet below manhole rim
Pipe Diameter	**Maximum d/D Ratio PDWF(2)**
8 Inches and Smaller	0.75
12 Inches and Larger	0.85
Maximum Flow Depth for New Sewers	
Pipe Diameter	**Maximum d/D Ratio under PWWF(2)**
8 Inches and Smaller	0.67
12 Inches and Larger	0.75
Design Storm	
10-year, 24-hour storm	
Head Loss in Existing Pipelines	
Gravity Pipeline	Manning's n = 0.013
Pressure Pipelines	Hazen Williams C = 120
Lift Stations and Force Mains	
Minimum Velocity	3 ft/s
Maximum Velocity	8 ft/s
Lift Station Capacity	Firm Capacity(3) under Peak flows

Notes:
(1) Minimum Slope values are based on pipeline flowing half full at 2 ft/s.
(2) PWWF = Peak Wet Weather Flows; PDWF = Peak Dry Weather Flows.
(3) Firm capacity represents the lift stations capacity with the largest pump out of service.

ES.5 Water Supply Analysis

ES.5.1 Existing Water Supply Sources

The City's has three sources of potable water supply: groundwater pumped from the Main San Gabriel Basin (Main Basin), surface water imported from the Metropolitan Water District of Southern California (MWD), and a mix of groundwater and surface water purchased from Pasadena Water and Power (PWP). Groundwater pumped from four wells in the Main Basin and is the primary source of water supply for the City. The annual water supply mix for the period 1990 through 2019 is shown in Figure ES.4. The total amount of water produced and used has decreased from the long-term average of approximately 4,600 afy per year (1990-2019) to an average of approximately 3,600 afy per year in the past five years (2015-2019).

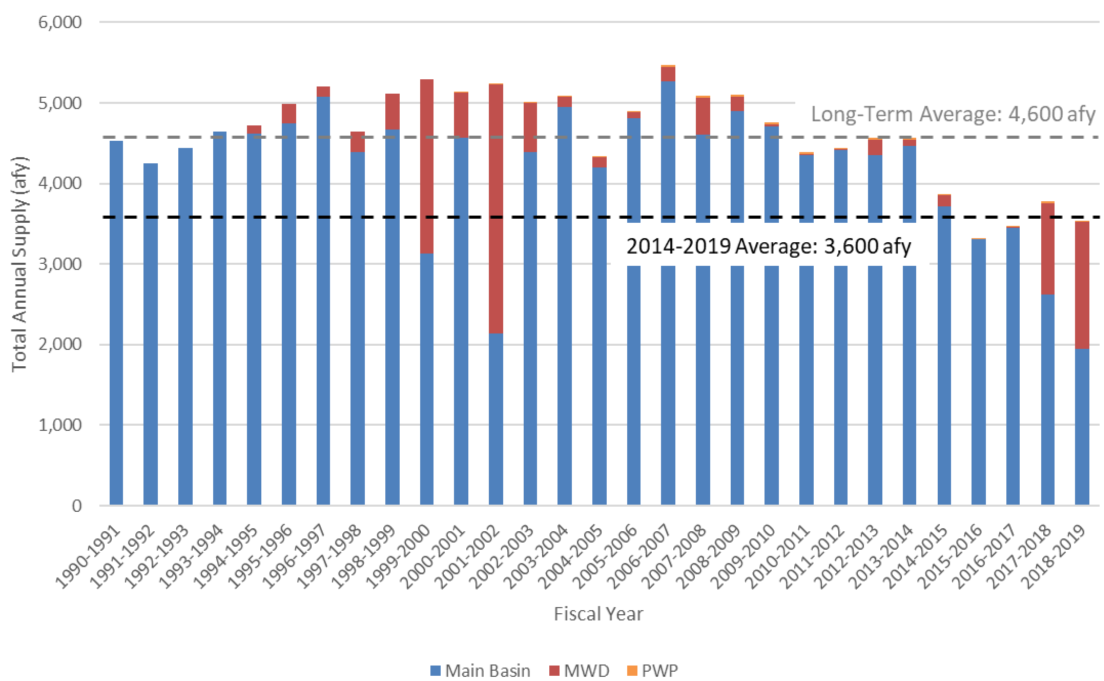

Figure ES.4 Historical Annual Supply by Water Source

ES.5.2 Water Quality

The City's drinking water meets or surpasses all federal and state drinking water standards. The City's wells provide high quality water for drinking, although maximum contaminant levels (MCLs) for Nitrate, PCE, and 1,2,3-TCP have been exceeded in the past. When these MCLs are exceeded, groundwater is either blended with other sources of water to get to concentrations below 80 percent of MCLs, or well water production is reduced and water is purchased from MWD. Imported water from MWD is of high quality that does not exceed MCLs. Similarly, the water purchased from PWP groundwater supply is of high quality and it has not exceeded MCLs in recent years.

ES.5.3 Potential Future Water Sources

As shown in Figure ES.5, the City's groundwater rights have historically not been enough to meet its total water demand, so the City has either paid replenishment fees to pump additional groundwater or purchased additional water from MWD, or a combination of both measures. Additionally, Figure ES.5 shows the projected groundwater pumping rights through the year 2025, as predicted by the Watermaster and water demand projections as dictated by General Plan growth and RHNA allocations.

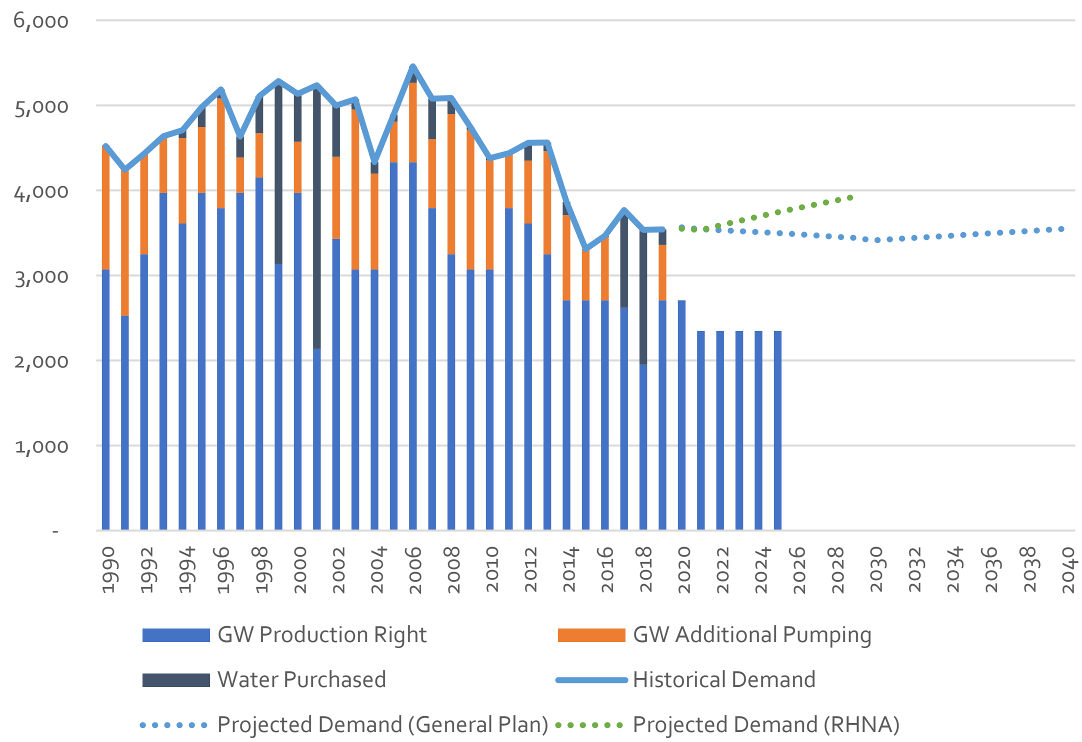

Figure ES.5 South Pasadena Historical and Projected Supply and Demand

Future demands, like historical demands, are likely to exceed the City's groundwater production rights. It is projected that the City will need to continue to exceed their groundwater pumping rights (as allowed by the Watermaster) and pay the replenishment fee to do so and also continue to augment water supply with water purchased from MWD as needed. Other potential water supplies to offset potable water demand needs include recycled water, stormwater, and water conservation.

Water conservation is expected to increase to meet state requirements, helping to minimize the amount of replenishment water and MWD purchases required. It is recommended that the City continue with the reconstruction of Graves Well #1 in order to further diversify groundwater sources to mitigate future potential groundwater quality issues in other wells. Stormwater projects may slightly decrease irrigation demands in the park, but utilizing recycled water, or implementing larger stormwater capture efforts and are not likely to be viable in the near future.

Finally, it may be prudent for the City to explore implementing additional backup connections with surrounding agencies to provide water in emergency scenarios. One such connection may be made with the Los Angeles Department of Water and Power (LADWP) near Monterey Road and Kolle Avenue along the western edge of the City.

ES.6 Potable Water System Analysis

The potable water system analysis included the City's existing and future potable water distribution systems, water supplies, and storage facilities. These water systems were identified and evaluated. Then, based on the system evaluation results, improvement projects were identified to address the identified deficiencies.

ES.6.1 Existing Potable Water System Analysis

The existing potable water system facilities include five pressure zones, four groundwater wells, seven storage reservoirs, six booster pump stations (PSs), three pressure reducing valves (PRVs), and approximately 83 miles of pipeline.

The City's hydraulic model of the potable water system was reviewed and updated as part of this One Water 2050 Plan. A potable water system hydraulic model is a simplified representation of the real potable water distribution system that can assess the capacity of that distribution system. In addition, potable water models can perform "what if" scenarios to assess the impacts of future developments and land use changes. In the One Water 2050 Plan, the City's hydraulic model was updated in a new software, current and future demands were allocated to customers in the model, and the model was calibrated to test its results against known conditions.

The updated hydraulic model was used for the following analyses of the existing system:

- Existing Water Supply Analysis.
- Existing Storage Analysis.
- Existing Pump Station Analysis.
- Existing System Pressure Analysis.
- Existing Pipeline Velocity Analysis.
- Rezoning Analysis of the Magnolia Pressure Zone.
  - Revised Minimum Pressure Analysis.
  - Revised Storage Analysis.
  - Revised Pump Station Analysis.
- Fire Flow Analysis.
  - Existing Distribution System Configuration (before rezoning).
  - Existing Distribution System with Rezoning Modifications.
- Water System Facilities Field Condition Assessment.
- Pipeline Replacement Analysis.

ES.6.2 Future System Analysis

The goal of the future system analysis is to evaluate the water distribution system under various operating conditions utilizing the evaluation criteria and the future demand projections described above. Similar to the existing system analysis, the following analyses were conducted for the future system analysis:

- Future Water Supply Analysis.
- Future Storage Analysis.
- Future Pump Station Analysis.
- Future System Pressure Analysis.
- Future Pipeline Velocity Analysis.
- Future Fire Flow Analysis.

Recommended improvements to the water system based on the existing and future system analyses are included in the CIP of this One Water 2050 Plan.

ES.7 Recycled Water System Feasibility Analysis

The City currently does not have a recycled water system but could potentially receive recycled water from the City of Pasadena (Pasadena), the Upper San Gabriel Valley Metropolitan Water District (USGVMWD or Upper District), and the Central Basin Municipal Water District (Central Basin MWD). These recycled water supply options available to the City have significant cost and uncertainty associated with them. Receiving recycled water from Pasadena would require Pasadena to first construct their own recycled water system to distribute recycled water and extend this system from the Rose Bowl area to the Glenarm Power Plant or the construction of a scalping plant that would produce recycled water for the Glenarm Power Plant. Receiving recycled water from the Upper District would require the construction of an approximately 8-mile-long pipeline, which would likely be cost-prohibitive at a cost of $2,200 per af. Similarly, receiving recycled water from the Central Basin MWD would require the construction of an approximately 6.5 mile long pipeline, which may also likely be cost-prohibitive.

As described in Section ES 3.2, recycled water customers were identified who could potentially use non-potable recycled water for irrigation. Total estimated potential recycled water demand for all of these customers was estimated at 176 afy, over half of which would go to the Arroyo Seco Golf Course. To evaluate the feasibility of implementing a non-potable recycled water system in the City, several pipeline alignments were developed to serve recycled water to the potential recycled water customers. These pipeline alignment options were developed with the objective of being as cost-effective as possible or serving the largest volume of recycled water with the shortest possible distribution system.

All recycled water pipeline options start with a connection to Pasadena's potential future recycled water system at the Glenarm Power Plant. However, if recycled water were to be provided by the Central Basin MWD instead of Pasadena or the Upper District, the connection would likely be at the southern end of the City instead. Of the seven recycled water pipeline options evaluated, Option 3 was found to be the most cost-effective. The Option 3 recycled water pipeline would start From the Glenarm Power Plant, then go southwest to serve the San Pascual Equestrian Center, Arroyo Park, a Caltrans irrigation area, and the Arroyo Seco Golf course via Columbia Street, Hermosa Street, and Arroyo Drive. This option would consist of 2.4 mi of pipeline, serve an estimated 140 afy of recycled water to customers, and have a unit cost of approximately $1,900 per af.

Although Option 3 is expected to be the most cost-effective of the recycled water options evaluated, at $1,900 per af, using recycled water is more costly than the City's groundwater supply, which costs roughly $315 per af. Depending on the purchase cost of recycled water from Pasadena, this option may also be more expensive than the purchase of imported water from MWD for $1,268 per af (Tier 2, with USGVMWD fees).

Besides cost considerations, the key constraint for implementing Option 3 is the uncertainty associated with the recycled water system implementation by the City of Pasadena. Both the uncertainty around timing and point of connection makes it difficult for the City of South Pasadena to plan for and implement a recycled water system. If Pasadena were to implement their planned recycled water program, Option 3 is the most cost-effective alternative for serving recycled water in the City, especially if alternative water supplies were to become more expensive or less reliable.

ES.8 Wastewater Collection System Analysis

The City's wastewater collection system consists primarily of gravity sewers with a combined length of 56 miles ranging from 6 to 18 inches in diameter. There is only one sewer lift station located in Arroyo Park with one force main to pump the wastewater back to the gravity main along Arroyo Drive. The City does not own or operate a wastewater treatment plant; instead, all flows are routed into the regional trunk sewer system of LACSD for treatment at the Whittier Narrows Water Reclamation Plant (WRP).

In 2009, the City had a large number of sanitary sewer overflows (SSOs), and due to the City's failure to comply with state Water Discharge Requirements (WDR), the Regional Water Quality Control Board (RWQCB) filed a consent decree in 2011 to inspect and repair their sewer system. As a result, between 2014 and 2017, the City performed 33 miles of rehabilitation of sewers with trenchless cured-in-place pipe (CIPP) and 1.1 miles of sewer replacement, totaling approximately 60 percent of the City's collection system. Since this work has been completed, the City has not had any significant SSOs.

ES.8.1 Existing Sewer System Analysis

A sewer system model is a simplified representation of the real sewer collection system. Sewer system models can assess the conveyance capacity for a collection system and can also be used to perform "what if" scenarios to assess the impacts of increased flows due to future developments and land use changes, system upgrades or modifications, and operational changes. A new sewer system hydraulic model was developed for the City as part of this One Water 2050 Plan.

The new hydraulic model was used for the following ADF and PWWF analyses of the existing system:

- Gravity System Evaluation.
- Rehabilitation and Replacement Improvements.
- Stoney Lift Station Condition Assessment.
- Existing Sewer System Maintenance.

ES.8.2 Future Sewer System Analysis

The goal of the future system analysis is to evaluate the collection system under various operating conditions utilizing the evaluation criteria and the future flow projections described in previous sections. As part of the future system analysis, the planning year 2050 or build-out was evaluated. There were no capacity deficiencies resulting from the existing system analysis; thus, no new sewer pipes were added to the hydraulic model for the future system analysis. The only change between the existing system and future system analysis was the higher ADWF due to projected water use growth. It is expected that many R&R pipelines will be replaced by 2050, however for conservative planning purposes they were unchanged between the existing and future model scenarios.

The future sewer system analysis consists of a gravity system evaluation as well as an R&R analysis and did not include a lift station analysis as Stoney Lift Station was already analyzed in the existing system analysis.

Recommendations for rehabilitation and replacement improvements for the existing and future sewer system are included in the CIP.

ES.9 Stormwater Management

Stormwater and urban runoff is rain or melting snow that flows over the ground. In urban or developed areas, stormwater runs over pavement and parking lots, picking up oil and other pollutants before flowing into a nearby storm drain, combined collection system, stream, river, or ocean. In more natural areas including parks and wetlands, stormwater can recharge into the ground, filtered through soil aquifer treatment (SAT) and be stored in underlying aquifers.

Due to the high amount of impervious surfaces in urban areas, rainfall cannot soak into the ground through these surfaces and thus does not replenish groundwater supplies. Impervious surfaces also increase the amount and speed of water entering storm drains or natural waterways. The result is an increase in the severity and frequency of floods and a decrease in base flows in our streams and water in our groundwater aquifers.

Stormwater management is moving towards a multi-benefit approach throughout Southern California that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation, while also creating additional benefits for communities in the watershed and addressing applicable federal, state, and regional, stormwater quality regulations.

ES.9.1 Existing Stormwater Drainage System and Ongoing Projects

The City's stormwater is collected and conveyed through City-owned storm drains, the Los Angeles County Flood Control District (LACFCD) storm drainage system, and an open channel - the Arroyo Seco. Of the approximately 2,608 acres for the City, approximately 25 percent of stormwater runoff flows within the Upper Los Angeles River (ULAR) Watershed via the Arroyo Seco, approximately 40 percent flows to the Lower Los Angeles River Watershed via the Chavez Ravine, and approximately 35 percent drains to the Rio Hondo.

Stormwater management throughout the City is implemented through programs required by the MS4 Permit that include non-structural and structural best management practices (BMPs). Non-structural BMPs are policies and procedures that manage land use in order to lessen the impacts of resource development and redevelopment on storm impacts on stormwater quality and quantity and are often referred to as institutional control measures or minimum control measures. Structural BMPs are facilities designed and constructed for the treatment of stormwater with respect to quality and quantity.

The City is implementing trash capture devices and low flow diversions as structural BMPs. Additionally, the City is participating in a number of regional projects that have received funding from the Los Angeles County Safe Clean Water (SCW) Program. Each regional project intends to achieve multiple benefits, including increasing water supply, groundwater recharge, flood control, recreation and/or enhancement of habitat. Regional projects emphasize subsurface retention and infiltration and/or use as a primary function. These projects include the following:

- Arroyo Seco San Rafael and San Pascual Treatment/Infiltration Projects.
- Arroyo Seco Lower Arroyo Park Infiltration Basin Facility.
- Arroyo Seco Golf Course Wetland Facility.
- Arroyo Seco Golf Course Driving Range Wetland/Infiltration Facility.
- Huntington Drive Regional Green Street.
- Rio Hondo Load Reduction Strategy – Alhambra Wash Dry-Weather Diversion Project.

In addition to the above projects, the City has applied for SCW funds for the Camino Verde Stormwater/Infiltration Project and funding for this project is currently under consideration.

ES.9.2 Future Stormwater Management Opportunities

Additional opportunities to capture stormwater runoff by the City will be possible as SCW Program more funding become available. Future opportunities include implementation of stormwater capture projects and green street projects. City parks, including Arroyo Park North, Garfield Park, Eddie Park, Library Park, Orange Grove Park, and War Memorial Park provide viable opportunities for larger stormwater capture projects. In addition to the ongoing Huntington Drive Green Street Project, there may be opportunities to implement green street projects along Fair Oaks Avenue and Mission Street.

ES.10 Capital Improvement Plan

The proposed CIP presents improvement projects based on the potable water, recycled water, wastewater, and stormwater system evaluations conducted as part of this One Water 2050 Plan. The CIP is divided into three phases; near-term, mid-term, long-term. The near-term CIP includes projects phased in the years FY2022/2023 through FY2029/2030, the mid-term CIP includes projects phased in the years FY2030/2031 through FY2039/2040, and the long-term CIP includes project that are phased in the years FY2040/2041 through FY2049/2050.

The cost estimates presented in the CIP have been prepared for general master-planning purposes and for guidance in project evaluation and implementation. Costs are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo's experience on other similar projects. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as preliminary alignment generation, investigation of alternative routings, and detailed utility and topography surveys. All costs are in 2021 dollars and do not include escalation due to inflation. In 2021, costs have increased significantly due to various social and economic conditions; appropriate adjustments for current conditions will be needed when budgeting for projects.

ES.10.1 Potable Water CIP

The potable water system CIP is summarized by improvement category and phase in Table ES.8. The potable water CIP through the year 2050 is estimated to cost $191.9 million, which is approximately 77 percent of the total CIP (or $248.6 million) through long-term.

Table ES.8 Summary of Potable Water Improvement Costs by Project Category

Project Category	Near-Term FY22/23-FY29/30 ($ Million)	Mid-Term FY30/31-FY39/40 ($ Million)	Long-Term FY40/41-FY49/50 ($ Million)	Total ($ Million)
Fire Flow Improvements	$3.6	$8.5	$0	$12.1
Capacity & Reliability	$0.4	$6.0	$0	$6.4
R&R Improvements	$46.5	$49.2	$76.5	$172.2
Other	$-	$0.6	$0.6	$1.1
Grand Total	$50.5	$64.3	$77.1	$191.9
Number of Years	7	10	10	N/A
Total Annual Cost ($/year)	$7.2	$6.4	$7.7	N/A
Anticipated Developer Funding	$0	$6.0	$0	$6.0
City Funded CIP	$50.5	$58.3	$77.1	$185.5
City Annual Cost ($/year)	$7.2	$5.8	$7.7	N/A

Note:
(1) Numbers may vary slightly due to rounding.

ES.10.2 Recycled Water System CIP

Based on the recycled water analysis in this One Water 2050 Plan, alignment Option 3 would be the most cost effective and efficient recycled water alternative. This alignment has a capital cost of $3.47 million. However, the key constraint for implementing Option 3 is the uncertainty associated with the recycled water system implementation by the City of Pasadena. Both the uncertainty around timing and point of connection makes it difficult for South Pasadena to plan to implement a recycled water system. Therefore, no money is allocated for recycled water in the CIP.

ES.10.3 Wastewater CIP

The wastewater system CIP is summarized by improvement category and phase in Table ES.9. The wastewater CIP through the year 2050 is estimated to cost $14.8 million, which is approximately 6 percent of the total CIP (or $248.6 million) through long-term.

Table ES.9 Summary of Wastewater Improvement Costs by Project Category

Project Category	Near-Term FY22/23-FY29/30 ($ Million)	Mid-Term FY30/31-FY39/40 ($ Million)	Long-Term FY40/41-FY49/50 ($ Million)(2)	Total ($ Million)
Sewer Lining	$0.9	$1.1	$1.1	$3.0
Sewer Replacement	$3.2	$3.8	$3.8	$10.8
Sewer Point Repair	$0.1	$0.1	$0.1	$0.4
Other	$0.2	$0.2	$0.2	$0.7
Grand Total	**$4.3**	**$5.2**	**$5.2**	**$14.8**
Number of Years	7	10	10	N/A
Total Annual Cost ($/year)	**$0.6**	**$0.5**	**$0.5**	**N/A**
Anticipated Developer Funding	-	-	-	-
City Funded CIP	$4.3	$5.2	$5.2	$14.8
City Annual Cost ($/year)	**$0.6**	**$0.5**	**$0.5**	**N/A**

Note:
(1) Numbers may vary slightly due to rounding.

ES.10.4 Stormwater CIP

The stormwater system CIP is summarized by project type and phase in Table ES.10. The stormwater CIP through the year 2050 is estimated to be $41.9 million, which is approximately 17 percent of the total CIP (or $248.6 million) through long-term

Table ES.10 Summary of Stormwater Improvement Costs by Project Type

Project Type	Near-Term FY22/23-FY29/30 ($ Million)	Mid-Term FY30/31-FY39/40 ($ Million)	Long-Term FY40/41-FY49/50 ($ Million)(2)	Total ($ Million)
Green Streets	$5.5	$-	$-	$5.5
Ongoing Regional Projects	$33.7	$-	$-	$33.7
Potential Future Projects	$-	$-	$2.7	$2.7
Grand Total	**$39.2**	**$-**	**$2.7**	**$41.9**
Number of Years	7	10	10	N/A
Total Annual Cost ($/year)	**$5.6**	**$-**	**$0.3**	**N/A**
Identified Grant Funding	$8.8	$-	$-	$8.8
City Funded CIP	$30.4	$-	$2.7	$33.1
City Annual Cost ($/year)	**$4.3**	**$-**	**$0.3**	**N/A**

Note:
(1) Numbers may vary slightly due to rounding.

ES.11 Integrated Systems CIP

The integrated systems CIP for the City's water, recycled water, wastewater, and stormwater systems is summarized in Table ES.11 and graphically depicted on Figure ES.6. As shown in Table ES.11, the combined CIP costs for all three systems through planning year 2050 is estimated to be about $345.4 million, respectively.

Table ES.11 Integrated CIP by System and Phase

Project Type	Near-Term FY22/23-FY29/30 ($ Million)	Mid-Term FY30/31-FY39/40 ($ Million)	Long-Term FY40/41-FY49/50 ($ Million)(1)	Total ($ Million)
Potable Water System(2)	$50.5	$64.3	$77.1	$191.9
Recycled Water System	$-	$-	$-	$-
Wastewater System(3)	$4.3	$5.2	$5.2	$14.8
Stormwater System(4)	$39.2	$-	$2.7	$41.9
Grand Total	**$94.0**	**$69.5**	**$85.5**	**$248.6**
Number of Years	7	10	10	N/A
Total Annual Cost ($/year)	**$13.4**	**$7.0**	**$8.5**	**N/A**
Anticipated Developer Funding	$-	$6.0	$-	$6.0
Anticipated Grant Funding	$8.8	$-	$-	$8.8
City Funded CIP	$85.3	$63.5	$85.0	$233.8
City Annual Cost ($/year)	**$12.2**	**$6.4**	**$8.5**	**N/A**

Notes:
(1) Numbers may vary slightly due to rounding.
(2) Potable Water CIP shown on Table 10.13.
(3) Wastewater CIP shown on Table 10.14.
(4) Stormwater CIP shown on Table 10.15.

As shown on Figure 10.8, the potable water system CIP comprises the largest portion of cost with $191.9 million (77 percent) of the total combined CIP, while the stormwater system CIP represents the second largest cost with $41.9 million (17 percent). The wastewater system accounts for the remaining 6 percent of the CIP.

The phasing of the integrated CIP by system is depicted on Figure ES.6 . As shown on this figure, about $94.0 million of project costs are included in the near-term phase and $69.5 million are scheduled for the mid-term phase. The long-term CIP costs are $85.5 million.

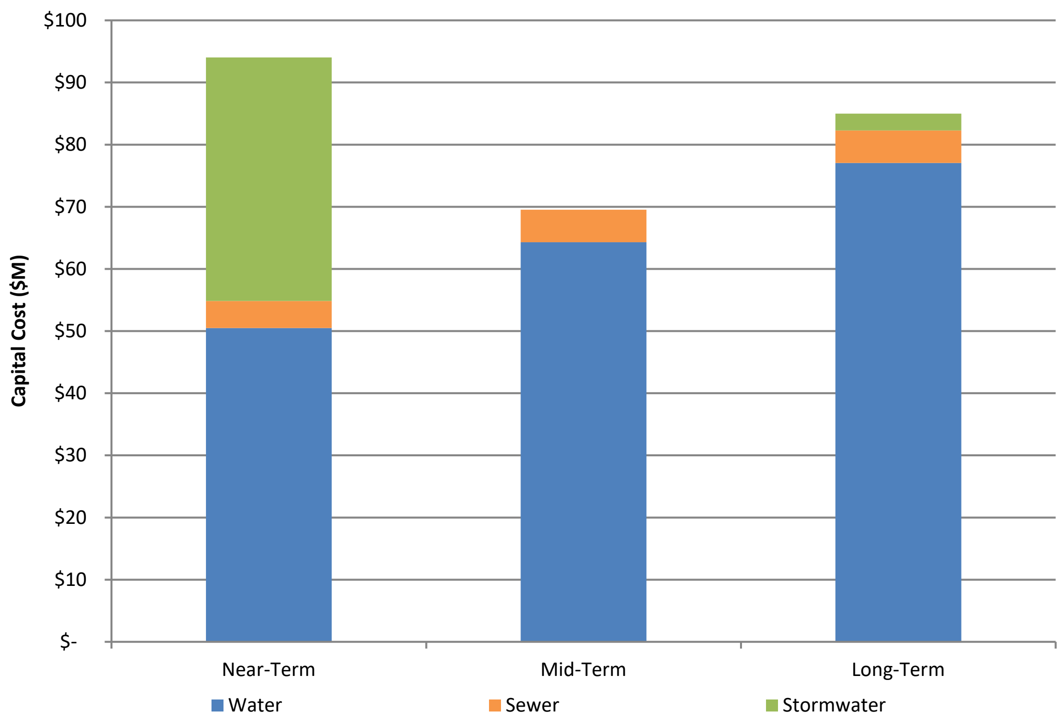

Figure ES.6 Integrated Systems CIP by Phase

Chapter 1 - Introduction

Chapter 1

INTRODUCTION

The City of South Pasadena (City) has retained Carollo Engineers, Inc. (Carollo) to prepare an One Water 2050 Plan that evaluates the City's potable water, wastewater, stormwater, potential recycled water, and water resources system. This One Water 2050 Plan will provide strategic guidance and justification for system improvements both capital projects and system operations of the City's potable water, wastewater, and stormwater systems, as well as the potential for a future recycled water system. These recommendations are summarized in the Capital Improvement Plan presented in Chapter 10.

This chapter presents the Plan's background, purpose and objectives, description of the study area and planning horizon, and overview of the report organization. In addition, the plan authorization and acknowledgements are included in this chapter. A list of references used to prepare this IMP is provided in Appendix A.

1.1 Authorization

The City of South Pasadena authorized Carollo Engineers, Inc. to prepare this One Water 2050 Plan on December 18, 2019. The professional services agreement is defined in South Pasadena Contract No. 2020-005, and in Carollo's contract 11822A.00.

1.2 City History

In early 1874, the area that is now South Pasadena was a part of the San Gabriel-Orange Grove Association. In 1875, the stockholders of the association voted to name their town Pasadena and just three years later, residents living in the southern portion of Pasadena considered themselves South Pasadenans. In 1888, the City incorporated with a population of slightly over 500, becoming the sixth municipality in Los Angeles County.

With establishment of the Raymond Hotel and the Cawston Ostrich Farm, the small community was able to attract tourists and increasingly large waves of new residents to the Pasadena area in the late 19th and early 20th Centuries. With completion of the Pacific Electric Short Line, putting the entire city within easy walking distance of the "red car" stations, South Pasadena became one of the first suburbs of Los Angeles.

Located just 6 miles northeast of downtown Los Angeles and directly south from the City of Pasadena, the relatively small 3.5 square mile City is now home to approximately 26,000 residents. South Pasadena is known for its historical homes, tree-lined streets, attractive neighborhood parks, excellent public schools, and small-town community atmosphere. The City is considered built out and has not experienced any significant population growth since the early 1970s despite some densification along Mission Street, Fair Oaks Avenue, and Huntington Drive, the City's main thoroughfares.

1.3 Project Background

This One Water 2050 Plan is the City's first integrated master plan that takes a holistic look at the City's water, wastewater, stormwater, and potential recycled water systems.

The City has prepared and calibrated a hydraulic model of the water distribution system in 2012, which has been used to conduct hydraulic evaluations for individual developments since then. However, a comprehensive water master plan has not been prepared. The City's water distribution system is separated into five pressure zones and includes about 85 miles of pipeline ranging from 2 to 24-inches in diameter, five storage reservoirs, two elevated tanks, and six booster stations. The City's water system has a significant portion of old pipes, with roughly 67 percent installed prior to 1950, that will need to be incorporated in a prioritized rehabilitation and replacement (R&R) program as part of this One Water 2050 Plan.

The City did not have hydraulic models of its sewer collection system nor stormwater drainage system. However, the City has developed a geographical information system (GIS) layers of its water, wastewater, and stormwater systems that need verification and updating as part of this One Water 2050 Plan. The updated sewer collection system GIS files is used to prepare the City's first wastewater collection model that will be used to analyze the system improvement needs under existing and future flow conditions. The City's sewer collection system consists of about 58 miles of pipeline ranging from 8 inches to 18 inches in diameter. The City has two lift stations, but does not own nor operate any wastewater treatment facilities. Approximately, 60 percent of the City's sewer mains have been rehabilitated between 2014 and 2017 following an extensive CCTV inspection of the City's sewer network between 2009 and 2011. Since this major rehabilitation effort, the City's sewer system performance has significantly increased, eliminating historic sewer overflows caused by sewer defects and root intrusion. The most recent Sewer System Management Plan (SSMP) was completed in 2009 and updated to reflect the extensive system upgrades as part of this One Water 2050 Plan.

The City's stormwater and urban runoff is collected and conveyed through a network of streets, catch basins, and a 100 percent separate stormwater drainage system to various receiving water bodies. This stormwater drainage system is maintained by both the City and the Los Angeles County Flood Control District (LACFCD). To reduce discharge of pollutants and meet compliance targets of the Municipal Separate Storm Sewer System (MS4) Permit, the City participated in the Upper Los Angeles River Enhanced Watershed Management Plan (EWMP) which identifies regional stormwater capture and recharge projects. In addition, recently voters approved the Safe, Clean Water Program (SCWP), which provides another project and funding opportunity for the City within Rio Hondo and Upper Los Angeles River Watershed Areas. The ongoing and potential future stormwater management projects are described and the existing stormwater drainage system GIS is updated as part of the One Water 2050 Plan.

The City is a member agency of the Upper San Gabriel Valley Municipal Water District (Upper District), the regional potable and recycled water supplier. However, the City currently does not use recycled water in its service area due to the absence of dedicated infrastructure to convey recycled water to supplies to the City. The closest recycled water pipeline of Upper District is located in the Whittier Narrows area, roughly 10 miles from the City's eastern boundary. However, the City of Pasadena is considering serving recycled water to their Glenarm Power Plant, located immediately north of City's boundary. The One Water 2050 Plan evaluates the feasibility of various recycled water system configurations in case a recycled water supply connection can be made with Pasadena or Upper District, or by participating in a regional indirect potable reuse program.

1.4 Purpose and Objectives

The goal of this One Water 2050 Plan is to guide the City with making the right investments at the right time for its potable water distribution, wastewater collection, stormwater drainage systems, as well as the potential for using recycled water. To achieve this goal, a number of key objectives can be identified that define the major tasks of this Plan. These objectives are:

- Develop projections for the near-term (year 2025) and long-term (year 2050) potable water demands, wastewater flows, and potential recycled water demands.
- Define planning and evaluation criteria for the City's potable water, wastewater, and recycled water systems.
- Update the City's water, wastewater, and stormwater GIS to accurately reflect existing conditions, along with base maps for the City's use.
- Develop/update hydraulic models for the City's potable water and wastewater collection systems to identify system deficiencies and size system improvement needs.
- Identify necessary recycled water system facilities to serve the City's potential recycled water customers.
- Describe stormwater management opportunities, both within City limits and regionally, to advance implementation of EWMP recommendations, meet MS4 regulations, and realize the potential regional project and funding opportunity from the SCWP.
- Prepare an integrated CIP with phasing of recommended improvements for the City's water, wastewater, stormwater, and recycled water systems.

1.5 Study Area Boundary

The City is located in Los Angeles County, approximately 6 miles northeast of downtown Los Angeles and approximately 2.5 miles south of the center of the City of Pasadena. The 3.44-square-mile city is bordered on the north by the City of Pasadena, on the east by the City of San Marino, on the southeast by the City of Alhambra, on the west and southwest by the City of Los Angeles.

The City's study area for the potable water and wastewater master planning components of this One Water 2050 Plan coincides with City boundary (see Figure 1.1). However, the study area of the recycled water and stormwater components extend outside the City boundary to consider regional solutions such as groundwater recharge in the Raymond Basin and/or Main San Gabriel Basin with neighboring agencies.

1.6 Planning Horizon

The planning horizon of this One Water 2050 Plan is year 2050. However, this planning horizon may be extended depending on the timing of the completion of the 2021 Housing Plan Update, which is part of the 2021 General Plan Update that is currently being prepared to incorporate new housing requirements from Regional Housing Needs and Assessment (RHNA) and SCAG (see Section 2.3.4.).

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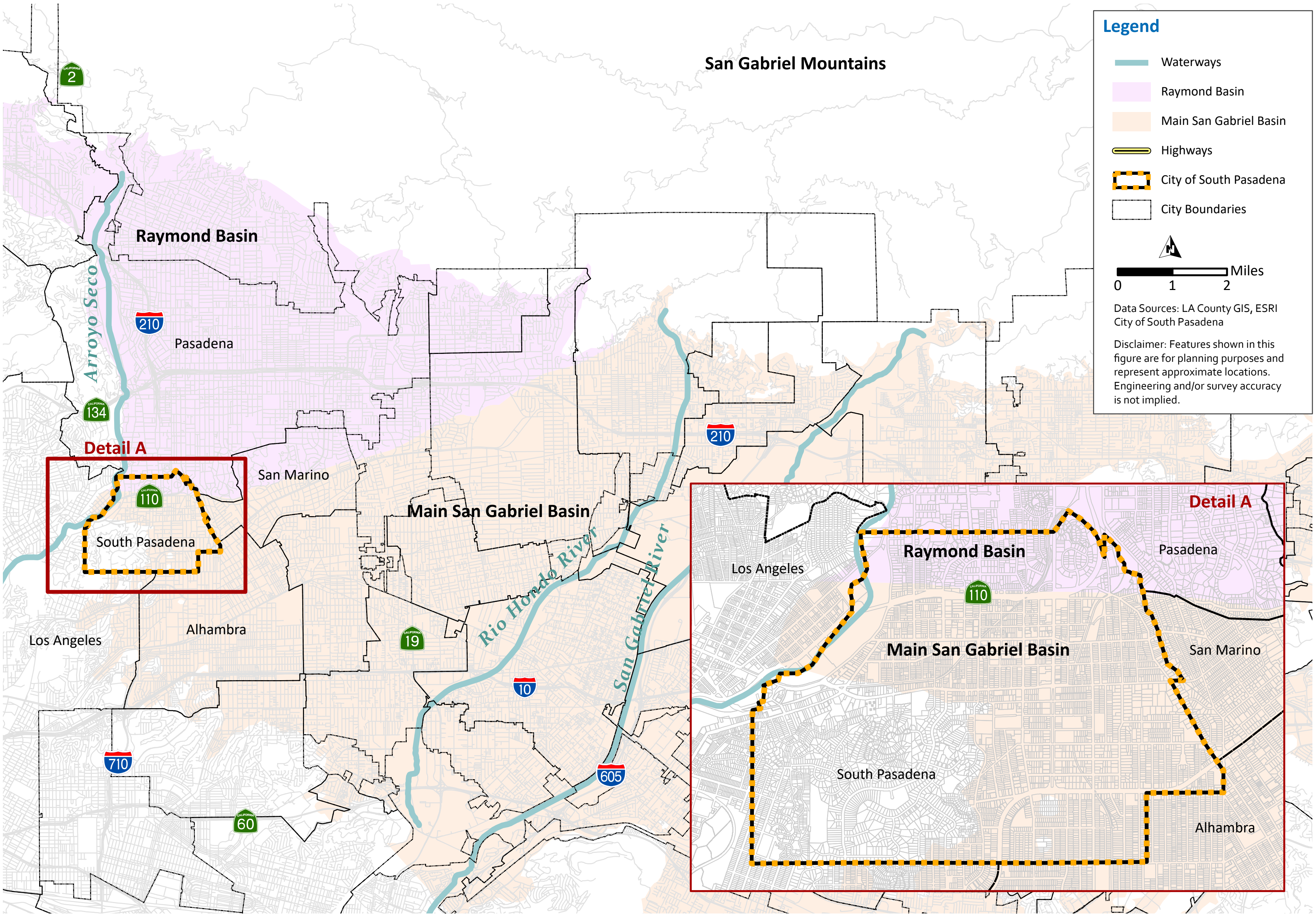

Figure 1.1 Study Area

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1.7 Report Organization

Chapter 1 – Introduction: This chapter presents the project background; purpose and objectives; study area; and planning horizon of this One Water 2050 Plan.

Chapter 2 – Land Use and Population: This chapter describes the city boundary, local climate conditions, and presents a discussion of the existing and future land use. In addition, City's historical and projected population trends are described through the planning horizon.

Chapter 3 – Water Demands and Wastewater Flows: This chapter summarizes the existing potable water demands for the City's potable water system. This chapter also discusses demand-forecasting methodology and provides a summary of potable and recycled water demand projections. In addition, this chapter presents the historical and existing wastewater flows and characteristics for the City's wastewater collection system. Finally, future wastewater flow projections are presented. Stormwater flows are not quantified as part of this One Water 2050 Plan.

Chapter 4 – System Evaluation Criteria: This chapter presents the planning criteria and methodologies for the analysis used to evaluate the existing water, wastewater collection, and recycled water systems and associated facilities. The criteria described in this chapter are used to identify existing system deficiencies and size future improvements.

Chapter 5 – Water Supply Analysis: This chapter describes the existing potable water sources, groundwater and imported water. Future supply sources considered and described are recycled water, stormwater, and inter-agency agreements with neighboring agencies. The chapter concludes with a recommended supply plan.

Chapter 6 – Potable Water System Analysis: This chapter starts with an overview of the City's existing potable water system, followed by a description of the hydraulic water model update. The water system analysis is separated in the evaluation under existing and future demand conditions. The system evaluation includes hydraulic modeling analysis, facility capacity analysis, field inspections of the water facilities, and pipeline R&R program. The recommended water system improvements to mitigate the identified deficiencies are summarized at the end of the chapter.

Chapter 7 – Recycled Water System Feasibility Analysis: This chapter presents an overview of the City's existing recycled water systems of neighboring agencies that could provide a potential connection to the City. Potential recycled water customers are summarized and the feasibility of recycled water layouts are explored with a new recycled water model. The chapter concludes with recycled water system recommendations.

Chapter 8 – Wastewater Collection System Analysis: This chapter starts with an overview of the City's existing wastewater collection system, followed by a description of the creation of the wastewater hydraulic model. The collection system analysis is separated in the evaluation under existing and future flow conditions. The system evaluation includes hydraulic modeling analysis, facility capacity analysis, and pipeline R&R program based on review of the city-wide CCTV inspection program. The recommended wastewater collection system improvements to mitigate the identified deficiencies are summarized at the end of the chapter.

Chapter 9 – Stormwater Management: This chapter discusses the existing and anticipated future stormwater regulations. The existing stormwater drainage system is described, followed by existing stormwater management practices. The chapter is concluded with a description of future stormwater management opportunities, both inside the city limits and regional recharge opportunities in the Raymond Basin and Main Basin.

Chapter 10 – Capital Improvement Plan: This chapter presents proposed potable water, recycled water, wastewater collection, and stormwater system CIPs, along with the planning level cost estimating assumptions. A comprehensive integrated CIP is presented that phases the proposed improvements in near-term and long-term planning periods.

Chapter 11 – Funding: The chapter presents a concise description of existing revenue streams, including the ability of the existing rates and capacity charges to meet the CIP needs identified in Chapter 10. Several financial options, including potential future funding sources, are summarized.

1.8 Acknowledgements

We would like to thank the following City staff for their assistance and oversight of this project:

- Shahid Abbas – Public Works Director.
- Ted Gerber, P.E. – Deputy Public Works Director (and City's One Water 2050 Plan Project Manager).
- Anteneh Tesfaye – Water Operations Manager.
- Kristine Courdy – Deputy Public Works Director.
- Margaret Lin – Manager Long Range Planning & Economic Development.
- Julian Lee – Deputy Public Works Director (Past).
- Joanna Hankamer – Planning and Building Director (Past).
- Garrett Crawford – Public Works Operations Manager (Past).

The following Carollo staff members were principally involved in this project:

- Gil Crozes, PhD – Principal-in-Charge.
- Inge Wiersema, P.E. – Project Manager.
- Matthew Huang, P.E. – Project Engineer.
- Rachel Gross, P.E. – Lead Planner.
- Ryan Hejka, P.E. – Lead Hydraulic Modeler and Staff Engineer.
- Kevin Christensen – GIS Specialist.
- Miko Aivazian, P.E. – Lead Structural Engineer.
- Matthew Huckaby, P.E. – Civil/Mechanical Engineer.
- Tim Loper, P.E. – Technical Advisor/Lead Quality Control.
- Ryan Orgill, P.E. – Hydraulic Modeling Review.

Chapter 2 - Study Area, Land Use, and Population

Chapter 2

STUDY AREA, LAND USE, AND POPULATION

This chapter presents the key characteristics of the study area of this One Water 2050 Plan. Following a description of the City's service area and local climate conditions, the City's land use is presented including land use classifications and planned developments. This chapter concludes with a description of the historical population trends within the City and projected populations through 2050, the planning period of the One Water 2050 Plan. The new developments, land use planning, and population projections described in this chapter form the basis for the water demand and wastewater flow projections presented in Chapter 3.

2.1 City Service Area

The City of South Pasadena encompasses a 3.44 square mile area in Los Angeles County, located approximately 6 miles northeast of downtown Los Angeles and approximately 2.5 miles south of the center of the City of Pasadena. As shown on Figure 2.1, the City is bordered on the north by the City of Pasadena, on the east by the City of San Marino, on the southeast by the City of Alhambra, on the west and southwest by the City of Los Angeles.

The western border is also delineated by the Arroyo Seco, which originates in the San Gabriel Mountains to the north and confluences with the Los Angeles River, just north of downtown Los Angeles, and ultimately flows into the Pacific Ocean.

The City's service area for the potable water and wastewater collection generally coincides with City boundary. A few exceptions where the City service potable water outside the City boundary include a small number of parcels along Pine Crest Drive, Garfield Avenue, and San Pascual Avenue. The potential recycled water service area would also coincide with the City boundary, however, future recycled water and stormwater projects could also be situated outside the City boundary, such as groundwater recharge of advanced treated wastewater for indirect potable reuse (IPR) and regional partnerships for the MS4 compliance. Hence, the study area of this One Water 2050 Plan is not strictly limited to the City's boundary depicted on Figure 2.1.

2.2 Climate

The City is located in the western portion of the San Gabriel Valley, which has a dry climate characterized by warm summers and mild winters. The study area is subject to significant variations in annual precipitation with an annual average rainfall of 19.8 inches. Most of the annual precipitation occurs during the period from December through March. Temperatures range from an average minimum of 43 degrees Fahrenheit in January to an average maximum of 89 degrees Fahrenheit in August.

Evapotranspiration (ETo) is the quantity of moisture that is transpired by a reference plant, such as an irrigated grass lawn, and evaporated from soil. ETo is important to water resource management because irrigation requirements relate directly to ETo.

To achieve maximum efficiency, irrigators need to apply enough water to meet the crop's ETo demand. ETo correlates with temperature, rising to more than 6 inches per month in the summer and falling to about 2 inches per month in the winter. As are summarized in Table 2.1, the City's estimated total annual ETo is 50 inches per year.

Table 2.1 Climate

Month	Ave Rainfall[2] (inches)	Average Minimum Temperature[2] (degrees F)	Average Maximum Temperature[2] (degrees F)	Average ETo[1] (inches)
January	4.31	42.95	66.66	2.17
February	4.43	44.37	68.06	2.54
March	3.31	46.23	70.23	3.85
April	1.32	49.06	73.73	4.61
May	0.44	52.50	76.42	5.21
June	0.13	56.03	81.98	6.00
July	0.03	60.23	88.58	6.58
August	0.08	60.58	89.39	6.38
September	0.36	58.88	87.42	4.95
October	0.67	53.73	80.95	3.55
November	1.59	47.43	74.03	2.48
December	3.15	43.33	67.27	1.90
Annual	**19.83**	**51.28**	**77.06**	**50.22**

Notes:
(1) Source: California Irrigation Management Information System (CIMIS), Station No. 159 – Monrovia (Period of record 1999-2020).
(2) Source: National Oceanic and Atmospheric Administration (NOAA), Station No. 46719 – Pasadena (Period of record 1893-2020).

2.3 Land Use

2.3.1 Existing Land Use

The City's General Plan guides development within the City's planning boundary and establishes long-range development policies. Land use information is an integral component in determining the amount of future water use and wastewater generation within the City. The type of land use in an area will affect the volume and timing of water use as well as the volume, timing, and water quality characteristics of the wastewater generation. Adequately estimating the water use and generation of wastewater from various land use types is important in sizing and maintaining effective water and sewer system facilities.

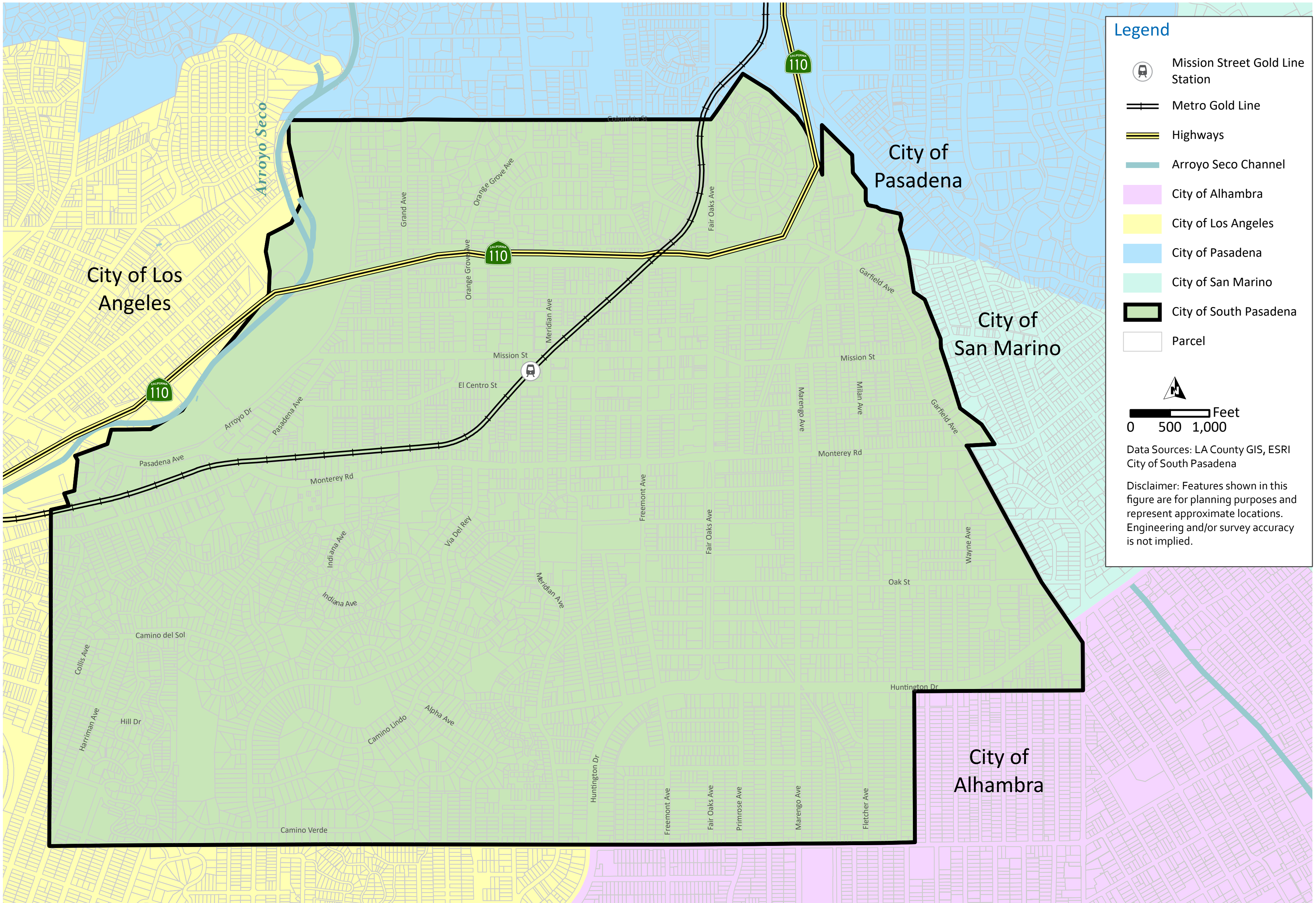

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Figure 2.1 City Boundary

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The City's most recent General Plan was updated in 2020 to provide a vision for the next 20 years. The General Plan and the Downtown Specific Plan classifies land use into the categories listed in Table 2.2.

Table 2.2 Land Use Designation

Land Use Category(1)	Definition
Very Low Density Residential	0-3.9 units/ acre. This designation permits detached single-family homes and is characterized by lots over 10,000 square feet.
Low Density Residential	4-5.9 units/acre. This designation permits detached single-family homes and is characterized by lots of 5,000 to 10,000 square feet.
Medium Density Residential	6-13.9 units/acre. This designation permits attached housing types, such as townhomes and duplexes and detached single-family homes on smaller lots.
High Density Residential	This designation permits multi-family residential development. It is intended to identify and conserve existing concentrations of such development in the city. These areas are characterized by multi-story apartments and condominiums.
Professional Office	Primarily Class B office space catering to small businesses and professional services providers. Some larger Class A office space.
Commercial/Retail	Consists of auto-oriented retail and service uses including convenience retail, supermarkets, restaurants, and personal services.
Mixed Use	Encourages a wide range of building types depending on neighborhood characteristics that house a mix of functions, including commercial, entertainment, office, and housing at approximately 24 to 30 units per acre and 14 to 24 units per acre outside the Downtown Specific Plan area. An intensity of 2.5 FAR is permitted throughout the City and an FAR of up to 3.0 is allowed at the Ostrich Farm.
Civic	Accommodates civic functions such as government offices, libraries, schools, community center, and places of religious worship.
Parks, Open Space, and Conservation	Includes active and passive public parks of all sizes to maintain open space areas for public recreation and leisure resources. These zones can range from small pocket parks to larger community parks and may include playgrounds or other recreation facilities. Conservation zones are intended to preserve the natural characteristics of properties that have been acquired by the City, while providing the public opportunities for recreation and passive enjoyment.

Notes:
(1) General Plan Land Use categories obtained from City's General Plan and the Downtown Specific Plan.

As shown in Table 2.2, four categories represent residential land use types with varying building densities ranging from less than 4 to more than 14 units per acre. In addition, the mixed-use land use category allows high density residential with specific density ranges for dedicated areas in the City. The City does not have any parcels designated for industrial use.

The distribution of land use within the study area is depicted on Figure 2.2. As shown, the areas with higher residential densities are located along the City's three main corridors, namely Fair Oaks Avenue, Mission Street, and Monterey Road. The areas with the lowest building density are the neighborhood Monterey Hills, the area north of the 110 Freeway, and some pockets in the southeast corner of the City north of Huntington Drive. The City's parks are scattered throughout, with the major open space area along the Arroyo Seco.

2.3.2 Near-Term Developments

While there is relatively strong demand for residential, office, and retail uses within South Pasadena, the actual amount and scale of development that can occur is limited by the amount of available land, financial feasibility of new development, fiscal priorities, and the level of acceptable density aligned with community character and vision.

For residential uses, the scale and character of new development that is possible based on available opportunities differs by area. Whereas smaller mixed-use infill development is appropriate for Mission Street, Fair Oaks Avenue and Huntington Drive can accommodate larger buildings via redevelopment of suburban format retail centers and large surface parking lots.

A listing of large (over 10-unit) pending developments that have been submitted to the City's Planning Commission as of June 2020 and listed in Table 2.3. As shown, these developments are in various implementation stages ranging from "pending approval" to "pending building permit". If all developments listed in Table 2.3 are approved and constructed as currently proposed, these near-term developments would contribute to 194 of the 589 planned new residential units that are included in the 2020 General Plan Update, as well as 13,394 square feet of commercial development. It should be noted that the size and number of residential units may change and that some projects may not be approved or constructed.

Table 2.3 Near-Term Developments

Development Name or Type	Location	Number of Residential Units	Commercial Space (sq. ft.)	Development Status
Mission Bell Project	1105-1115 Mission St	36	7,394	Approved by PC
Senior Housing Complex	625 Fair Oaks Ave	86	n/a	Approved by PC
7 Patios Mixed-Use	899 El Centro	57	6,000	Pending Approval
15-Unit Condo on Monterey Rd	181-187 Monterey Rd	15	n/a	Pending Approval
Totals		**194**	**13,394**	

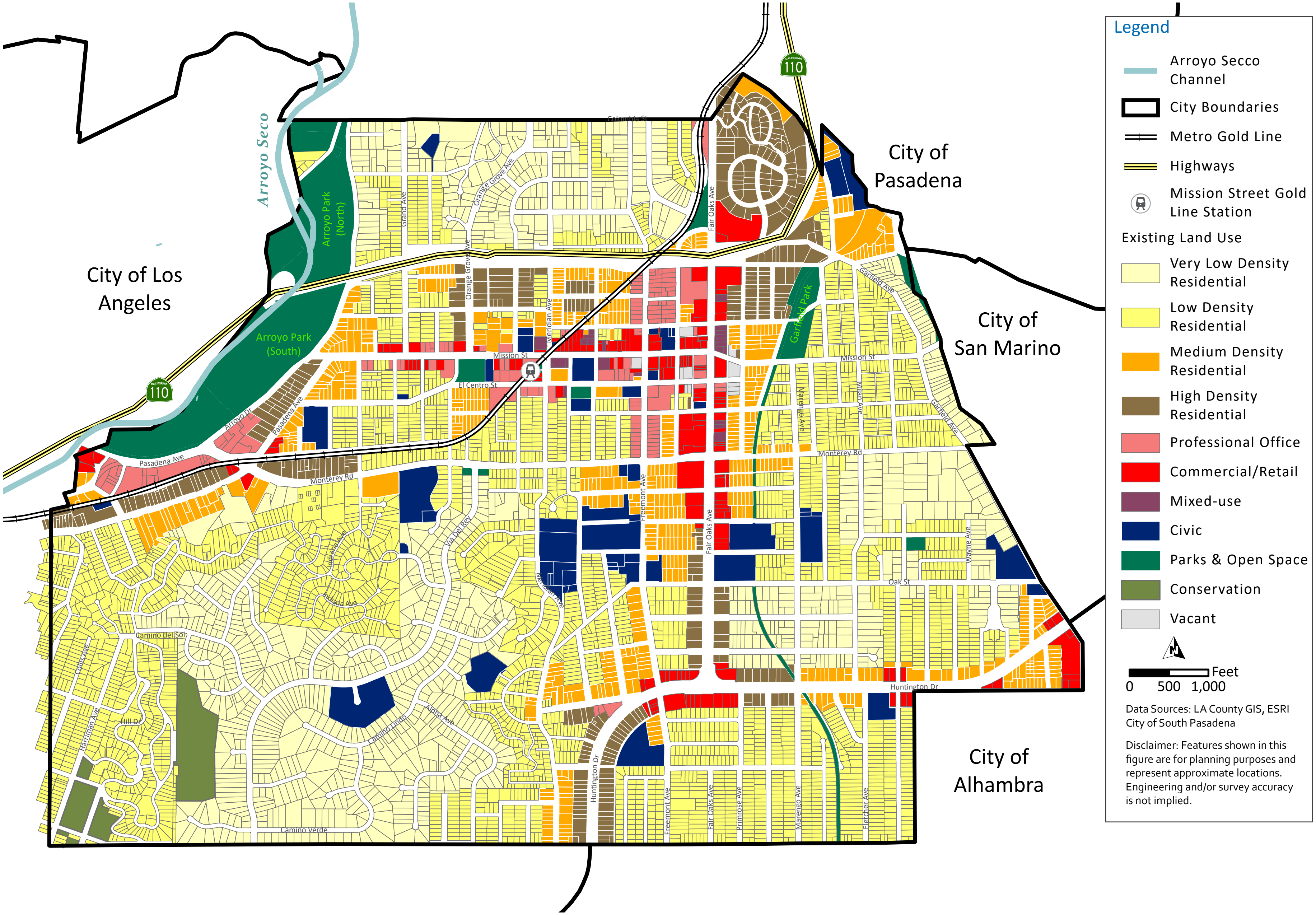

Figure 2.2 Land Use Map

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2.3.3 Future Land Use

The General Plan guides the type land use changes in different areas. The established areas are preserved and maintained, while growth is redirected to corridors in the Downtown area, Ostrich Farm District, and neighborhood centers along Huntington Drive. These three primary growth areas are depicted on Figure 2.3.

South Pasadena is approaching build out conditions. As of 2015, there were only 56 vacant residential parcels remaining, which is less than 1 percent of the 5,717 residential parcels. Moreover, there were less than 20 vacant non-residential parcels remaining. Hence, the City has limited capacity for growth.

The 2020 general plan accommodates the addition of 589 new residential units over the next 20 years, primarily located in Downtown along Mission Street and Fair Oaks Avenue, the Ostrich Farm, and along Huntington Drive. The number and area of the planned future residential units are listed in Table 2.4.

Table 2.4 Capacity for Future Development

Land Use Category	Residential Units	Size (Acres)
Mixed Use – Downtown	300	n/a
Mixed Use – Ostrich Farm District	75	n/a
Mixed Use – Huntington Drive Centers	50	n/a
Mixed Use – Other	75	n/a
Neighborhood Very Low	5	2.20
Neighborhood Low	60	9.74
Neighborhood Medium	5	0.20
Neighborhood High	19	0.38
Total	**589**	**12.52**

As shown in Table 2.4, future development is estimated to result in 589 new residential units by 2040. As stated in the 2020 General Plan Update, it is the City's goal to preserve and enhance distinctive residential neighborhoods, provide housing opportunities for all, reinvest in the downtown corridors and neighborhood centers, and ensure that new development contributes its fair share towards the provision of adequate parks, schools, and other public facilities.

2.3.4 2021 General Plan Update

The RHNA is a requirement of State housing law that determines projected housing needs for all jurisdictions in California and requires that each jurisdiction plan for its allocation of future housing. The State has allocated 1.3 million housing units to SCAG. SCAG has made a draft allocation of 2,062 housing units to South Pasadena for the period between 2021 and 2029. South Pasadena will plan for these additional housing units in its 2021 Housing Element Update.

As the Housing Element is still under development, there is still uncertainty about the timing and spatial distribution of the additional residential units. In addition, the 2021 Housing Element update may also incorporate other future land use changes as the allowable building densities and maximum building height may be modified to accommodate the State mandate. For the purposes of this One Water 2050 Plan, it is assumed that the 2,062 new units required by the

RHNA by 2029 will be added to the three main growth areas that are described in the General Plan: the Downtown area, Ostrich Farm District, and neighborhood centers along Huntington Drive. More details regarding the RHNA requirement and it's expected impact on the City's water and wastewater services can be found in Appendix B.

2.4 Population and Employment

This section describes the City's historical, current, and projected population as well as the City's current and projected employment.

2.4.1 Historical and Existing Population

Historical population estimates from the California Department of Finance from years 2010 through 2019 are presented in Table 2.5. As of 2019, the total existing population within the City's boundaries was estimated at 26,245, which is 649 more people than in 2010. Figure 2.4 shows that population growth in the City has slowed since 1970 as the City approaches full buildout. Average annual population growth since 2010 has been approximately 0.3 percent.

Table 2.5 Historical Service Area Population

Year	Population(2)	Growth from Previous Year
2010	25,596	0.4%
2011	25,722	0.5%
2012	25,820	0.4%
2013	25,933	0.4%
2014	26,188	1.0%
2015	26,369	0.7%
2016	26,337	-0.1%
2017	26,315	-0.1%
2018	26,276	-0.1%
2019	26,245	-0.1%

Notes:
(1) Source: Historic population values are from Report E-4, California Department of Finance, Table 2.
(2) Calculated based on City population and adjusted by removing parcels believed to be on septic systems.

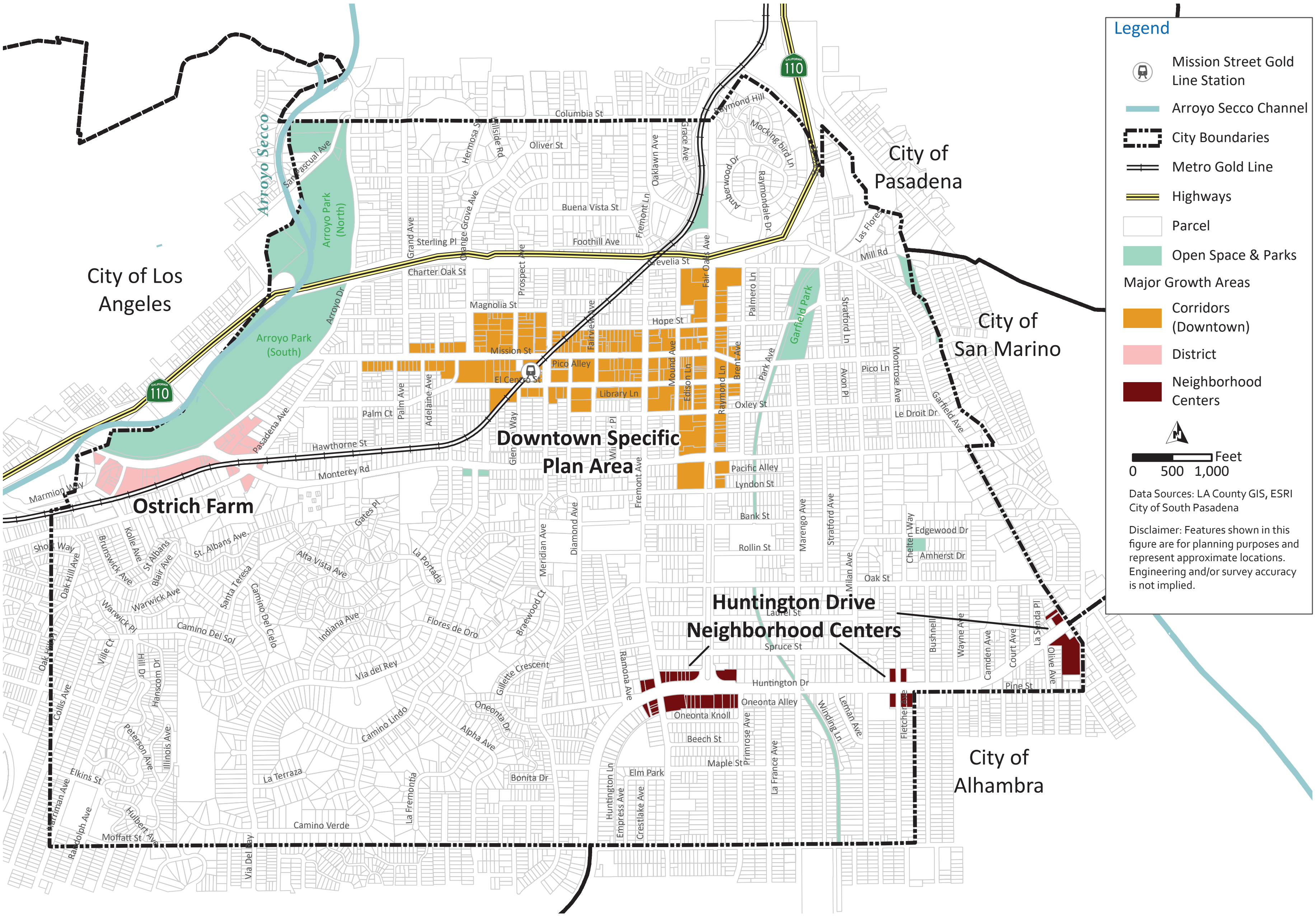

Figure 2.3 Major Growth Areas

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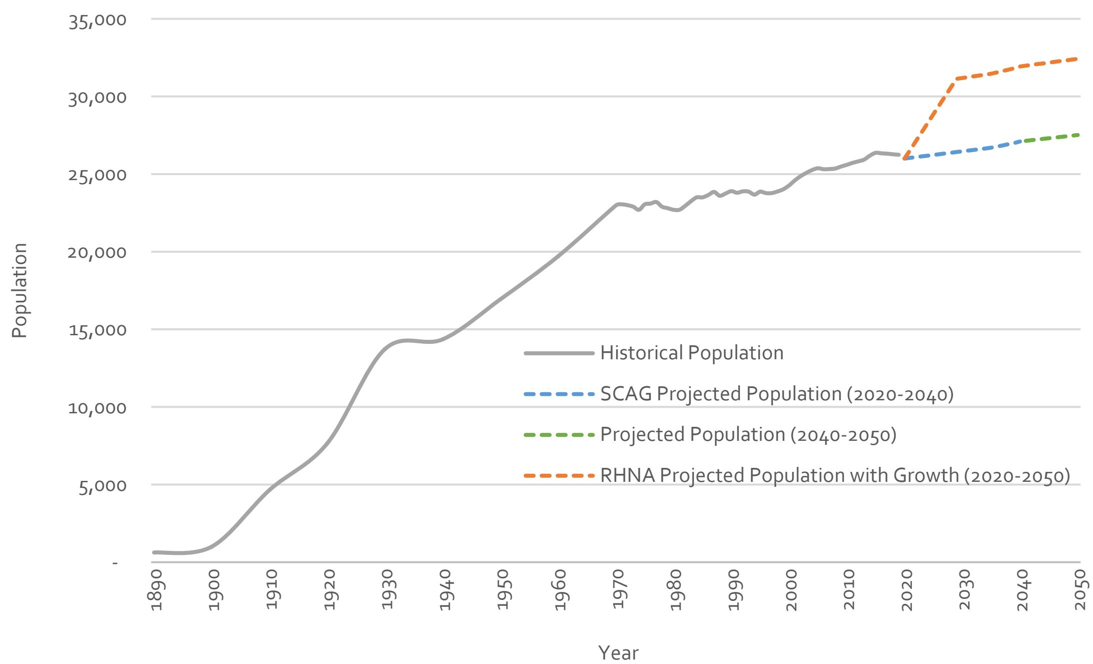

Figure 2.4 Historical and Projected City Population

2.4.2 Projected Population

The City's population is expected to increase modestly from 26,245 in 2019 to 27,100 in 2040 according to projections made by the Southern California Association of Governments (SCAG) and as shown in Table 2.6 and Figure 2.4. SCAG projections incorporate demographic trends, existing and projected land use, and input and projections from the California Department of Finance and the United States Census Bureau. This projection from SCAG equates to an average annual population increase of 0.2 percent per year between years 2000 and 2020. Further extrapolation of the City's population using this 0.2 percent growth rate yields a population estimate of 27,500 in year 2050.

Table 2.6 Service Area Population Projections

Year	SCAG and General Plan Total Service Area Population(1)	RHNA Total Service Area Population
2020	26,000	26,000
2025	26,200	28,900
2030	26,500	31,200
2035	26,700	31,500
2040	27,100	31,900
2045	27,300	32,200
2050	27,500	32,400

Notes:
(1) Projections for 2020, 2035, and 2040 were provided by SCAG. Projections for 2025 and 2030 were interpolated between 2020 and 2035. Projections for 2045 and 2050 were extrapolated from 2040 using average projected growth rates from 2020 through 2040. Interpolated and extrapolated estimates have been rounded to the nearest hundred.
(2) RHNA population projections include the addition of 2,062 units to the City by 2029 and assumes an annual growth rate of 0.2 percent after that through 2050.

Although the population projection from SCAG and the City's General Plan are prepared independently, it should be noted that the projected population increase of 855 people by 2040 would translate in an average housing density of 1.5 people per unit, if accommodated in the 589 new residential units. This is substantially lower than the City's current residential density of 2.5 persons per dwelling unit. However, the actual distribution of population growth will be absorbed City-wide, rather than solely within the new units.

The growth that would occur by meeting the RHNA requirement of adding 2,062 new residential units would be more substantial than that projected by SCAG. Adding these units by 2030 would result in the addition of approximately 5,200 people to the City for a total population of 31,200. Since the RHNA's time horizon only extends through 2030, population is assumed to resume the 0.2 percent annual growth rate projected by SCAG through 2050 for the purposes of this One Water 2050 Plan. Table 2.6 and Figure 2.4 show the two population projections and the sharp increase in population anticipated with compliance with the RHNA required housing additions.

2.4.3 Existing and Projected Employment

In addition to population projections, SCAG provides employment projections through 2040 based on national population and employment forecasts. Employment is expected to increase at a modest annual growth rate of 0.3 percent, which is slightly higher than the projected annual population growth rate of 0.2 percent. SCAG projects that the current employment of 9,900 will increase to approximately 10,500 by 2040. Further extrapolation of projected employment using the 0.3 percent growth rate yields an employment estimate of 10,800 in 2050. Employment projections are listed in Table 2.7. While the population added by meeting the RHNA requirement would also likely increase service area employment, employment projections for that growth scenario is not included in this One Water 2050 Plan.

Table 2.7 Service Area Employment Projections

Year	Total Service Area Employment
2012	9,300
2020	9,900
2025	10,000
2030	10,100
2035	10,200
2040	10,500
2045	10,700
2050	10,800

Note:
(1) Projections for 2020, 2035, and 2040 were provided by SCAG. Projections for 2025 and 2030 were interpolated between 2020 and 2035. Projections for 2045 and 2050 were extrapolated from 2040 using average projected growth rates from 2020 through 2040. Interpolated and extrapolated estimates have been rounded to the nearest hundred.