CITY OF OCEANSIDE

2015 Integrated Master Plan

VOLUME 1

Water Master Plan

Final Report & Appendices | June 2015

carollo

Engineers...Working Wonders With Water®

CITY OF OCEANSIDE
2015 INTEGRATED MASTER PLANS

2015 WATER MASTER PLAN

June 2015

FINAL REPORT

REGISTERED PROFESSIONAL ENGINEER
INGE WIERSEMA
No. 66123
CIVIL
STATE OF CALIFORNIA

199 SOUTH LOS ROBLES, SUITE 530 • PASADENA, CALIFORNIA 91101 • P. 626.535.0180 • F. 626.535.0185

CITY OF OCEANSIDE
INTEGRATED MASTER PLAN

WATER MASTER PLAN

TABLE OF CONTENTS

Page No.

CHAPTER 4: EXISTING WATER SYSTEM FACILITIES

CHAPTER 5: MODEL DEVELOPMENT

CHAPTER 6: EVALUATION CRITERIA

CHAPTER 7: EXISTING SYSTEM EVALUATION

CHAPTER 8: FUTURE SYSTEM EVALUATION

CHAPTER 9: CAPITAL IMPROVEMENT PLAN

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

-This Page Left Blank Intentionally-

LIST OF ABBREVIATIONS

Abbreviation	Description
A	Agriculture
ac	Acre
AC	Asbestos cement
afy	Acre-feet per year
ADD	Average Day Demand
AR	Agricultural/Residential
AS	Special Agricultural Water Rate
AWWA	American Water Works Association
BMP	Best Management Practices
BPP	Basin pumping percentage
BPS	Booster pump station
Carollo	Carollo Engineers, Inc.
C	Commercial
CA	Commercial Agriculture
CC	Community Commercial
cf	Cubic feet
cfs	Cubic Feet per Second
CI	Cast iron
CI	Civic Institutional
CIMIS	California Irrigation Management Information System
CIP	Capital Improvement Program or cast iron pipe
City	City of Oceanside
CMLCS	Cement mortar lined coated steel
CRA	Colorado River Aqueduct
CUWCC	California Urban Water Conservation Council
CWA	County Water Authority
DIP	Ductile iron pipe
DMM	Demand Management Measures
DOF	Department of Finanace
DWR	Department of Water Resources
EAR	Estate A Residential
EBR	Estate B Residential
EPS	Extended period simulation
ERU	Equivalent Residence Unit
ETo	Evapotranspiration
F	Fahrenheit
FCF	Flow Control Facilities
ft	Feet
ft-msl	feet above sea level
G	City/Government Account
GA	Grouped Agriculture

Abbreviation	Description
GAC	Granular Activated Carbon
GC	General Commercial
GI	General Industrial
GIS	Geographic Information Systems
Gpcd	Gallons per capita dat
gpd/ac	Gallons per day per acre
GR	Grouped Agricultural/Residential
H	Government Harbor Sub
HDR	High Density Residential
HGL	Hydraulic Grade Line
I	Irrigation
IC	Construction
IWMP	Integrated Water Master Plan
LDR	Low Density Residential
LI	Light Industrial
M	Multi-Family Residential
MBGPF	Mission Basin Groundwater Purification Facility
MDA	Medium Density - A
MDB	Medium Density - B
MDC	Medium Density - C
MDD	Max Day Demand
MFR	Multi family residential
MG	Million gallons
mg/L	Milligrams per liter
mgd	Million gallons per day
mi	Mile
Min.	Minimum
MinDD	Minimum Day Demand
MinMD	Minimum Month Demand
MMD	Maximum month demand
MOU	Memorandum of Understanding
MS	Master-Metered Single Family Home
Msl	Mean sea level
MT	Multi-Family Residential where the meters T off
MWD	Metropolitan Water District, see MWDSC
MWDSC	Metropolitan Water District of Southern California
N/A	Not applicable
NC	Neighborhood Commercial
NCDP	North County Distribution Pipeline
OS	Open Space
PC	Professional Commercial
PF	Peaking Factor
PHD	Peak hour demand
PI	Private Industrial

Abbreviation	Description
ppl/du	Persons per dwelling unit
PRS	Pressure regulating station
PRV	Pressure reducing valve
PS	Pump station
psi	Pounds per square inch
PVC	Polyvinyl chloride
R	Single-Family Residential
RA	Commercial Agricultural/Residential
RMWD	Rainbow Municipal Water District
RO	Reverse Osmosis
RPI	Research Park Industrial
RS	Agricultural/Residential Special Agricultural Water Rate
RT	Single Family Residential where the meters T off
S	Special Users
SC	Special Commercial
SCADA	Supervisory Control and Data Acquisition
SANDAG	San Diego Association of Governments
SDCWA	San Diego County Water Authority
SFDR	Single Family Detached Residential
SFR	Single family residential
SSS	Steady state simulation
STL	Steel
SWP	State Water Project
TAP	Tri-Agency Pipeline
TAZ	Transportation Analysis Zone
TCP	Trichloropropane
TM	Transmission Main
TR	Trace
UHDR	Urban High Density Residential
UWMP	Urban Water Management Plan
VID	Vista Irrigation District
VIP	Victaulic iron pipe
VWD	Vallecitos Water District
WC	Water Consumption Only
WDF	Water demand factor
WFP	Weese Filtration Plant
WMP	Water System Master Plan
WRF	Water Reclamation Facility
WTP	Water treatment plant
μg/L	Micrograms per liter

-This Page Left Blank Intentionally-

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

The purpose of this Water Master Plan (WMP) is to aid the City of Oceanside (City) in the planning, development, and financing of wastewater collection system facilities, to provide reliable and enhanced service for existing customers, and to serve anticipated land use changes and growth. This WMP considers existing flow conditions as well as future growth projected by a number of specific near-term development projects and the San Diego Association of Governments' (SANDAG's) long-term regional growth projections. The objective of this master plan is to serve as a strategic planning guide for upgrading, improving, and expanding the City's wastewater collection system.

ES.2 STUDY AREA

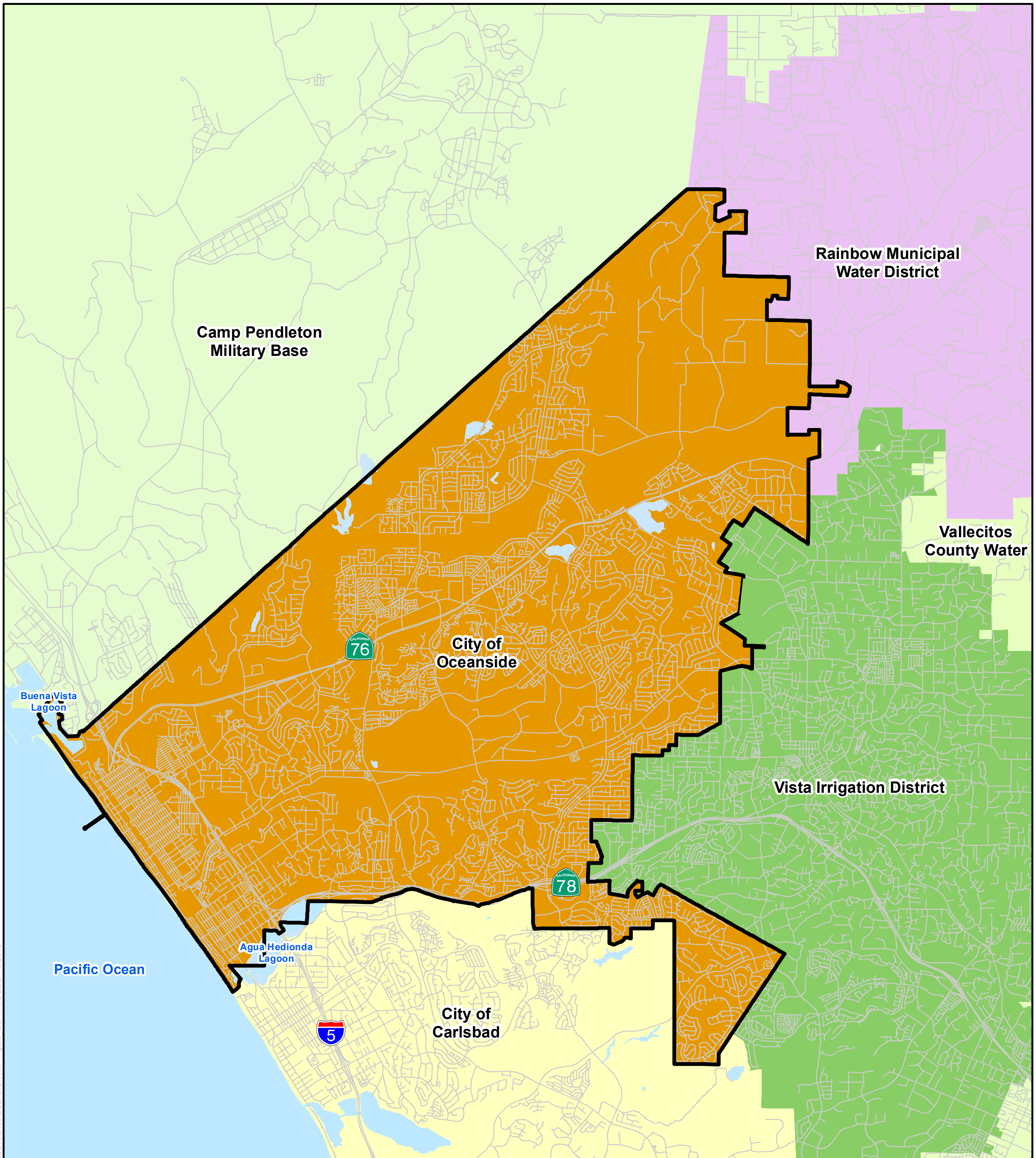
The City is located 35 miles north of the City of San Diego, encompassing about 42 square miles. The study area for this master plan is the City's water service area, which closely coincides closely with the City boundary as described in Chapter 1.

As shown on Figure ES.1, the City's service area is bordered by the Carlsbad Municipal Water District to the south, Camp Pendleton Military Base to the north, and the Pacific Ocean on the west. On the eastern side, the City's service area is bounded by Rainbow Municipal Water District (northeast) and Vista Irrigation District (southeast).

The City can be characterized by varied topography and rolling hills that increase from sea level in the southwestern end to elevation of up to 930 feet above mean sea level (msl) approximately 10 miles inland.

ES.3 LAND USE

The City's General Plan was most recently updated in 2002, and was amended most recently in June 2012. The City's General Plan defines many elements of land use, including the distribution of land use types and both near-term and long-range development plans (Oceanside, 2002).



Legend

Streets

Bodies of Water

Oceanside Service Area

Neighboring Agencies

CWA Vista Irrigation District

Carlsbad Municipal Water District

Pendleton Military Reservation

Rainbow Municipal Water District

Vallecitos County Water District

N

0 1 2 Miles

Figure ES.1
Service Area Boundary
Water Master Plan
City of Oceanside

carollo

One significant development anticipated in the north of the City's service area is the Morro Hills Development. The Morro Hills Plan proposes that this development be composed of new low-density residences. In addition, the El Corazon Plan and Rancho Del Oro Plan entail the development of significant new industrial space within the City. Residential, commercial, and even some open space are included along the periphery of these developments.

Significant amounts of redevelopment are planned for the downtown area around City Hall and out to the beachfront within the Coastal Zone Boundary. Finally, a large portion of the City is zoned for agricultural use, the majority of which is located in the northeast portion of the City.

In addition to the developments described above, there is also discussion among landowners in the Morro Hills Area (east of the Morro Hills Development described previously) to sell their agricultural land and convert this area to estate or low-density residential area. This could potentially replace about 3,000 acres of agricultural land with 600 to 1,000 homes. Due to the uncertainty of this development, this WMP does not consider this land use conversion. The potential impact of this conversion of the required water and sewer system infrastructure improvement needs is evaluated in a separate study.

ES.4 POPULATION

The United States (U.S.) Census Bureau performs a census every 10 years, providing population estimates for municipalities throughout the country. The California Department of Finance (DOF) estimates population during non-census years using the previous census as a benchmark. Following the 2010 Census, the DOF revised their previous estimates for the City years between 2000 and 2010 to make historical estimates consummate with the 2010 Census.

Historical population estimates for 1997 through 2013 are depicted graphically on Figure ES.2. As shown on this figure, the population estimates made by the DOF based on 2000 Census data were substantially higher (16,000 people for 2010) than those based on actual counts made during the 2010 Census. After the 2010 Census data was received, the U.S. Census Bureau revised their population estimates for the years 2001-2010.

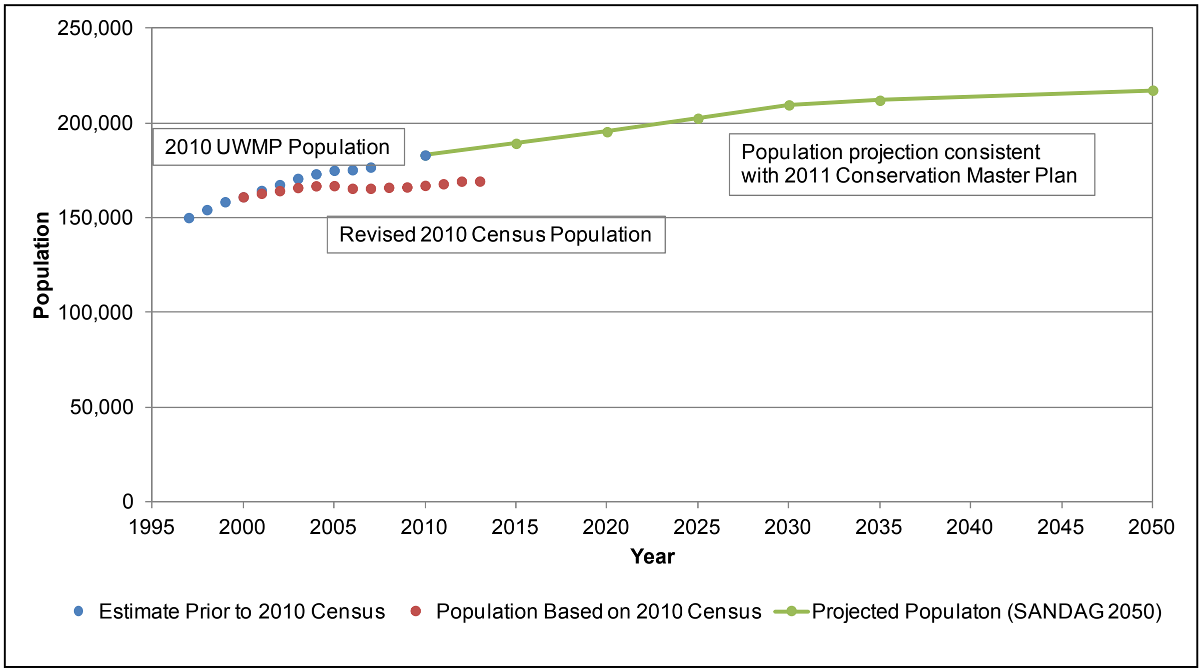


Figure ES.2 Historic and Projected Population

The initial population projection for 2010 was about 16,000 people (or 10 percent) higher than the 2010 Census population count. This difference represents a significant discrepancy in the data. Some potential reasons for this overestimation prior to the 2010 Census include the semi-transient nature of the nearby military population at Camp Pendleton and reduced economic activity due to the financial crisis late in the decade. The cause of this discrepancy could be important in anticipating the potential for recovery of the population in the future. It should be noted that the City faced a similar issue in the early 1990s, during the Desert Storm operation in 1990 and 1991. At that time, thousands of troops from nearby Camp Pendleton were deployed to the Middle East, with the local economy suffering, and sewer flows decreasing dramatically.

Population projections are based on the SANDAG 2050 Regional Growth Forecast. As discussed above, annual population estimates were revised substantially following the 2010 Census. The adjusted population estimates have not yet been incorporated into SANDAG's population estimates presented on Figure ES.2. However, for this master plan, the projected population was not reduced based on the population discrepancy. In part, this is because the reasons cited above for the discrepancy could potentially be only temporary influences. Especially if the population reduction occurred due to economic considerations, recovery to previous population levels could occur much faster than predicted by projected population growth rates. Thus, for conservative planning purposes and consistency with the City's 2011 Water Conservation Plan, it was decided to use the SANDAG 2050 population projections. This population projection is also graphically depicted on Figure ES.2.

The study area population is expected to continue to grow through year 2050. The majority of this growth is projected to occur in the next 15 to 20 years. The 2050 population is projected to be approximately 217,000 people.

ES.5 EXISTING AND FUTURE WATER DEMANDS

The City purchases imported water from SDCWA, who obtains water from MWDSC. Water is imported by the MWDSC through the Colorado River Aqueduct (CRA) and the California State Water Project (SWP). MWDSC sells both treated and untreated water to its member agencies, including SDCWA. The SDCWA owns and operates its own aqueduct and reservoir system that also conveys both treated and untreated water to its member agencies, including the City of Oceanside.

SDCWA supplies both treated and untreated imported water to the City through five aqueduct connections. Treated imported water is conveyed directly to the City's water distribution system, while untreated imported water is first conveyed to the City’s Weese Water Filtration Plant (WFP). Treated water from this plant is then delivered to the City's distribution system.

The annual water supply in 2012 was 27,852 acre-ft, which equates to an average day demand (ADD) of 24.9 million gallons per day (mgd). The maximum month demand (MMD) in 2012 was 32.4 mgd, while the maximum day demand (MDD) was calculated to be approximately 40.0 mgd. For conservative planning purposes, a MDD peaking factor of 1.85 was used in this Water Master Plan.

For conservative planning purposes, water demands were forecasted using a combination of a population and land use based demand forecasting methods. To develop long-term demands, a per unit population based methodology was utilized, while a land use based projection was used to project the City’s near-term water demand.

Long-term demand forecasting utilized population projections to project future water use. An average per capita water use expressed in gpcd was developed by examining historical demands and planning documents. The water use target of 142 gpcd from the 2010 UWMP was used to provide a consistent and conservative planning basis. This water use target was assumed to be realistic for per capita water use in year 2020 and beyond as the City’s water use in 2012 was estimated at 147 gpcd. The per capita water use (gpcd) was then combined with population projections from the SANDAG 2050 regional growth forecast (population) to project the City’s future water demand.

This method of demand projection is consistent with the regional growth estimate for all years through 2050. Furthermore, this consistency this will allow the City to use this projection additional planning efforts for the next few years. The benefits of using the SANDAG 2050 regional growth forecast are described in more detail in Chapter 2.

The forecasted water demands are summarized in Table ES.1.

Table ES.1 Water Demand Projections
Water Master Plan
City of Oceanside

Year	Population(1)	Per Capita Water Use (gpcd)	Annual Demand(2) (afy)	Average Day Demand (mgd)	Maximum Day Demand(3) (mgd)
2015	189,275	157	33,286	29.7	55.0
2020	195,455	142	31,089	27.8	51.3
2025	202,529	142	32,214	28.8	53.2
2030	209,602	142	33,339	29.8	55.1
2035	212,024	142	33,725	30.1	55.7
2050	217,364	142	34,574	30.9	57.1

Notes:
(1) Population projections from Chapter 2 (SANDAG, 2010).
(2) Annual Demand based on population projections and 2010 UWMP per-capita demand targets.
(3) MDD estimated using an assumed MDD/ADD factor of 1.85

As shown in Table ES.1, the City's future water demands are expected to increase from approximately 28,000 afy in 2012 to over 34,000 afy in 2050. This represents an average annual growth of about 0.5 percent.

ES.6 HYDRAULIC MODEL

The City provided Carollo with a copy of the most recently updated water system hydraulic model. The City's water model was originally constructed in 1999 using the H_2ONET® water modeling software application. The model was updated and converted to H_2OMap® Water as part of the 2008 WMP. To analyze the potable water distribution system, the City's existing H_2OMap Water® hydraulic model was updated and calibrated to estimate, or predict, how the water distribution system responds under a given set of conditions. The results of the modeling analysis are presented in this WMP.

ES.7 POTABLE WATER SYSTEM EVALUATION

This section summarizes the evaluation of the City's potable water system facilities and identifies current and future system deficiencies.

ES.7.1 Existing Water Distribution System

The vast majority of the City's water supply consists of imported water, which enters the distribution system at high elevations (HGL 800 and 900), while groundwater from the MBGPF enters the distribution system at low elevations (HGL 320 and 511). With the exception of groundwater, water is typically conveyed by gravity through PRSs from the inland hills in the northeast, to the downtown area along the ocean in the southwest. Many of the City's booster PSs are primarily used during emergencies when water needs to be pumped up from reservoir storage to meet demands in higher pressure zones.

Currently, the City manages a potable water system that consists of approximately 28 pressure zones, 574 miles of pipeline, 8 groundwater wells, 12 storage reservoirs, 9 booster pumping stations (PS), 2 water supply PSs located at MBGPF, 5 imported connections, 54 pressure regulating stations (PRS), and 7 altitude valves. These facilities are shown on Figure ES.3.

ES.7.2 Water Supply Reliability

The City of Oceanside receives water supplies from San Diego County Water Authority (SDCWA or CWA) and groundwater from the Mission Basin. Imported water currently contributes to approximately 87 percent of the total annual water supply and the remaining 13 percent of water is supplied by the Mission Basin Groundwater Purification Facility (MBGPF).

As part of the City's water supply reliability evaluation, the number of days of available storage in the City's distribution system was evaluated during multiple outage scenarios under MDD conditions. Based on the analysis completed, Scenario 3 (outage of CWA No. 4 connection and NCDP-1 pipeline), Scenario 6 (outage of NCDP-1 pipeline), and Scenario 8 (outage of CWA No. 3, 4 and 5) resulted in the usage of emergency storage under MDD conditions. In Scenarios 3 and 4, 6 to 8 days of emergency storage is available under MDD conditions and a surplus of storage exists under MinDD conditions. In Scenario 8, 1 to 2 days of emergency storage is available under MDD conditions and surplus of supply exists under MinDD conditions. However, the available supply sources would not be able to reach all pressure zones within the existing system. Facility improvements are suggested to improve supply reliability by adding new reservoirs and upgrading or adding new pump stations to the distribution system.

ES.7.3 Water Distribution System Evaluation

The water distribution system was evaluated using the hydraulic model based on the criteria described in Chapter 6 to determine system deficiencies and identify improvement projects to address these deficiencies. The distribution system evaluation included system pressures, pipeline velocity, fire flow, storage, and pump station capacity analyses under existing and 2050 demand conditions. In addition, the need for repair and rehabilitation projects along with future plant projects were analyzed as part of the WMP. The findings and recommendations of these analyses are described in detail in Chapter 7.

ES.7.4 Water System Rehabilitation

The City's GIS data was entered into the BAM Model to conduct a statistical analysis of decay and failure of pipelines based on age, material, and diameter. The BAM model identified approximately 144 miles of pipeline within the City that are anticipated to reach the end of their lifespan by year 2050. Starting in year 2020, approximately 4.1 miles of asbestos concrete pipeline, along with moderate amounts of steel and concrete pipeline, would require replacement. Then, approximately 11.9 miles of pipeline would require replacement between 2020 and 2029, approximately 39.1 miles of pipeline between 2030 to 2039 and approximately 89.2 miles of pipeline between 2040 to 2049.

However, age-based analysis is a good initial, coarse screening method but it does not necessarily indicate the condition of the pipe is poor and nearing the end of its useful life. To determine the priority and urgency of pipeline replacements, pipeline condition assessments need to be conducted in the near-term and long-term phases to gather the necessary data to prioritize the age-based pipeline replacements. Based on the findings of the field condition assessments, certain pipelines may only require rehabilitation and not replacement in the future to extend the useful life of each pipeline, where cost-effective.

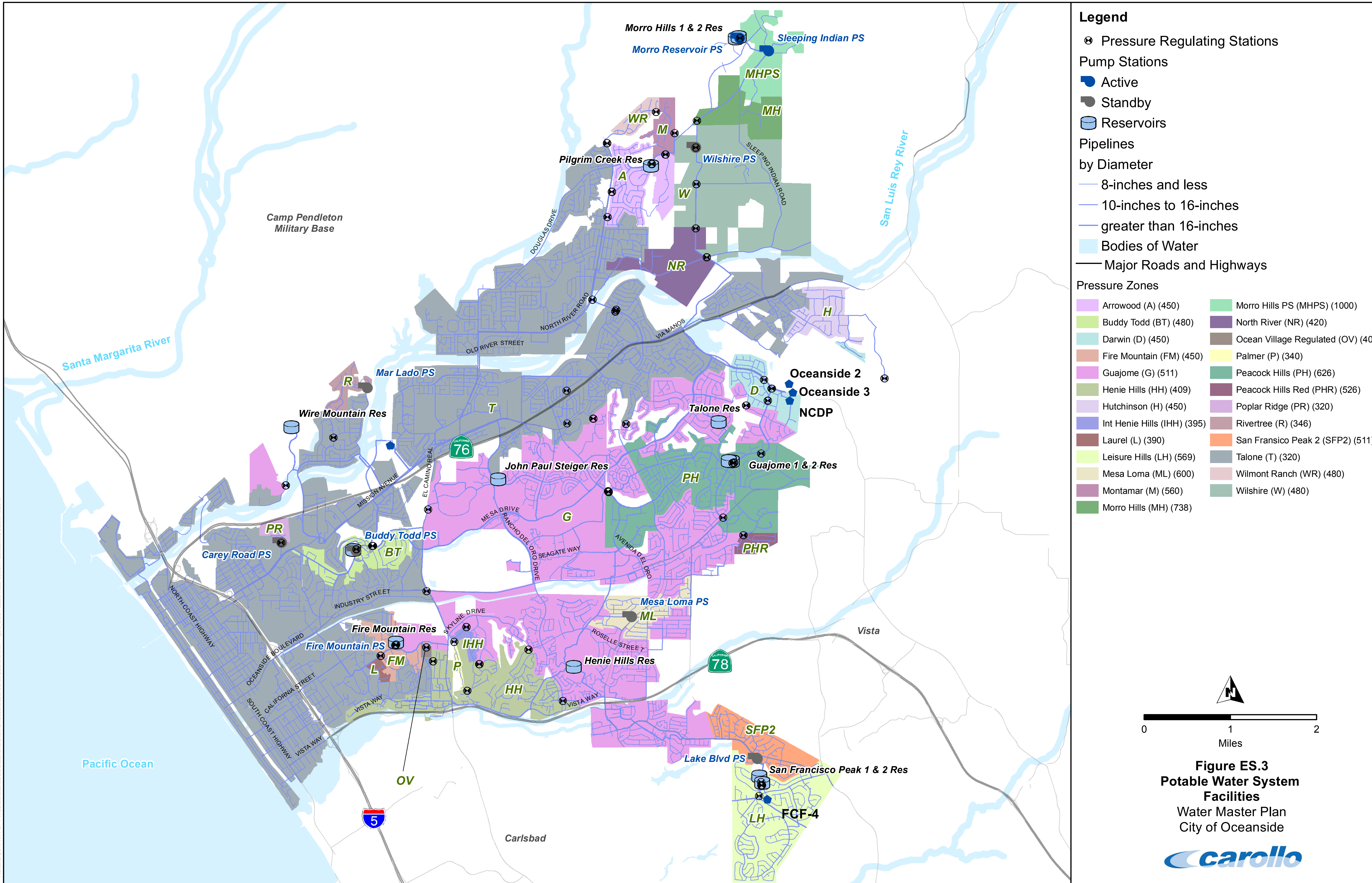


Figure ES.3
Potable Water System Facilities
Water Master Plan
City of Oceanside

ES.7.5 Water System Recommendations

In summary, the following major water system improvement projects are recommended and included in the CIP:

- 16 fire flow improvement projects with a combined length of 6 miles to address existing system fire flow deficiencies with an estimated capital cost of $10 million. In addition, the replacement of approximately 33 miles of small diameter pipelines (4-inch and 6-inch) to address fire flow deficiencies with an estimated capital cost of $60 million.
- 7 storage projects with a combined capacity of 35 MG with an estimated capital cost of $67 million. The proposed reservoirs include the Zone 800 Reservoir (10 MG), Guajome 3 Reservoir (7 MG), Fire Mountain 2 Reservoir (4 MG), Wire Mountain 2 Reservoir (4 MG), El Corazon Reservoir (5 MG), Henie Hills Reservoir (1 MG), and Guajome 4 Reservoir (4 MG).
- 5 pump station projects with a combined capacity of 1,340 HP and an estimated capital cost of $9 million. The proposed pump stations include the Lake Boulevard PS Upgrade, Sleeping Indian PS Upgrade, Morro Hills PS Upgrade, the Zone 800 PS, and the Zone 511 PS Upgrade.
- IRP Study, PDR, injection wells, and treatment facilities to provide approximately 5 MG of local supply to the City at an estimated capital cost of $43 million.
- Ocean Desalination Study and treatment facilities to provide approximately 5 MG of local supply to the City at an estimated capital cost of $76 million.
- Nearly 18 miles of new transmission mains to serve the future developments and capacity improvements with an estimated capital cost of $54 million.
- Nearly 128 miles of water main rehabilitation or replacement by year 2050 with an estimated capital cost of $233 million. This excludes the small diameter pipeline replacements, which are included under the fire flow improvement projects.

The proposed potable water system improvement projects are depicted on various figures in Chapter 7.

ES.8 CAPITAL IMPROVEMENT PLAN

Project cost estimates were calculated based on elements, such as the project location, size, length, land acquisition needs, and other factors. Allowances for project contingencies consistent with an “Order of Magnitude” estimate are also included in the project costs prepared as part of this WMP.

The proposed capital improvements are prioritized based on their urgency to mitigate existing deficiencies and condition issues and for servicing future growth, which are presented in Figure ES.4. The implementation phases are separated into two phases, near-term and long-term. As mentioned previously, the near-term phase extends from 2014 to 2020, and the long-term phase begins in 2021 and continues until 2050. A summary improvement costs by phase is provided in Table ES.2. As listed in Table ES.2, the total estimated cost for potable water system improvements through the year 2050 is nearly $622.4 million. The vast majority of improvement projects ($519.6 million) are associated with long-term improvements.

The distribution of project cost by project type are listed in Table ES.3 and depicted on Figure ES.5. As shown on Figure ES.5, the majority of the proposed improvements consist of rehabilitation projects. Pipeline rehabilitation and replacement (R&R) accounts for approximately 37.5 percent of the total CIP cost. Capacity projects account for approximately 32.2 percent of the recommended improvement projects, while the remaining 19.4 percent of CIP costs are associated with other projects, such as the future IPR and Ocean Desalination facilities and miscellaneous items.

Table ES.2 Existing Versus Future User Costs
Water Master Plan
City of Oceanside

	Implementation Phase		
Reimbursement Category	**2015-20 ($ Million)**	**2020-50 ($ Million)**	**Total ($ Million)**
Cost to Existing Users	$90.2	$456.0	**$546.2**
Cost to Future Users	$12.6	$63.6	**$76.2**
Total	**$102.8**	**$519.6**	**$622.4**
Number of Years	5	30	35
Costs Per Year	**$20.6**	**$17.3**	**$17.8**

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

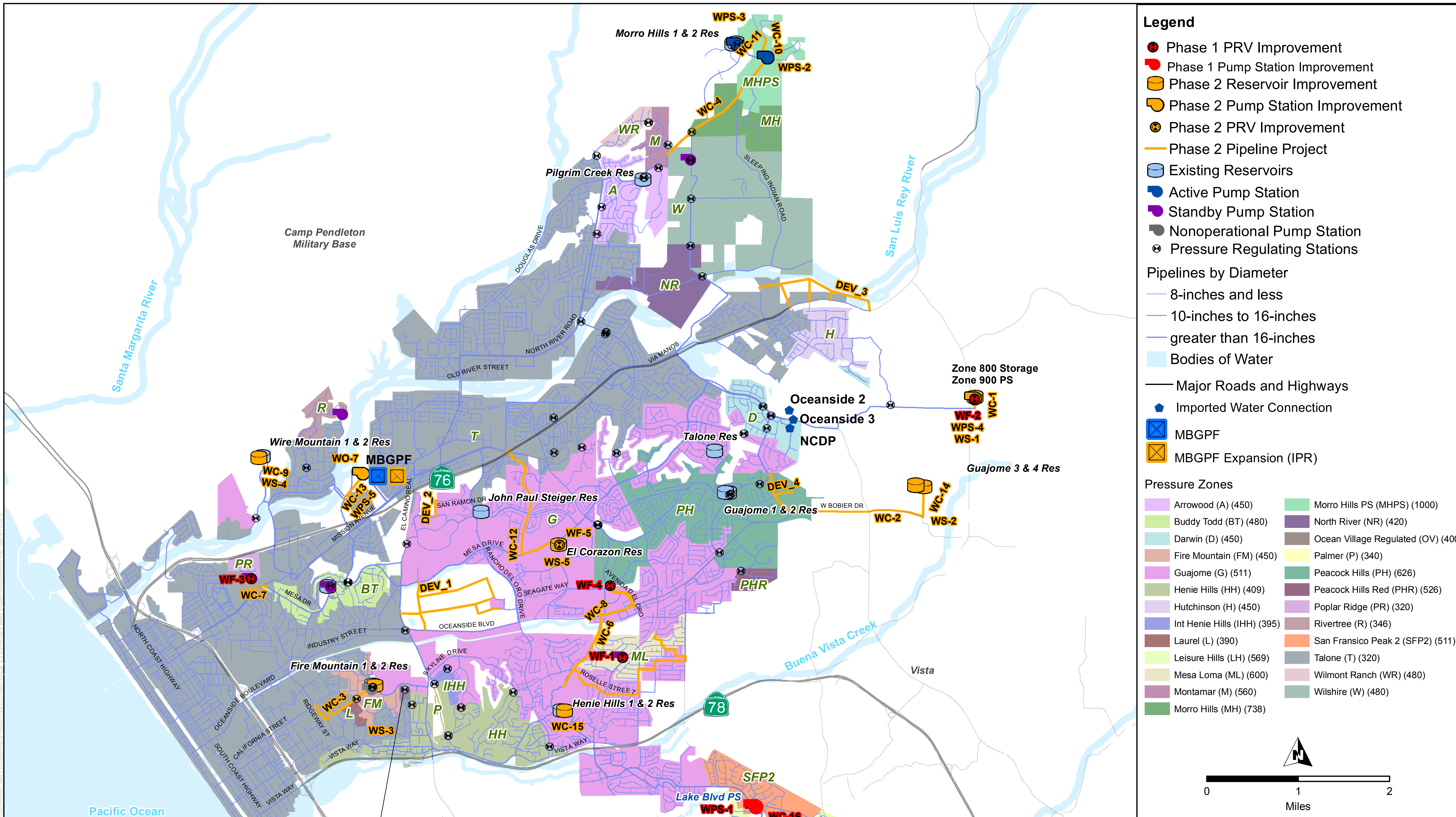


Figure ES.4
Proposed Water System Improvements
Water Master Plan
City of Oceanside

Table ES.3 Summary of Capital Improvement Costs by Project Type Water System Master Plan City of Oceanside				
	Implementation Phase			
Project Category	2015-2020 ($ Million)	2020-2050 ($ Million)	Total 2015 to 2050 ($ Million)	Percentage (%)
Capacity Improvements				
Pipelines	$1.0	$52.6	$1.0	8.6%
Fire Flow Pipelines	$36.2	$34.2	$36.2	11.3%
Storage Reservoirs	$ -	$66.7	$ -	10.7%
Pump Stations	$2.0	$6.8	$2.0	1.4%
PRSs	$0.7	$0.2	$0.7	0.1%
Capacity Subtotal	**$39.9**	**$160.5**	**$200.4**	***32.2%***
Repair & Rehabilitation Improvements				
Pipelines	$4.2	$229.1	$233.3	37.5%
Storage Reservoirs	$24.8	$15.7	$40.5	6.5%
Pump Stations	$0.9	$6.1	$7.0	1.1%
PRSs	$0.5	$2.2	$2.6	0.4%
Weese	$11.0	$1.0	$12.0	1.9%
MBGPF	$6.0	$ -	$6.0	1.0%
R&R Subtotal	***$47.2***	***$254.1***	***$301.3***	***48.4%***
Other	$15.7	$105.0	$120.7	19.4%
Grand Total	**$102.8**	**$519.6**	**$622.4**	**100%**

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

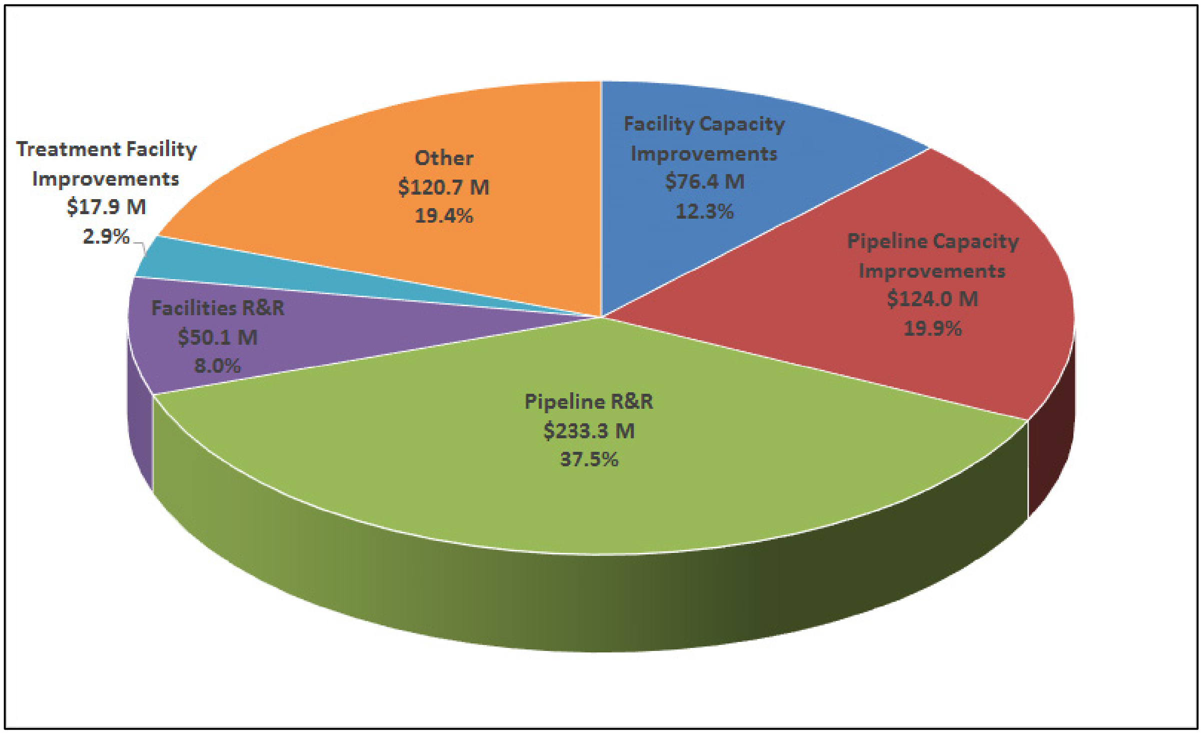


Figure ES.5 CIP Costs by Project Type

INTRODUCTION

The City of Oceanside (City) has retained Carollo Engineers, Inc. (Carollo) to prepare this Water System Master Plan (WMP). The WMP is part of a larger effort to produce an Integrated Water Master Plan (IWMP) for the City's potable water, recycled water, and wastewater collection systems. This chapter presents the purpose, objectives, and background of this WMP and the scope of work of this project. A list of references used to prepare this master plan is provided in Appendix A.

1.1 BACKGROUND

The City's previous water master plan was completed in 2008. This master plan was prepared by Carollo. This previous master plan was also part of a comprehensive planning effort that consisted of six documents that covered infrastructure planning for the City's water, recycled water, and wastewater collection systems as well as a technology plan, a collection system plan, and a rate study. The phasing and cost estimates of the recommended projects were summarized in a capital improvement program (CIP) with a total estimated capital cost of $207 million (2008 dollars).

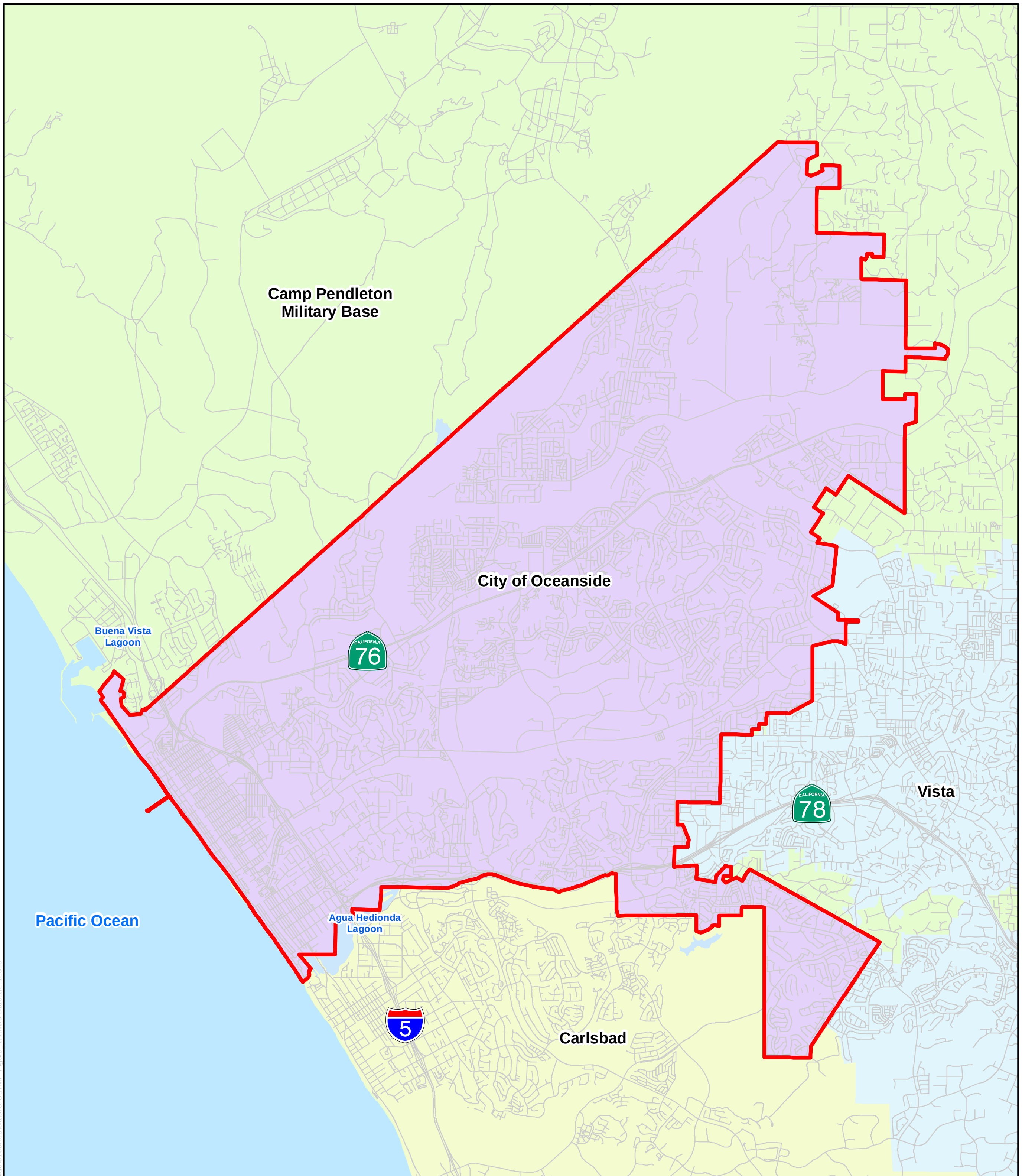
As the previous master plan is more than five years old, coupled with substantial water demand reductions due to water conservation efforts and the economic downturn, the City decided to update the 2008 water master plan and develop a new capital improvement program that prioritizes the necessary water infrastructure upgrade and expansion projects.

1.2 GOALS AND OBJECTIVES

The purpose of this master plan is to update the previous master plan and aid the City in the planning, development, and financing of water system facilities to provide reliable and enhanced service for existing customers, and to serve anticipated land use changes and growth. This WMP considers existing conditions as well as future plans presented in the City's General Plan. Where available, specific development plans have been considered. The objective of this master plan is to serve as a strategic planning guide for upgrading, improving, and expanding the City's water system. The planning horizon of this WMP is year 2050.

1.3 CITY BOUNDARY

The City currently occupies approximately 42 square miles in the northern part of San Diego County, California. The study area of this WMP is the City's water service area, which is depicted on Figure 1.1.



Legend

Service Area Boundary

Streets

Neighboring Cities

Carlsbad

San Marcos

Vista

Water

Miles

0 1 2

Figure 1.1
Water Service Area
Water Master Plan
City of Oceanside

carollo

As shown on Figure 1.1, the City is bordered on the west by the Pacific Ocean, on the north by Camp Pendleton Military Base, on the south by the City of Carlsbad, and on the east by the City of Vista and unincorporated San Diego County land. The City's water service area (and study area of this WMP), closely coincides with the City boundary and is described in Chapter 2. Due to the close overlap, information obtained for the entire City was used to describe the City's service area and perform calculations presented in this WMP.

1.4 REPORT ORGANIZATION

The WMP has been organized into nine chapters, an executive summary, and multiple appendices that provide supporting documentation for the information presented in the report. The subjects discussed in each chapter are briefly described below:

Chapter 1 – Introduction. This chapter presents the need for this WMP and the objectives of the master plan.

Chapter 2 – Study Area, Land Use, and Population. This chapter presents a discussion of this master plan's planning area, near-term land use, and population forecast.

Chapter 3 – Water Demands. This chapter presents historical production and consumption, existing water consumption, and future water demand projections.

Chapter 4 – Existing Water System Facilities. This chapter presents an overview of the City's existing water distribution system network and facilities, such as groundwater wells, pump stations, and storage reservoirs.

Chapter 5 – Model Development. This chapter describes the development and calibration of the City's water distribution hydraulic model. This model was calibrated for both steady state conditions using fire flow test results, and extended period simulation (EPS) conditions using 24-hour data from the City's SCADA system.

Chapter 6 – Evaluation Criteria. This chapter presents the planning criteria and methodologies for analysis used to evaluate the existing distribution system and its facilities, and to address the existing system deficiencies and future improvements. The developed criteria address the water supply capacity, storage capacity, acceptable service pressures, fire flow requirements, and distribution main performance.

Chapter 7 – Existing System Evaluation. This chapter presents the findings and results of the capacity evaluation and hydraulic modeling analysis for the existing system under various demand and supply conditions. This chapter concludes with the proposed improvements that can mitigate the identified deficiencies under existing demand condition.

Chapter 8 – Future System Evaluation. This chapter presents the findings and results of the capacity evaluation and hydraulic modeling analysis of the water distribution system to meet the projected water demands. Analysis was performed for both near-term and build-out demand conditions. This chapter concludes with the proposed improvements that are required to meet the identified deficiencies under future demand conditions.

Chapter 9 – Capital Improvement Plan. This chapter presents a CIP for the City's water distribution system. This program incorporates all recommended projects identified in the existing system analysis (Chapter 7) and the future system analysis (Chapter 8). This CIP includes planning level cost estimates and the proposed project phasing for both near-term and future demand conditions.

1.5 ACKNOWLEDGEMENTS

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

- Jason Dafforn, P.E., Interim Water Utilities Director
- Cari Dale, Water Utilities Director (former)
- Rosemarie Chora, Water Utilities Division Manager
- Sabrina Dolezal, P.E., Assistant Engineer (former)
- Talli Carey, GIS Analyst (former)
- Teresa Gomez, Senior Management Analyst
- Robert Gutierrez, Water Distribution Supervisor
- Amy Czajkowski, Project Manager (President of PARC Civil)

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

- Inge Wiersema, P.E., Project Manager
- Richard Humpherys, P.E., Technical Review
- Brian Brenhaug, P.E., Project Engineer
- Amy Martin, Project Engineer
- Bijan Sadeghi, P.E., Staff Engineer
- John Meyerhofer, GIS/Graphics

In addition, the following other staff members were involved in this project:

- Greg Gilbert, Orange County Fire Protection
- Kurt Baum, Wachs Water Services

STUDY AREA, LAND USE, AND POPULATION

This chapter presents a discussion of this master plan's planning area characteristics, the land use classifications, historical population trends, and projected populations for the planning period of this master plan. Planned developments and information obtained on build-out land use will be discussed. Details presented in this chapter on near-term developments and projected population form the basis for the demand projections that were developed for this WMP, which are presented in Chapter 3.

2.1 STUDY AREA

The City is located 35 miles north of the City of San Diego, encompassing about 42 square miles. The study area for this master plan is the City's water service area, which closely coincides with the City boundary as described in Chapter 1.

As shown on Figure 2.1, the City's service area is bordered by the Carlsbad Municipal Water District to the south, Camp Pendleton Military Base to the north, and the Pacific Ocean on the west. On the eastern side, the City's service area is bounded by Rainbow Municipal Water District (northeast) and Vista Irrigation District (southeast).

The City can be characterized by varied topography and rolling hills that increase from sea level in the southwestern end to elevation of up to 930 feet above mean sea level (msl) approximately 10 miles inland.

2.2 CLIMATE

The City has a mild, coastal climate with limited variation in average temperatures over the course of the year. As shown in Table 2.1, the average annual temperature between 2003 and 2012 was 60.2 degrees Fahrenheit (degrees F), with an average annual rainfall of 11.2 inches as measured at the National Weather Service Oceanside Marina Weather Station 046377. It should be noted that this data is based on the rainfall station in the harbor, and a lower average is experienced further inland.

Evapotranspiration (ETo) is the quantity of moisture that is transpired by plants and evaporated from soil. ETo is important to water resource management because irrigation requirements relate directly to ETo. Irrigators who are working to achieve maximum yields and growth need to apply water to meet the crop's ETo demand. ETo for the City ranges from about 2 inches per month during the winter to more than 6 inches per month during the summer. Annual ETo is 48.7 inches per year (CIMIS, 2013).

The difference between the average precipitation and ETo is typically used to estimate irrigation demands. On an annual basis, each acre of irrigated land will require about 37.5 inches, or 3 acre-feet of water per year (afy).

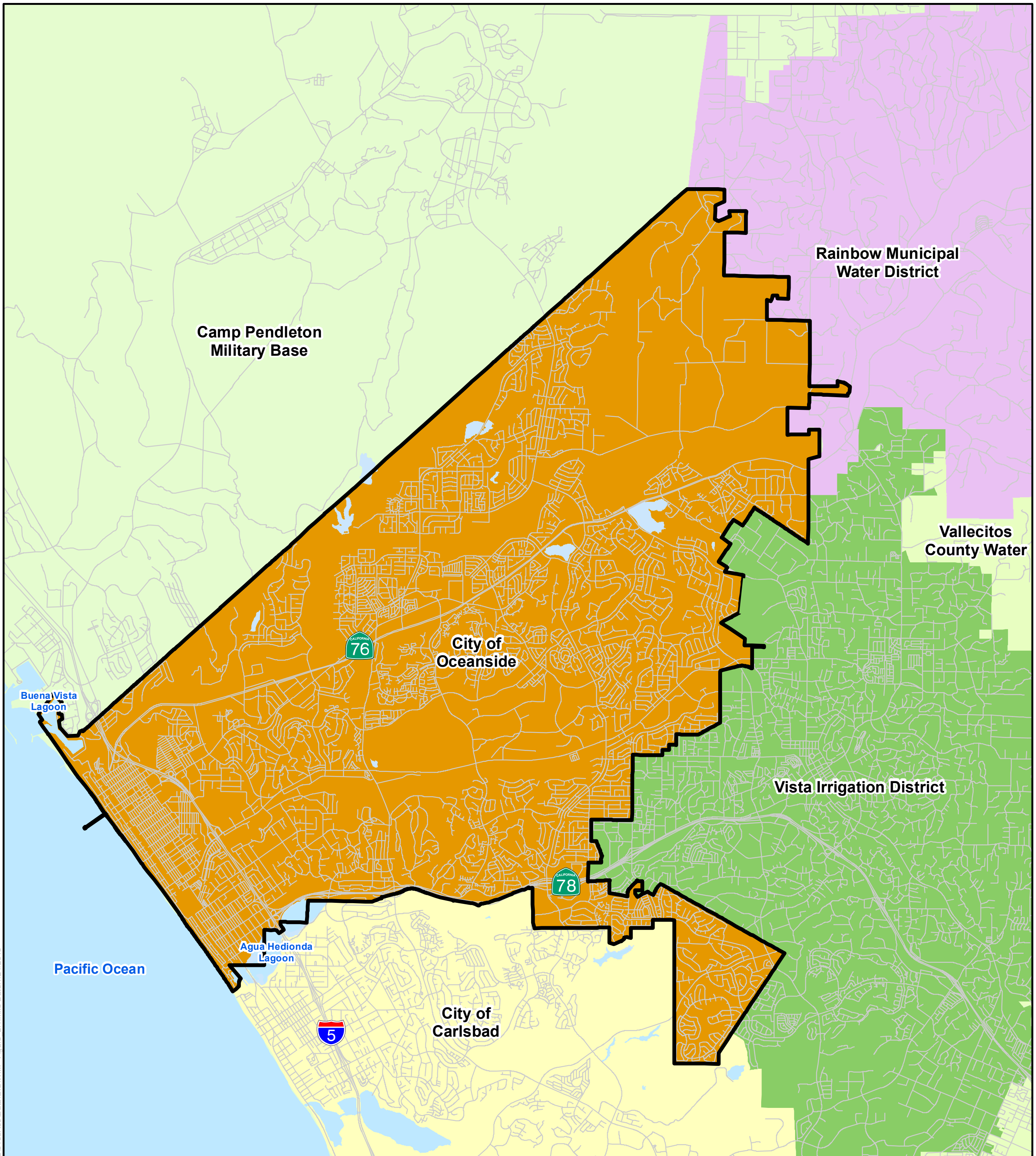
Table 2.1 Historic Climate Data
Water Master Plan
City of Oceanside

Month	Average Temperature(1) (degrees F)	Monthly Average ETo(2) (inches)	Average Total Precipitation(1) (inches)
January	55.1	2.08	2.1
February	54.3	2.40	2.9
March	55.8	3.70	0.7
April	57.6	4.79	0.9
May	60.5	5.35	0.2
June	62.9	5.72	0.1
July	66.9	6.06	0.0
August	67.3	5.98	0.0
September	66.4	4.60	0.1
October	63.1	3.61	1.4
November	58.0	2.44	0.7
December	53.9	1.99	2.1
Annual Average or Total	**60.2**	**48.7**	**11.2**

Notes:
(1) Source: National Weather Service Oceanside Marina Weather Station 046377. Annual Climatological Summary for December 2002 through November 2012 [http://www.ncdc.noaa.gov/].
(2) Source: California Irrigation Management Information System (CIMIS) Station 49 located in Oceanside. Monthly Average ETo assumed from March 1986 through April 2002 [http://wwwcimis.water.ca.gov].

2.3 EXISTING LAND USES

The City's General Plan was updated in 2002 and was amended most recently in June 2012. The City's General Plan defines many elements of land use, including the distribution of land use types and near-term and long-range development plans (Oceanside, 2002). Historically, the City has included significant agricultural components. Over the last few decades, large portions of the agricultural areas have been converted to residential planned communities. Land use categories and their corresponding water use classification are listed in Table 2.2. Current development plans call for some portions of the City to be redeveloped. This process will further contribute to growth and increased demand, but the overall composition of uses is not anticipated to change significantly.



Legend

- Streets
- Bodies of Water
- Oceanside Service Area

Neighboring Agencies

- CWA Vista Irrigation District
- Carlsbad Municipal Water District
- Pendleton Military Reservation
- Rainbow Municipal Water District
- Vallecitos County Water District

Figure 2.1
Service Area Boundary
Water Master Plan
City of Oceanside

carollo

Table 2.2 Land Use Designations Water Master Plan City of Oceanside		
Water Use	**Land Use Category**	**Land Use Code**
Low Density Residential	Estate A Residential	EA - R
Low Density Residential	Estate B Residential	EB - R
Low Density Residential	Single Family Detached Residential	SFD - R
Medium Density Residential	Medium Density – A Residential	MDA - R
Medium Density Residential	Medium Density – B Residential	MDB - R
Medium Density Residential	Medium Density – C Residential	MDC - R
High Density Residential	High Density Residential	HD - R
High Density Residential	Urban High Density Residential	UHD - R
Commercial	Community Commercial	CC
Commercial	Neighborhood Commercial	NC
Commercial	General Commercial	GC
Commercial	Special Commercial	SC
Commercial	Professional Commercial	PC
Commercial	Civic Institutional	CI
Commercial	Private Institutional	PI
Industrial	General Industrial	GI
Industrial	Light Industrial	LI
Industrial	Research Park Industrial	RP-I
Other	Agriculture	A
Other	Open Space	OS

2.4 PROJECTED LAND USE

The City's 2002 General Plan presented the planned land use types for build-out condition of the City's service area, which illustrates that many developments and redevelopments are anticipated within the planning horizon. The projected land use details for the 2002 General Plan are included in Appendix B. The information in Appendix B was utilized to estimate acreages for projected land use types. Figure 2.2 depicts the planned land use types within the City's service area.

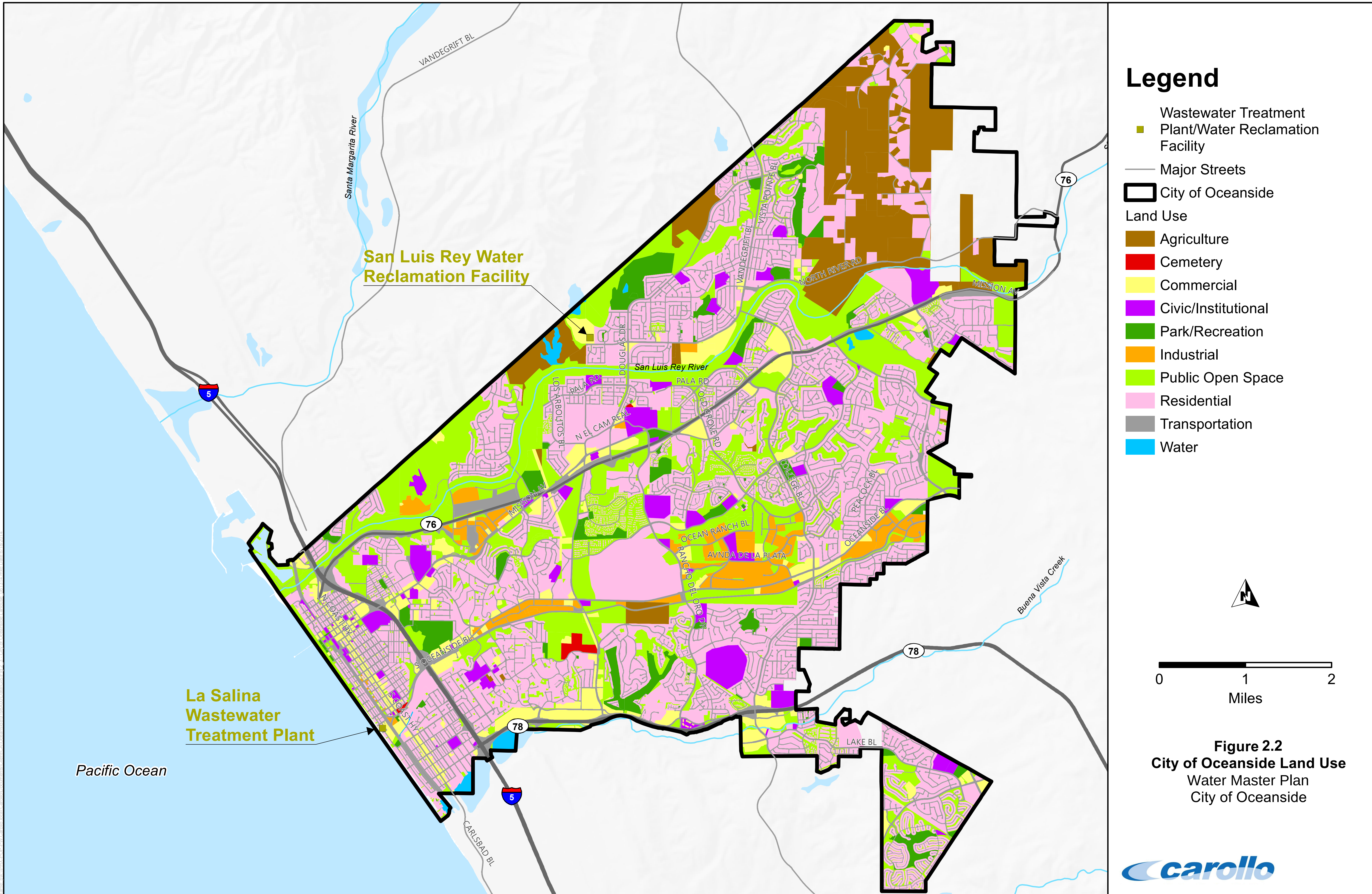


Figure 2.2
City of Oceanside Land Use
Water Master Plan
City of Oceanside

Source: SANDAG (2013)

One significant development is located in the north of the City's service area is the Morro Hills Development. The Morro Hills development is primarily composed of new low-density residences and is nearly built out at the time of this plan preparation. In addition, the El Corazon Plan and Rancho Del Oro Plan entail newer developments with significant new industrial space within the City. Residential, commercial, and even some open space are included along the periphery of these developments.

Significant amounts of redevelopment are planned for the downtown area around City Hall and out to the beachfront within the Coastal Zone Boundary. Finally, a large portion of the City is zoned for agricultural use, the majority of which is located in the northeast portion of the City.

In addition to the developments described above, there is also discussion among landowners in the Morro Hills Area (east of the Morro Hills Development described previously) to sell their agricultural land and convert this area to estate or low-density residential area. This could potentially replace about 3,000 acres of agricultural land with 600 to 1,000 homes. Due to the uncertainty of this development, this WMP does not consider this land use conversion. The potential impact of this conversion of the required water and sewer system infrastructure improvement needs is evaluated in a separate study.

2.5 NEAR-TERM DEVELOPMENTS

The City's planning department provided a listing of several developments that are either currently under construction or planned to be implemented in the (near) future. This information is included in Appendix B. To reduce the number of developments and obtain a manageable number of near-term developments, only major developments were indentified separately for the near-term demand projections, while small developments were excluded. Small developments were defined as developments less than an acre in size or consisting of less than 100 residential units or less than 100 hotel rooms. With this simplification, 23 major developments remained as individual projects for the near-term water demand projections, while the remaining developments were included as in-fill. The locations of these major developments are shown on Figure 2.3, while the number of units or size or the developments are summarized in Table 2.3.

As shown in Table 2.3, these major near-term developments were grouped into three categories; residential, hotel/retail, and industrial/office projects. The listed residential developments range in size from 90 to 1,007 units, with a total of 2,228 units. The hotel/retail developments range from 93 to 426 rooms and from 3,000 square-feet to 55 acres, with a total of 1,800 units and 79 acres. The industrial/office developments range from 39,835 square feet to 400 units, with a total of 180 acres and 524 units.

Table 2.3 Near-Term Development Details
Water Master Plan
City of Oceanside

Development Name	Approximate Address	Quantity/Size
Residential		
The Belvedere	901 Mission Avenue	90 live/work lofts
Mission Cove Affordable Housing(1)	3200 Mission Avenue	150 family, 138 senior units
OceanPointe	300 Stage Coach Road	198 condominium units
Terraza RDO Village XII	Old Grove Road	338 units
Spring Creek Senior Community Living	Old Ranch Road	131 units
The Villages of Morro Hills(2)	Vandergrift Boulevard	1,007 units
Melrose Heights(3)	Oceanside Boulevard	931 units
Total		**2,228 units**
Hotel/Retail		
Hyatt Place	1103 N Coast HWY	127 rooms, 3,000-square-foot retail, 24 condominium units
Springhill Suites Marriot	211 Mission Avenue	149 hotel rooms, 6,400-square-foot restaurant
S.D. Malkin Resort Hotel	Mission Avenue	289 hotel rooms, 47 boutiques, 48 timeshares
The Inns at Buena Vista Creek	Jefferson Street	426 hotel rooms, 10,000-square-foot meeting facility
El Corazon	Oceanside Boulevard	55 acres
Courtyard by Marriott	3501 Seagate Way	140 hotel rooms
Oceanside Pavilion	Mission Avenue	950,000 square feet
Holiday Inn	3350 Mission Avenue	93 hotel rooms
Motel 6	909 N Coast HWY	123 hotel rooms
CityMark Mixed Use	Myers Street	231 units, 150 hotel rooms, 38,000-square-foot commercial
Total		**1,800 units and 79 acres**
Industrial/Office		
Pacific View Medical Office	3300 Waring Road	39,835 square feet
Tri-City Medical Center	4200 Vista Way	57,476 square feet
Ocean Ranch Corporate Center	3728 Maritime Way	400 acres
Pacific Coast Business Park	1301 Rocky Point Drive	124 acres
Pacific Coast Medical Center	Rocky Point Drive	80,284 square feet
Total		**524 units and 180 acres**

Notes:
Source: City of Oceanside, Pending Developments, May 2013.
(1) In construction.
(2) Near term development refer to developments anticipated to be completed by 2020
(3) Based on water billing data, approximately 75 percent of the anticipated units are in place and consuming water. Thus, 25 percent of the anticipated units (252 units) will be included in the near term demand projection.

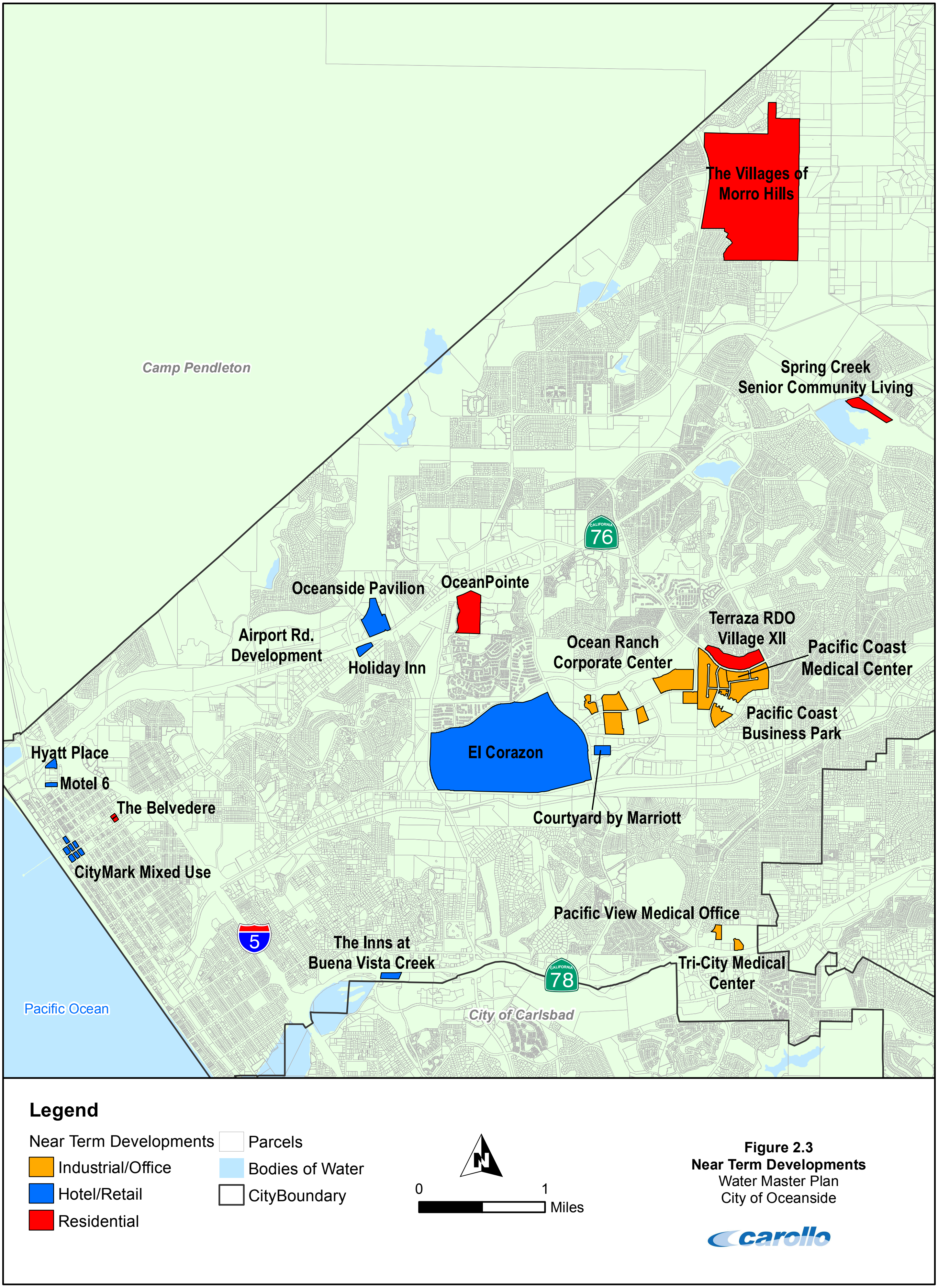


Figure 2.3
Near Term Developments
Water Master Plan
City of Oceanside

2.6 EXISTING HISTORICAL POPULATION

The US Census estimated the 2010 City population as 167,086 people. Historical population estimates for 1997 through 2013 are depicted graphically on and presented in Table 2.4. As shown in Table 2.4, the population estimates made by the California Department of Finance (DOF) were substantially higher (16,000 people for 2010) than counted during the 2010 Census. The US Census prepared revised population estimates after the 2010 Census data was received to adjust previous population estimates.

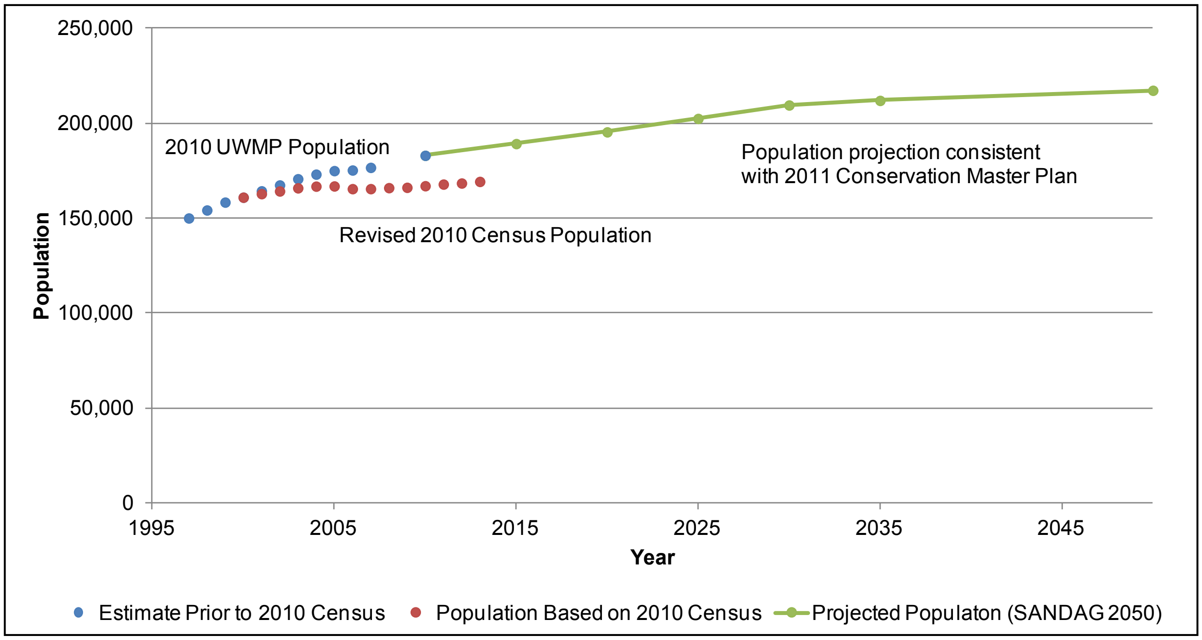


Figure 2.4 Historic and Projected Population

As shown in Table 2.4, the initial population projection for 2010 was about 16,000 people (or 10 percent) higher than the 2010 US Census population count. This difference represents a significant discrepancy in the data. Some potential reasons for this overestimation prior to the 2010 Census include the semi-transient nature of the nearby military population at Camp Pendleton and reduced economic activity due to the financial crisis late in the decade. The cause of this discrepancy could be important in anticipating the potential for recovery of the population in the future.

It should be noted that the City faced a similar issue in the early 1990s, during the Desert Storm operation in 1990 and 1991. At that time, thousands of troops from nearby Camp Pendleton were deployed to the Middle East, with the local economy suffering, and water demand decreasing dramatically.

Table 2.4	**Historical Population Water Master Plan City of Oceanside**	
Year	**Annual Population Estimates Prior to 2010 Census**(1)	**Revised Annual Population Estimates Based on 2010 Census**(2)
2013	-	169,350
2012	-	169,312
2011	-	167,943
2010	183,095	167,086
2009	-	166,242
2008	-	166,064
2007	176,743	165,545
2006	175,357	165,539
2005	175,038	166,958
2004	173,183	166,859
2003	170,769	165,962
2002	167,494	164,312
2001	164,398	162,907
2000	161,039	161,039
1999	158,451	-
1998	154,300	-
1997	150,090	-

Notes:

(1) Annual Population Estimates Prior to 2010 Census based on 2000 Census data estimated by the DOF, obtained from the City's 2010 Urban Water Management Plan (UWMP) (Oceanside, 2011a).

(2) Census-based data taken from the DOF "E-4 Population Estimates for Cities, Counties and State, 2001-2010," November 2012, and "E-4 Population Estimates for Cities, Counties and State, 2011-2013," May 2013. Data from 2010 is directly from the US Census, while other years use the Census as a benchmark.

The DOF estimates population during non-census years using the previous census as a benchmark. Following the 2010 Census, the DOF revised their previous estimates for the City years between 2000 and 2010 to make historical estimates consummate with the 2010 Census. As the 2010 UWMP was prepared prior to the availability of 2010 Census data (and consistent with the Department of Water Resources (DWR) guidelines), the City's 2010 UWMP historical population estimates were based on the more aggressive Annual Population Estimates Prior to 2010. The 2010 UWMP used these estimates to calculate baseline and target per-capita water conservation related to SBx7-7 (20 by 2020). The DOF adjustment could thus affect the water conservation targets that the City is required to meet by 2020. It is anticipated that the 2015 UWMP DWR guidebook will provide guidance to agencies facing this issue.

To maintain consistency between this WMP and previous planning documents and to base future infrastructure needs on the more conservative population estimate, the City decided to use the pre-2010 census population estimates for the year 2010 population estimate and the 2050 SANDAG forecast for future planning years.

2.7 PROJECTED POPULATION

Projected population for the City's service area is presented in Table 2.5. Population projections are based on the San Diego Association of Governments (SANDAG) 2050 Regional Growth Forecast.

Table 2.5 Population Projections
Water Master Plan
City of Oceanside

Year	Projected Population(1)
2010	183,095
2015	189,275
2020	195,455
2025	202,529
2030	209,602
2035	212,024
2050	217,364

Note:
(1) SANDAG 2050 Regional Growth Forecast (for years that were not projected in the Regional Growth Forecast, interpolation of the Oceanside 2011 Water Conservation Plan was used).

As discussed in Section 2.6, annual population estimates were revised substantially following the 2010 Census. The adjusted population estimates have not yet been incorporated into SANDAG's population estimates presented in Table 2.4. However, for this master plan, the projected population will not be reduced based on the population discrepancy. In part, this is because the reasons cited in Section 2.6 for the discrepancy could potentially be only temporary influences. Especially if the population reduction occurred due to economic considerations, recovery to previous population levels could occur much faster than predicted by projected population growth rates. Thus, for conservative planning purposes and consistency with the City's 2011 Water Conservation Plan, it was decided to use the SANDAG 2050 population projections.

As shown in Table 2.5, the study area population is expected to continue to grow through year 2050. The majority of this growth is projected to occur in the next 15 to 20 years. The 2050 population is projected to be approximately 217,000 people. This population projection is also graphically depicted on Figure 2.3.

As shown on Figure 2.3, the historic population listed in the 2010 UWMP leads into the population projections for the future. While the population data from the DOF lists lower numbers in the most recent years, it also demonstrates an upward trend moving forward. For this reason, the population projection should provide an accurate, if potentially conservative planning basis.

-This Page Left Blank Intentionally-

Chapter 3

WATER DEMANDS

This chapter describes the City's existing and projected future water demands. The existing water demand section consists of a discussion of the historical water consumption, historical water production, and the identification of water loss and peaking factors. The future water demand section consists of a description of water demand factors (WDF), the water demand projection through year 2050, and the anticipated phasing of demands. This chapter is concluded with a discussion on water conservation measures and the anticipated impacts these measures will have on the City's future water demands.

3.1 HISTORICAL DEMANDS

Water demands represent water that leaves the distribution system through metered or unmetered connections, or at pipe joints (leaks) or breaks. Water demands occur throughout the distribution system based on the number and type of consumers in each location.

This section includes a description of the historical water consumption, historical water production, and the estimated amount of water loss or unaccounted for water, which is defined as the difference between production and consumption. Peaking factors, which are indicators of the variation in demand on a seasonal and daily basis, are also discussed.

3.1.1 Historical Water Consumption

The City provided historical customer billing records per account for the period 2010 through 2012. The historical metered water use for these three years are summarized by billing classification in Table 3.1 and graphically presented on Figure 3.1.

Table 3.1 Historical Annual Consumption by Usage Type
Water Master Plan
City of Oceanside

Year	Annual Demand by Customer Class (afy)							Total Annual Demand (afy)
	Single Family Residential	Multi Family Residential	Commercial	Government	Irrigation	Agriculture	Other	
2010	11,648	4,285	2,033	838	3,510	1,506	632	**24,455**
2011	11,731	4,403	2,046	726	3,658	1,548	669	**24,781**
2012	12,082	4,559	2,147	755	4,210	1,804	721	**26,278**

Note:
Source: Data for January 2010 through February 2013 provided by the City. Excludes recycled water demand. Meters are read on a monthly basis. Customer classification was consolidated from the 22 billing classifications the City uses for its billing system.

The billing classifications include various land use types that can be summarized as follows:

- **Agriculture Accounts**: This category includes billing types Commercial Agriculture (CA), Agricultural/Residential Special Agricultural Water Rate (RS), Grouped Special Agricultural Water Rate (GS), Grouped Agricultural/Residential (GR), Commercial Agricultural/Residential (RA), and Special Agricultural Water Rate (AS).
- **Commercial Accounts**: This category includes Commercial (C).
- **Government Accounts**: This category includes City/Government Account (G), and Government Harbor Sub meters (H)
- **Irrigation Accounts**: This category includes Irrigation (I).
- **Multi Family Residential (MFR) Accounts**: This category includes Multi-Family Residential (M), and Multi Family Residential where the meters T off (MT).
- **Other Accounts**: This category includes Special Users (S) and Construction Meters (IC).
- **Single Family Residential (SFR) Accounts**: This category includes Single-Family Residential (R), Single Family Residential where the meters T off (RT), and Master-Metered Single-Family Home (MS).

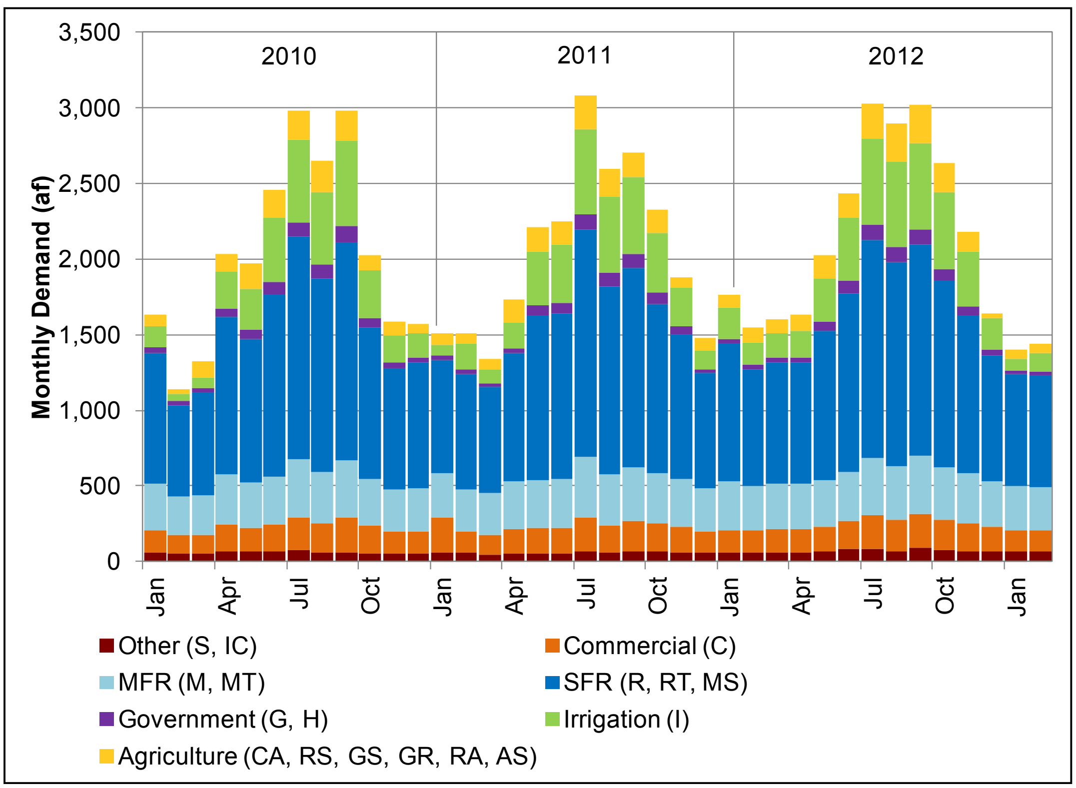


Figure 3.1 Monthly Demand by Customer Class

As shown on Figure 3.1, the City's commercial and multi-family residential (MFR) demands are fairly consistent throughout the year, as most commercial and MFR sites will also include a separate irrigation meter. Seasonal peaking is most pronounced in the single family residential (SFR), irrigation, and agricultural usage types. As the City's meters are read monthly, the seasonal variation observed on Figure 3.1 can only provide monthly peaking factors, including Maximum Month Demand (MMD) and Minimum Month Demand (MinMD). Daily peaking factors can only be derived from production and/or Supervisory Control and Data Acquisition (SCADA) data. The breakdown of all demand for 2012 are illustrated on Figure 3.2.

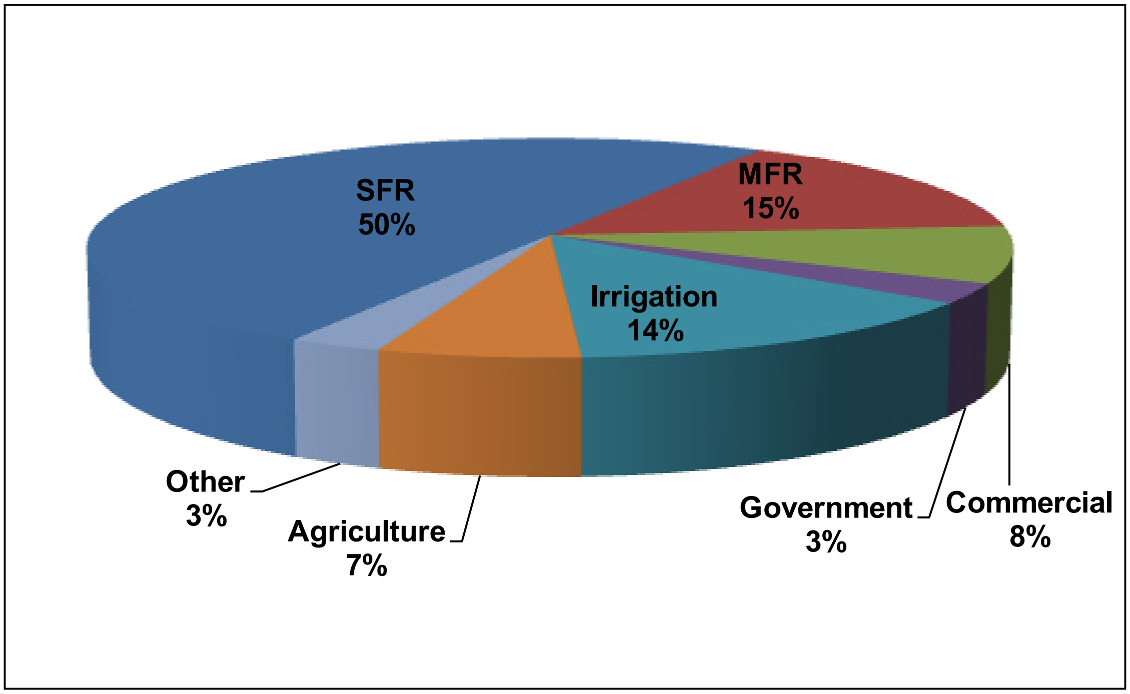


Figure 3.2 2010 Demand Breakdown by Customer Class

As shown on Figure 3.2, residential demand, including both SFR and MFR accounted for 65 percent of the City's demands in 2012. Irrigation and commercial accounts were the two next largest consumers, representing roughly 14 percent and 8 percent of the City's demand. Agriculture, government, and other represented 7 percent, 3 percent, and 3 percent, respectively.

3.1.2 Number of Accounts

The City's historical customer billing records included a total of 43,380 meters. The number of meters increased by 239 between 2010 and 2013 as additional customers were connected to the system. A breakdown of the number of customers by customer class from 2012 is included in Table 3.2.

Table 3.2 Number of Meters by Customer Class Water Master Plan City of Oceanside			
Customer Class	**Abbreviation**	**Class Grouping**	**Number of Meters**
Single Family Residential	SFR	R, RT	38,108
Multi-family Residential	MFR	M, MS, MT	2,027
Commercial/Institutional	Comm./Ind	C	1,603
Industrial	Ind	S	11
Landscape Irrigation	LS Irr	I, IC	1,203
Other/City Gov't	Other/Gov	G	293
Agricultural Irrigation	Ag Irr	A, AS, AR, CA, GA, GR, GS, RA, RS	135
Total			**43,380**

Notes:
(1) Data from February 2013.
(2) Agriculture/Residential (AR), Grouped Agriculture (GA), Grouped Agriculture/Residential (GR), and Water Consumption Only (WC) not represented in 2010-2013 billing data.
(3) Classifications “RT” and “MT” are serviced with a tee connection to their domestic and irrigation usage.

As multiple meters can be associated with a single customer account, the City’s billing data included 40,617 customer accounts. Nearly 5 percent of the City’s customers have multiple meters that typically consist of two more different customer classes.

Several of the City’s agricultural customer classifications include residential (indoor) water usage, which typically is for the water usage of a house on a farm. These categories include AR, RA, GR, and RS. Customer classifications GS, GA, and AS are fully agricultural irrigation, with no domestic usage. All of the City’s parks are currently mixed use, meaning that the sprinklers are not separately piped from restrooms and water fountains, and fall within the City/Government Accounts classification.

3.1.3 Historical Water Supply

The historical water production from 2003 through 2012 is presented by water source in Table 3.3 and is illustrated on Figure 3.3. As shown, the City obtains water from two primary sources; groundwater from the Mission Basin Groundwater Purification Facility (MBGPF) and Imported Water from the San Diego County Water Authority (SDCWA). A small amount of recycled water is also produced as the San Luis Rey Water Reclamation Facility (WRF).

Table 3.3	Historical Annual Water Supply by Source Water Master Plan City of Oceanside			
Year[1]	**Mission Basin GPF (afy)**	**Imported Water (afy)**	**Potable System Total (afy)**	**Recycled Water[2] (afy)**
2003	3,085	29,759	**32,844**	-
2004	2,304	32,484	**34,788**	78
2005	2,304	31,307	**33,611**	80
2006	2,126	32,185	**34,311**	209
2007	2,219	33,366	**35,585**	109
2008	1,677	31,373	**33,050**	66
2009	2,813	27,979	**30,792**	74
2010	4,455	21,765	**26,221**	130
2011	4,028	22,735	**26,763**	104
2012	3,704	24,148	**27,852**	135

Notes:
(1) Source: City provided data.
(2) Recycled water data from 2005 to 2010 - 2010 UWMP. 2004, 2011, and 2012 data is generated from golf course recycled water meter.

As listed in Table 3.3 and shown on Figure 3.3, the City's water supply gradually increased until 2005, after which it declined significantly, especially between 2007 and 2010. The annual water supply in 2012 was 27,852 afy or 24.9 million gallons per day (mgd). With an annual water supply of 27,852 afy and a population of 169,312 in year 2012, the average daily per capita demand was about 147 gallons per day per capita (gpcd).

Imported water can be subdivided in treated and untreated water. Untreated water obtained from SDCWA is treated by the City's Weese Water Treatment Plant (WFP), which accounts for the majority of the City's imported water supply in the period 1996 through 2012. Groundwater treated at the Mission Basin GPF has accounted on average for 10 percent of the City's water supply in this period, ranging from 5 to 17 period on an annual basis.

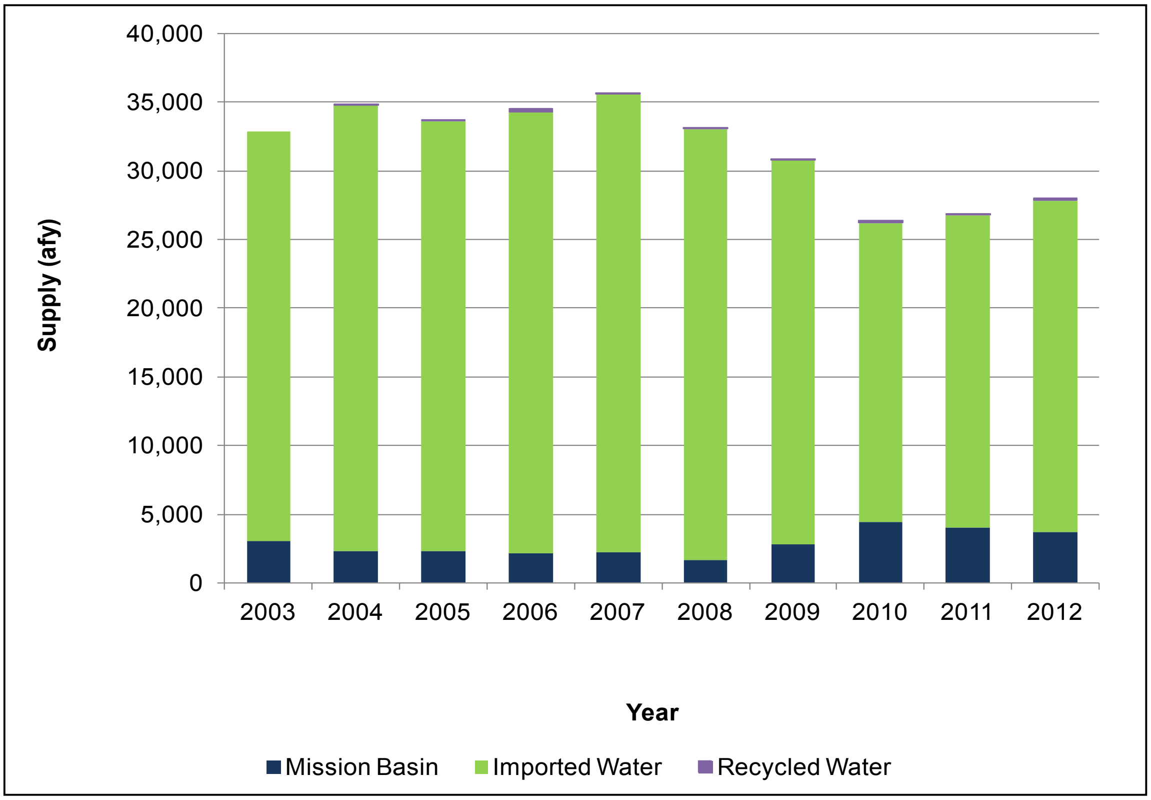


Figure 3.3 Annual Supply by Source

3.1.4 Unaccounted for Water

The difference between water production (or supply) and consumption (billed to customers) is defined as unaccounted-for-water, or water loss. Water loss may be attributed to leaking pipes, unmetered or unauthorized water use, inaccurate meters, treatment losses, or other events causing water to be withdrawn from the system and not measured. Specific events that cause water loss include tank overflows, hydrant flushing, street cleaning, system flushing, and fire fighting. It should be noted that the City's estimated unaccounted for water for the years 2010 through 2012 is summarized in Table 3.4.

Table 3.4 Estimated Unaccounted for Water
Water Master Plan
City of Oceanside

Year	Demand (afy)	Supply (afy)	Unaccounted for Water (afy)	Unaccounted for Water (%)
2010	24,455	26,221	1,765	6.6%
2011	24,781	26,763	1,982	7.4%
2012	26,278	27,852	1,574	5.3%

Note:
(1) Source: Billing data from Table 3.1 and supply data from Table 3.3.

Due to the configuration of the pipelines conveying treated water from the WFP and treated imported water from SDCWA necessitate that calculations of flows entering the City's distribution system be conducted upstream of WFP. Thus, the unaccounted for water estimated in Table 3.4 may include treatment losses at WFP, depending on the operational configuration during the period of comparison.

According to AWWA standards, the water loss for well-operated systems is typically less than 10 percent and many systems have water losses of less than 5 percent annually. As shown in Table 3.4, the City's unaccounted for water for years 2010 through 2012 is within the typical range of water losses of other water purveyors, especially considering the possible inclusion of treatment losses at the WFP.

3.2 WATER DEMAND FORECASTING METHODOLOGY

There are many different demand forecasting methods that range in both detail and scope. Based on a review of the available data, it was determined that the most accurate demand forecasting method for this water master plan is a combination of a population and land use based demand forecasting methods. To develop long-term demands, a per unit population based methodology was utilized, while a land use based projection was used to project the City's near-term water demand.

Long-term demand forecasting utilized population projections to project future water use. An average per capita water use expressed in gpcd was developed by examining historical demands and planning documents. The water use target of 142 gpcd from the 2010 UWMP was used to provide a consistent and conservative planning basis. This water use target was assumed to be realistic for per capita water use in year 2020 and beyond as the City's water use in 2012 was estimated at 147 gpcd. The per capita water use (gpcd) was then combined with population projections from the SANDAG 2050 regional growth forecast (population) to project the City's future water demand.

This method of demand projection is consistent with the regional growth estimate for all years through 2050. Furthermore, this consistency this will allow the City to use this projection additional planning efforts for the next few years. The benefits of using the SANDAG 2050 regional growth forecast are described in more detail in Chapter 2.

3.3 WATER DEMAND FACTORS

A water demand factor (WDF) is defined as the estimated amount of water usage per area for a certain land use type. WDFs are typically expressed in gallons per day per acre (gpd/ac). These factors are used to estimate the average day demand (ADD) for existing and potential development areas by multiplying the WDF with the total number of acres of each land use category. WDFs were developed as part of this WMP to project demands for planned development where land use details are known at this time (see Section 3.5).

WDFs are typically determined from a combination of geocoded billing records and land use information using spatial GIS routines. WDFs can also be verified against other agencies with similar land use and climate conditions.

Water demand factors for the existing system were initially determined through a sampling process using the geospatially matched billing records. The billing records had been used to develop an ADD for each meter based on data from January 2010 through February 2013. After geospatially placing the billing data at the demand locations, water demand factors using billing data were calculated for sample areas of each land use type located throughout the City's water service area. These WDFs for the existing system are presented in Table 3.5.

Table 3.5 Water Demand Factors
Water Master Plan
City of Oceanside

Land Use	Land Use Category(1)	Sampled WDF Range (gpd/ac)	Demand Forecast WDF (gpd/ac)
Low-Density Residential	EA-R, EB-R, SFD-R	850-1,250	1,500
Medium-/High-Density Residential	MDA-R, MDB-R, MDC-R, HD-R, UHD-R, HD-R, UHD-R	2,350-2,800	3,000
Commercial	CC, NC, GC, SC, PC, CI, PI	700-1,150	1,500
Industrial	GI, LI, RP-I	2,200	2,500

Note:
(1) Land Use Categories are described in Table 2.2.

As shown in Table 3.5, the sampled WDFs for the City's land uses range between 850 and 2,800 gpd/ac. For conservative planning purposes, the recommended WDF are rounded up for the range in WDFs calculated from the various sample areas that were selected. For example, the WDF samples in the low-density residential (LDR) category ranged from 850 through 1,250 gpd/ac. For future water demand forecasting, a factor of 1,500 gpd/ac was used for currently vacant areas representing a LDR land use type. As shown in Table 3.5, the WDFs utilized for the water demand forecast, range from 1,500 gpd/ac for LDR and commercial land use types to 3,000 gpd/ac for medium to high-density residential (HDR) land use types.

Typically, water use of high and medium density residential areas are identified separately, but are combined for the City because the City has very limited amount of land zoned for HDR development. In addition, these HDR zoned areas mostly appear to be underdeveloped using satellite imagery are typically used for mid-density housing. When water meter geospatial data was overlaid with zoning data, most high-density land appeared to be serviced by single family meters, further demonstrating the presence of mid density residential use. Finally, none of the future developments listed in Chapter 2 and further discussed in Section 3.5 are HDR. Therefore, definition of a water demand factor for the HDR land use category is not critical for the projection of the City's Near-Term and ultimate water demands in this WMP.

3.4 PEAKING FACTORS

Peaking factors are typically used to determine the water demands for conditions other than ADD conditions. Peaking factors 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 cold winter day due to increased irrigation demands.

Common peaking factors include factors for maximum day demands (MDD), minimum day demands (MinDD), and peak hour demand (PHD) periods. Peaking factors are determined using the water system demands for a selected period and dividing the quantity by the ADDs. The MDD factor, for example, is determined by comparing the water demands for the day of the year with the highest daily water demand to the ADD.

There are basically three types of peaking factors used in water master plans. These are:

1. Monthly Peaking Factors
2. Daily Peaking Factors
3. Hourly Peaking Factors

These peaking factors not only reflect a different time scale, but are often calculated using different data sources. The City's peaking factors and data used to establish these are discussed below.

3.4.1 Monthly Peaking Factors

Monthly peaking factors represent the seasonal demand variation on a monthly basis, such as the Maximum Month Demand (MMD) and Minimum Month Demand (MMD) peaking factors. In absence of daily production data for an entire calendar year, these factors can often easily be established from monthly production (or supply) summaries or historical billing data. The City's monthly peaking factors are summarized in Table 3.6.

Table 3.6	Monthly Peaking Factors Water Master Plan City of Oceanside				
Year	**Average Annual Demand (mgd)**	**Maximum Month Demand (mgd)**	**Minimum Month Demand (mgd)**	**MMD Peaking Factor**	**MinMD Peaking Factor**
2010	23.39	32.54	14.04	1.42	0.55
2011	23.89	32.44	17.77	1.38	0.68
2012	24.89	32.13	16.50	1.32	0.68
Average	**24.06**	**32.37**	**16.10**	**1.37**	**0.64**
2015 WMP	N/A	N/A	N/A	**1.5**	**0.7**

Source:
(1) Historical production data for the period 2010-2012.

As shown in Table 3.6, the peaking factors used in the 2015 WMP for MMD and MinMD conditions are 1.5 and 0.7, respectively. These factors represent typical values observed by many other water agencies in Southern California.

3.4.2 Daily Peaking Factors

Historical supply records are typically used to determine the seasonal demand factors, such as MDD/ADD or MinDD/ADD. Hourly data from Supervisory Control and Data Acquisition (SCADA) systems and other field recorders are typically used to create a 24-hour water usage curve or diurnal pattern. The maximum hour demand factor based diurnal from this SCADA curve is then used to determine the PHD peaking factor.

The maximum day peaking factor represents the ratio of the largest daily demand observed in one year to the ADD for the same year. This factor can then be applied to the ADD of future planning years to project maximum day water demands. The estimated MDD is commonly used to establish water supply, storage, and pumping capacity requirements.

Historical water supply records from SCADA were used to establish the City's MDD peaking factor. The City provided historical data from their SCADA system on a daily interval for the month of August for the last three years (2010 through 2012). The maximum day supply was divided by the average day supply of the same year to obtain a ratio that represents the MDD seasonal peaking factor (PF). These ratios are listed in Table 3.7.

Table 3.7 Maximum Day Demand Seasonal Peaking Factors Water Master Plan City of Oceanside				
Year	Average Annual Demand (afy)	Day of Maximum Demand	Maximum Day Demand (mgd)	(PF)
2010	26,203	August 24	43.2	1.85
2011	26,763	August 2	39.5	1.65
2012	27,852	August 17	40.0	1.61
Average	**26,939**	**N/A**	**40.9**	**1.70**
2015 WMP				**1.85**

Notes:
(1) For 2010 and 2011, only the month of August was reviewed. Daily data for August 2011 was missing the last week. For 2012, the months of July and August were reviewed; although Mission Basin GPF data was not available on a daily interval for the month of July.
(2) Minimum Day Demand data was not available during the writing of this report, but monthly data was used to generate a minimum monthly demand factor of 0.05 for February 2010. This is a relatively low factor, and indicative of a low demand year.

As shown in Table 3.7, the MDD PF varied between 1.85 in 2010 and 1.61 in 2012. It should be noted that the supply calculation was conducted at the raw imported water connections, deducting flows for Vista Irrigation District (VID) and Vallecitos Water District (VWD). Thus, losses at the WFP, which could be higher during MDD, are included in the MDD PF.

In addition, it should be noted that 2010 was overall a low demand year, due to statewide water shortages and accompanied by mandatory reductions on imported water. Demands may have been atypical due to this demand reduction. When the average annual demand is relatively low and hot summer demands remain similar to preceding years, the MDD peaking factor is typically relatively high. As shown in Table 3.7, the City also experienced the highest MDD PF in this year (1.85).

Although the average PF of the 3-year period is 1.70 and consistent with the MDD peaking factor used in the previous master plan, it is recommended to use a MDD peaking factor of 1.85 for this master plan. This peaking factor is conservative, yet realistic, as it is likely that future water restriction will occur with the continued water supply challenges in the Bay Delta and climate change projections that both contribute to the likelihood of higher peaking factors in the future.

3.4.3 Hourly Peaking Factors

Variations in water demand also occur during a 24-hour period. In residential areas, there are often two peak use periods, in the morning between 6 a.m. and 10 a.m. and again in the late afternoon between 5 p.m. and 8 p.m. These peak demand periods reflect the increased usages in toilets, bathrooms, and kitchens of people before they leave their homes in the morning and when they return late afternoon. Recycled water systems or areas that have automatic sprinkler systems for irrigation typically experience peak demand periods late at night through the early morning hours.

Hourly peaking factors are derived from diurnal patterns that are typically developed from SCADA data collected for model calibration. The diurnal patterns developed as part of this master plan are presented in Chapter 5 (Model Development). The maximum hourly peaking factors that were calculated using SCADA data obtained from August 20 through August 22 ranged from 1.5 to 1.8. The peak hour demands occurred between 6:00 a.m. and 8:00 a.m. To calibrate the model, August 20, 2013 was selected as the calibration date, which had a PHD peaking factor 1.6. For conservative planning purposes, the maximum PHD peaking factor of 1.8 was used in this master plan. The minimum hour demand peaking factor recorded in the same period was approximately 0.65. A summary of recommended and aggregate peaking factors is presented in Table 3.8.

Table 3.8 Peaking Factors Summary
Water Master Plan
City of Oceanside

Hourly Demand Condition	Daily Demand Condition				
	Minimum Day	Minimum Month	Average Day	Maximum Month	Maximum Day
Minimum Hour	0.33	0.46	**0.65**	0.98	1.80
Average Hour	**0.50**	**0.70**	**1.00**	**1.50**	**1.85**
Peak Hour	0.90	1.30	**1.80**	2.70	3.30

Note:
(1) Peaking Factors calculated using PFs listed in bold: 0.5 for minimum hour demand; 1.8 for PHD; 0.5 for MinDD; 0.7 for MinMD; 1.5 for MaxMD; and 1.85 for MDD.

3.5 NEAR-TERM DEMAND PROJECTIONS

Demand projections based on land use are typically developed using a combination of General Plan information, Specific Plans (if any), vacant land information, aerial photography, and water demand factors.

In order to develop Near-Term demand projections (up to the year 2020), the future land uses and development projects were identified and described in Chapter 2. Each development project was then geospatially located throughout the service area. The projects and land uses were phased based on the development timing and then existing demands deducted where applicable. Each land use type in the study area was assigned water demand factor expressed in gpd/ac. The WDFs for each land use type were applied to all Near-Term land use categories.

The future demand of the Near-Term developments was estimated according to the number of dwelling units (DU) or gross acreage of residential, hotel/retail, or office/industrial as determined by the City's planning department. Where gross acreage was not available to combine with a water demand factor, developments were assigned a number of dwelling units based on the number of rooms, units, lofts, condos, boutiques, or families slated for that area. For residential developments, an average gpd/DU of 400 was developed by combining the 2010 UWMP target of 142 gpcd with the 2010 Census average household size of 2.8. For hotel and retail developments, an average unit demand of 115 gpd/room was developed based on historical billing records and the water use numbers for several existing hotels in the service area that were contacted.

The estimated demands are presented in Table 3.9. As shown in this table, it is estimated that the study area will experience and total Near-Term demand increase of nearly 1.7 mgd or nearly 1,900 afy. Approximately 0.9 mgd (or 1,000 afy) of these demands is associated with residential developments. The remaining 0.8 mgd (or 900 afy) are associated with hotel, retail, industrial, and office developments. Under MDD conditions, these developments are estimated to add nearly 3.1 mgd of water demand to the system.

3.6 LONG-TERM DEMAND PROJECTIONS

To develop long-term demand projections, per unit forecasting was used to combine population growth with average consumption to yield total demand. The average demand per person, or per capita demand, was determined by looking at historical use data for the period 2000 through 2012. Based on the City's 2010 Urban Water Management Plan (UWMP), a per capita use of 157 gallons per capita per day (gpcd) was used for 2015 and 142 gpcd for 2020 and subsequent planning years. These per capita demands were applied to population projections to develop demand estimates for any planning year in the future for which a population projection has been developed.

While the per capita demand targets are combined with population projections to yield demand forecasts, the targets themselves were determined via DWR's methodologies. As discussed in Chapter 2, the historical population data has been updated to show a lower population than previously assumed, which has *increased* the estimated historical per capita demand. The updated data is compared with the 2010 UWMP calculations on Figure 3.4.

As shown on Figure 3.4, the City's historical per capita demand was higher than calculated in the 2010 UWMP due to SANDAG's revised population estimates. This figure also shows that the City's per capita demand have decreased consistently since 2006. To maintain a consistent planning basis, as well as incorporate conservation efforts into demand forecasting, the water demand targets set forth in the 2010 UWMP were used for the water demand projections prepared for this WMP.

Table 3.9 Near-Term Demand Projections Water Master Plan City of Oceanside

Development Name	Unit	Equivalent Residential Units	Unit Demand (gpd/DU or gpd/room)	Gross Acreage	WDF (gpd/ac)	ADD (mgd)
Residential						**0.90**
The Belvedere	90 live/work lofts	90	400			0.04
Mission Cove Affordable Housing	150 family, 138 senior	288	400			0.12
OceanPointe	198 condominium	198	400			0.08
Terraza RDO Village XII	338	338	400			0.14
Spring Creek Senior Community Living	131	131	400			0.05
The Villages of Morro Hills[1,3,4]	252		400			0.10
Melrose Heights	931		400			0.37
Hotel/Retail						**0.33**
Hyatt Place	127 rooms, 3,000 sq. ft. retail, 24 condos	151	115			0.02
Springhill Suites Marriot	149 hotel rooms, 6,400 sq. ft. restaurant	149	115			0.02
S.D. Malkin Resort Hotel	289 rooms, 47 boutiques, 48 timeshares	337	115			0.04
The Inns at Buena Vista Creek	426 rooms, 10,000 sq. ft. meeting facility	426	115			0.05
El Corazon	25 ac. commercial (Ocean blvd), 19 ac. commercial (Village), 11 ac. hotel			55	1,500	0.08

Table 3.9 Near-Term Demand Projections Water Master Plan City of Oceanside						
Development Name	**Unit**	**Equivalent Residential Units**	**Unit Demand (gpd/DU or gpd/room)**	**Gross Acreage**	**WDF (gpd/ac)**	**ADD (mgd)**
Courtyard by Marriott(3)	140 hotel rooms	140	115			0.02
Oceanside Pavilion(1)	950,000 sq. ft.			24	1,500	0.04
Holiday Inn	93 rooms	93	115			0.01
Motel 6	123 rooms	123	115			0.01
CityMark Mixed Use(3)	231 units, 150 hotel rooms, 38,000 sq. ft. commercial	381	115			0.04
Industrial/Office						**0.46**
Pacific View Medical Office	39,835 sq. ft.			4	2,500	0.01
Tri-City Medical Center	57,476 sq. ft.			3	2,500	0.01
Ocean Ranch Corp. Center	75 ac.			75	2,500	0.19
Pacific Coast Business Park	90 ac.			90	2,500	0.23
Pacific Coast Medical Center	80,284 sq. ft.			8	2,500	0.02
Total(1)						**1.69**

Notes:
(1) Gross acreage is based on digitized parcel area of lot.
(2) Based on a per capita demand target of 142 gpcd (Oceanside, 2011a) and an average household size of 2.80 (Census, 2010).
(3) As of May 2013, the City's Planning reported a status of currently Under Construction or Construction Complete. The remaining Hotel / Retail developments were assigned statuses of either Entitled or Application on File.
(4) Based on water billing data, 75 percent of the anticipated units included in Villages of Morro Hills are actively taking water and included in existing demands. Thus, 25 percent of the 1,007 planned units are included in the Near-Term demand projections.

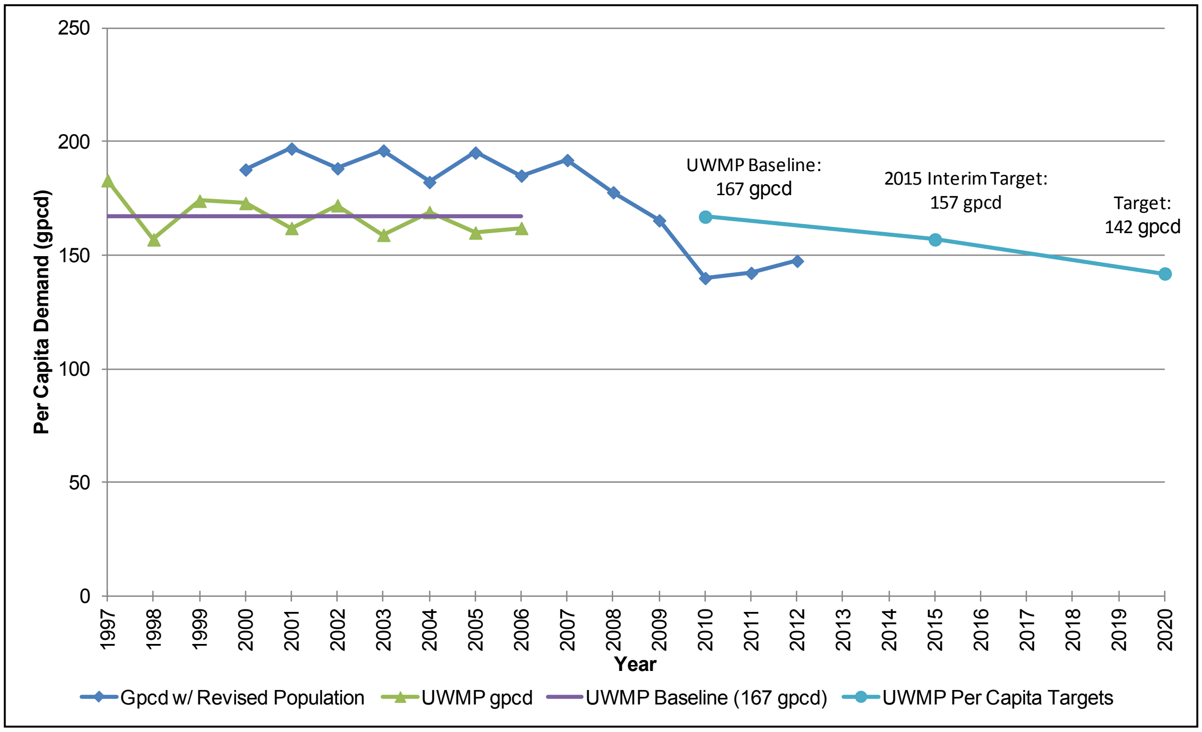


Figure 3.4 Historic Per-Capita Water Demand – UWMP and Revised

Demand projections using the 2010 UWMP per capita demand targets through 2050 are shown in Table 3.10.

Table 3.10 Water Demand Projections
Water Master Plan
City of Oceanside

Year	Population[(1)]	Per Capita Water Use (gpcd)	Annual Demand[(2)] (afy)	Average Day Demand (mgd)	Maximum Day Demand[(3)] (mgd)
2015	189,275	157	33,286	29.7	55.0
2020	195,455	142	31,089	27.8	51.3
2025	202,529	142	32,214	28.8	53.2
2030	209,602	142	33,339	29.8	55.1
2035	212,024	142	33,725	30.1	55.7
2050	217,364	142	34,574	30.9	57.1

Notes:
(1) Population projections from Chapter 2 (SANDAG, 2010).
(2) Annual Demand based on population projections and 2010 UWMP per-capita demand targets.
(3) MDD estimated using an assumed MDD/ADD factor of 1.85

As shown in Table 3.10, demand is projected to increase from nearly 28,000 afy in 2012 (see Table 3.3) to over 34,000 afy in 2050. This represents an average annual growth of about 0.5 percent. The ADD and MDD in year 2050 are projected to increase accordingly to approximately 31 mgd and 57 mgd, respectively.

The demand projections are illustrated on Figure 3.5. As discussed, the increase in demand in 2015 is due to adopting the per capita water demand projections from the 2010 UWMP. The Near-Term demands listed in Table 3.9 confirm this anticipated increase, as discussed in more detail in Section 3.6.1.

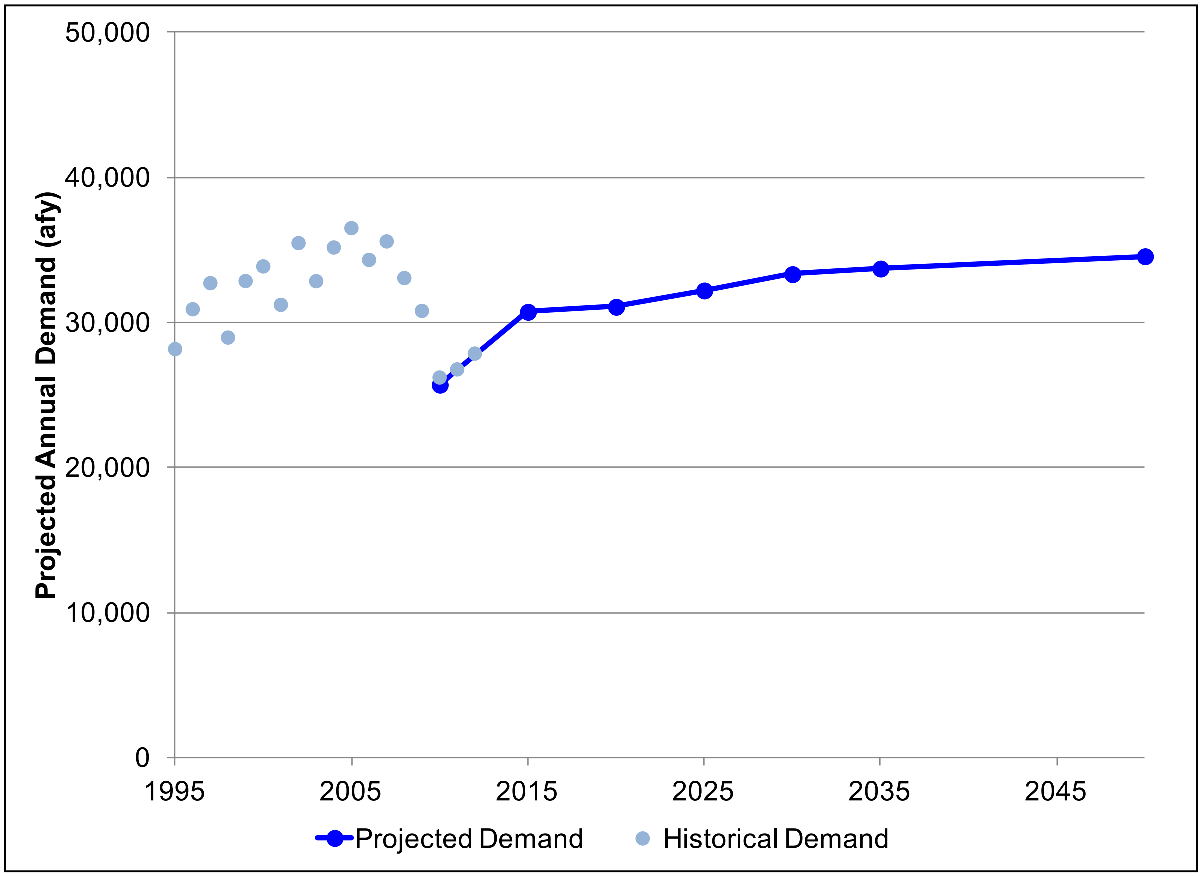


Figure 3.5 Projected Water Demand

As shown on Figure 3.5, demands are projected to increase over the next 40 years. Consistent with SBx7-7 targets listed in the 2010 UWMP, there will be an increase in demand to the year 2015, then a gradual increase as per capita demand is reduced but population continues to grow. With the exception of 2015, demand is anticipated to follow an approximately similar trend to population.

3.6.1 Integration with Near-Term Demands

The Near-Term demands discussed in Section 3.5 and listed in Table 3.9 were integrated into the long-term demand forecast. While the demand increase between 2010 and 2015 is a product of the UWMP target per-capital demand methodology, the increase can also be used to account for these development-specific demands.

Figure 3.6 illustrates the demand projections from Figure 3.5, with existing demands, near-term demands, and long-term all shown separately.

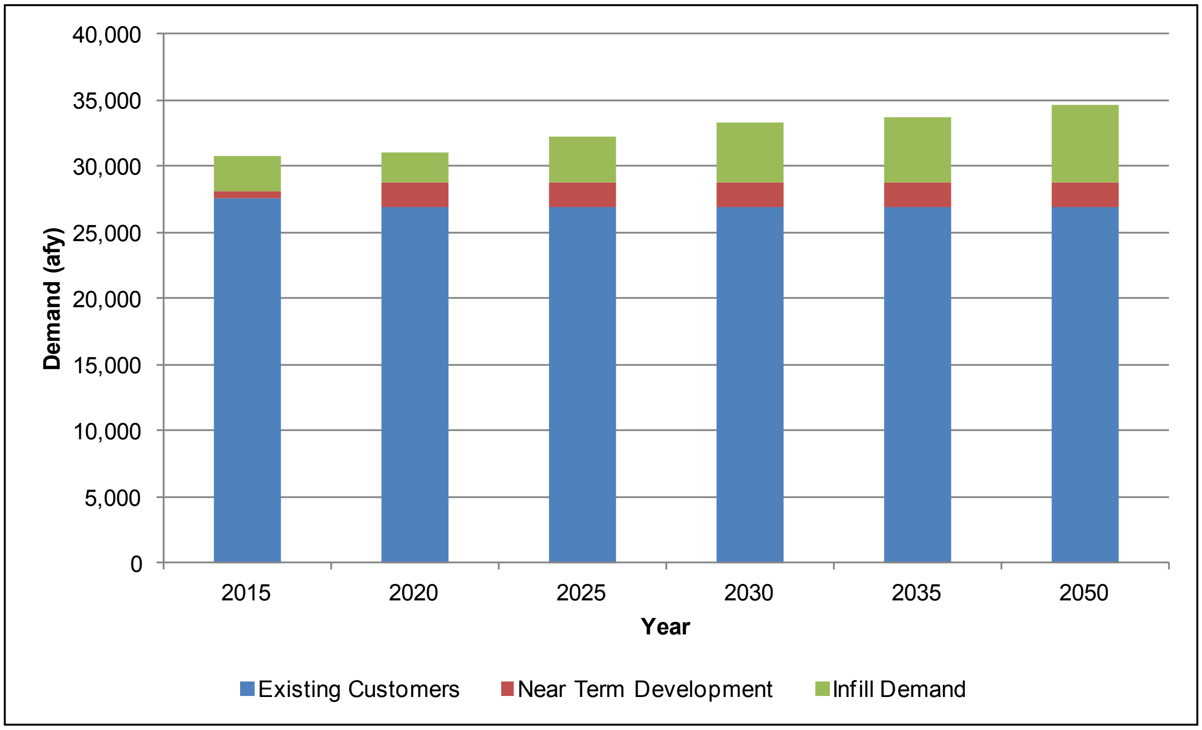


Figure 3.6 Near and Long-Term Demands

As shown on Figure 3.6, projected demand is composed of both developments taking place by the year 2020 (Near-Term), and the background increase attributed to continuous population growth (infill and densification). Existing demand accounts for the majority of usage in the future, while currently planned developments entail approximately 1,900 afy of additional demand. Additional demand consists of background residential and commercial growth.

Geospatial allocation of future demands is discussed in more detail in Chapter 6.

3.6.2 Water Conservation

The City has been a signatory to the Memorandum of Understanding (MOU) for urban water conservation with the California Urban Water Conservation Council (CUWCC) since 1997. The MOU contains 14 Best Management Practices (BMP), also known as demand management measures (DMM), that the City has committed to use good-faith efforts to implement. The 14 BMPs include:

1. Water survey programs for single family residential and multi-family residential customers.
2. Residential plumbing retrofit.
3. System water audits, leak detection, and repair.
4. Metering with commodity rates for all new connections and retrofit of existing connections.
5. Large landscape conservation programs and incentives.
6. High-efficiency washing machine rebate programs.
7. Public information programs.
8. School education programs.
9. Conservation programs for commercial, industrial, and institutional accounts.
10. Wholesale agency programs.
11. Conservation pricing.
12. Water conservation coordinator.
13. Water waste prohibition.
14. Residential ultra-low-flush toilet replacement programs.

The City's 2010 Urban Water Management Plan (UWMP) explains that the City maintains compliance with all the BMPs. As the City continues to pursue and improve upon water conservation and implementation of the 14 BMPs, the City's water demand per person is anticipated to decrease.

Currently, Oceanside partners with the SDCWA and the Metropolitan Water District of Southern California (MWDSC) for most of its current offering of programs, such as landscape site surveys. The City has sponsored a landscape water management class for homeowners in 2008 and 2009. An emphasis on residential outdoor water use is important because as much as 60 percent of residential water use goes to irrigating landscapes. Over 25 separate rebate programs have been historically offered to the City's customers through MWDSC and SDCWA. They range from toilet and washing machine rebates to residential and business customers to "Smart" irrigation controller rebates.

As discussed in the 2011 Water Conservation Plan, having these programs available does not guarantee large water savings with minimal effort. The actual uptake of these programs by City customers determines how much water is being saved by the current program. This will require that the City be proactive in marketing and educating customers as to the benefits of installing water efficient devices and changing water use habits.

Because the conservation efforts are so clearly defined in both the 2010 UWMP and 2011 Water Conservation Plan, the previously presented demand projections assume conservation goals will be met. The water use targets discussed earlier in this chapter are a product of conservation projection methodologies. If the City were to cease its conservation efforts, water use would presumably increase to the baseline level of 167 gpcd presented in the 2010 UWMP. The projected water demands with both this baseline water use (without water conservation scenario) and the water use targets of the 2010 UWMP (with water conservation) are presented in Table 3.11.

Table 3.11 Conservation Demand Projections
Water Master Plan
City of Oceanside

Year	Population[(1)]	Target Conservation Demand (gpcd)	Projected Annual Demand (afy)	Baseline Demand (gpcd)	Annual Non-Cons. Demand (afy)	Total Conservation (afy)
2015	189,275	145	30,742	167	35,407	4,665
2020	195,455	142	31,089	167	36,563	5,473
2025	202,529	142	32,214	167	37,886	5,672
2030	209,602	142	33,339	167	39,209	5,870
2035	212,024	142	33,725	167	39,662	5,937
2050	217,364	142	34,574	167	40,661	6,087

Notes:
(1) Population projections from Chapter 2 (SANDAG 2050).
(2) Annual Demand based on population projections and 2010 UWMP per-capita target demand of 142 gpcd. 2010 demand from UWMP.

As shown in Table 3.11, demand projections using a gpcd of 167 result in a demand increase from 35,000 afy in 2015 to over 40,000 afy in 2050. This ultimately results in more than 5,000 afy of additional demand compared to the 142 gpcd projections, which already incorporate conservation. The difference between these two demand projections is visually presented on Figure 3.7.

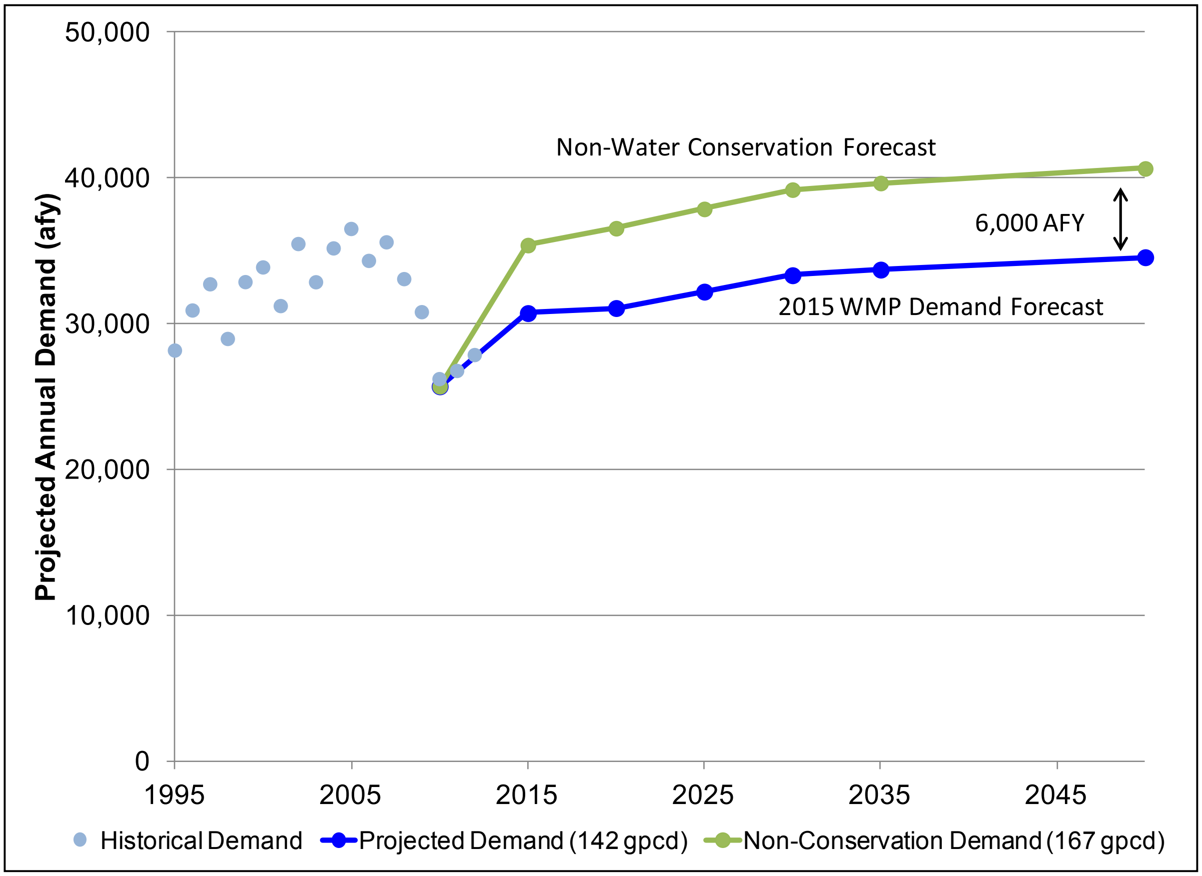


Figure 3.7 Conservation Demand Reduction

As shown on Figure 3.7, the non-conservation demand projection results in comparatively higher annual demand. In both scenarios, demand increase is projected to parallel population growth. This figure also provides an indication of the significance of water conservation in terms of water supply needs. Due to the anticipated water conservation effort by the City, the projected water demand is not expected to exceed the 2005 water demand by 2050. However, if water conservation would not take place, the system demand is expected to exceed historic levels by 2020.

-This Page Left Blank Intentionally-

EXISTING WATER SYSTEM FACILITIES

This chapter presents an overview of the City's existing water distribution system, water supply, and storage facilities. First the City's water supply sources are described, followed by a description of the City's water distribution system and its facilities. This section is concluded with a description of the existing water demands and distribution of demands by pressure zone.

4.1 WATER SUPPLY SOURCES

The City's water supplies include imported water from SDCWA and groundwater from the Mission Basin Groundwater Purification Facility (MBGPF). Locations where the City takes these supplies, including the City's water treatment facilities, are presented on Figure 4.1. Each source is discussed in detail in the following sections.

4.1.1 Imported Water

The City purchases imported water from SDCWA, who obtains water from MWDSC. Water is imported by the MWDSC through the Colorado River Aqueduct (CRA) and the California State Water Project (SWP). MWDSC sells both treated and untreated water to its member agencies, including SDCWA. The SDCWA owns and operates its own aqueduct and reservoir system that also conveys both treated and untreated water to its member agencies, including the City of Oceanside.

SDCWA supplies both treated and untreated imported water to the City through five aqueduct connections. Treated imported water is conveyed directly to the City's water distribution system, while untreated imported water is first conveyed to the City's Weese Water Filtration Plant (WFP). Treated water from this plant is then delivered to the City's distribution system.

The characteristics of the five aqueduct connections, referred to as flow control facilities (FCF), are summarized in Table 4.1 and Table 4.2, while their approximate locations are shown on Figure 4.1. As shown, the WFP, which is owned and operated by the City, is located several miles east of the City's service area, as shown on Figure 4.1. The WFP was commissioned in 1983 with a treatment capacity of 16 mgd. Since then, the overall treatment capacity has been increased to the current permitted capacity of 25 mgd (38.68 cfs).

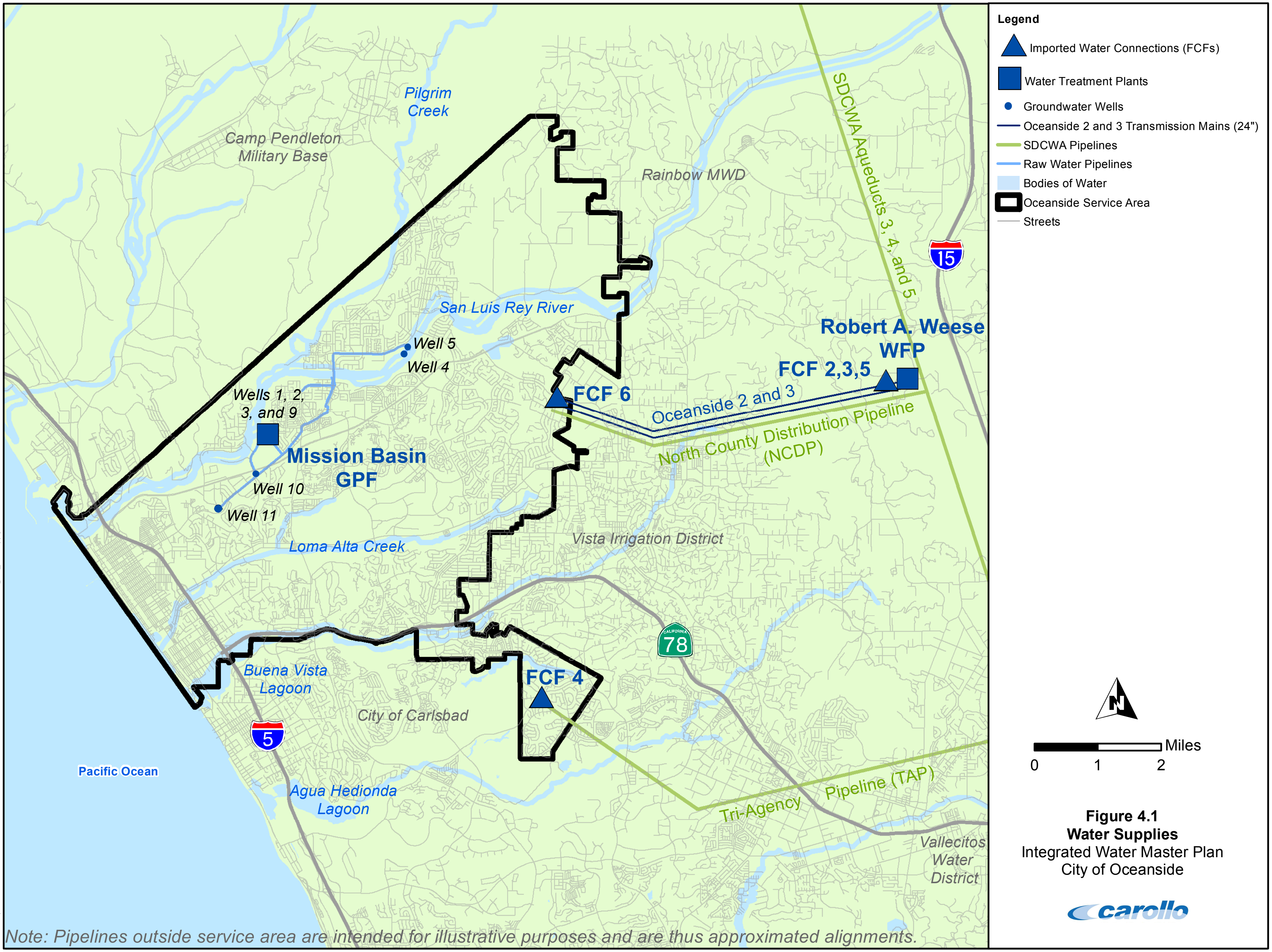


Figure 4.1
Water Supplies
Integrated Water Master Plan
City of Oceanside

Table 4.1	**Treated Imported Water Connections Characteristics Water Master Plan City of Oceanside**					
				Capacity		
FCF #	**Type**	**From**	**To**	**(gpm)**	**(cfs)**	**(mgd)**
2(1)	Treated	CWA Pipeline 4	Guajome (511) via Oceanside 2 or Peacock Hills (626) via Oceanside 3	17,500	39	25.2
3(1)	Treated	CWA Pipeline 4	Guajome (511) via Oceanside 2 or Peacock Hills (626) via Oceanside 3	17,500	39	25.2
4	Treated	Tri-Agency Pipeline	through Hydroelectric Plant to San Francisco Peak Area	8,100	18	11.6
6	Treated	NCDP(2)	Guajome (511)	31,850	71	45.9
Total Capacity				**74,950**	**167**	**107.9**

Notes:
(1) Treated FCFs 2 and 3 are used one at a time and can be configured to convey treated water from SDCWA Pipeline 4 to the distribution system or untreated water from SDCWA Pipeline 3 to WFP, which is then delivered to the distribution system via the Oceanside 2 and 3 pipelines or the North County Distribution Pipeline (NCDP).
(2) Under normal operating conditions, approximately 5.6 mgd of water is historically diverted from the NCDP to VID and VWD.

Table 4.2	**Untreated Imported Water Connections Characteristics Water Master Plan City of Oceanside**					
				Capacity		
FCF #	**Type**	**From**	**To**	**(gpm)**	**(cfs)**	**(mgd)**
2(1)	Untreated	CWA Pipeline 3	WFP	17,500	39	25.2
5	Untreated	CWA Pipeline 5	WFP	29,600	66	42.7
Total Capacity				**47,100**	**105**	**67.9**

Note:
(1) Treated FCFs 2 and 3 are used one at a time and can be configured to convey treated water from SDCWA Pipeline 4 to the distribution system or untreated water from SDCWA Pipeline 3 to WFP, which is then delivered to the distribution system via the Oceanside 2 and 3 pipelines or the North County Distribution Pipeline (NCDP).

FCFs 2 and 3 can convey both treated and untreated water from SDCWA Pipelines 3 and 4. These two FCFs operate one at a time and can supply up to 39 cubic feet per second (cfs) of treated water directly to the distribution system or up to 39 cfs of untreated water to the WFP. Treated water supplied directly to the distribution system from FCF 2 or 3 is conveyed about 5 miles to the City's service area through two 24-inch-diameter pipelines owned by the City and referred to as Oceanside 2 and Oceanside 3.

FCF 5 can also independently deliver up to 66 cfs of untreated imported water from SDCWA Pipeline 5 to the WFP, which can currently treat up to 38 cfs (25 mgd). The treated water is fed via gravity from the WFP into the distribution system via SDCWA's North County Distribution Pipeline (NCDP), which can also convey treated water from SDCWA Pipeline 4. NCDP supplies the City via FCF 6.

Up to 71 cfs of treated imported water can be delivered to the City's distribution system from the NCDP via FCF 6. The NCDP also supplies imported water to Rainbow Municipal Water District, Vista Irrigation District (VID), and Vallecitos Water District (VWD) through the SDCWA system. The historical deliveries to VID and VWD are approximately 9 cfs (or 5.6 mgd) during summer condition, which would reduce the available supply to the City to 62 cfs (or 40.3 mgd). FCF 4 can supply up to 18 cfs of treated imported water from the CWA Tri-Agency Pipeline (TAP) to the City's distribution system via a hydroelectric plant.

4.1.2 Groundwater

The Mission Basin Groundwater Purification Facility (MBGPF) is a desalting treatment facility that treats brackish groundwater extracted from the Mission Groundwater Basin. The MBGPF was put into service in 1992 with a capacity of 2.0 mgd, and expanded to its current capacity of 6.3 mgd in 2002. A granular activated carbon (GAC) process was added in 2009. The MBGPF currently treats water from eight groundwater wells. Four wells are located on site (Wells 1, 2, 3, and 9), while water from the remaining four wells are conveyed to the treatment plant via raw water pipelines. The locations of the MBGPF and the associated groundwater wells are shown on Figure 4.1, while characteristics of the treatment plant and wells are summarized in Table 4.3 and Table 4.4, respectively. As shown in Table 4.4, the wells located at the MBGPF are treated for TCP, iron, and manganese contamination.

Table 4.3 Mission Basin Groundwater Purification Facility Characteristics
Water Master Plan
City of Oceanside

Item	Description
Location	215 Fireside Drive
1992 Capacity	2.0 mgd
2002 Expanded Capacity	6.3 mgd
Primary Treatment	Reverse Osmosis (RO)
Secondary Treatment	Granular Activated Carbon (GAC)
Side Stream Treatment	Iron and manganese removal

Table 4.4 Groundwater Well Characteristics Water Master Plan City of Oceanside			
Well No.	Location	Contaminant	Nominal Capacity (gpm)
1	MBGPF	TCP, Iron, Manganese	750
2	MBGPF	TCP, Iron, Manganese	1,160
3	MBGPF	TCP, Iron, Manganese	1,500
4	North River Road, e/o Calle Montecito	Iron and Manganese	1,220
5	North River Road, e/o Calle Montecito	Iron and Manganese	1,165
9	MBGPF	TCP, Iron, Manganese	1,000
10	Firestation 7	TCP and Manganese	1,600
11	Firestation 7	TCP and Manganese	1,600

The MBGPF treatment process utilizes RO to reduce salt concentrations in the groundwater. The GAC process removes 1, 2, 3-trichloropropane (TCP) from Wells 1, 2, 3, 9, 10, and 11. Additionally, a side stream of raw water from Wells 4 and 5 is treated for iron and manganese removal and blended with the reverse osmosis (RO) permeate and GAC to provide the final product water. An additional treatment system is used to reduce iron and manganese. The RO membranes are Hydranautics Model ESPA 1 that operates at a feed pressure of approximately 150 pounds per square inch (psi). The facility is capable of removing the iron and manganese present in the on-site wells, and manganese from the off-site wells.

4.2 WATER DISTRIBUTION SYSTEM

Currently, the City manages a potable water system that includes 28 pressure zones, 8 groundwater wells, 12 water storage reservoirs at 9 sites, 9 booster pumping stations (PS), 2 water supply PSs located at MBGPF, 5 imported water connections, 54 pressure regulating stations (PRS), and 7 altitude valves. A map of the City's distribution system is presented on Figure 4.2. A hydraulic profile of the existing water system pressure zones and major water system facilities is shown on Figure 4.3. It should be noted that due to space constraints not all 54 PRSs are shown in the profile. However, a complete listing is included in Table 4.13.

The following section provides a description of the system pressure zones and water system facilities that comprise the City's distribution system, including, booster stations, reservoirs, PRSs, and emergency connections.

4.2.1 Pressure Zones

For water systems that have varied topography, such as the City, water distribution systems are typically divided into different hydraulic regions, known as pressure zones. The purpose of these pressure zones is to maintain adequate pressures throughout the distribution system in spite of varying topography. A hydraulic grade line (HGL) is established for each pressure zone and the high water levels in reservoirs are set to maintain these HGLs. The City's service area ranges in elevation from approximately 720 feet above mean sea level (ft-msl) in the eastern portion service area to about 10 ft-msl in the western portion of the service area. The characteristics of the City's 28 pressure zones are described in Table 4.5. The zones are sorted based on HGL in ascending order.

Table 4.5 Pressure Zones Summary
Water Master Plan
City of Oceanside

			Supply Sources to Pressure Zone		
Pressure Zone Name[(1)]	**HGL[(2)] (ft-msl)**	**Reservoirs**	**Booster Pump Stations**	**Pressure Regulating Stations[(3)]**	**FCFs and WTPs**
Talone	320	Talone, Pilgrim, John Paul Steiger, Fire Mountain, Wire Mountain	None	Buddy Todd Bypass PRS, Fire Mountain AV, Wire Mountain AV, Valley Heights PRS	MBGPF
Airport	320	None	None	Airport PRS	None
Poplar Ridge	320	None	Carey Road PS	Poplar Ridge Pump Station PRS	None
Palmer	340	None	None	Palmer Drive PRS, El Camino Country Club PRS	None
Rivertree	346	None	Rivertree PS	Shadowtree PRS	None
Laurel	390	None	None	Fire Mountain & Laurel PRS	None
Intermediate Henie Hills	395	None	None	Henie Hills Drive and Lynn Court PRS	None
Ocean Village Regulated	400	None	None	Via Esmarca PRS	None
Henie Hills	409	Henie Hills	None	Viscaya PRS, Oceanview & Carriage PRS, Buena Hills PRS	None

Table 4.5 Pressure Zones Summary
Water Master Plan
City of Oceanside

Pressure Zone Name[(1)]	HGL[(2)] (ft-msl)	Reservoirs	Supply Sources to Pressure Zone: Booster Pump Stations	Pressure Regulating Stations[(3)]	FCFs and WTPs
North River	420	None	None	Del Rio Elementary PRS, North River Road PRS, Wilshire River PRS	None
Arrowood	450	None	None	Granite PRS, Sonoma Hills PRS, Pilgrim Creek Reservoir Arrowood Regs PRS	None
Hutchinson	450	None	None	Hutchinson PRS	None
Fire Mountain	450	None	Fire Mountain PS	Fire Mountain Reservoir PRS	None
Darwin	450	None	None	Darwin PRS, Darwin e/o Whispering Palms PRS, Windella PRS	None
Wilmont Ranch	480	None	None	Wilmont 1 PRS, Wilmont 2 PRS	None
Wilshire	480	None	None	Wilshire Road PRS, North River Road & Wilshire PRS, Strawberry PRS	None
Buddy Todd	480	None	Buddy Todd PS	Mesa Drive PRS	None
Guajome	511	Guajome 1, Guajome 2	None	Darwin / Crestview PRS	FCF 2, FCF 3 (via 24” City Pipeline 2), MBGPF
San Francisco Peak 2 Pressure Zone	511	San Francisco Peak 2	None	San Francisco Peak 2 Reservoir AV	FCF 4

Table 4.5	Pressure Zones Summary Water Master Plan City of Oceanside				
			Supply Sources to Pressure Zone		
Pressure Zone Name(1)	**HGL(2) (ft-msl)**	**Reservoirs**	**Booster Pump Stations**	**Pressure Regulating Stations(3)**	**FCFs and WTPs**
Peacock Hills Reduced	526	None	None	Granada & Rose PRS	None
Montamar	560	None	None	F-1 PRS, F-2 PRS	None
Leisure Hills	569	San Francisco Peak 1	Lake Boulevard PS, Hydro PS	Leisure Village PRS, Leisure Village 2 PRS, San Francisco Peak Generator Bypass PRS	None
Mesa Loma	600	None	Mesa Loma PS	Peacock PRS	None
Peacock Hills	626	None	None	N Santa Fe Omoris 3 PRS	FCF 2, FCF 3 (via 24" City Pipeline 3)
Morro Hills	738	Morro Hills 1, Morro Hills 2	Wilshire PS	Wilshire PS PRS	None
Hydro-generator	800	None	None	None	FCF 4
Transmission	800	None	None	None	FCF 6
Morro Hills PS	1,000	None	Morro Hills PS, Sleeping Indian PS	None	None

Notes:
(1) Conveyance pressure zones, such as the Airport PZ, Hydrogenerator PZ, and Transmission PZ, are not presented on figure maps. The HGL of these pressure zones are primarily based on the conveyance of water supply throughout the distribution system and do not have system demand.
(2) Nominal HGL of the pressure zone; actual HGL will vary across the pressure zone depending on system conditions. Since the high water line is used for the nominal HGL, major pressure zones operate slightly below the nominal HGL.
(3) Acronyms: AV – Altitude Valve (generally supplying a reservoir from an upper pressure zone); FCF – Flow Control Facility; PRS – Pressure Regulating Stations (can include Pressure Regulating Valves and Pressure Sustaining Valves; see Table 4.13 for specific details on each PRS); PS – Pump Station.

As shown in Table 4.5 and depicted on Figure 4.2, the City's water distribution system is composed of 28 pressure zones and subzones that range in HGL from 300 to 1,000 ft-msl.

Each pressure zone operates at hydraulic grade elevations proportional to their ground elevations in order to provide appropriate service pressures.

Table 4.5 also lists the gravity reservoirs that are connected to each pressure zone, the PSs, PRSs, and water supply sources that feed each zone. The vast majority of the City's water supply consists of imported water, which enters the distribution system at high elevations (HGL 800 and 900), while groundwater from the MBGPF enters the distribution system at low elevations (HGL 320 and 511). With the exception of groundwater, water is typically conveyed by gravity through PRSs from the inland hills in the northeast, to the downtown area along the ocean in the southwest. Many of the City's booster PSs are primarily used during emergencies when water needs to be pumped up from reservoir storage to meet demands in higher pressure zones. As listed in Table 4.5, the City's water supply sources enter the distribution system as follows:

- Groundwater from the MBGPF supplies treated groundwater directly into the distribution system, with pump stations serving both the Guajome (511) Zone and the Talone (320) Zone.
- Treated imported water and/or water treated at the WFP that is conveyed with the NCDP through FCF 6 feed into the Transmission Zone at an HGL of about 800, and further conveyed to the Peacock Hills (626), Guajome (511), and Morro Hills (738), and Wilshire (480) zones via several PRSs.
- Treated water from the WFP and/or treated imported water from FCF 3 is conveyed through the Oceanside 2 and 3 pipelines that feed into the Guajome (511) Zone and Peacock Hills (626) Zones.
- Treated imported water from FCF 4 supplies water from the TAP to the San Francisco Peak 1 Zone via a hydroelectric plant located at the site of the San Francisco Peak Reservoirs.

4.2.2 Pipelines

The City's distribution system consists of approximately 574 miles of pipeline ranging from 2 inches to 42 inches in diameter. This section describes the distribution of pipelines by diameter, material, age, and pressure zone. A breakdown of all pipelines in the City by zone can be found on Figure 4.4.

4.2.2.1 Pipeline Distribution by Diameter

The distribution of pipeline diameters is summarized in Table 4.6 and is graphically presented on Figure 4.5.

Table 4.6 Pipeline Overview
Water Master Plan
City of Oceanside

Diameter (inches)	Length (ft)	Length (mi)[1]	Percent (%)
2	5,000	0.3	0.2%
3	1,600	0.3	0.1%
4	60,450	8.8	2.0%
6	312,250	58.0	10.3%
8	1,546,750	291.6	51.0%
10	381,400	71.8	12.6%
12	241,000	44.3	7.9%
14	114,700	21.5	3.8%
16	56,300	10.7	1.9%
18	83,900	15.9	2.8%
20	10,000	1.9	0.3%
21	6,400	0.2	0.2%
24	145,450	27.5	4.8%
27	12,700	2.4	0.4%
30	39,400	7.5	1.3%
33	6,100	1.2	0.2%
36	600	0.1	<0.1%
42	7,550	1.4	0.2%
Total	**3,031,550**	**574.2**	**100%**

Note:
(1) Pipeline information is based on GIS data provided by the City in 2013. Numbers may vary slightly in preceding tables due to rounding.

As shown in Table 4.6, over 80 percent of the City's pipelines consist of 6- to 12-inch-diameter pipelines.

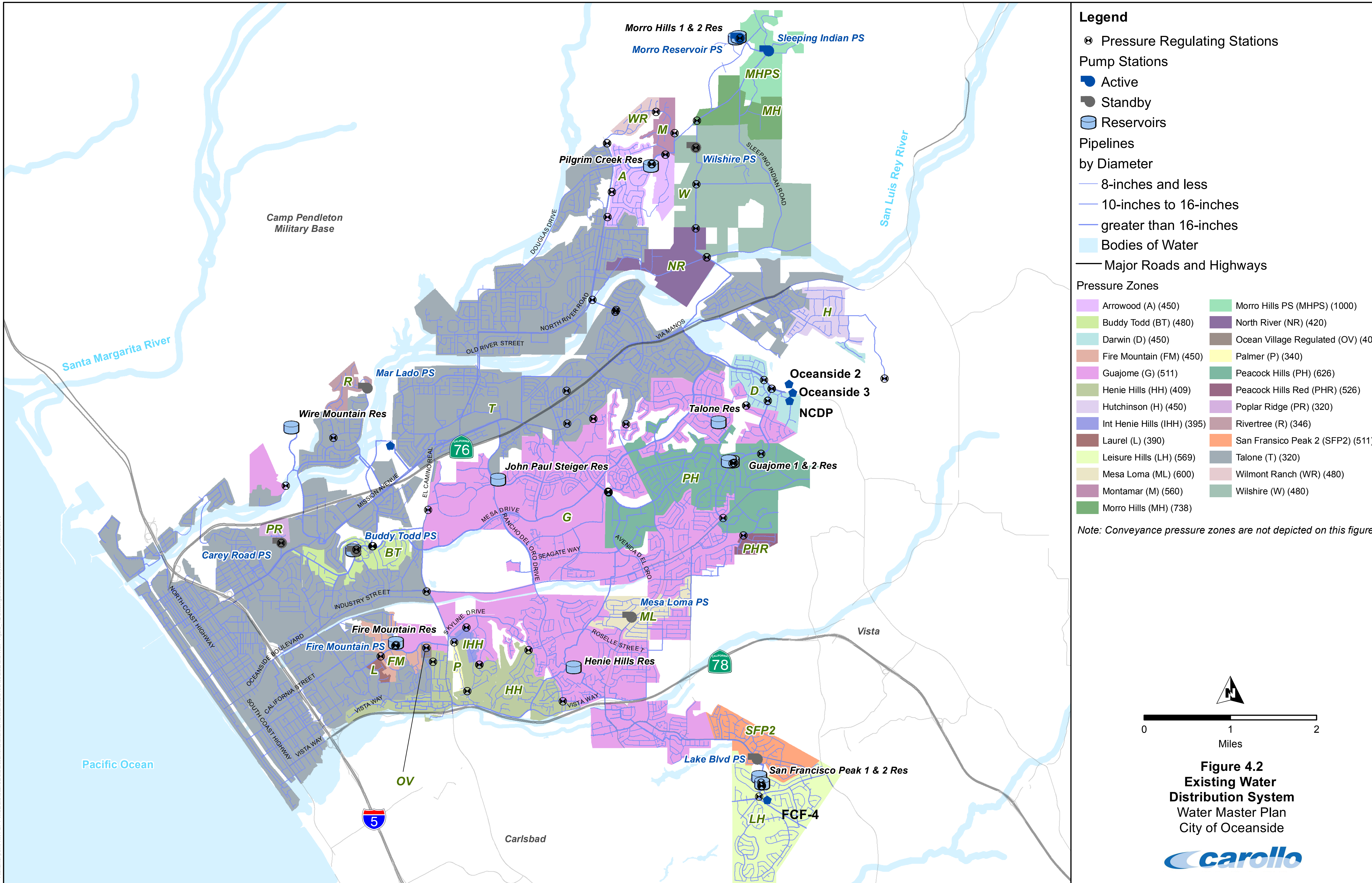


Figure 4.2
Existing Water Distribution System
Water Master Plan
City of Oceanside

carollo

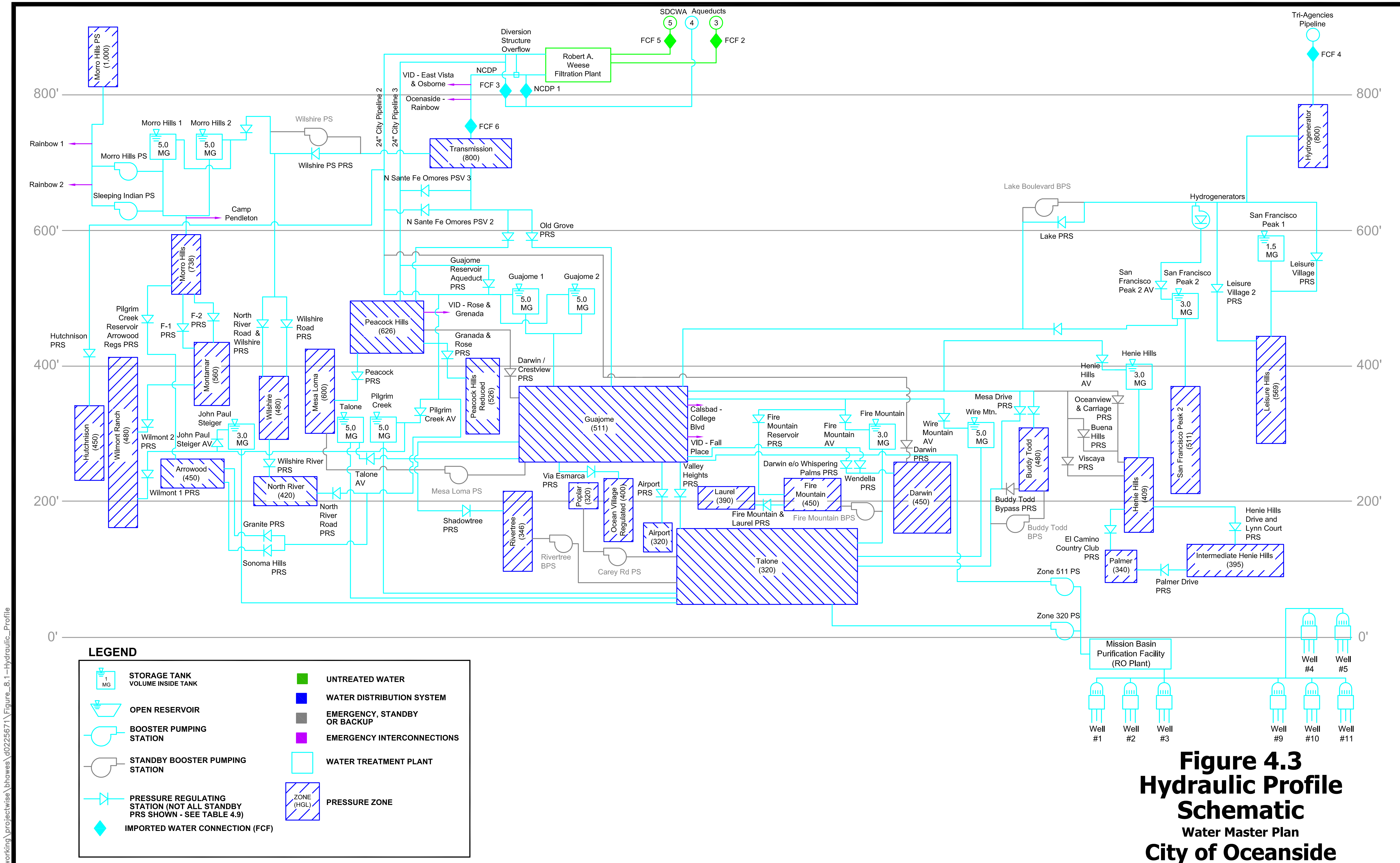


Figure 4.3
Hydraulic Profile Schematic
Water Master Plan
City of Oceanside

carollo

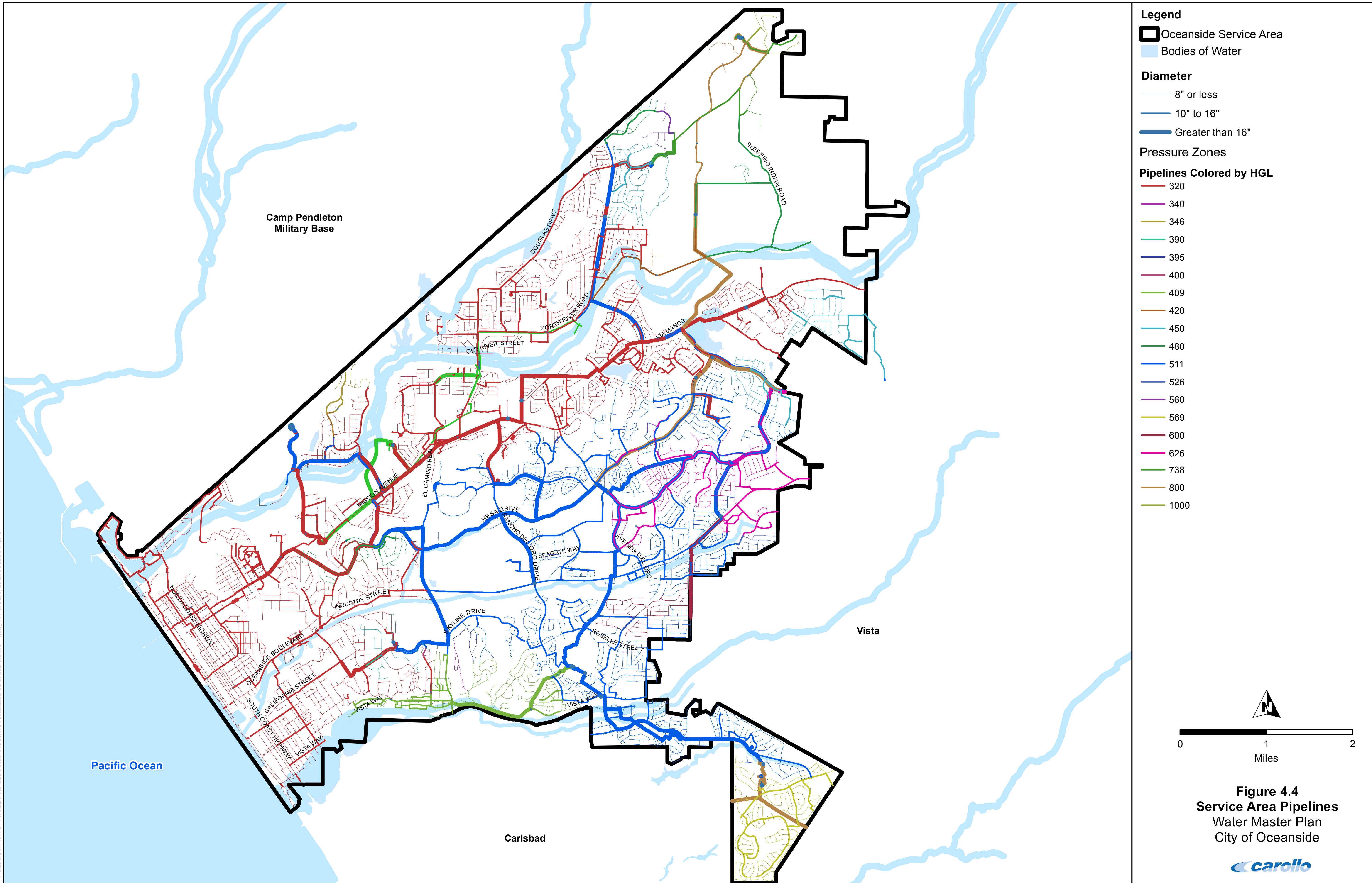


Figure 4.4
Service Area Pipelines
Water Master Plan
City of Oceanside

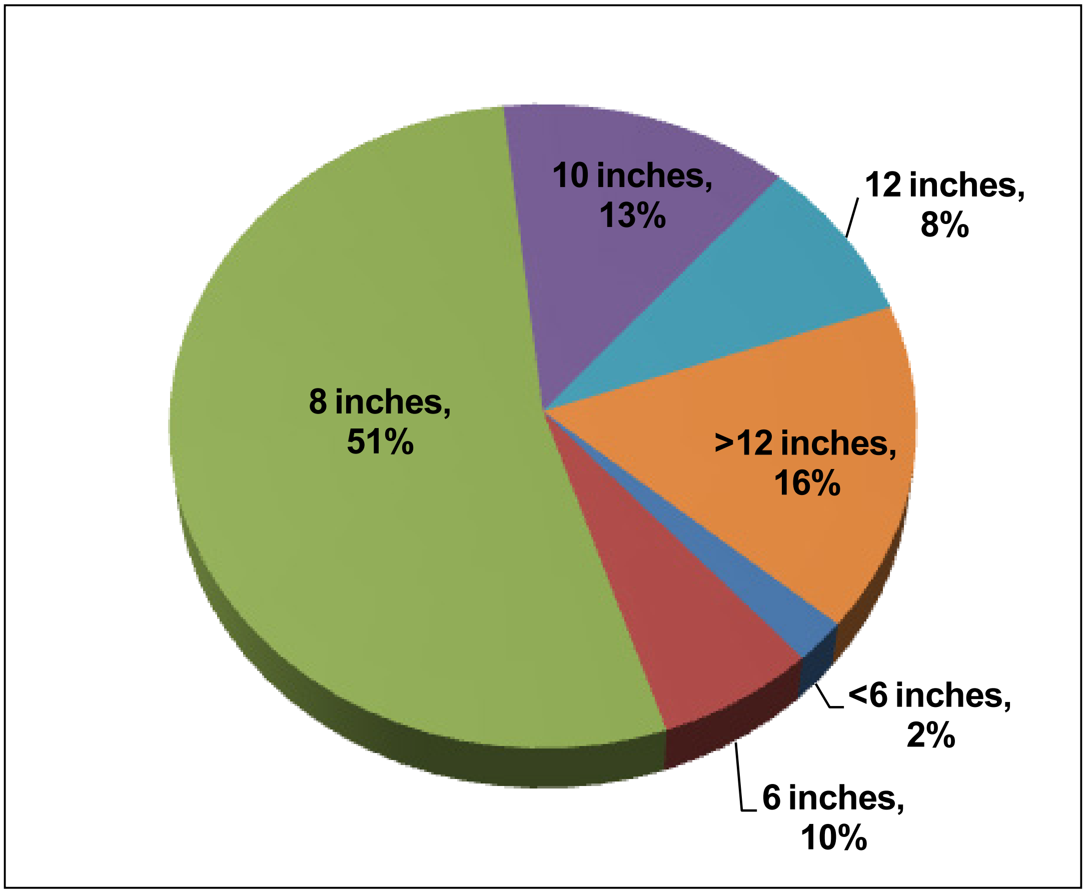


Figure 4.5 Pipeline Distribution by Diameter

As shown on Figure 4.5, the majority of the pipelines in the City have a diameter of 8 inches. Pipelines with diameters of 12-inches and smaller compose about 84 percent of the distribution system, while only 16 percent of the City's pipelines are greater than 12 inches in diameter (also referred to as transmission mains).

4.2.2.2 Pipeline Distribution by Material

The distribution of pipeline by material is summarized in Table 4.7 and is graphically presented on Figure 4.6. The material categories are asbestos cement (AC), polyvinyl chloride (PVC), ductile iron pipe (DIP), cast iron (CI), steel, concrete, and cement mortar lined coated steel (CMLCS). It should be noted that 3,600 feet of HDPE pipelines are included under PVC. The majority of the pipelines (375 miles, or 65 percent) are made of AC.

Table 4.7 Pipeline Diameter by Material
Water Master Plan
City of Oceanside

Diameter (in)	AC	DIP	PVC(1)	CI	Steel	CMLC	Concrete	Total Length(2)	% of Total Length
2	1,150	300	3,250	150	150	0	0	5,000	0.2%
3	550	450	550	50	0	0	0	1,600	0.1%
4	46,150	450	150	13,450	0	250	0	60,450	2.0%
6	298,950	1,300	4,100	4,500	2,250	100	1,050	312,250	10.3%
8	1,027,800	25,700	482,800	5,650	1,800	300	2,700	1,546,750	51.0%
10	310,800	7,200	58,050	3,050	1,250	100	950	381,400	12.6%
12	163,100	10,350	57,350	5,300	1,400	150	3,350	241,000	7.9%
14	67,350	2,300	6,800	0	450	18,600	19,200	114,700	3.8%
16	26,200	15,850	1,650	0	8,850	850	2,900	56,300	1.9%
18	22,500	22,900	1,950	450	500	3,300	32,300	83,900	2.8%
20	3,150	600	0	0	100	0	6,150	10,000	0.3%
21	0	0	0	0	0	0	6,400	6,400	0.2%
24	6,700	86,050	50	0	3,650	4,450	44,550	145,450	4.8%
27	1,150	0	0	0	0	3,850	7,700	12,700	0.4%
30	50	38,650	0	0	350	350	0	39,400	1.3%
33	6,100	0	0	0	0	0	0	6,100	0.2%
36	0	0	0	0	0	600	0	600	<0.1%
42	0	0	0	0	4,500	50	3,000	7,550	0.2%
Totals (ft)	**1,981,700**	**212,100**	**616,700**	**32,600**	**25,250**	**32,950**	**130,250**	**3,031,550**	**100%**
Totals (mi)	**375.3**	**40.2**	**116.8**	**6.2**	**4.8**	**6.2**	**24.7**	**574.2**	**100%**
Percent of Total	**65.3%**	**7.0%**	**20.3%**	**1.1%**	**0.8%**	**1.1%**	**4.3%**	**100.0%**	**n/a**

Notes:
(1) HDPE pipelines are included under PVC.
(2) Pipeline information is based on GIS data provided by the City in 2013. Numbers may vary slightly in previous and preceding tables due to rounding.

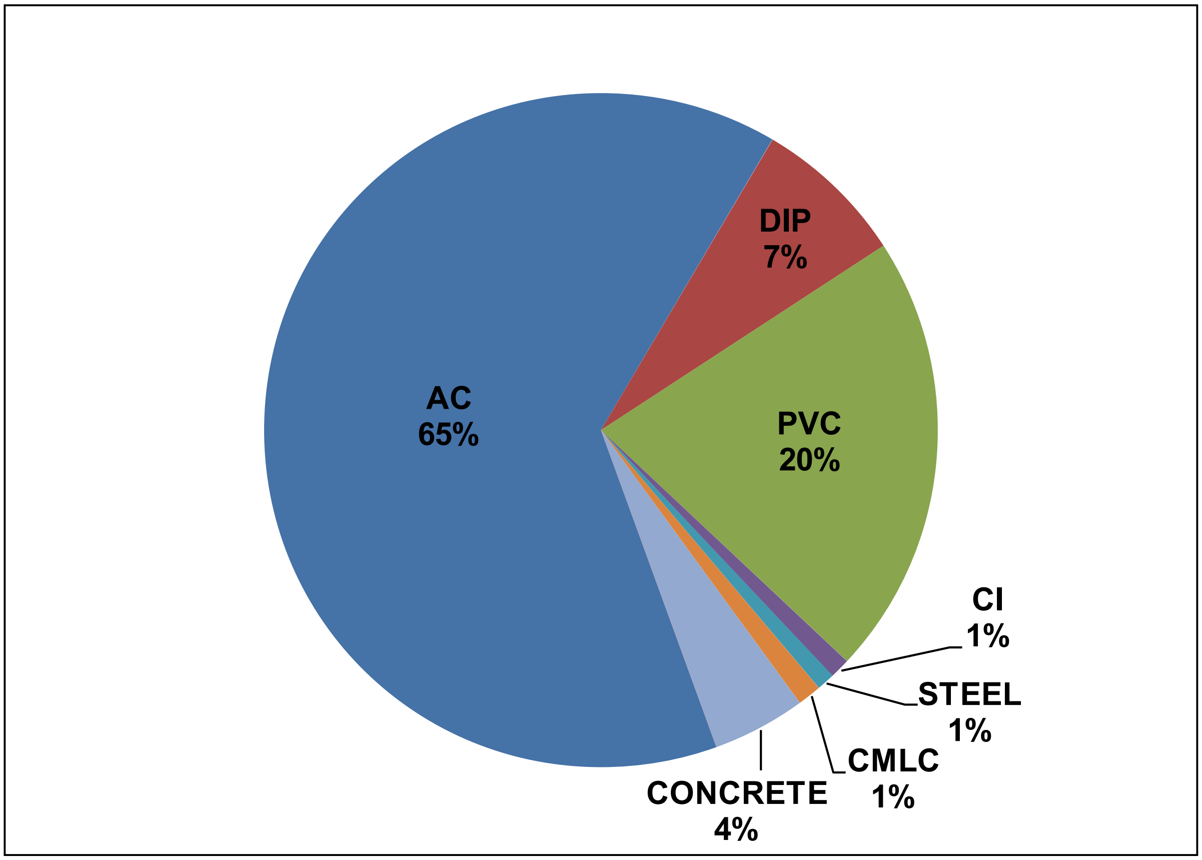


Figure 4.6 Pipeline Distribution by Material

As shown on Figure 4.6, the majority of the pipelines in the City are AC. PVC and DIP compose the second and third most common pipeline materials, comprising about 21 percent and 7 percent of the City's distribution system, respectively. The remaining 8 percent of the distribution system consists of concrete, CI, steel, and CMLCS pipelines.

The distribution of pipeline materials is shown again in Table 4.8, but also broken down by the decade of installation. This data shows the changes in materials used for new pipeline construction over the history of the system.

Table 4.8 Pipeline Distribution by Year and Material
Water Master Plan
City of Oceanside

Material	1924-1939	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2013	Unknown	Total Length (mi)(1)	Total Length (%)
AC	0.3	1.4	31.2	60.9	109.2	158.2	12.7	0.9	0.1	0.4	375.3	65%
DIP	0.0	0.0	0.0	0.1	0.5	12.2	17.0	10.3	0.0	0.0	40.2	7%
PVC(2)	0.0	0.0	0.0	0.0	0.1	6.1	50.4	58.1	1.4	0.7	116.8	20%
CI	4.5	0.2	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	6.2	1%
STEEL	0.0	1.2	0.5	0.9	0.1	0.0	1.9	0.1	0.0	0.1	4.8	1%
CONCRETE	0.0	1.1	2.6	9.1	5.9	4.8	0.2	0.0	0.0	1.0	24.7	4%
CMLC	0.0	0.7	2.5	0.4	0.1	1.6	0.9	0.1	0.0	0.0	6.3	1%
Totals (mi)	**4.8**	**4.6**	**37.8**	**71.6**	**115.9**	**182.9**	**83.1**	**69.5**	**1.5**	**2.4**	**574.1**	**100%**
Percent of Total	**0.8%**	**0.8%**	**6.6%**	**12.5%**	**20.2%**	**31.9%**	**14.5%**	**12.1%**	**0.3%**	**0.4%**	**100%**	**n/a**

Notes:
(1) Pipeline information is based on GIS data provided by the City in 2013. Numbers may vary slightly in previous and preceding tables due to rounding.
(2) HDPE pipelines are included under PVC.

As shown in Table 4.8, the majority of the City's distribution system was constructed between 1960 and 1999, with the bulk of that development occurring in the 1980s. The dominant material has historically been AC, but since 1990, the City has begun to favor PVC for new pipelines.

4.2.2.3 Pipeline Distribution by Age

The distribution of pipeline by age is summarized in Table 4.9. As shown, the majority of the City's distribution system (nearly 300 miles) was installed in the period 1970-1990, while substantial expansions of 83 and nearly 70 miles continued in the following two decades, respectively.

As shown in Table 4.9, 8-inch-diameter pipeline has always composed the majority of new pipelines in each decade. The 10-inch to 18-inch-diameter pipelines were installed primarily between 1960 and 1989. The bulk of 24-inch and 30-inch-diameter pipelines were installed later, mainly between 1970 and 1999. Finally, the majority of the 6-inch-diameter distribution pipelines were installed early in the system's development, between 1950 and 1979.

4.2.2.4 Pipeline Distribution by Pressure Zone

The City's water system is separated into 28 different pressure zones to distribute water across a range of elevations. Table 4.10 lists the length of pipeline and water demands by pressure zones. The data presented in Table 4.10 is obtained from the City's hydraulic model, and is therefore not exactly consistent with the data presented in Table 4.6 through Table 4.9.

As shown in Table 4.10, the distribution of pipeline length per pressure zone is closely correlated with the demand distribution by pressure zone. For example, the Talone pressure zone comprises 46 percent of the system's distribution system as well as 46 percent of the system-wide demand.

Table 4.9 Pipeline Diameter by Year
Water Master Plan
City of Oceanside

Diameter (in)	1924-1939	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2013	Unknown	Total Length (mi)(1)	% of Total Length
2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.6	1.0	0.1%
3	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.0%
4	2.4	0.7	4.6	1.7	0.9	0.6	0.2	0.1	0.1	0.2	11.4	2.0%
6	0.9	0.3	16.6	16.6	20.3	3.2	0.6	0.4	0.0	0.2	59.1	10.3%
8	0.6	0.6	6.4	22.8	56.1	108.3	51.6	45.8	0.7	0.0	292.9	51.0%
10	0.0	0.0	2.2	6.2	15.6	32.9	10.0	4.7	0.4	0.1	72.2	12.6%
12	0.8	0.0	2.9	9.9	7.5	10.3	5.0	8.8	0.4	0.2	45.7	7.9%
14	0.0	1.8	3.5	5.0	4.9	4.8	0.8	0.7	0.0	0.2	21.7	3.8%
16	0.0	1.2	0.9	0.2	1.9	5.2	0.7	0.5	0.0	0.0	10.7	1.9%
18	0.0	0.0	0.6	4.9	2.9	2.5	2.3	2.6	0.0	0.0	15.9	2.8%
20	0.0	0.0	0.0	0.6	0.5	0.8	0.0	0.0	0.0	0.0	1.9	0.3%
21	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.0	1.2	0.0%
24	0.0	0.0	0.0	1.2	5.1	10.1	7.7	3.4	0.0	0.0	27.5	4.8%
27	0.0	0.0	0.0	1.7	0.0	0.7	0.0	0.0	0.0	0.0	2.4	0.4%
30	0.0	0.0	0.0	0.0	0.0	2.0	3.1	2.3	0.0	0.0	7.5	1.3%
33	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	1.2	0.2%
36	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0%
42	0.0	0.0	0.0	0.6	0.0	0.0	0.9	0.0	0.0	0.0	1.4	0.2%
Totals (mi)	**4.8**	**4.6**	**37.8**	**71.6**	**115.8**	**183.0**	**83.1**	**69.4**	**1.6**	**2.4**	**574.2**	**100%**
Percent of Total	**0.8%**	**0.8%**	**6.6%**	**12.5%**	**20.2%**	**31.9%**	**14.5%**	**12.1%**	**0.3%**	**0.4%**	**100%**	**n/a**

Note:

(1) Pipeline information is based on GIS data provided by the City in 2013. Numbers may vary slightly in previous and preceding tables due to rounding.

Table 4.10	Distribution of Pipeline Length and Demand by Pressure Zone Water Master Plan City of Oceanside			
Zone Name	**ADD(1) (mgd)**	**ADD (%)**	**Pipeline (mi)(2)**	**Pipeline (% of total)**
Arrowood	0.44	2%	8.4	1%
Buddy Todd	0.20	1%	7.0	1%
Darwin	0.22	1%	5.5	1%
Fire Mountain	0.23	1%	3.8	1%
Guajome	6.08	24%	148.3	26%
Henie Hills	0.89	4%	18.9	3%
Hutchinson	0.28	1%	7.1	1%
Intermediate Henie Hills	0.05	<1%	1.0	<1%
Laurel	0.02	<1%	0.8	<1%
Leisure Hills	0.97	4%	19.2	3%
Mesa Loma	0.28	1%	9.7	2%
Montamar	0.12	<1%	1.5	<1%
Morro Hills	0.14	1%	4.0	1%
Morro Hills PS	0.34	1%	2.8	<1%
North River	0.48	2%	3.0	1%
Ocean Village Regulated	0.01	<1%	0.4	<1%
Palmer	0.03	<1%	0.9	<1%
Peacock Hills	1.08	4%	27.1	5%
Peacock Hills Reduced	0.07	<1%	1.8	<1%
Poplar Ridge	0.04	<1%	0.4	<1%
Rivertree	0.10	<1%	2.3	<1%
San Francisco Peak 2	0.43	2%	8.8	2%
Talone	11.43	46%	259.7	46%
Transmission(3)	0.41	2%	17.2	3%
Wilmont Ranch	0.16	1%	2.1	<1%
Wilshire	0.41	2%	4.7	1%
Total	**24.89**	**100%**	**566.4**	**100%**

Notes:
(1) 2012 average annual demand, allocated from billing data.
(2) The pipeline lengths presented in this table were obtained from the hydraulic model by pressure zone. This table does not include all pipelines in the City's GIS data, which are presented in Tables 4.6 to 4.9.
(3) The pipelines within the Hydrogenerator Zone are included in the Transmission Zone total.

4.2.3 Booster Pumping Stations

The City has nine booster PSs that deliver water from lower pressure zones to upper pressure zones of the distribution system along with two PSs located at the MBGPF. As the majority of the City's water supplies enter the distribution system in the upper pressure zones, most of the City's pump stations are typically in standby mode and operated only under emergency conditions. The hydraulic characteristics for each pump are summarized in Table 4.11.

Typically, pump stations consist of multiple pump units, including one spare pump to provide reliability in case of a breakdown or repair. In addition, critical booster pumping stations may be equipped with emergency power supplies in case of failure of the primary power source. As shown in Table 4.11, seven of the City's eleven PSs are typically in standby mode. The only PSs that operate on a daily basis are Sleeping Indian PS and Morro Hills PS as both stations need to pump imported water that enters the distribution system through FCF 6 at a HGL of 800 ft msl to the Morro Hills PS Zone (HGL 1000 ft msl) and the Zone 320 PS and the Zone 511 PS, which pump water from the MBGPF into the Guajome (HGL 511 ft msl) and Talone (HGL 320 ft msl) pressure zones. In the future, the City plans to take the Fire Mountain PS permanently out of service, which is currently a standby PS that pumps water from the Talone Zone (HGL 320 ft msl) to the Fire Mountain Zone (HGL 450 ft msl).

4.2.4 Storage Reservoirs

Water distribution systems rely on stored water to help equalize daily fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major source of supply.

The City's water system has 12 reservoirs at nine different sites with a combined capacity of 50.5 million gallons (MG). The locations of the City's existing reservoirs are shown on Figure 4.2, while detailed information for each of the reservoirs is summarized in Table 4.12.

As the City's imported water supplies originate at the upper elevations of the distribution system, the reservoirs are generally configured to be replenished from upper pressure zones, with an altitude valve from the upper pressure zone supplying the inlet.

**Table 4.11 Booster Pumping Stations
Water Master Plan
City of Oceanside**

Booster Station Name(2,3,4)	Total Capacity (gpm)	Pumping Units	Elev (ft)	Power (hp)	Year Constructed(5)	Backup Power	Standby(1)	From Pressure Zone	To Pressure Zone
Buddy Todd	1,200	3	280	50 50 50		N	Y	Talone (320)	Buddy Todd (480)
Fire Mountain	320	2	298	20 20		N	Y	Talone (320)	Fire Mountain (450)
Carey Road (Poplar Ridge)	625	3	204	40 40	1988	N	Y	Talone (320)	Poplar Ridge (320)
Rivertree (Mar Lado)	1,435	3	118	7.5 10 40	1989	Y	Y	Talone (320)	Mar Lado (346)
Sleeping Indian	1,600	3	655	50 [VFD] 50 60		Y	N	Morro Hills (738)	Morro Hills PS (1,000)
Morro Hills	900	2	712	30 [VFD] 30 [VFD]		N	N	Morro Hills (738)	Morro Hills PS (1,000)
Wilshire	2,250	3	343	75 75 75	1992	N	Y	Transmission (800)	Transmission (800)

Table 4.11 Booster Pumping Stations
Water Master Plan
City of Oceanside

Booster Station Name[2,3,4]	Total Capacity (gpm)	Pumping Units	Elev (ft)	Power (hp)	Year Constructed[5]	Backup Power	Standby[1]	From Pressure Zone	To Pressure Zone
Lake Boulevard (San Francisco Peak PS)	1,800	2	289	50 50		N	Y	Guajome (511)	San Francisco Peak 1 (569)
Mesa Loma	700	2	345	50 50		N	Y	Guajome (511)	Peacock Hills Reduced (600)
Total	**10,830**	**23**		**972.5**					

Notes:

(1) Standby indicates whether the pump station is as a backup supply. “N”, for No, indicates that the pump station is the primary supply for the associated pressure zone and is utilized under the typical operating configuration. “Y”, for Yes, indicates that the pump station is not utilized under the typical operating configuration, and instead the pump station would be used as a backup or under supply outage or emergency conditions.

(2) Acronyms: AV – Altitude Valve (generally supplying a reservoir from an upper pressure zone); FCF – Flow Control Facility; PRS – Pressure Regulating Stations (can include Pressure Regulating Valves and Pressure Sustaining Valves; see Table 4.13 for specific details on each PRS); PS – Pump Station.

(3) In addition to the booster pump stations listed in this table by pressure zone, the Zone 320 PS and the Zone 511 PS deliver water supply from the MBGPF to the Guajome and Talone pressure zones.

(4) Fire Mountain PS is currently not operated by the City and is planned for abandonment within the near-term. Carey Road (Poplar Ridge) PS is also not operated by the City, but can be utilized under fire flow conditions.

Table 4.12 Storage Reservoirs and Tanks
Water Master Plan
City of Oceanside

Reservoir Name	Volume (MG)	High Water Line (ft-msl)	Floor Elevation (ft-msl)	Height (ft)	(Equivalent) Diameter[1] (ft)	Construction Type[2]	Year Constructed	Pressure Zone
Fire Mountain	3	322	292	30	130	PST	1956	Talone (320)
Talone	5	320	290	30	168	PST	1982	Talone (320)
Pilgrim Creek	5	321	285	35.5	155	PST	1978	Talone (320)
John Paul Steiger	3	320	290	30	130	PST	1975	Talone (320)
Henie Hills	3	409	380	29	133	PST	1960	Henie Hills (409)
Morro Hills 1	5	738	708	30	168	PST	1963	Morro Hills (738)
Morro Hills 2	5	738	708	30	168	STL	1990	Morro Hills (738)
Guajome 1	5	511	481	30	168	PST	1962	Guajome (511)
Guajome 2	5	511	481	30	168	PST	1982	Guajome (511)
San Francisco Peak 1	1.5	569	545	24	103	PST	1960	San Francisco Peak 2 (511)
San Francisco Peak 2	5	511	481	30	168	PST	1984	Guajome (511)
Wire Mountain	5	320	290	30	168	PST	1995	Talone (320)
Total	**50.5**							

Notes:

(1) Geometry of reservoirs is assumed to be cylindrical. Diameter shown is effective diameter, or what would be the diameter if a reservoir of the same volume were cylindrical with the same height.

(2) Acronyms: PST – Pre-stressed Concrete (above ground); STL – Steel (above ground)

4.2.5 Pressure Regulating Stations

Pressure Regulating Stations (PRSs) allow distribution systems to transfer water from upper pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely draining the pressure out of the higher zone. The water is transferred through a valve that reduces the pressure to a specified pressure setting (pressure reducing feature), while maintaining the pressure in the upper pressure zones (pressure sustaining feature). PRS will often include several valves of various types, generally configured to use the smaller valves first and the larger valves when the smaller valve's flow capacity is not sufficient for the intended function.

The pressure sustaining feature prevents transfer of water into the lower pressure zone if the pressure in the upper zone drops below a certain level. This feature prevents low pressures or drainage of too much in the upper pressure zone.

The City's distribution system includes 54 PRSs, which convey and regulate water. Several of these PRS function in a standby, or backup role. The locations of these PRSs are shown on Figure 4.2 and Figure 4.3, while detailed information for PRS at each station is summarized in Table 4.13. It should be noted that the City's water GIS (PRV_regulator layer) includes 184 valves of several types. Most PRS include at least 2 valves; and many of the remaining valves were assumed to serve a private site (as they did not have a pipeline on both sides of the valve). These remaining valves are not included in Table 4.13.

As discussed in Section 4.2.4, the City's distribution system regularly replenishes water in lower pressure zones through altitude valves located at the City's reservoirs. While not necessarily a PRS, these valves functionally deliver water across pressure zone boundaries. The City's seven altitude valves are listed in Table 4.14.

PRSs are also typically outfitted with pressure relief valves that allow water to bleed from the higher pressure zone into the lower pressure zone if the pressure gets too high in the upper zone. Since pressure relief valves typically do not operate under normal system conditions, they are not included in Table 4.13. Similarly, PRS serving individual customer sites were excluded.

Table 4.13 Pressure Regulating Stations
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby[2]	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone	Pressure Setting (psi)
Airport	Airport Road / Bennett Hill Road	4, 8	N	PRV	60	511	320[5]	155, 148
Buddy Todd Bypass	Buddy Todd Pump Station Site	3, 8	Y	PRV	210	480	320	55, 50
Buena Hills	Buena Hills Drive / North Way	3, 6	Y	PRV	272	511	409	55, 50
College and Adams East	College Boulevard / Adams Street	3, 8	Y	PRV	85	511	320	
College and Adams West	College Boulevard / Adams Street	3, 10	Y	PRV	85	511	320	
Darwin	Darwin Drive / Santa Fe Avenue	3, 6	Y	PRV	200	511	450	75, 70
Darwin / Crestview	Darwin Drive / Crestview Drive	4, 10	Y	PRV	398	626	511	88, 80
Darwin e/o Whispering Palms	Darwin Drive / Whispering Palms	3, 8	N	PRV	256	511	450	75
Del Rio Elementary	Parker Street / North River Road	2, 4	N	PRV MS	98	420	420	100, 95
El Camino Country Club	Palmer Drive / Valley Glen Drive	3, 8	N	PRV	48	409	340	125
El Camino Real & Vista Oceana PRS	El Camino Real / Vista Oceana		N		222	511	511	
El Camino Real & Oceanside PRS	Oceanside Boulevard / El Camino Real	4, 10	Y	PRV	120	511	320	80, 70

Table 4.13 Pressure Regulating Stations
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby(2)	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone	Pressure Setting (psi)
F-1	Village Drive s/o Championship	3, 6	N	PSV/PRV	338	738	560	86, 96
F-2	Straightaway Lane Cul de Sac	3, 6	N	PSV/PRV	406	738	560	64, 72
Farel	Farel Street / Via Robles	3, 8	Y	PRV	150	409	320	65, 60
Fire Mountain & Laurel	Fire Mountain Drive / Laurel Road	4, 10	N	PRV	250	450	390	57, 48
Fire Mountain Reservoir	Fire Mountain Reservoir Site	3, 8	N	PRV	302	511	450	70, 65
Gallery	Gallery Drive / Pointillist Court	4, 8	Y	PRV	140	511	320	70, 65
Granada & Rose	Granada Drive / Rose Drive	3, 8	N	PRV	303	626	526	102, 92
Granite	Granite Place / Vandegrift Boulevard	3, 6	N	PSV PRV	154	511	450	132, 124
Guajome Reservoir Aqueduct	Guajome Reservoir Site	18, 18, 18	N	PSV	480	626	511	52, 55
Guajome Reservoir Bypass	Guajome Reservoir Site	12	Y		490			
Henie Hills Drive and Lynn Court	Henie Hills Road / Lynn Court	3, 8	/N	PRV	254	511	395	58, 52
Hutchinson	Hutchinson Street / Osborne Street	6, 12	N	PRV	358	511	450	40, 35
Leisure Village	San Francisco Peak Reservoir Site	4, 8	N	PRV	430	800	569	45, 40

Table 4.13 Pressure Regulating Stations
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby(2)	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone	Pressure Setting (psi)
Leisure Village 2	Cannon Road / Wisteria Drive	6	N	PRV	456	800	569	95
Mesa Drive	Mesa Drive / Foussat Road	4, 8	N	PRV	218	511	480	85, 78
Morro Hills Pump Station	Morro Hills Reservoir Site		N	Relief	714	1,000	800	
N Santa Fe/Omoris 2	Santa Fe Avenue / Darwin Drive	8, 12	N	PSV	206	800	511	
N Santa Fe/Omoris 3	Santa Fe Avenue / Darwin Drive	8, 12	N	PSV	206	800	626	
North River Road	Old River Road / College Boulevard	4, 12	N	PRV	84	511	420	150, 140
North River Road & Wilshire	Wilshire Road / North River Road	4, 12	Y	PRV	110	800	480	205, 200
Peacock	Oceanside Boulevard / Peacock Boulevard	10	N		342	626	600	112
Oceanview & Carriage	Oceanview Road / Carriage Circle	3, 8	Y	PRV	212	511	409	82, 76
Old Grove – 511	Old Grove Road / Ocean Ranch Boulevard	12, 16	N	PSV, PRV	326	800	511	205, 77
Old Grove – 626	Old Grove Road / Ocean Ranch Boulevard	6, 12	N	PRV	326	800	626	125, 115
Palmer Drive	Palmer Drive / Sonja Court	8	N	PRV	187	395	340	

Table 4.13 Pressure Regulating Stations
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby[(2)]	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone	Pressure Setting (psi)
Pilgrim Creek Reservoir	Pilgrim Creek Reservoir Site	6, 12	Y	PSV/PRV, PRV	288	738	511	160, 90
Pilgrim Creek Reservoir Arrowood Regs	Pilgrim Creek Reservoir Site	3, 6	N	PRV	288	738	450	86, 74
Poplar Ridge Pump Station	Carey Road Pump Station Site	8	Y	PSV	204	320	320	42
San Francisco Peak Generator Bypass	San Francisco Peak Reservoir Site	8, 10, 12	Y	PSV PRV	534	800	569	180
San Francisco Peak Irrigation	San Francisco Peak Reservoir Site	16	N		548	800	569	
Shadowtree	Shadow Tree Drive / Hollow Tree Drive	6, 12	N	PRV	98	511	346	133, 125
Sonoma Hills	Castellano Way / Vandegrift Boulevard	4, 8	N	PRV	158	511	450	115, 108
Valley Heights	Valley Heights Drive / Twins Haven Road	3, 6	N	PRV	140	511	320	70, 62
Via Esmarca	Via Esmarca / Costa Vista Way	4, 10	N	PRV	232	511	400	65, 60
Viscaya	Viscaya Way / Anda Lucia Way	3, 8	Y	PRV	172	511	409	100, 92
Wendella	Wendella / Sagewood	3, 6	N	PRV	196	511	450	104, 95
Wilmont 1	Vandegrift / Papgallo	4, 6	N	PRV	262	511	480	
Wilmont 2	Papagallo / Cockatoo Court	3, 6	N	PSV, PRV	262	560	480	122
Wilshire Pump Station	Wilshire Pump Station Site	6, 12	Y	PSV	344	800	800	

Table 4.13 Pressure Regulating Stations
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby(2)	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone	Pressure Setting (psi)
Wilshire River	Wilshire Road	3, 8	Y	PRV	220	480	420	90, 80
Wilshire Road	Wilshire Road / Las Tunas Drive	4, 8	N	PRV	346	800	480	115, 100
Strawberry	Wilshire Road (in strawberry field)	4, 10	N	PRV	326	738	480	105, 95

Notes:

(1) This list excludes PRS supplying individual sites.
(2) Standby indicates whether the PRS functions as a backup supply. "N", for No, indicates that the PRS is the primary supply for the associated pressure zone and is utilized under the typical operating configuration. "Y", for Yes, indicates that the PRS is not utilized under the typical operating configuration, and instead the PRS would function during a low pressure condition. Typically, the HGL corresponding to the pressure setpoint of a standby PRS would be significantly lower than that of the primary PRS for the pressure zone.
(3) Acronyms: PSV – Pressure Sustaining Valve; PRV – Pressure Reducing Valve.
(4) Not listed in this table are Avenida del Gado PRS and Magdalena PRS, pressure regulating stations physically connected to the distribution system but not used and planned for abandonment.
(5) The pressure setting of Airport PRS is consistent with the HGL of the Talone Zone (320), but it supplies an isolated area of the Talone Zone.

Table 4.14 Altitude Valves
Water Master Plan
City of Oceanside

Name	Location	Valve Size (in)	Standby[(1)]	Regulating Type	Elevation (ft-msl)	Upstream Zone	Downstream Zone
Fire Mountain Altitude Valve	Fire Mountain Reservoir Site	14	N	AV	292	511	320
Henie Hills Reservoir Altitude Valve	Henie Hills Reservoir Site	14	N	AV	380	511	409
John Paul Steiger Altitude Valve	John Paul Steiger Reservoir Site	16	N	AV	300	511	320
Pilgrim Creek Altitude Valve	Pilgrim Creek Reservoir Site	14	N	AV	285	800	320
San Francisco Peak 2 Reservoir AV	San Francisco Peak Reservoir Site	6, 12	N	AV	534	800	569
Talone Altitude Valve	Talone Reservoir Site	16	N	AV	290	511	320
Wire Mountain Altitude Valve	Wire Mountain Reservoir Site	16	N	AV	290	511	320

Notes:
(1) Standby indicates whether the altitude valve functions as a backup supply. “N”, for No, indicates that the valve is the primary supply for the associated pressure zone and is utilized under the typical operating configuration.
(2) Acronyms: AV – Altitude Valve (generally supplying the inlet of a reservoir with water from an upper pressure zone).

4.2.6 Emergency Interconnections

Water distribution systems are often connected to neighboring water systems to allow the sharing of supplies during short-term emergencies or during planned shutdowns of a primary supply source. The City currently has nine emergency interconnections, as summarized in Table 4.15.

Table 4.15 Emergency Interconnections
Water Master Plan
City of Oceanside

Neighboring Agency	Location	Size/ Capacity (cfs)	Pressure Zone (HGL)	Direction
VID	Rose and Granada	8	Peacock	Oceanside
VID	Fall Place	8	Peacock	Oceanside
VID	E. Vista Way and Osborne	14	Guajome	serves both Oceanside and VID
RMWD	Camino Corto	6	Morro Hills	Oceanside
RMWD	Camino Corto	6	Morro Hills	Oceanside
RMWD	WFP	8	Rainbow	Rainbow Municipal Water District
Carlsbad	Vista Way and El Camino Real	16	Henie Hills	serves Carlsbad
Carlsbad	College South of Esplanade	8	San Francisco Peak	serves Carlsbad
Camp Pendleton	Morro Hills Reservoir	12	Morro Hills	Camp Pendleton

As shown in Table 4.15, the City has three (3) emergency interconnections with Vista Irrigation District (VID); three (3) with Rainbow Municipal Water District (RMWD); two (2) with the City of Carlsbad (Carlsbad); and one (1) with Camp Pendleton

4.3 EXISTING DEMANDS BY PRESSURE ZONE

As discussed in Chapter 3, the City's existing ADD (based on the calendar year 2012) was nearly 25 mgd. Table 4.16 presents the breakdown of the system demands by pressure zone obtained from the hydraulic model after geocoding the 2012 billing data.

Table 4.16 Demands by Pressure Zone
Water Master Plan
City of Oceanside

Zone Name	Existing ADD(1) (mgd)	Existing MDD(2) (mgd)	Demand (% of total)
Arrowood	0.44	0.81	1.75%
Buddy Todd	0.20	0.38	0.82%
Darwin	0.22	0.40	0.88%
Fire Mountain	0.23	0.42	0.91%
Guajome	6.08	11.25	24.44%
Henie Hills	0.89	1.64	3.56%
Hutchinson	0.28	0.51	1.11%
Intermediate Henie Hills	0.05	0.09	0.19%
Laurel	0.02	0.03	0.07%
Leisure Hills	0.97	1.79	3.89%
Mesa Loma	0.28	0.51	1.11%
Montamar	0.12	0.22	0.47%
Morro Hills	0.14	0.26	0.57%
Morro Hills PS	0.34	0.64	1.38%
North River	0.48	0.88	1.92%
Ocean Village Regulated	0.01	0.02	0.04%
Palmer	0.03	0.06	0.13%
Peacock Hills	1.08	2.00	4.33%
Peacock Hills Reduced	0.07	0.14	0.30%
Poplar Ridge	0.04	0.07	0.16%
Rivertree	0.10	0.18	0.39%
San Francisco Peak 2	0.43	0.80	1.73%
Talone	11.43	21.14	45.91%
Transmission	0.41	0.75	1.64%
Wilmont Ranch	0.16	0.29	0.64%
Wilshire	0.41	0.76	1.66%
Total	**24.89**	**46.04**	**100.0%**

Notes:
(1) 2012 average annual demand, allocated from billing data.
(2) Existing ADD multiplied by MDD PF of 1.85.
(3) Numbers may vary slightly from previous tables due to rounding.

As shown in Table 4.16, the majority of the City's demands are concentrated in the Guajome (511) and Talone (320) pressure zones. This distribution of demands is proportional to the pressure zone size and length of distribution pipelines per pressure zone as discussed in Section 4.2.1.

-This Page Left Blank Intentionally-

MODEL DEVELOPMENT

This chapter documents the procedures used to update and calibrate the City's hydraulic model used for this Water Master Plan (WMP). The purpose of this documentation is to provide an overview of the model update process, including steps taken to calibrate the model. In addition, this chapter details how the projected demands developed in Chapter 3 were allocated in the existing model.

5.1 DATA SOURCES

A description of data sources used in the model update and calibration process is provided below:

- **Existing Water Model.** The City provided Carollo with a copy of the most recently updated water system hydraulic model. The City's water model was originally constructed in 1999 using the H_2ONET® water modeling software application. The model was updated and converted to H_2OMap® Water as part of the 2008 WMP.
- **City As-Built Drawings.** Record drawings for major water system facilities were used to update the hydraulic model, where needed and available.
- **Water GIS Layers.** GIS layers of the water distribution system were provided by the City. The layers provide the location, unique ID, length, and pipe diameter for all water mains within the City.
- **Water Consumption Data.** Water billing records from 2012 were provided by the City and were the primary source for existing demand allocation in the hydraulic model.

5.2 MODEL UPDATE

A hydraulic computer model of the water distribution system is an important tool for many analyses of a water system. Models are used as a part of water master plans to identify deficiencies in water systems, and to size capital improvements. The widespread use of personal computers and availability of hydraulic modeling software has made network analysis modeling efficient and practical for virtually any water system.

Developing a good hydraulic model begins with entering the best available information into the database and calibrating the model to match existing conditions in the field. Once the model has been calibrated, it becomes an invaluable tool to solve planning and operational problems. It can simulate the existing and future water systems, identify system deficiencies, analyze impacts from increased demands, and determine the appropriateness of proposed improvements for the system.

The City's existing hydraulic model was developed in H_2OMap Water®. At the start of this project, it was agreed that the model would be updated in the H_2OMap Water® modeling software platform. H_2OMap Water® consists of multiple products that work together to bring a graphical approach to the analysis and design of water distribution systems. The program includes seamless integration with the City's GIS data.

5.2.1 Diurnal Patterns

As a part of the calibration process, the City provided hourly Supervisory Control and Data Acquisition (SCADA) for all of the City's supply sources and reservoirs. This data was used to establish a daily diurnal demand pattern by balancing the total inflow into the water distribution system and the change in storage. Figure 5.1 presents the resulting hourly demand factors, which are based on the August 20, 2013 SCADA data. As shown in this figure, the City's water demand peaks at around 6:00 AM with an hourly peaking factor of nearly 1.6 (1.58). This peaking factor and diurnal pattern was applied for the model calibration discussed in Section 5.3. A separate diurnal with a more conservative PHD factor of 1.8 was used for this system analysis.

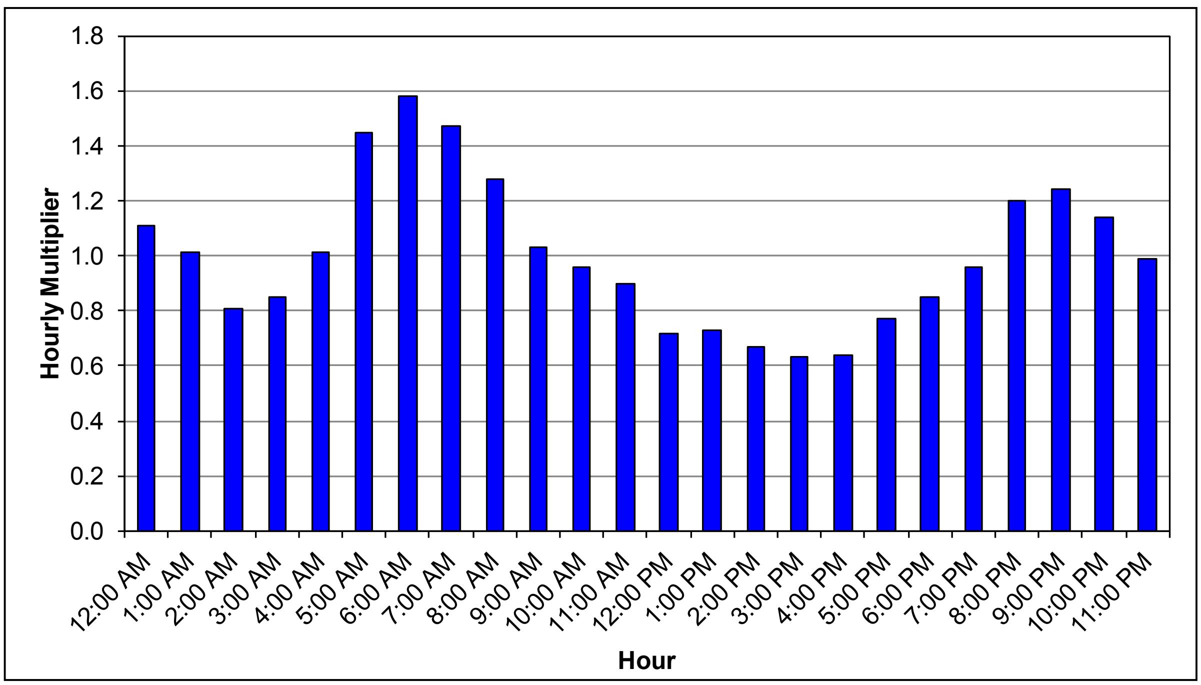


Figure 5.1 System-Wide Diurnal Pattern (Aug. 20, 2013)

For the Morro Hills PS pressure zone, which consists primarily of agricultural residential water use, a separate diurnal pattern was developed to better replicate the unique demand behaviors of this zone. The Morro Hills PS pressure zone diurnal is shown on Figure 5.2. As shown on Figure 5.2, water use in this zone in minimal at nighttime, and peaks at around 11:00 AM with an hourly peaking factor of approximately 4.0.

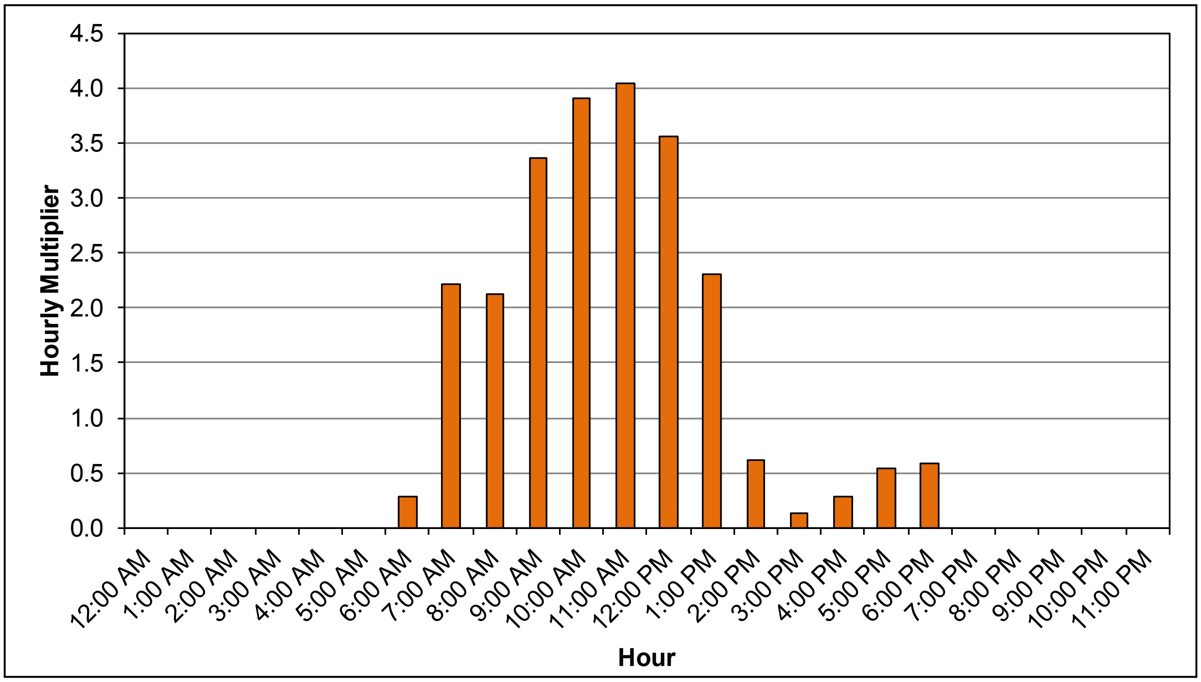


Figure 5.2 Morro Hills PS Hydropneumatic Zone Diurnal

5.2.2 Demand Allocation

The City's previous water system hydraulic model, which was developed as part of the 2008 WMP, included demands for the year 2005 and year 2030. These demands were allocated into the previous water model based on land use and unit water factors that were developed for the 2008 WMP. For this WMP, it was determined that the water demands in the hydraulic model should be reallocated to better reflect current demand distribution. The hydraulic modeling software has an option of assigning up to ten different demand types for each demand node. The next sections summarize the process used to allocate the existing (2012) and future water demands within the model.

5.2.2.1 Existing Demand Allocation

Several methods can be used for the allocation and estimation of water demands within the system, depending on the type of information that is available. Demands were allocated using the parcel-level method, which uses the City's water consumption database, by parcel, to allocate the demands to the nearest node in the distribution system hydraulic model.

Using the City's 2012 water billing records, the water demands for the water users were represented as point demands in the hydraulic model in order to accurately represent actual measured water consumption. Address points for each billing record were geocoded and then linked to the nearest node in the hydraulic model. The billing record demands were then linked to the model and assigned as demands under **Demand Type 1**. Finally, the water consumption based demands allocated into the model were scaled up to match the

2012 Average Day Demand (ADD) calculated from the City's production records to adjust for unaccounted for water. As shown in Table 3.4 in Chapter 3, the 2012 demands were approximately 26,278 afy (or 23.5 mgd) and the supply was 27,852 afy (or 24.5 mgd), which is a difference of approximately 5.3 percent.

5.2.2.2 Future Demand Allocation

As discussed in Chapter 3, two sources were used for future demands: known near-term developments (see Table 3.9 in Chapter 3) and population growth projected by SANDAG (SANDAG, 2010) shown in Table 3.10.

The SANDAG's Regional Growth Forecast included projections by transportation analysis zone (TAZ), which were used as a basis for spatial allocation of future demands. TAZs are areas similar population composition, development plans, and densities used for transportation analysis as a part of the Regional Growth Forecast. Within the City's service area, the area of each TAZ ranges between 7 and 1,940 acres in size.

Demands for near-term developments were allocated directly based on the parcel footprint as shown on Figure 2.2 and listed in Table 2.3.

Demand projections for the near-term demands were deducted from the overall growth and, where residential near-term developments fell within or generally coincided with TAZ boundaries, SanDAG population growth anticipated between 2008 and 2050 was assumed to be accounted for by the near-term developments. Reductions in population between 2008 and 2050 were assumed to be anomalous and ignored. The balance of future growth was distributed (pro-rated) based on the remaining population growth in each TAZ. Within the hydraulic model, future demands were allocated to separate fields from existing demands.

Additionally, as described in Section 3.6, the City's per capita water demand is projected to decrease in the future in accordance with the City's 2010 UWMP per capita water use target. Therefore, the existing (2012) water demands allocated needed to be reduced to match the City's per capita water use target. This was accomplished by applying negative demands in the model.

The demand types used in the model for the future demand allocation are as follows:

- **Demand Type 2:** Near-term Demands assumed to be in place by 2020, which equated to a demand increase of approximately 1.7 mgd.
- **Demand Type 3:** Long-term Residential Demands assumed to be in place by 2050 based on SanDAG projections, which equated to a demand increase of approximately 3.6 mgd.

- **Demand Type 4:** Long-term Non-Residential Demands assumed to be in place by 2050 based on SanDAG projections, which equated to a demand increase of approximately 1.6 mgd. The demands were allocated based on existing billing classification distribution.
- **Demand Type 5:** Long-term Build-Out of Morro Hills, which equated to a demand increase of approximately 0.4 mgd.
- **Demand Type 6:** Future water conservation, which is represented by negative demands to reflect a decrease in water usage. The decrease in usage equated to approximately 1.0 mgd, or a reduction of 4 percent within each pressure zone.

5.3 MODEL CALIBRATION

This section summarizes overall methodology employed to calibrate the City's water system hydraulic model and provides a detailed description of each of the major components of the model calibration process.

5.3.1 Model Calibration Data Collection

To coordinate the data requirements for model calibration and field-testing, a model calibration plan was prepared which described what SCADA and field data needs were required to calibrate the updated hydraulic model. The calibration plan included site maps for specific test locations, pressure logger locations, and included a list of the SCADA data needs, durations, time intervals, and units. This section summarizes the data collection process that was conducted per the calibration plan.

5.3.2 SCADA Data Gathering

Field-testing and data gathering for model calibration took place from August 16, 2013 through August 23, 2013. Carollo coordinated with City staff to obtain 5-minute data for all of the major SCADA points within the water distribution system, including reservoir levels, booster pump station flows and discharge pressures, and supply connection flows. This data was used to generate the diurnal patterns described in Section 5.2.1 and for the Extended Period Simulation (EPS) model calibration. Table 5.1 identifies the SCADA data sources that were available for model calibration.

Table 5.1 EPS Calibration Data Gathering Parameters
Water Master Plan
City of Oceanside

Facility Name	Measurement	Unit	Interval	Source
Reservoirs				
Fire Mountain Reservoir	level	ft	5 min	SCADA
Talone Reservoir	level	ft	5 min	SCADA
Pilgrim Reservoir	level	ft	5 min	SCADA
John Paul Steiger Reservoir	level	ft	5 min	SCADA
Henie Hills Reservoir	level	ft	5 min	SCADA
Morro Hills 1	level	ft	5 min	SCADA
Morro Hills 2	level	ft	5 min	SCADA
Guajome Reservoir 1	level	ft	5 min	SCADA
Guajome Reservoir 2	level	ft	5 min	SCADA
San Francisco Peak 1	level	ft	5 min	SCADA
San Francisco Peak 2	level	ft	5 min	SCADA
Wire Mountain Reservoir	level	ft	5 min	SCADA
Booster Stations				
Buddy Todd Pump Station	discharge pressure	psi	5 min	SCADA
Poplar Ridge Pump Station	discharge pressure	psi	5 min	SCADA
Rivertree Pump Station	discharge pressure	psi	5 min	SCADA
Sleeping Indian Pump Station	flow	gpm	5 min	SCADA
Morro Hills Pump Station	flow	gpm	5 min	SCADA
	discharge pressure	psi	5 min	SCADA
Mesa Loma Pump Station	discharge pressure	psi	5 min	SCADA
Supply Connections				
FCF 6	flow	gpm	5 min	SCADA
FCF 4	flow	gpm	5 min	SCADA
Mission Basin GPF	flow	gpm	5 min	SCADA

Note:
(1) SCADA information not available for Pressure Reducing Stations (PRV and PSV).

5.3.3 Temporary Pressure Logger Installation

In addition to the data obtained from the City's SCADA system from the major system facilities, Carollo also provided four temporary pressure loggers to City staff that were attached to hydrants within the City's distribution system. The data obtained from the temporary pressure loggers consisted of 1-minute pressure data for the duration of the EPS data gathering period. Figure 5.3 shows the hydrant locations where the temporary pressure loggers were installed.

Table 5.2 Pressure Loggers
Water Master Plan
City of Oceanside

Site	Logger No.	Pressure Zone	Intersection
1	C5	Talone	Wisconsin Avenue and South Ditmar Street
2	C4	Rivertree	Shadow Tree Drive Near Morning View Drive
3	C3	Guajome	Corporate Centre Near Oceanic Drive
4	C6	Talone	Securidad Street and Avenue Descanso

5.4 MODEL CALIBRATION METHODOLOGY AND RESULTS

The purpose of a water system hydraulic model is to estimate, or predict, how the water distribution system will respond under a given set of conditions. One way to test the accuracy of the hydraulic model is to create a set of known conditions in the water system and then compare the results observed in the field against the results of the hydraulic model simulation using the same conditions.

The calibration process for the City's water distribution system hydraulic model consisted of two parts: (1) a macro calibration and (2) an EPS calibration. This section summarizes the results of this calibration process.

5.4.1 Macro Calibration

Initially, the model was run under existing demand conditions and necessary adjustments were made to produce reasonable system pressures. Such adjustments include modifications of pipeline connectivity, operational controls, ground elevations, and facility characteristics.

The macro calibration process involves several steps to verify that the model produces reasonable results:

- **Transmission Main Connectivity.** Using the connectivity features of the modeling software, the connectivity of the transmission mains within the distribution system was verified. Problems found using the connectivity locators are reviewed to determine whether adjustments were needed to the connectivity of the model. Output reports of pipe flow characteristics, such as headloss (feet per thousand feet [ft/kft]) and velocity (feet per second [fps]) were also used to locate problem areas where additional adjustments may be necessary.
- **System Pressures.** The macro calibration compared the model output to the typical pressures observed within the distribution system in pounds per square inch (psi). This process was used to locate major errors in model creation, elevations, or connectivity, as well as changes that reflect how operational controls of the system should be implemented in the model.
- **Facility Characteristics/Operational Controls.** Hydraulic model results were compared to data provided by the City to verify that facility attributes entered into the model, such as the physical characteristics of the tanks and pumps, produced results comparable to what the City experiences. Carollo worked extensively with City operations staff to understand the operational characteristics of each facility so that they were simulated appropriately in the model.

5.4.2 Extended Period Simulation Calibration

The extended period calibration is intended to calibrate the EPS capabilities of the hydraulic model by closely matching the model pressures and flows to field conditions over a 24-hour period of similar demand and system boundary conditions. Pressure data, reservoir level data, and source water and booster pump flows were recorded to create diurnal patterns and obtain EPS calibration data. The primary varied parameters for this calibration were operational controls and pipeline roughness coefficients, although other parameters were also adjusted as calibration results were generated. Carollo worked closely with City operations staff to model each facility with appropriate controls.

From the 7-day calibration data gathering period, Tuesday, August 20, 2013, was selected to be used for the 24-hour EPS calibration day. Tuesday was chosen because it produced the most typical system diurnal with no unusual flow spikes or dips.

The estimated daily demand for this day was about 19,640 gpm (or 28.3 mgd). This is approximately 14-percent higher than the average annual supply in 2012 of 24.9 mgd. For the EPS calibration, the 2012 ADD was scaled up by a factor of 1.14 to match this estimated demand condition during the calibration day.

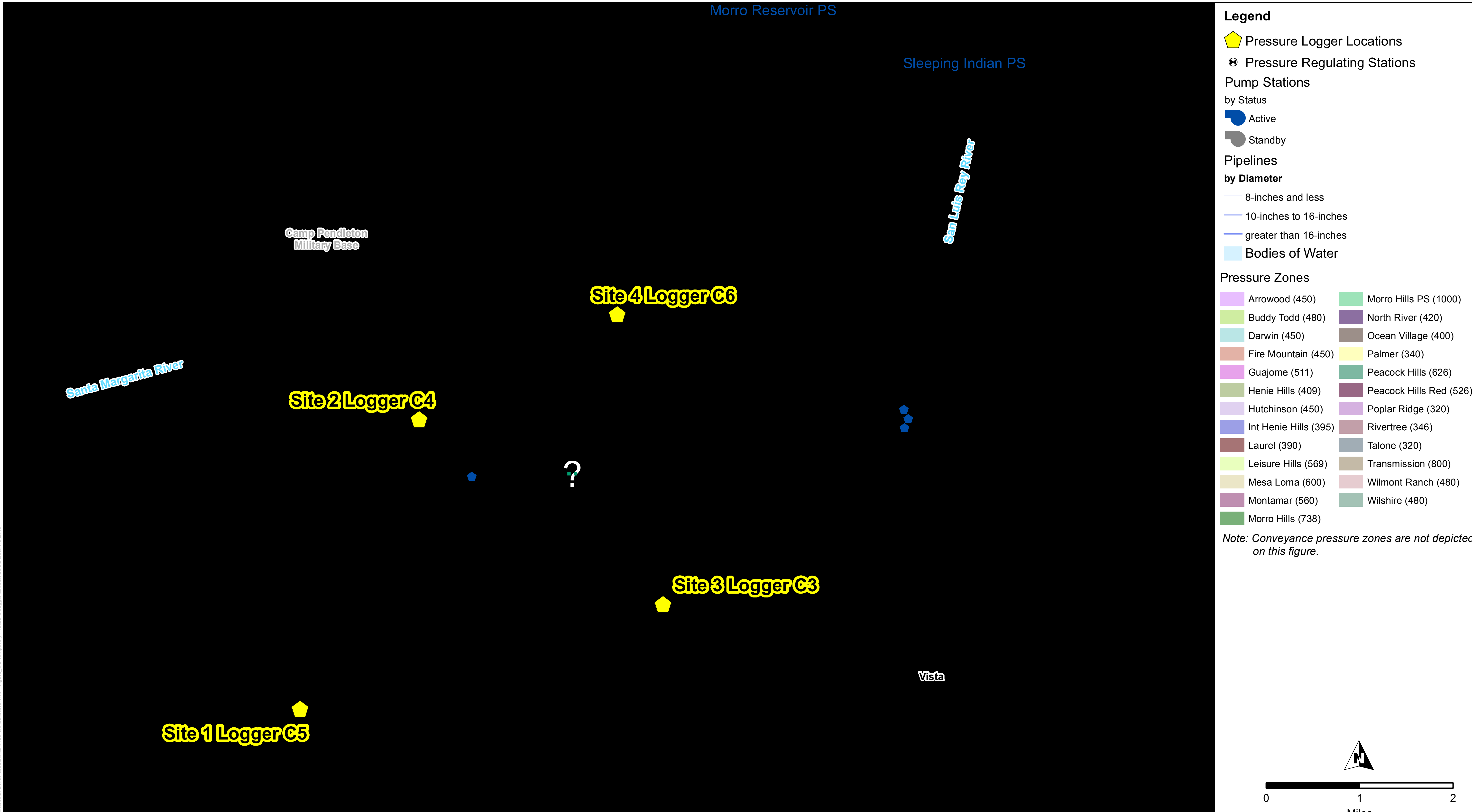


Figure 5.3
Temporary Pressure Logger Locations
Water Master Plan
City of Oceanside

The EPS calibration compared model simulated booster pump station flows, suction, and discharge pressures, reservoir levels, and PRV upstream and downstream pressures to the field measured data. In addition, model simulated pressures at the pressure logger locations were compared to the actual field pressures recorded during the calibration day.

The EPS model results for each calibration point presented in Table 5.1 are presented in Appendix D. To promote legibility of this report chapter, a few sample of the EPS calibration are shown on Figure 5.4 through Figure 5.6. Figure 5.4 and Figure 5.5 present a comparison of model results to observed field conditions for the Fire Mountain Reservoir level and the Poplar Ridge Pump Station discharge pressure, respectively. Figure 5.6 presents a comparison of models results to the pressure logger C4 site.

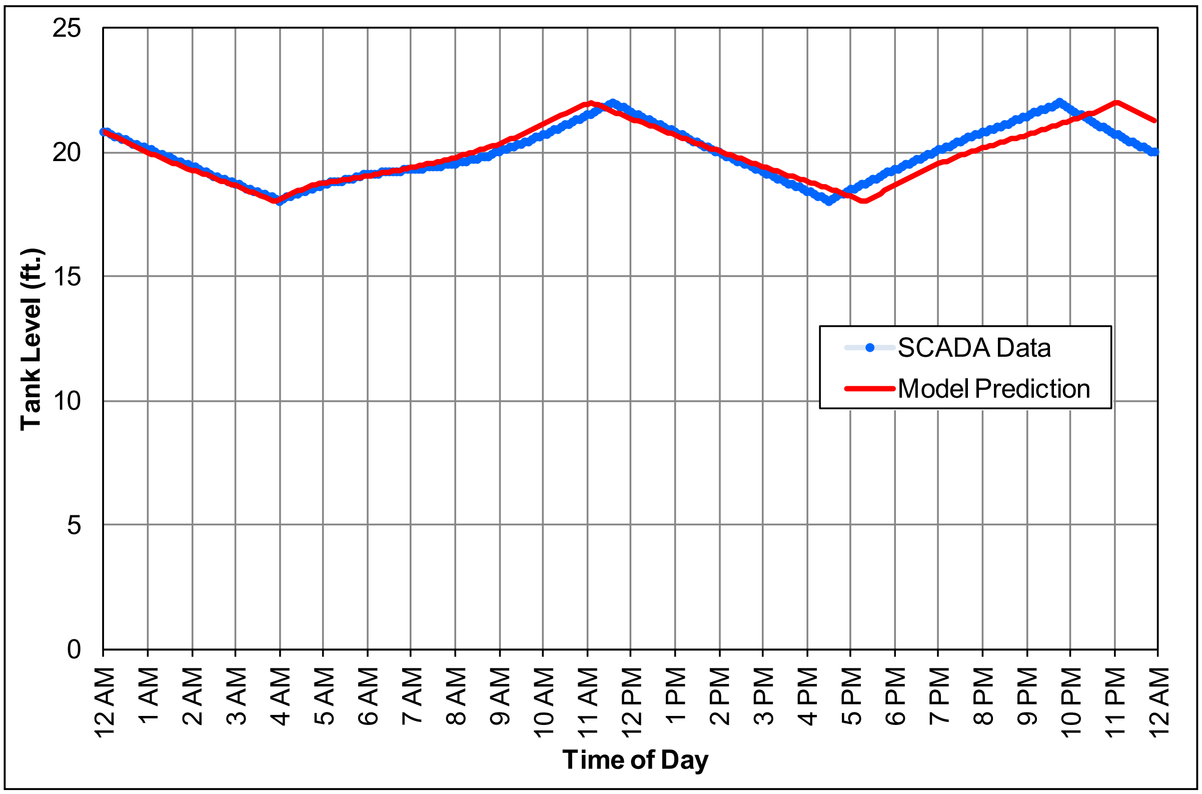


Figure 5.4 EPS Calibration Results – Fire Mountain Reservoir Level

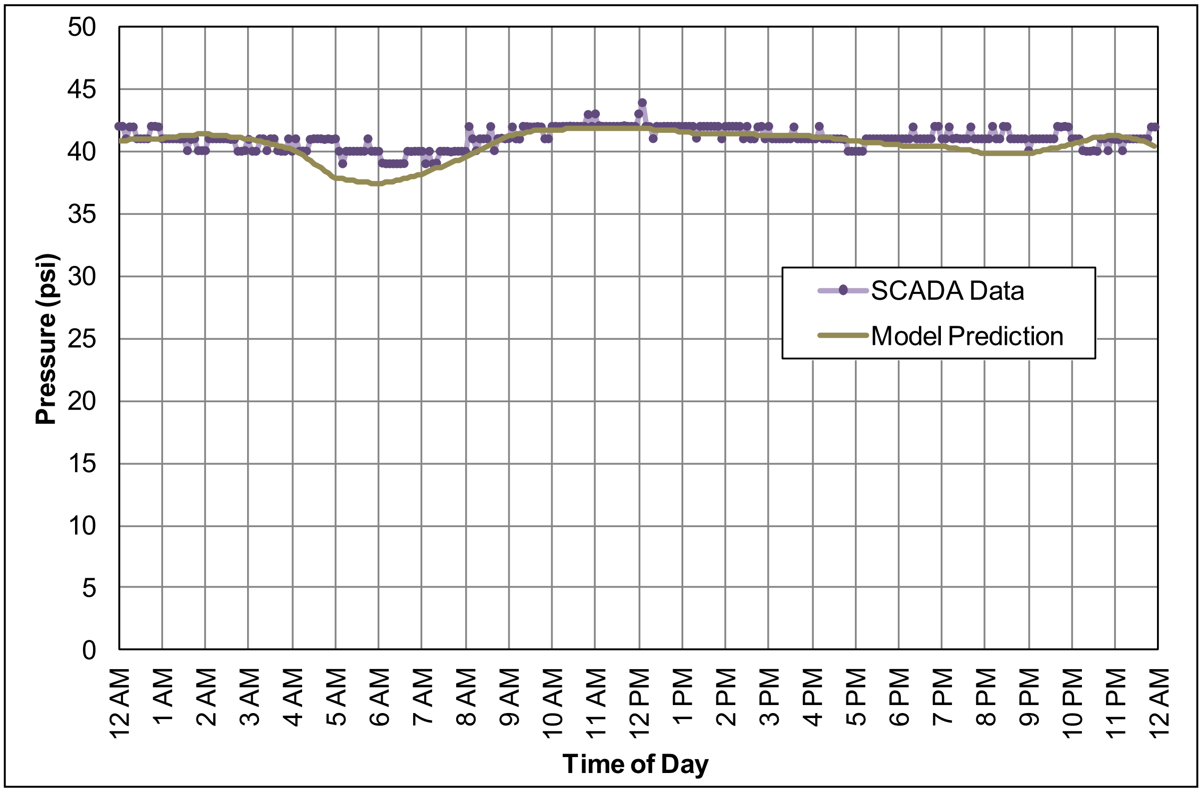


Figure 5.5 EPS Calibration Results – Poplar Ridge PS Discharge Pressure

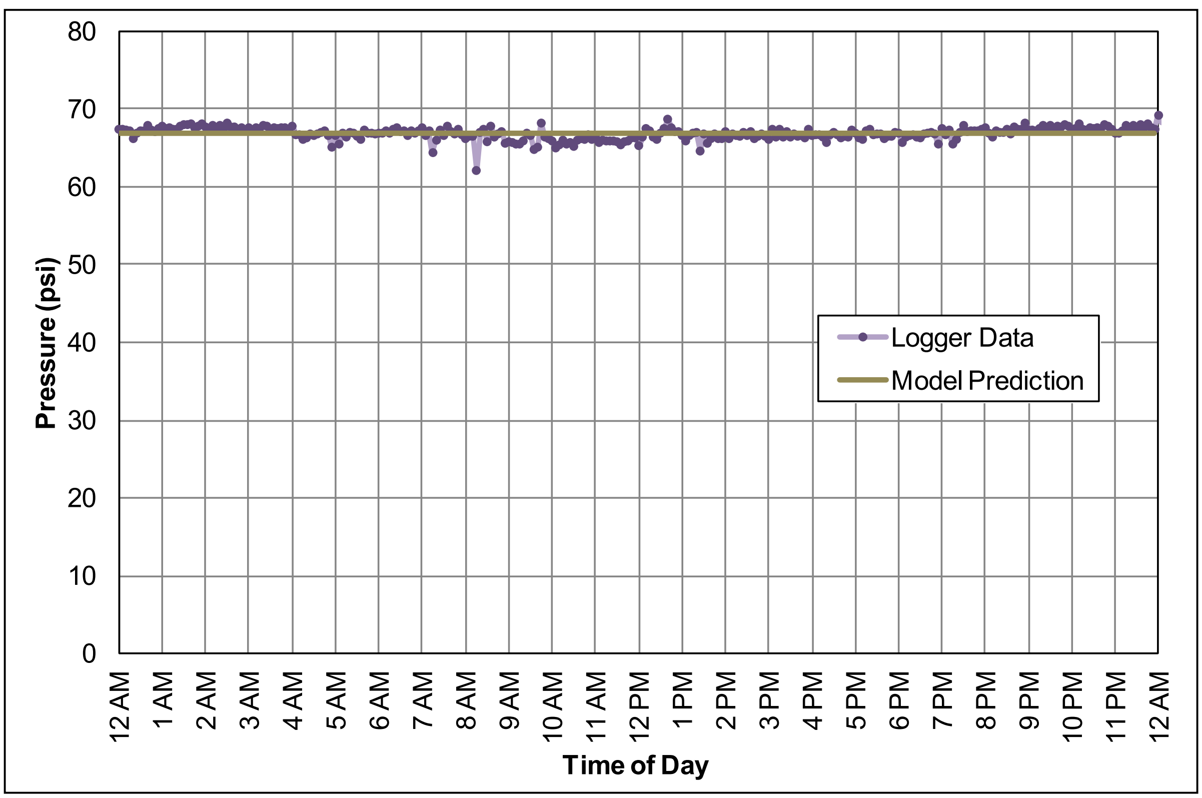


Figure 5.6 EPS Calibration Results – Pressure Logger C4

5.4.3 Calibration Result Summary

Overall, it can be concluded that the trends seen in the field data are well predicted by the model, with some minor differences. The calibration results indicate the model predicts conditions very similar to those observed in the field. Based on the results of the calibration, it can be concluded that the model is sufficiently calibrated to conduct hydraulic analysis for the preparation of this WMP. The model provides an accurate representation of the City's distribution system and system operations to a level suitable for the distribution system analysis described in Chapters 7 and 8, as well as the City's future modeling endeavors.

The model calibration comparison plots of all SCADA and pressure logger points used for the model calibration are included in Appendix D.

-This Page Left Blank Intentionally-

EVALUATION CRITERIA

This chapter presents the planning criteria and methodologies for the analysis used to evaluate the existing water system and associated facilities, which are utilized to identify existing system deficiencies and size future improvements and expansions.

6.1 WATER SYSTEM EVALUATION CRITERIA

The City's water system is evaluated under a range of normal and emergency operating conditions and demand scenarios. The normal operating conditions are:

- Average Day Demand (ADD)
- Peak Hour Demand (PHD)
- Maximum Day Demand (MDD)
- MDD plus Fire Flow (MDD+FF)

Distribution system evaluation criteria are required to determine the performance of the City's water system under the range of operating conditions as discussed above and to identify system deficiencies and improvement projects. Under each operating condition, the capacities and performance of the water system are compared with the evaluation criteria to determine which pipelines or water facilities need to be upgraded or replaced. The evaluation criteria for water system evaluations in this WMP consist of the following categories:

- System Pressure
- Pipeline Velocity
- Storage Volume
- Pump Station (PS) Capacity
- Pressure Reducing Station (PRS) Capacity

The evaluation criteria used for the evaluation of the City's potable water system are summarized in Table 6.1. Detailed descriptions for each evaluation criterion are provided following the table.

Table 6.1 WMP Distribution System Evaluation Criteria
Water Master Plan
City of Oceanside

Description	Value	Units
Maximum Pressure		
Without Service Lateral Pressure Regulator	80	psi
With Service Lateral Pressure Regulator	150	psi
Triggering Potential Improvements (maximum pressures evaluated under ADD conditions)	200	psi
Minimum Pressure		
Peak Hour Demand (PHD)	40	psi
Maximum Day Demand (MDD) + Fire Flow	20	psi
Pipeline Criteria		
Maximum Velocity with PHD	7	fps
Maximum Velocity with MDD + Fire Flow	10	fps
Design Velocity for New Pipelines	7	fps
Hazen-Williams C-factor	130	n/a
Minimum Size for Pipeline Replacement	8	inches
Fire Fighting Capabilities		
Single Family Residential	1,500	gpm for 2 hours
Multiple Family Residential	3,000	gpm for 2 hours
Commercial	4,000	gpm for 4 hours
Industrial	4,000	gpm for 4 hours
Institutional	4,000	gpm for 4 hours
Storage Volume		
Operational	25% of MDD	MG
Fire Fighting	Highest fire flow requirement of pressure zone group(1)	
Emergency	100% MDD	
Pump Stations & PRV Stations	See Table 6.2	

Note:
(1) The pressure zones within the system have been grouped based on the storage that is shared within the zone. Currently, there are 5 group pressure zones within the system.

6.1.1 System Pressures

Minimum system pressures are evaluated under both PHD and MDD plus fire flows conditions. Maximum system pressures are evaluated under ADD. The minimum pressure criterion for PHD demand conditions is 40 pounds per square inch (psi), while the minimum pressure criterion under MDD with fire flow conditions is 20 psi. The pressure analysis is limited to demand nodes, because only locations with service conditions need to meet such pressure requirements. Lower pressures are only acceptable for junctions at water system facilities and on transmission mains. However, no pressure shall be less than 5 psi to avoid potential water quality issues.

Maximum system pressures are evaluated under the ADD conditions. The maximum pressure criterion for normal ADD conditions is 80 psi for service connections without individual pressure-reducing valves. In areas where the maximum pressure exceeds 80 psi, individual pressure-reducing valves are required on service connections; however, the system pressure shall generally not exceed 150 psi. A maximum pressure of 200 psi was used to trigger the need for pipeline improvements, assuming that the typical pipelines installed are limited to 200 psi. The actual pipe class of pipelines identified for high pressure improvement shall be verified with as built drawings and/or field inspection prior to design as this is beyond the scope of this WMP.

6.1.2 Pipeline Velocities

Pipeline velocities are evaluated using three different maximum velocity criteria for selected flow conditions under both existing and future demand scenarios. For transmission and distribution pipelines, a maximum velocity of 7 feet per second (fps) was used for ADD and PHD conditions, respectively. Fire hydrant laterals are excluded from these criteria, as higher velocities are acceptable. Under fire conditions, velocities of up to 10 fps were allowed. Ideally, all transmission and distribution pipelines should have maximum velocities less than 7 fps in order to minimize headloss; however, higher velocities in existing pipelines is not, by itself, sufficient justification for pipeline replacement.

6.1.3 Storage Capacity

The total storage required for a water system is evaluated in three components.

- Storage for operational use
- Storage for fire fighting
- Storage for emergencies

These three components are determined for each pressure zone to evaluate the ability of the water system to meet the storage criteria on both a zone-by-zone basis, as well as a system-wide basis. These three storage requirements are discussed in more detail below.

6.1.3.1 Operational Storage

Operational storage is defined as the quantity of water that is supplied to meet daily fluctuations in demand beyond the quantity of water that is produced on a daily basis. It is necessary to coordinate the production rates of water sources and the available storage capacity in a water system to provide a continuous flow of treated water supply to the system. Water systems are often designed to supply the average flow on the day of maximum demand. Water storage is then used to supply water for peak hour flows that may occur throughout the day. This operational storage is continuously replenished throughout the day to maintain water quality.

American Water Works Association (AWWA) recommends an operational supply volume ranging from one-quarter to one-third of the demand experienced during one maximum day. It is recommended that pressure zones in the City's water system have operational storage of 25 percent of the MDD supplied by that reservoir.

6.1.3.2 Fire Flow Storage

The governing fire department shall provide the City with the fire flow rate and duration to determine if fire storage is required for a pressure zone. The values provided in Table 6.1 are simply provided as a reference and are based on typical values for water utilities. Fire flow storage is determined based on the single greatest fire flow requirement (flow and duration) within each pressure zone group.

6.1.3.3 Emergency Storage

Storage is also required to meet system demands during emergencies. Emergencies cover a wide range of rare but probable events, such as water contamination, failure at a water treatment plant, power outages, transmission pipeline ruptures, several simultaneous fires, and earthquakes. The volume of water that is needed during an emergency is usually based on the estimated amount of time expected to elapse before the disruptions caused by the emergency are corrected. The occurrence and magnitude of emergencies is difficult to predict and therefore, the City's recommended emergency storage is set to 100 percent of MDD per pressure zone.

6.1.4 Pump Station Capacity

Typically, a pump station consists of multiple pump units, including one spare pump to provide reliability in case of a breakdown or repair. In addition, critical booster pumping stations may be equipped with emergency power supplies in case of failure of the primary power source. Based on the unique hydraulic characteristics of the City's water system, capacity criteria for the booster pump stations are defined per facility based on their purpose and functionality within the distribution system.

For the purpose of this Master Plan, the capacity and design criteria were modified to reflect system conditions typically evaluated as part of a master plan. The pump station evaluation criteria used in this WMP can be divided into the following four categories:

- In zones that are gravity fed through PRSs with gravity storage, pump stations shall be able to meet PHD conditions. These pump stations would not be typically operated under normal demand conditions.
- In pumped zones without gravity storage and a redundant supply source, pump stations shall be able to meet PHD and MDD plus FF conditions. The pump stations within this category are operated under normal demand conditions; therefore, the combined capacity of the pump stations are also evaluated to confirm that the MDD plus fire flow conditions can be met within the pumped zone utilizing the existing capacity of the pump stations that serve the zone.
- In pumped zones without gravity storage and a single supply source, pump stations shall be able to meet PHD or MDD plus fire flow of the downstream zone with the largest unit out of service. In lieu of upsizing deficient pump stations, a secondary supply source to the zone can be utilized to satisfy the criteria.
- Pump stations utilized for reliability shall be able to supply the storage deficiency within a pressure zone or be able to accommodate additional local supply to the potable water system.

In addition, pump stations that provide service to upper pressure zones under normal operating conditions shall have back-up power during power outages to meet MDD conditions. A list of the pump station evaluation criteria is listed in Table 6.2.

Table 6.2 Pump Station Evaluation Criteria
Water Master Plan
City of Oceanside

Pump Station	From Zone	To Zone	Criteria
Gravity Fed Zone with Gravity Storage (through PRS)			
Buddy Todd PS	Talone	Buddy Todd	PHD of the Buddy Todd Zone
Fire Mountain PS	Talone	Fire Mountain	Non-Operational (City to Abandon)
Rivertree (Mar Lado) PS	Talone	Rivertree	PHD of the Rivertree Zone
Lake Blvd (SF Peak) PS	Guajome	San Francisco Peak 1	PHD of the SF Peak 2 Zone

Table 6.2 Pump Station Evaluation Criteria
Water Master Plan
City of Oceanside

Pump Station	From Zone	To Zone	Criteria
Pumped Zone without Gravity Storage and Redundant Supply Source			
Sleeping Indian PS	Morro Hills	Morro Hills PS	PHD (or combined MDD + FF)
Morro Hills PS	Morro Hills	Morro Hills PS	PHD (or combined MDD + FF)
Pumped Zone without Gravity Storage and Single Supply Source			
Mesa Loma PS	Guajome	Mesa Loma	PHD or MDD + FF of the downstream zone with largest unit out of service
Carey Rd (Poplar Ridge) PS	Talone	Poplar	PHD or MDD + FF of the downstream zone with largest unit out of service
Back-Up			
Wilshire PS	Transmission	Transmission	N/A – Not Currently Operated
Reliability			
Lake Blvd (SF Peak) PS	Guajome	San Francisco Peak 1	Storage Deficiencies
Zone 800 PS (Future)	Zone 800 Reservoir (Future)	Transmission	Storage Deficiencies
MBGPF 511 PS	MBGPF	Guajome	Additional Supply

6.1.5 Repair and Rehabilitation

The City's GIS data was used to conduct a cursory level pipeline replacement analysis and to prepare planning level cost estimates for the CIP. The repair and rehabilitation (R&R) pipeline analysis was based on the approximate anticipated life span for pipelines of each material in the City's system, which are listed in Table 6.3.

As shown in Table 6.3, pipeline life spans are estimated to range from roughly 65 to 85 years depending on pipeline material. A smoothing function period was not used for this analysis. Cast iron pipes are assumed to have the shortest lifespan with 65 years, while PVC pipes are assumed to have the longest lifespan with 85 years.

Planning level cost estimates for the pipeline R&R analysis were based on unit costs from recent projects within the region. The unit costs are listed in Chapter 9. By combining the material based pipeline lifespan with approximate costs per diameter, the future replacement costs for the City's entire system were estimated.

Table 6.3 Useful Life of Water Mains
Water Master Plan
City of Oceanside

Water Pipe Material	Anticipated Life Span (years)
Asbestos Cement (AC)	75
Cast Iron Pipe (CIP)	65
Cement Mortar Lined & Coated Steel Pipe (CMLC)	80
Concrete Pipe (CONCRET)	80
Ductile Iron Pipe (DIP)	82
Polyvinyl Chloride Plastic (PVC)	85
HDPE	85
Steel Cylinder Pipe (STEEL)	80

Notes:
(1) "Time to first failure" refers to the number of years after installation at which replacements are expected to begin.
(2) "Replacement curve" is the duration of the replacement era, beginning at time to first failure. Failures are normally distributed within the replacement curve duration.

-This Page Left Blank Intentionally-

EXISTING SYSTEM EVALUATION

7.1 INTRODUCTION

The goal of the existing system analysis is to evaluate the existing distribution system under various operating conditions utilizing the evaluation criteria described in Chapter 6 and the existing system demands listed in Chapter 4. The following analyses are described in this section:

1. Water Supply Analysis
2. System Pressure Analysis
3. Pipeline Velocity Analysis
4. Transmission Main Capacity Analysis
5. Fire Flow Analysis
6. Storage Analysis
7. Pump Station Analysis
8. Distribution Rehabilitation and Repair

The recommended system improvements required to meet the evaluation criteria under existing demand conditions are summarized at the end of this chapter.

7.2 EXISTING WATER SUPPLY ANALYSIS

Currently, the City of Oceanside receives water supplies from San Diego County Water Authority (SDCWA or CWA) and groundwater from the Mission Basin, which are discussed in Chapter 4. Imported water currently contributes to approximately 87 percent of the total annual water supply as listed in Table 7.1. The remaining 13 percent of water is supplied by the Mission Basin Groundwater Purification Facility (MBGPF).

Table 7.1 Historical Supply and Demand (2012)
Water Master Plan
City of Oceanside

Supply Source	Average Annual Supply		Maximum Day Demand[1,2]	
	(afy)	%	(mgd)	%
Imported	24,148	87%	35.2	88%
MBGPF	3,704	13%	4.8	12%
Total	**27,852**	**100%**	**40**	**100%**

Notes:
(1) 2012 max day demand occurred on August 17 with a peaking factor of 1.85.
(2) Based on SCADA data from August 2013.

7.2.1 Water Supply Balance Outage Scenarios

Based on the current capacity of the imported water supply sources and MBGPF, demands within the City can be met under normal operating conditions. This section presents an analysis of the City's water supply balance under Maximum Day Demand (MDD) conditions for the eight outage scenarios described below. For all scenarios, it is assumed that the primary pressure zones that are supplied by the main connections would still be able to feed into the connected subzones that are at a lower hydraulic grade line (HGL) during an outage. The water supply balance for these eight outage scenarios are presented in Table 7.2. The scenarios include:

- Scenario 1 – CWA Aqueduct 3 Outage
- Scenario 2 – CWA Aqueduct 5 Outage
- Scenario 3 – CWA Aqueduct 4 Outage
- Scenario 4 – Tri Agencies Pipeline Outage (FCF-4)
- Scenario 5 – MBGPF Outage
- Scenario 6 – NCDP-1 Outage
- Scenario 7 – City Pipelines 2 and 3 Outage
- Scenario 8 – CWA 3, 4 and 5 Outage

Scenario 1 - CWA Aqeduct 3 Outage: The untreated water supply from CWA 3 or flow control facility 2 (FCF-2) is out of service in this scenario. The remaining connections in service include:

- Untreated water from FCF-5, which is sent to the Weese Filtration Plant (WFP) for treatment. The treated water is then diverted through FCF-6 into the Transmission Zone (HGL 800).
- Treated water from the tri-agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Guajome Zone.
- Treated water from CWA 4 connection (or FCF-3), which is sent through the two 24-inch diameter City Pipelines that feed into Guajome Zone, Peacock Hills Zone and Hutchinson Zone.

As shown in Table 7.2, the remaining supply capacity in Scenario 1 is 66.3 mgd, while the existing MDD is 46.0 mgd. Hence, there is a supply surplus of 20.3 mgd in this scenario.

Scenario 2 - CWA Aqueduct 5 Outage: The untreated water supply from CWA 5 (or FCF-5) is out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 connection (or FCF-2) is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated water from the tri-agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.

As shown in Table 7.2, the remaining supply capacity in Scenario 2 is 81.4 mgd, while the existing MDD is 46.0 mgd. Hence, there is a supply surplus of 35.4 mgd in this scenario.

Scenario 3 - CWA Aqueduct 4 Outage: The treated water from CWA 4 (or FCF-3) and the NCDP-1 pipeline is out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 7.2, the remaining supply capacity in Scenario 3 is 41.1 mgd, while the existing MDD is 46.0 mgd. Hence, there is a deficit of 4.9 mgd in this scenario.

Scenario 4 – Tri Agencies Pipeline Outage (FCF-4): The treated water from the tri agencies pipeline (or FCF-4) is out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 7.2, the remaining supply capacity in Scenario 4 is 69.8 mgd, while the existing MDD is 46.0 mgd. Hence, there is a surplus of 23.8 mgd in this scenario.

Scenario 5 – MBGPF Outage: The treated water from the MBGPF is out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.

As shown in Table 7.2, the remaining supply capacity in Scenario 5 is 76.9 mgd, while the existing MDD is 46.0 mgd. Hence, there is a surplus of 30.9 mgd in this scenario.

Scenario 6 – NCDP-1 Outage: The NCDP-1 pipeline diverting the treated water from the CWA 4 connection is out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone. Another alternative would be to take the treated water from CWA 4 (or FCF-3) and divert it through the two 24-inch diameter City Pipelines in lieu of utilizing CWA 3 or CWA 5.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 7.2, the remaining supply capacity in Scenario 6 is 41.1 mgd, while the existing MDD is 46.0 mgd. Hence, there is a deficit of 4.9 mgd in this scenario.

Scenario 7 – City Pipelines 2 and 3 Outage: The City Pipelines that divert treated water from the WFP and CWA 4 (or FCF-3) connection are out of service in this scenario. The remaining connections in service include:

- Untreated water from CWA 3 (or FCF-2) or CWA 5 (FCF-5) connections are not in use due to the capacity limitation of FCF-6.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.

- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 7.2, the remaining supply capacity in Scenario 7 is 56.4 mgd, while the existing MDD is 46.0 mgd. Hence, there is a surplus of 10.4 mgd in this scenario.

Scenario 8 – CWA 3, 4 and 5 Outage: The main imported water connections CWA 3 (or FCF-2), CWA 4 (or FCF-3) and CWA 5 (FCF-5) are out of service in this scenario. The remaining connections in service include:

- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 7.2, the remaining supply capacity in Scenario 8 is 16.1 mgd, while the existing MDD is 46.0 mgd. Hence, there is a deficit of 29.9 mgd in this scenario.

7.2.2 Water Supply Balance Conclusion

As shown in Table 7.2, the City will have sufficient supply capacity to meet 100 percent of the existing MDD under all but three scenarios. To help mitigate supply deficiencies, emergency storage can be utilized. The City's criteria for emergency storage is currently 100 percent of MDD. However, the City's existing available emergency storage is approximately 32.3 MG. Under the following outage scenarios listed in Table 7.2, the deficiencies are as follows:

- In Scenario 3, the CWA Aqueduct 4 (treated) is out of service and the NCDP-1 is not utilized. The remaining three supply sources provide 41.1 mgd out of the 46.0 mgd of supply required, which creates a deficiency of 4.9 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions, 6 days of storage is available to offset supply deficiencies. Under MinDD conditions, a surplus of supply exists.
- In Scenario 6, the NCDP-1 is out of service. The remaining three supply sources provide 41.1 mgd out of the 46.0 mgd of supply required, which creates a deficiency of 4.9 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions, 6 days of storage is available to offset supply deficiencies. Under MinDD conditions, a surplus of supply exists.

Table 7.2 Existing Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[1]**	**Balance (mgd)**
1	CWA Aqueduct 3 (untreated)	FCF-2	CWA 5 (untreated) to WFP[3] to FCF-6		25.0		
	(earthquake, pipeline		FCF-4 (tri-agencies pipeline)	11.6			
	failure or maintenance)		MBGPF[4]	4.5			
			CWA 4 (treated) to FCF-3 to two 24-inch pipelines[5]	25.2			
		Total		***41.3***	***25.0***	***46.0***	***+20.3***
2	CWA Aqueduct 5 (untreated)	FCF-5	CWA 3(untreated) to FCF-2 to WFP to two 24-inch pipelines		25.0		
	(earthquake, pipeline	FCF-3[2]	FCF-4 (tri-agencies pipeline)	11.6			
	failure or maintenance)		MBGPF[4]	4.5			
			CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
		Total		***56.4***	***25.0***	***46.0***	***+35.4***
3	CWA Aqueduct 4 (treated)	FCF-3	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
	(earthquake, pipeline	NCDP-1	FCF-4 (tri-agencies pipeline)	11.6			
	failure or maintenance)		MBGPF[4]	4.5			
		Total		***16.1***	***25.0***	***46.0***	***-4.9***

Table 7.2 Existing Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	**Outage Scenario**	**Assumptions**					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[1]**	**Balance (mgd)**
4	Tri-Agencies Pipeline (treated)	FCF-4	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
	(earthquake, pipeline		CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
	failure or maintenance)		MBGPF[4]	4.5			
		Total		***44.8***	***25.0***	***46.0***	***+23.8***
5	MBGPF	MBGPF	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
	(power outage or plant		CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
	failure)		FCF-4 (tri –agencies pipeline)	11.6			
		Total		***51.9***	***25.0***	***46.0***	***+30.9***
6	NCDP-1	NCDP-1	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines or CWA 4 (treated) to FCF-3		25.0		
	(pipeline failure)		FCF-4 (tri-agencies pipeline)	11.6			
			MBGPF[4]	4.5			
		Total		***16.1***	***25.0***	***46.0***	***-4.9***

Table 7.2 Existing Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[(1)]**	**Balance (mgd)**
7	Both 24-inch Pipelines	Pipeline 2	CWA 3 or 5 (untreated) to WFP to NCDP-1 to FCF-6 (not in use due to capacity limitation of FCF-6)		0.0		
	(local earthquake)	Pipeline 3	CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
			FCF-4 (tri-agencies pipeline)	11.6			
			MBGPF[(4)]	4.5			
		Total		***56.4***	***0.0***	***46.0***	***+10.4***
8	CWA Aqueducts 3, 4 & 5	FCF-2	FCF-4 (tri-agencies pipeline)	11.6			
	(major earthquake)	FCF-3	MBGPF[(4)]	4.5			
		FCF-5					
		FCF-6					
		NCDP-1					
		Total		***16.1***	***0.0***	***46.0***	***-29.9***

Notes:
(1) Existing demand includes 2012 ADD (24.9 mgd) multiplied by a peaking factor of 1.85.
(2) FCF-2 and FCF-5 cannot be used in combination.
(3) WFP has a total capacity of 25 mgd
(4) The permitted capacity of MBGPF is 6.3 mgd. However, the current operational capacity is approximately 4.5 mgd. With treatment plant upgrades, a reduction in constituents in wells, fully functional well sites and an increase in basin water levels water supply production could be maximized.
(5) The two 24-inch diameter pipelines have a capacity of 25.2 mgd. The pipelines are labeled as City Pipeline 2 and City Pipeline 3 in Figure 7.4.

- In Scenario 8, CWA 3, 4, and 5 are out of service, which are the main imported water supply sources to the City. The remaining two supply sources provide 16.1 mgd out of the 46.0 mgd of supply required, which creates a deficiency of 29.9 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions, 1 days of storage is available to offset supply deficiencies. Under MinDD conditions, a surplus of supply exists; however, the available supply sources would not be able to reach all pressure zones within the existing system. Facility improvements are suggested to improve supply reliability by adding new reservoirs and upgrading or adding new pump stations to the distribution system.

To help improve supply reliability within the system the following infrastructure improvements are recommended:

- CIP ID WPS-1: An upgrade at the Lake Boulevard PS site is suggested. This pump station pumps water from San Francisco Peak 2 reservoir to San Francisco Peak 1 reservoir, which offsets the future storage deficit within the Leisure Hills Zone, which would be needed under emergency conditions.
- CIP ID WPS-4: A future pump station within the 800 pressure zone is also suggested. This pump station would pump water into the main Transmission Zone to offset the existing and future storage deficits within the pressure zones that are fed from this zone.
- CIP ID WS-1: Additional storage within the 800 pressure zone would mitigate supply deficiencies within the zones that are fed by the Transmission Zone under emergency conditions.

The detail regarding these proposed facilities are described in Section 7.3.5, Section 7.3.6, and Sections 8.5 and 8.6 in Chapter 8.

7.3 HYDRAULIC SYSTEM ANALYSIS

Based on the evaluation criteria described in Chapter 6, the distribution system was evaluated under existing demand conditions. The hydraulic model was used to identify pressure, velocity, capacity, and fire flow deficiencies. The proposed improvements to mitigate the deficiencies within the system are identified as follows in Chapters 7 to 9:

- DEV – New development pipeline improvement
- WC – Pipeline capacity improvement
- SDR – Small diameter pipeline replacement
- FF – Fire Flow capacity improvement
- WF – Pressure regulating station/valve improvement
- WPS – Pump station capacity improvement

- WS – Storage capacity improvement
- WRP – Pipeline repair and rehabilitation improvement
- WRS – Storage repair and rehabilitation improvement
- WRPS – Pump station repair and rehabilitation improvement
- WRWF – Pressure regulation station improvement
- WTP – WFP improvement
- MBP – MBGPF improvement
- WO – Other improvement

7.3.1 Pressure Analysis

The City's distribution system primarily supplies water by gravity from upper pressure zones to lower pressure zones without the use of pump stations. To maintain pressures within the City's distribution system, 54 PRSs are in place. The City's system pressures were evaluated using the hydraulic model to identify areas with maximum pressures above 80 psi for service laterals without pressure regulators and 150 psi for service laterals with pressure regulators. Minimum pressures below 40 psi under PHD and 20 psi under MDD and fire flow conditions were also analyzed.

7.3.1.1 High Pressures

When conducting the pressure analysis of the existing system using the hydraulic model, majority of the maximum predicted pressures were between 80 psi to 150 psi under ADD conditions, which is depicted on Figure 7.1. Since most service laterals include pressure regulators, this analysis demonstrates that nearly all system pressures are sufficient according to the evaluation criteria listed in Chapter 6. However, pressures ranging between 150 psi to 200 psi were identified as high pressure deficiencies. As shown in Table 7.3, 1.3 percent of the high pressure nodes identified in the hydraulic model had pressures between 150 psi to 160 psi and 0.5 percent of the high pressure nodes had pressures between 160 psi to 200 psi. Majority of the high pressures nodes were located in the Henie Hills pressure zone and only slightly exceeded the pressure criteria of 150 psi by approximately 10 psi or less. Pressures slightly above 200 psi were also identified within the system, which equated to approximately 0.2 percent of the high pressure nodes. These nodes were primarily located along main transmission lines; therefore, they may not have an impact on customer pressures.

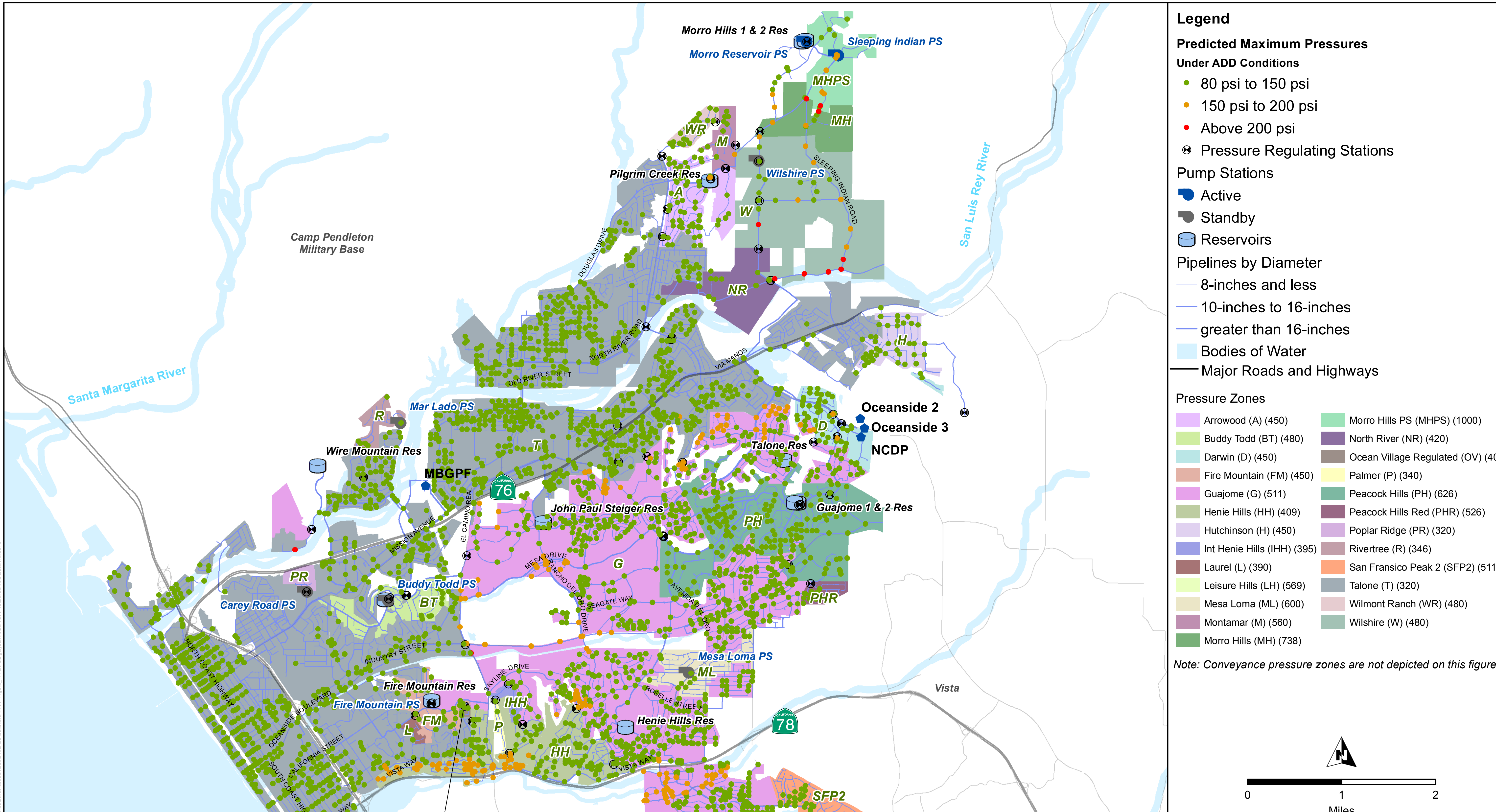


Figure 7.1
Existing System
High Pressure Deficiencies
Water Master Plan
City of Oceanside

carollo

To help mitigate high pressure issues within the existing system, additional PRSs would need to be installed along with the potential need for paralleled transmission mains to maintain connectivity within pressure zones and avoid the potential need for new PSs. However, as the City has operated the system at these high pressures for many years, improvement projects are not identified as for this Master Plan CIP. It is recommended that the City monitor and track pipeline breaks in these areas and implement structure solutions such as replacements with high pressure class pipelines or PRSs in these areas to mitigate the impact of these high pressures locally.

Table 7.3 High Pressure Nodes Under ADD Conditions
Water Master Plan
City of Oceanside

Pressure Zone (with High Pressure)	150–160 (psi)	160-170 (psi)	170-180 (psi)	180-190 (psi)	190-200 (psi)	>200 (psi)
Guajome	7	9	0	1	0	0
Henie Hills	44	12	1	0	0	0
Leisure Hills	3	0	0	0	0	0
Morro Hills PS	7	3	1	1	0	3
North River	0	0	0	0	0	1
Peacock Hills	1	0	0	0	0	0
Talone	0	0	2	0	0	0
Transmission	1	1	0	2	0	0
Wilshire	1	1	3	1	0	5
Total High Pressure Nodes	**64**	**26**	**7**	**5**	**0**	**9**
Percentage(1)	**1.3%**	**0.5%**	**0.1%**	**0.1%**	**0.0%**	**0.2%**

Note:
(1) The total number of nodes that represent the water system within the model is approximately 5,107.

7.3.1.2 Low Pressures

Instances of low pressures in the existing system were minimal, which is demonstrated on Figure 7.2. As shown in Table 7.4, only 0.7 percent of low pressure nodes ranged between 35 psi to 40 psi and 0.4 percent ranged between 30 psi to 35 psi under MDD conditions. The majority of the low pressures occurred in the Guajome, Mesa Loma, and Talone pressure zones and were approximately 5 psi to 10 psi below the minimum pressure criteria of 40 psi. Recommended improvements to correct the pressure deficiencies are discussed in Section 7.3.3.5. The remaining low pressure nodes within the existing system were 30 psi or below and occurred near PRSs, pump stations or at the end of a gravity fed zone. The location of the low pressure nodes within these ranges should not have a direct effect on customer pressures within the existing system because of their location. To help mitigate low pressure issues that may impact customers in the future within the Talone, Guajome, Mesa Loma, and Buddy Todd pressure zones, adjustments to existing PRS's settings or new PRSs are recommended.

Table 7.4 Low Pressure Nodes Under MDD Conditions
Water Master Plan
City of Oceanside

Pressure Zone (with Low Pressure)	40-35 (psi)	35-30 (psi)	30-25 (psi)	25-20 (psi)	<20 (psi)
Arrowood	1	0	0	0	0
Buddy Todd	4	0	2	1	0
Fire Mountain	1	2	0	1	0
Guajome	10	8	1	0	1
Leisure Hills	2	0	0	0	0
Mesa Loma	1	5	0	0	0
Montamar	1	1	0	2	1
Morro Hills PS	0	2	1	1	2
Peacock Hills	1	0	0	0	1
Talone	13	4	13	3	1
Total Low Pressure Nodes	**34**	**22**	**17**	**8**	**6**
Percentage(1)	**0.7%**	**0.4%**	**0.3%**	**0.2%**	**0.1%**

Note:
(1) The total number of nodes that represent the water system within the model is approximately 5,107.

7.3.2 Velocity Analysis

The hydraulic model was used to evaluate pipeline velocities in the existing system under PHD conditions. Based on the criteria listed in Chapter 6, the maximum velocity under PHD conditions is 7 fps. The hydraulic analysis was conducted with the assumption that all small diameter (4-inch and 6-inch) pipeline replacement projects labeled SDR-4 and SDR-6 in the CIP, were already implemented. It was concluded that five pipelines within the existing system had velocity deficiencies, which are shown on Figure 7.3 and are listed in Table 7.5. The deficient pipelines included the following pipelines:

- WV-1 is an 8-inch diameter pipeline located within the Buddy Todd PS pressure zone from Mesa Drive to Sea Ridge Road. This 2,400 feet (or 0.5 miles) stretch of pipeline has a velocity of 7.9 fps under PHD conditions. To mitigate the deficiency, upsizing the pipeline to a 12-inch diameter would reduce the velocity to meet the criteria specified in Chapter 6.

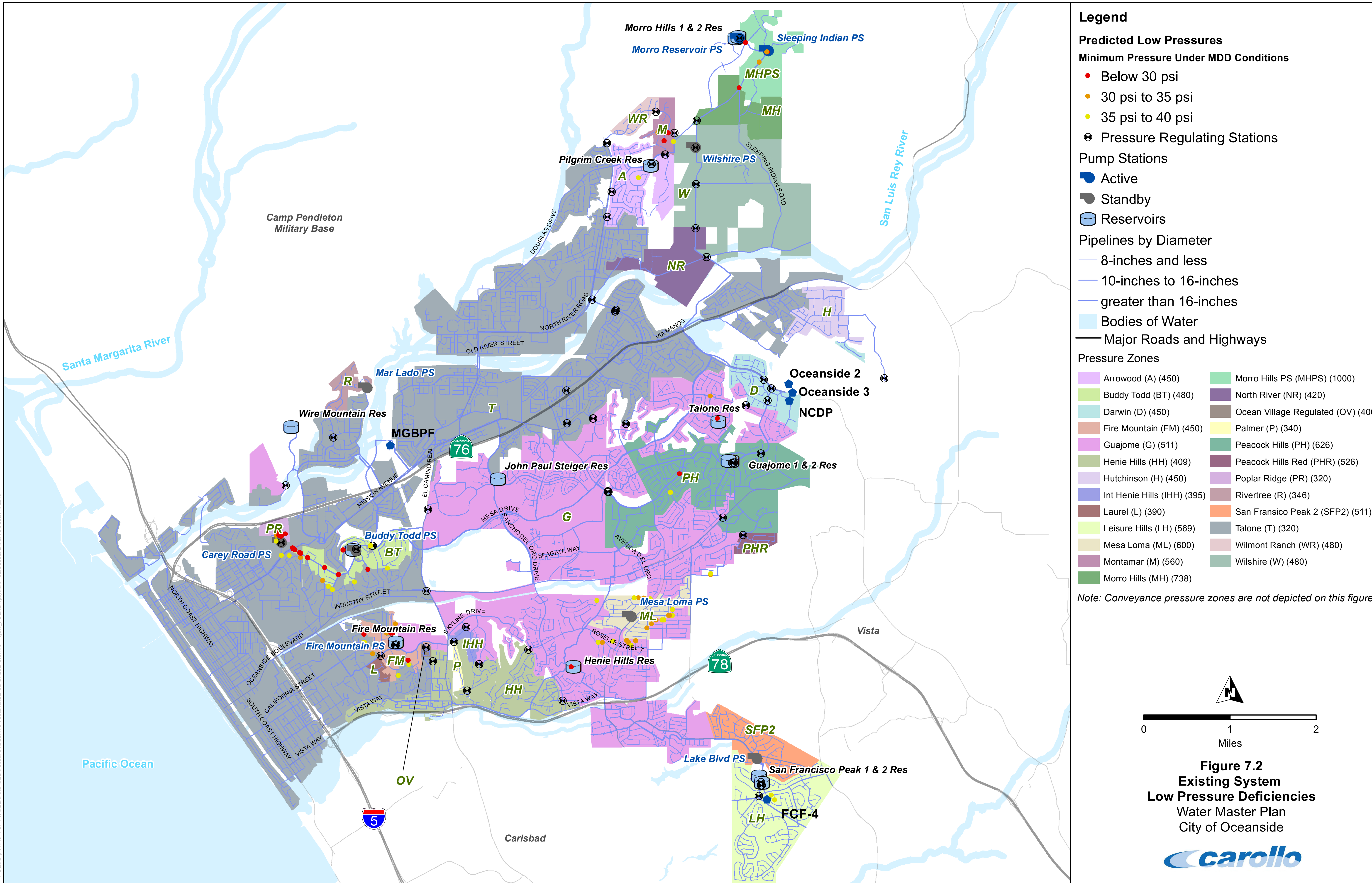


Figure 7.2
Existing System
Low Pressure Deficiencies
Water Master Plan
City of Oceanside

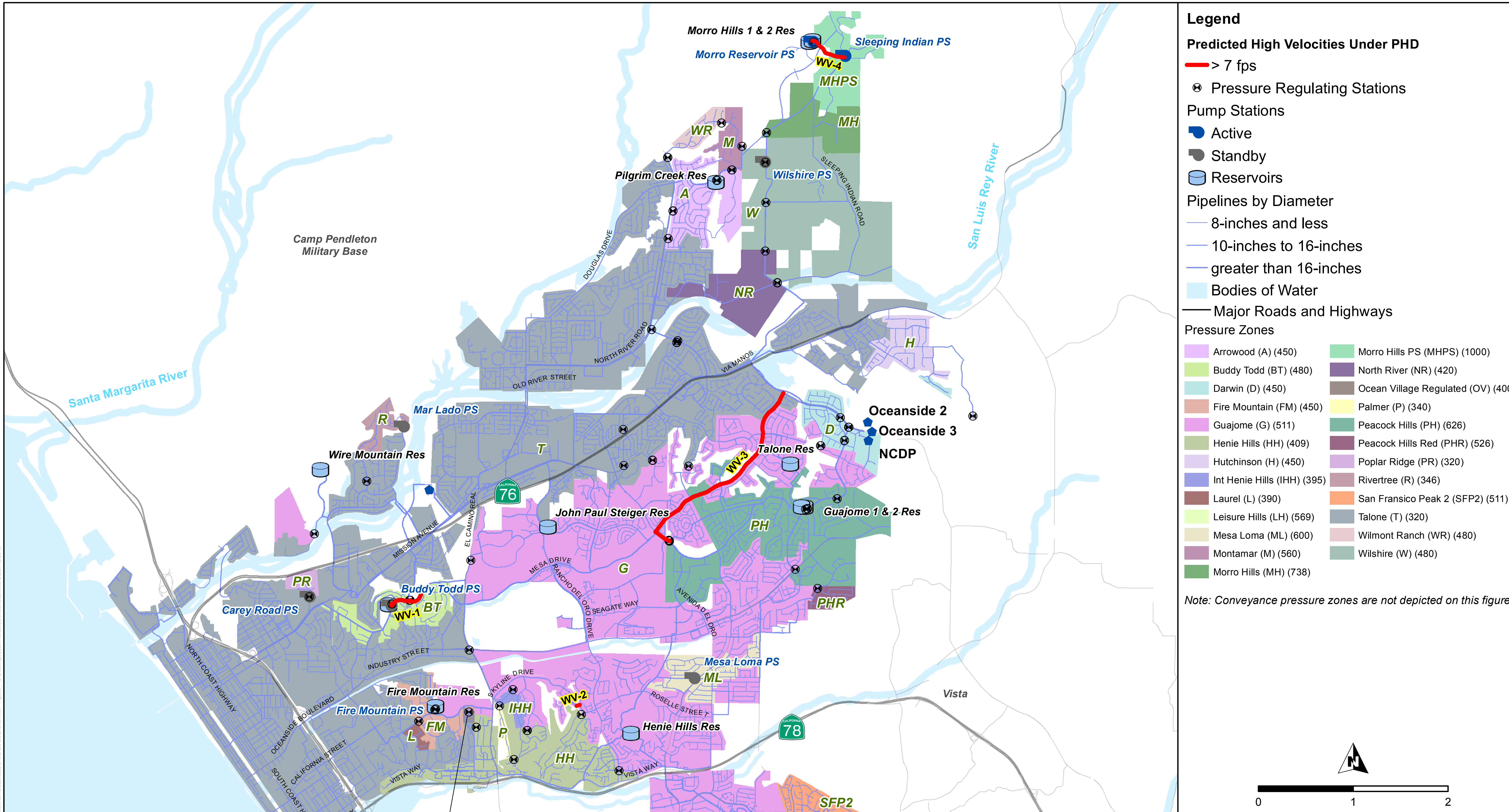


Figure 7.3
Existing System
High Velocity Pipelines
Water Master Plan
City of Oceanside

- WV-2 is an 8-inch diameter pipeline located within the Guajome pressure zone from Summer Set Way to Anda Lucia Way. This 200 feet (or <0.1 miles) stretch of pipeline has a velocity of 8.0 fps under PHD conditions. To mitigate the deficiency, upsizing the pipeline to a 12-inch diameter would reduce the velocity to meet the criteria specified in Chapter 6.
- WV-3 is a pipeline ranging in diameter between 16-inches to 24-inches within the Guajome, Peacock Hills, and Talone pressure zones, which is located along North Mesa Drive from North Santa Fe Avenue to a PRS on Old Grove Road. This 12,300 feet (or 2.3 miles) stretch of pipeline has a velocity of 9.5 fps under PHD conditions. To mitigate the deficiency, upsizing the pipeline to a diameter ranging between 20-inches to 30-inches would reduce the velocity to meet the criteria specified in Chapter 6.
- WV-4 is a 14-inch pipeline within the Morro Hills PS pressure zone from the Sleeping Indian Pump Station to Morro Hills Reservoirs 1 and 2.

To improve the deficiencies within the WV-1 through WV-4 pipeline alignments, it would be recommended to upsize the pipelines according to the sizes in Table 7.5 when the segments reach the end of their useful life.

Table 7.5 Velocity Improvements Under PHD Conditions
Water Master Plan
City of Oceanside

CIP-ID	Velocity (ft/s)	Diameter (in)		Length	
		Existing	Upgrade	(ft)	(mi)
WV-1	7.9	8	12	2,400	0.5
WV-2	8.0	8	12	200	<0.1
WV-3	9.5	24	30	12,300	2.3
WV-4	10.8	14	16	2,100	0.4
Total				**17,000**	**3.2**

7.3.3 Transmission Main Capacity Analysis

As the City's distribution system has been sized to accommodate larger demands, most of proposed transmission main improvements are driven by storage recommendations discussed in Section 7.3.5. The recommended transmission mains are presented on Figure 7.4 and are described below.

7.3.3.1 WC-1 – Reservoir Connection TM for Future Zone 800 Reservoir

This 36-inch diameter transmission main connects the Zone 800 Reservoir to Oceanside 2 and 3 pipelines, or the pipeline from FCF 6 entering the City. As the City does not own any parcels of sufficient size near the Zone 800 Reservoir site, the required length of this pipeline could be longer depending on what parcel is found to be available. For CIP planning purposes, the pipeline is estimated to be 1,000 feet (or 0.2 miles) in length. Since the Zone 800 Reservoir is planned to be pumped storage, ground elevation is not as critical in site selection. The reservoir site would also need to accommodate a booster pumping station to pump water out of the reservoir back into Oceanside 2 and Oceanside 3.

7.3.3.2 WC-2 – Reservoir Connection TM for Guajome Zone Reservoirs

This 36-inch diameter transmission main connects the proposed Guajome Reservoirs 3 and 4 to the main Guajome Zone distribution system located along San Luis Rey Avenue, West Bobier Drive, Melrose Drive, which then connects to a pipeline along Darwin Drive. Given the lack of suitable topography at an elevation of 491 feet, the identified reservoir sites are located approximately one mile east of the City boundary. If suitable sites are not identified, pumped storage could be used at a lower elevation, or expansion of storage in the lower pressure zones with associated booster pumping station capacity could be used to satisfy this deficiency. For CIP planning purposes, the pipeline is estimated to be 12,300 feet (or 2.3 miles) in length.

7.3.3.3 WC-3 – Reservoir Connection TM for Fire Mountain Reservoir 2

This 24-inch diameter transmission main connects the Fire Mountain Reservoir 2 to the Talone Zone distribution system. The pipeline initiates south of Fire Mountain Reservoir 1 and is located along Fire Mountain Drive, Ridgeway Street, and then connects to a pipeline along California Street. This 24-inch diameter pipeline replaces an 18-inch diameter pipeline constructed in 1952 and reduces headloss to the Talone Zone, allowing a slightly increased HGL for the zone and increased utilization of the reservoir volume of the Talone Reservoir. This size is reduced from the recommended sizing in the previous WMP. For CIP planning purposes, the pipeline is estimated to be 4,600 feet (or 0.9 miles) in length.

7.3.3.4 WC-4 – TM to Improve System Operations for Pilgrim Creek Reservoir

This 18-inch diameter transmission main replaces an existing transmission main connecting the Morro Hills Reservoirs to Pilgrim Creek Reservoir, supplying a few subzones along the way. The existing transmission main is a 14-inch diameter steel pipeline installed in 1948. Under existing conditions, high velocities (about 6.9 fps) are predicted when Pilgrim Creek Reservoir is filling if the HGL of the Guajome Zone near Pilgrim Creek Reservoir is below the pressure reducing valve setpoint of Pilgrim Creek Reservoir PRS (so that the Pilgrim Creek Reservoir pulls from Morro Hills). These velocities are substantially dependent on the pressure sustaining setpoint of the same PRS, which were slightly uncertain. If velocity is too high, pressures in the Montamar Zone suffer. A replacement 18-inch diameter pipeline is recommended based on predicted velocities and operations of the future system.

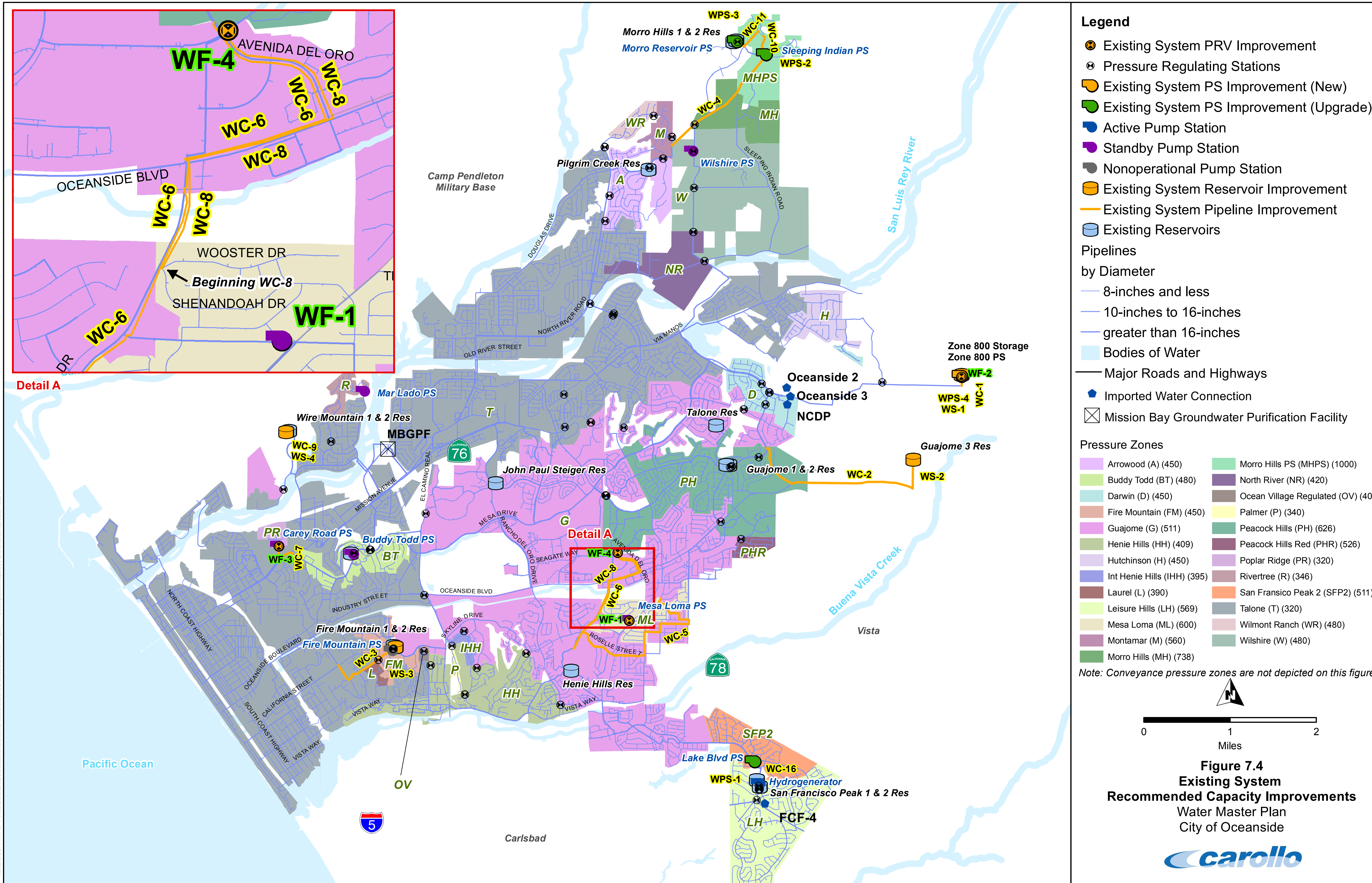


Figure 7.4
Existing System
Recommended Capacity Improvements
Water Master Plan
City of Oceanside

It is recommended that, if the City wants to be able to control more directly whether the Pilgrim Creek Reservoir is filled from Morro Hills or Guajome, remote control capabilities be added to the Pilgrim Creek Reservoir PRS, both to monitor grade at this location in each of the three major pressure zones at this location, and to adjust the setpoint remotely of the PRV/PSV. For CIP planning purposes, the pipeline is estimated to be 8,000 feet (or 1.5 miles) in length.

7.3.3.5 WC-5 and WC-6 – TM to Improve Headloss and Low Pressures

Pressures in the southeast area of the Guajome Zone, surrounding Mesa Loma Zone but especially south of the Mesa Loma Zone are predicted through hydraulic modeling to be below the minimum pressure evaluation criteria, in the range of 35 psi to 40 psi. This is worsened in the future system analysis, with excess water from FCF-4 not raising the southeastern edge of the Guajome Zone slightly. Opportunities for reducing headloss between the north portion of the Guajome Zone are limited, but there are relatively few large diameter transmission mains in the immediate vicinity of this area.

One opportunity for reducing headloss is the proposed large diameter transmission main supplying Henie Hills Reservoir.

The proposed WC-6 transmission main replaces an existing transmission main connecting the Guajome Zone to Henie Hills Reservoir. The existing transmission main is a 27-inch diameter CCP installed in 1962. Increasing the diameter of the pipeline to 36-inches reduces headloss during the peak periods of demand (when Henie Hills Reservoir is filling) from about 9 feet to about 2 feet. North of Oceanside Boulevard, the pipeline was installed more recently, so a separate alignment is recommended rather than replacement of the pipeline. The WC-6 pipeline is located from Avenida Del Oro to the intersection of Cameo Drive and Colgate Drive, which is where the pipeline connects to the existing system.

WC-5 is a companion project to WC-6, consisting of 12-inch diameter pipelines supplying the local distribution pipelines from WC-5 and the area of the Guajome Zone north of Mesa Loma Zone. A small pressure regulating station (WF-1) at the Mesa Loma PS forms the final piece of the solution to these pressure deficiencies, nudging pressures just a couple psi more, such that they reach 40 psi. The WC-5 pipeline is located along Roselle Street, Thunder Drive, Lewis Street, Cedar Road, Thomas Street, Emerald Drive, Galbar Street, Alana Circle, Norma Street and connects to a pipeline along Joann Drive.

For CIP planning purposes, the WC-5 pipeline is estimated to be 7,800 feet (or 1.5 miles) in length and the WC-6 pipeline is estimated to be 9,200 feet (or 1.7 miles) in length.

7.3.3.6 WC-7 and WC-8 – Back-Up Supply TMs

In lieu of upgrading the Mesa Loma PS and Carey Road PS to meet the pump station criteria specified in Chapter 6, two 8-inch diameter pipelines and two 8-inch PRSs (CIP ID's WF-4 and WF-5) are proposed to provide additional supply to both the Mesa Loma pressure zone and the Poplar pressure zone under MDD plus fire flow conditions.

WC-7 is an 8-inch diameter transmission main that connects the Buddy Todd pressure zone to the Polar pressure zone. The pipeline is located along Mesa Drive at Mission Avenue to Carey Road. The proposed Carey Road PRS (WF-4) is located along the pipeline alignment to regulate downstream pressures with two 8-inch PRSs. For CIP planning purposes, WC-7 is estimated to be 2,100 feet (or 0.4 miles) in length.

WC-8 is an 8-inch diameter transmission main that connects the Peacock Hills pressure zone to the Mesa Loma pressure zone. The pipeline is located along Avenida Del Oro, Oceanside Boulevard and connects to a pipeline at the intersection Wooster Drive and Shenandoah Drive. The proposed Avenida De La Plat PRS (WF-5) is located along the pipeline alignment to regulate downstream pressures with two 8-inch PRSs. For CIP planning purposes, WC-8 is estimated to be 5,700 feet (or 1.1 miles) in length.

7.3.3.7 WC-9 – Reservoir Connection TM for Wire Mountain Reservoir 2

This 24-inch diameter transmission main connects the Wire Mountain Reservoir 2 to the existing Wire Mountain 1 Reservoir transmission main, which distributes water into the Talone pressure zone. For CIP planning purposes, WC-9 is estimated to be 500 feet (or 0.1 miles) in length.

7.3.3.8 WC-10 and WC-11 – Pump Station Upgrades TMs

To mitigate the pump station deficiencies to meet the criteria specified in Chapter 6, upgrades to the Sleeping Indian Pump Station and Morro Hills Pump Station are proposed. To accommodate the upgraded pump station capacities, pipeline upsizing is also needed. The Indian Hills PS downstream piping would be upsized from 8-inches in diameter to 16 - inches in diameter. The pipeline connects the Sleeping Indian PS to the pipeline along Indian Hill Way. The Morro Hills Pump Station downstream piping would be upsized from 10-inches in diameter to 16-inches in diameter. The pipeline connects the Morro Hills PS to the pipeline along Sleeping Indian Road. For CIP planning purposes, WC-10 is estimated to be 1,300 feet (or 0.3 miles) in length and WC-11 is estimated to be 3,200 feet (or 0.6 miles) in length.

7.3.3.9 WC-16 – Lake Boulevard Interconnect to San Francisco Peak 1 Reservoir TM

To accommodate the storage deficit, a 16-inch diameter transmission main connecting the Lake Boulevard PS to the San Francisco Peak 1 Reservoir has been included in the City's CIP budget. This transmission main would be utilized to pump water from the San

Francisco Peak 2 Reservoir to the San Francisco Peak 1 Reservoir. For CIP planning purposes, the pipeline is estimated to be 500 feet (or 0.9 miles) in length.

7.3.4 Fire Flow Analysis

A fire flow analysis was completed utilizing the evaluation criteria listed in Chapter 6. Based on these criteria, the existing fire flow system was evaluated to verify that a minimum pressure of 20 psi was met while maintaining a flow ranging from 1,500 gpm to 4,000 gpm within the corresponding land use category, which are shown on Figure 7.5. The results are of the analysis are presented in Table 7.6 and Table 7.7.

7.3.4.1 Small Diameter Replacement Program

To correct immediate fire flow deficiencies throughout the City's distribution system, the replacement of 4-inch and 6-inch diameter pipelines were assumed to be implemented first. As listed in Table 7.6, approximately 55,200 feet (or 10.4 miles) of 4-inch diameter pipelines are assumed to be upsized to 8-inch diameter pipelines and approximately 120,400 feet (or 22.8 miles) of 6-inch diameter pipelines are proposed to be upsized to 8-inch diameter pipelines. The location of these "small diameter" replacements are shown on Figure 7.6. As part of the ongoing Phase 1-5 Waterline Replacement Projects, approximately 69,800 linear feet of the "small diameter" pipelines will replaced, which includes the 4-inch diameter pipelines in Capistrano. The remaining fire flow deficiencies that were not mitigated by these small diameter pipeline replacements were addressed with the proposed fire flow improvements discussed in Section 7.3.4.2. As shown in Table 7.6 and Figure 7.6, the majority of small diameter replacements are located in the Talone Zone west of the Fire Mountain PS along California Street and in the Buddy Todd Zone south of the Carey Road PS along Mesa Drive.

7.3.4.2 Fire Flow Improvements

As shown in Table 7.7, 16 fire flow improvements have been proposed involving upsizing existing pipelines and/or completing pipeline loops with a combined length of approximately 32,800 feet (or 6 miles). The locations of the recommended improvement projects are shown on Figure 7.6. As shown in Table 7.7 and Figure 7.6, the majority of these fire flow improvements are located in the western section of the Talone Zone.

7.3.5 Storage Analysis

As described in Chapter 4, the distribution system contains twelve (12) storage reservoirs with a total storage volume of 50.5 MG. The storage evaluation is performed separately for each pressure zone (PZ) and then by pressure zone group. The storage criteria, described in Chapter 6, consists of three components:

1. Operational storage
2. Fire flow storage
3. Emergency storage

As discussed in Chapter 6, the operational storage criteria was set at 25 percent of MDD, the emergency storage was set at 100 percent of MDD and the fire flow storage was set at the highest fire flow requirement within the pressure zone group evaluated. The highest fire flow requirement in the City's service area is 4,000 gpm for four (4) hours. The fire flow storage criteria was applied to the primary pressure zones, which are the pressure zones containing storage reservoirs within a pressure zone group. This analysis assumes one fire per major pressure zone group. Pressure zone groups are presented in Appendix F. It should be noted that the City's distribution system includes significant connectivity between pressure zones due to the presence of 56 PRSs. Therefore, surplus storage in the City's upper pressure zones can often count towards the storage deficit in lower pressure zones

A summary of the required and available storage volumes is presented in Table 7.8, while details of this analysis are presented in Appendix F. As shown in Table 7.8, the existing storage analysis demonstrates that the City's existing storage is deficient by approximately 22.5 MG. The deficiencies and recommended storage improvements are as follows (see Figure 7.4):

- The Guajome PZ group contains the zones Buddy Todd, Darwin, Guajome, Ocean Village Regulated, and Rivertree. With a combined demand of 12.23 mgd, the required storage is 16.25 MG. However, only 10.00 MG is currently available resulting in a storage deficit of 6.25 MG. To resolve this deficit, a new 7 MG storage tank (Guajome 3 Reservoir) is proposed at a parcel east of San Luis Rey Avenue, which is adjacent to the Guajome Zone. With this improvement in place, there is a 0.75 MG storage surplus under existing demand conditions in the Guajome PZ group. Based on the ratio of existing versus future customer benefit, 89 percent of the proposed reservoir capacity is allocated to existing users.
- The Talone PZ group contains the zones Fire Mountain, Laurel, Poplar and Talone. With a combined demand of 21.67 mgd, the required storage is 28.04 MG. However, only 21.00 MG is currently available resulting in a storage deficit of 7.04 MG. To resolve this deficit, two new 4 MG storage tanks (Fire Mountain Reservoir 2 and Wire Mountain Reservoir 2) are proposed. The proposed location of the 4 MG Fire Mountain Reservoir 2 is at the existing Fire Mountain Reservoir site within the Fire Mountain Zone. The proposed location of the 4 MG Wire Mountain Reservoir 2 is at the existing Wire Mountain Reservoir site, which is adjacent to the Talone Zone. With these improvements in place, there is a 0.96 MG storage surplus under existing demand conditions in the Talone PZ group. Based on the ratio of existing versus future customer benefit, 88 percent of the proposed reservoir capacities is allocated to existing users.
- The Henie Hills PZ group contains the zones Henie Hills, Intermediate Henie Hills, and Palmer. With a combined demand of 1.79 mgd, the required storage is 3.19 MG. However, only 3.00 MG is currently available resulting in a storage deficit of 0.19 MG. This deficit is addressed in the future storage analysis in Chapter 8.

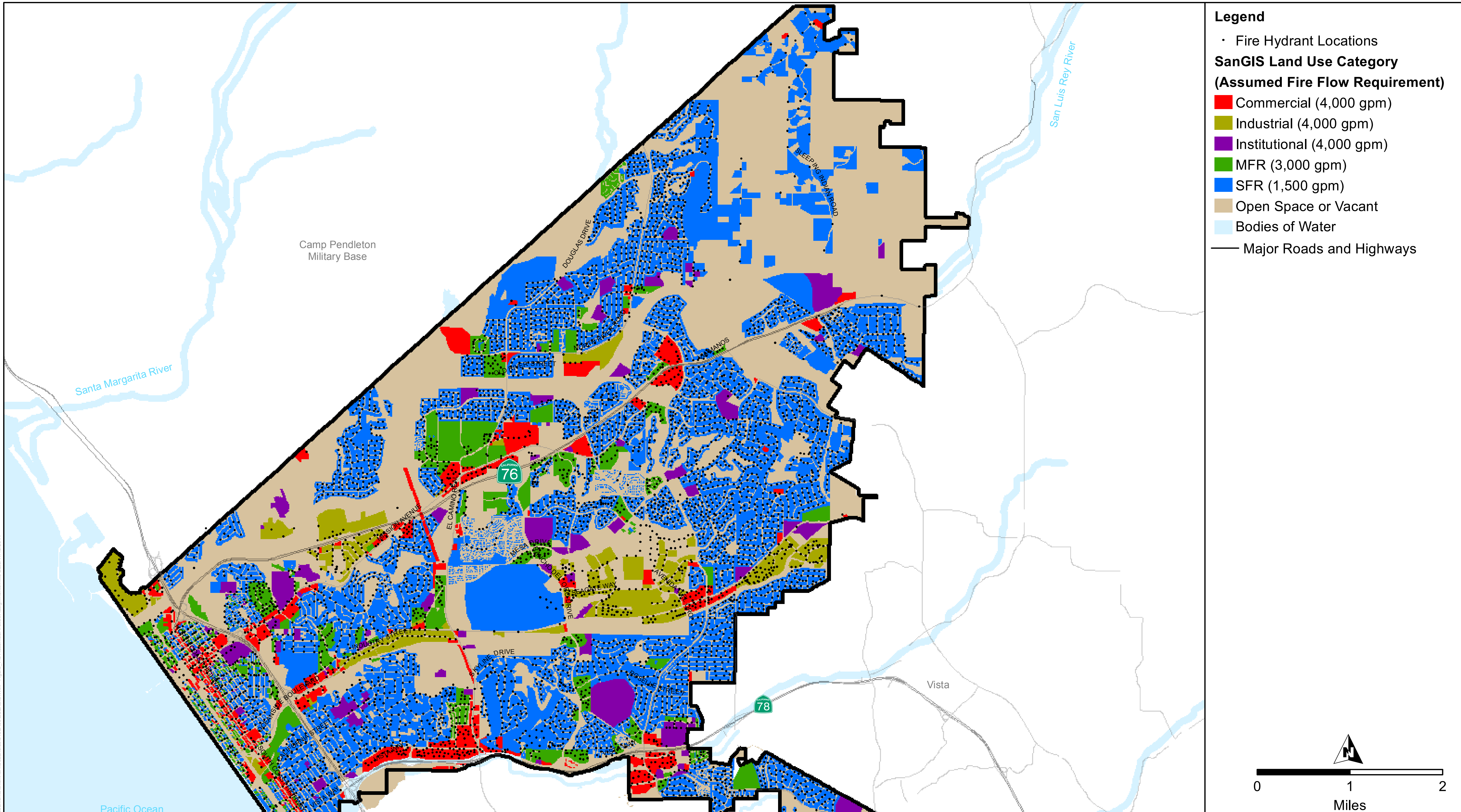


Figure 7.5
Fire Flow Demand Allocation
By Land Use Category
Water Master Plan
City of Oceanside

carollo

Table 7.6 Small Diameter Pipeline Replacements
Water Master Plan
City of Oceanside

Pressure Zone	Length of 4-Inch Diameter Replacement Projects[1] (ft)	Length of 4-Inch Diameter Replacement Projects[1] (mi)	Length of 6-Inch Diameter Replacement Projects[2] (ft)	Length of 6-Inch Diameter Replacement Projects[2] (mi)	Total Length (mi)
Arrowood	0	0.0	0	0.0	0.0
Buddy Todd	5,700	1.1	8,500	1.6	2.7
Darwin	0	0.0	0	0.0	0.0
Fire Mountain	1,800	0.3	7,600	1.4	1.8
Guajome	1,200	0.2	15,000	2.9	3.1
Henie Hills	800	0.1	6,800	1.3	1.4
Hutchison	0	0.0	0	0.0	0.0
Intermediate Henie Hills	0	0.0	300	0.0	0.1
Laurel	0	0.0	2,800	0.5	0.5
Leisure Hills	0	0.0	0	0.0	0.0
Mesa Loma	0	0.0	0	0.0	0.0
Montamar	0	0.0	0	0.0	0.0
Morro Hills	0	0.0	0	0.0	0.0
Morro Hills PS	3,200	0.6	0	0.0	0.6
North River	0	0.0	600	0.1	0.1
Peacock Hills	0	0.0	1,700	0.3	0.3
Peacock Hills Reduced	0	0.0	300	0.1	0.1
Poplar	300	0.1	300	0.1	0.1
San Francisco Peak 2	0	0.0	700	0.1	0.1
Talone[3]	42,200	8.0	73,100	13.9	21.8
Transmission	0	0.0	1,200	0.2	0.2
Wilmont Ranch	0	0.0	0	0.0	0.0
Wilshire	0	0.0	1,500	0.3	0.3
Total	**55,200**	**10.4**	**120,400**	**22.8**	**33.2**

Notes
(1) These projects are identified as SDR-4 in the CIP (Chapter 9).
(2) These projects are identified as SDR-6 in the CIP (Chapter 9).
(3) All of downtown is part of Phase 1-5 Water Replacements

Table 7.7 Fire Flow Improvements
Water Master Plan
City of Oceanside

CIP Project ID	Pressure Zone	Description	Diameter (in.)	Pipeline Length (ft)
FF-01	Peacock Hills	Lee Dr at North Ave to Oceanside Blvd	8	900
	Peacock Hills	North Ave to the end of Vista Pacific Dr	12	1,500
FF-02	Talone	South Coast Hwy at Withery St. In Talone	8	300
FF-03	Talone	Zeiss St at Loretta St west to 12" pipe	12	1,300
FF-04	Poplar	Acacia Ave at Willow Ave	8	700
	Poplar	Poplar Rd at Carey Rd	12	800
FF-05	Talone	Soto St at Krim Pl	8	300
FF-06	Talone	Dunstan St. at Eldean Ln	8	700
FF-07	Talone	San Diego St at Laurel St	8	700
	Talone	Holly St at Dubuque St and San Diego St at Laurel St	12	900
FF-08	Talone	Mesa Dr at Edgewood Dr	12	600
FF-09	Talone	Garrison St at Oceanside Blvd and Industry St at Garrison St	8	400
	Talone	Garrison St at Oceanside Blvd	12	4,800
FF-10	Talone	Maxon St at Country Club Ln	8	7,000
FF-11	Guajome	Along Bradley St and Hope St near Marcella St	8	1,500
FF-12	Hutchison	Belmont Park Rd from Spur Ave	8	2,600
	Hutchison	Belmont Park Rd from Serene Road to second fork	12	700
FF-13	North River	Stallion Dr at Mare Rd	12	1,100
FF-14	Leisure Hills	Cannon Rd at Melrose Dr	8	3,600
FF-15	Guajome	Mesa Dr at Rancho Del Oro Park	12	1,300
FF-16	Leisure Hills	Mystra Dr at Cannon Rd	12	1,100
Total	**N/A**	**N/A**	**N/A**	**32,800**

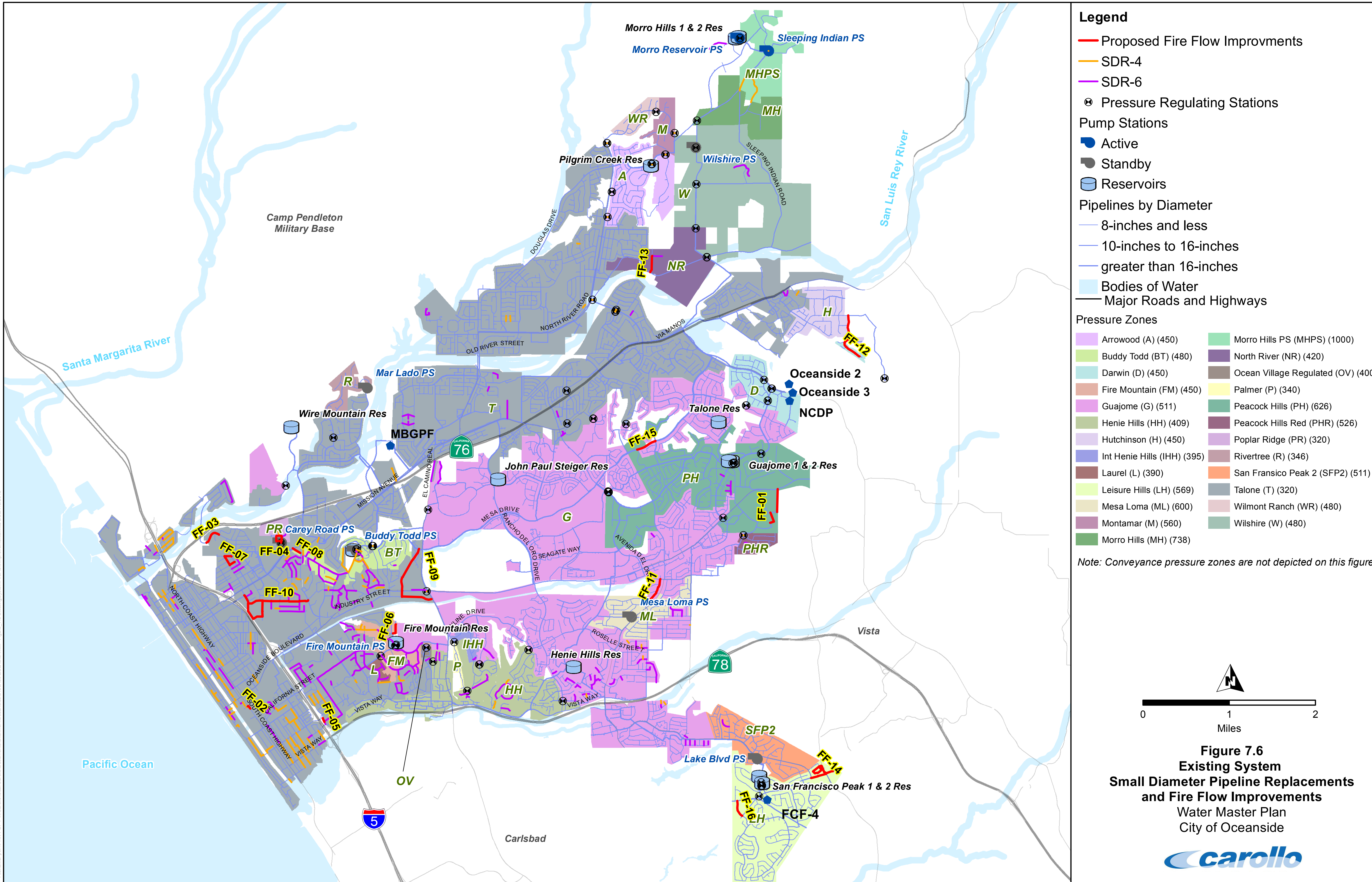


Figure 7.6
Existing System
Small Diameter Pipeline Replacements and Fire Flow Improvements
Water Master Plan
City of Oceanside

- The Leisure Hills PZ is the only pressure zone within this pressure zone group. With a combined demand of 1.79 mgd, the required storage is 3.20 MG. However, only 1.50 MG is currently available resulting in a storage deficit of 1.70 MG. To resolve this deficit, the surplus storage within the San Francisco Park 2 pressure can be utilized, which requires the Lake Side Boulevard pump station upgrade to move water from the San Francisco Peak 2 Reservoir to the Leisure Hills Zone.
- The FCF-6 PZ group contains the zones Mesa Loma, North River, Peacock Hills, Peacock Hills Reduced, Transmission, and Wilshire. With a combined demand of 5.07 mgd, the required storage is 7.29 MG. However, no storage is available within the FCF-6 resulting in a storage deficit of 7.29 MG. To resolve this deficit, a new 10 MG storage tank (Zone 800 Reservoir) is proposed. The location of the site has not been determined. However, for planning purposes, the reservoir is assumed to be located east of the service area near the Oceanside 2 and Oceanside 3 pipelines. With this improvement in place, there is a 2.71 MG storage surplus under existing demand conditions in the FCF-6 PZ group. Based on the ratio of existing versus future customer benefit, 73 percent of the proposed reservoir capacity is allocated to existing users.

As shown in Table 7.8, there are storage deficiencies or improvements identified for the Morro Hills and San Francisco Peak 2 pressure zone groups.

Table 7.8 Existing Storage Analysis
Water Master Plan
City of Oceanside

Pressure Zone	Existing MDD (mgd)	Required Storage (MG)	Available Storage (MG)	Zone Balance (MG)	Proposed Facility	Proposed Capacity (MG)	PZ Group Balance with New Storage (MG)
Morro Hills PZ Group							
Arrowood	0.81	1.01	0.0	-1.0			
Hutchinson	0.50	0.62	0.0	-0.6			
Montamar	0.22	0.27	0.0	-0.3			
Morro Hills	0.26	1.29	10.0	+8.7			
Morro Hills PS	0.64	0.80	0.0	-0.8			
Wilmont Ranch	0.29	0.37	0.0	-0.4			
Subtotal Morro Hills PZ Group	***2.71***	***4.35***	***10.00***	***5.65***	***N/A***	***0.0***	***+5.65***
Guajome PZ Group							
Buddy Todd	0.38	0.47	0.0	-0.5			
Darwin	0.40	0.51	0.0	-0.5			
Guajome	11.25	15.03	10.0	-5.0	Guajome Res 3	7.00	
Ocean Village Regulated	0.02	0.02	0.0	-0.0			
Rivertree	0.18	0.22	0.0	-0.2			
Subtotal Guajome PZ Group	***12.23***	***16.25***	***10.00***	***-6.25***	***N/A***	***7.00***	***+0.75***
Talone PZ Group							
Fire Mountain	0.42	0.53	0.0	-0.5	Fire Mtn Res 2	4.00	
Laurel	0.03	0.04	0.0	-0.0	Wire Mtn Res 2	4.00	
Talone (includes Poplar)	21.21	27.47	21.0	-6.5			
Subtotal Talone PZ Group	***21.67***	***28.04***	***21.00***	***-7.04***	***N/A***	***8.00***	***+0.96***

Table 7.8 Existing Storage Analysis
Water Master Plan
City of Oceanside

Pressure Zone	Existing MDD (mgd)	Required Storage (MG)	Available Storage (MG)	Zone Balance (MG)	Proposed Facility	Proposed Capacity (MG)	PZ Group Balance with New Storage (MG)
Henie Hills PZ Group							
Henie Hills	1.64	3.01	3.0	-0.0			
Intermediate Henie Hills	0.09	0.11	0.0	-0.1			
Palmer	0.06	0.08	0.0	-0.1			
Subtotal Henie Hills PZ Group	***1.79***	***3.19***	***3.00***	***-0.19***	***N/A***	***0.0***	***-0.19(1)***
San Francisco Peak 2 PZ Group							
San Francisco Peak 2	0.80	1.96	5.0	+3.0			
Subtotal San Francisco Peak 2 PZ Group	***0.80***	***1.96***	***5.00***	***3.04***	***N/A***	***0.0***	***+3.04***
Leisure Hills PZ Group							
Leisure Hills	1.79	3.20	1.5	-1.7			
Subtotal Leisure Hills PZ Group	***1.79***	***3.20***	***1.50***	***-1.70***	***N/A***	***0.0***	***-1.70(2)***
FCF 6 PZ Group							
Mesa Loma	0.53	0.66	0.0	-0.7			
North River	0.92	1.14	0.0	-1.1			
Peacock Hills	1.97	2.46	0.0	-2.5			
Peacock Hills Reduced	0.14	0.17	0.0	-0.2			
Transmission	0.75	1.90	0.0	-1.9	Zone 800 Res	10.00	
Wilshire	0.76	0.95	0.0	-1.0			
Subtotal FCF 6 PZ Group	***5.07***	***7.29***	***0.00***	***-7.29***	***N/A***	***10.00***	***+2.71***
Total	**46.05**	**64.3**	**50.50**	**-22.5**	**N/A**	**25.00**	**-1.89**

Notes

(1) This storage deficit is addressed as part of the future system improvements (see Table 8.3).
(2) This storage deficit can be mitigated with the Lake Boulevard PS upgrade project (CIP ID:WPS-1).

7.3.6 Pump Station Analysis

As discussed in Chapter 4, the City relies primarily on supplies from upper zones through pressure reducing stations rather than boosted supplies from lower pressure zones. Thus, booster pump stations represent backup supplies rather than the primary supply for pressure zones with the exception of Morro Hills PS. Evaluation criteria for each pump station were therefore determined on a case by case basis.

The pump station analysis evaluates the existing pump station capacities based on the evaluation criteria in Chapter 6, which define the firm capacity of the individual pump stations within the system. The results of the analysis are summarized in Table 7.9, while details are presented in Appendix G. The City currently has 9 pump stations (PS) with a combined capacity of nearly 10,830 gpm (or 15.6 mgd). As shown in Table 7.9 and on Figure 7.4, the following PS improvements are recommended:

- **Gravity Fed Zone through PRS without Gravity Storage:** There are four existing pump stations within this category, which include the Buddy Todd PS, Fire Mountain PS, Rivertree (Mar Lado) PS and the Lake Boulevard (SF Peak) PS. Currently, the following pump stations are deficient:
  - The Lake Boulevard PS has a current capacity of 1,800 gpm. The required capacity of the pump station is 3,235 gpm, which results in a deficiency of 5,835 gpm. To resolve this deficit of 4,035 gpm, three additional 1,400 gpm pumps are recommended. This 100 HP PS upgrade would result in a total capacity of 6,000 gpm. Based on the projected growth within the City's service area, 90 percent of the proposed pump station capacity is allocated for existing user benefit.
  - As shown in Table 7.9, there are not any pump station deficiencies or improvements identified for the Buddy Todd PS and the Rivertree (Mar Lado) PS. The Fire Mountain PS is currently non-operational and is planned for abandonment by the City within the near future.
- **Pumped Zone without Gravity Storage and Redundant Supply Source:** There are two existing pump stations within this category, which include the Sleeping Indian PS and the Morro Hills PS. Currently, the combined capacity of both pump stations is not sufficient to meet MDD plus fire flow demand conditions. Therefore, it is recommended to upgrade the Sleeping Indian PS and Morro Hills PS by adding two 500 gpm pumps at each site to mitigate the deficiency. This 100 HP PS upgrade to each site would result in a total capacity of 2,600 gpm at Sleeping Indian PS and 1,900 gpm at Morro Hills PS, which would contribute to 100 percent of the existing user benefit. Based on the existing configuration at each of the sites, transmission main upgrades (WC-10 and WC-11) would be required to accommodate the additional flow capacities.
- **Back-Up Pump Stations:** The Wilshire PS is not typically operated. Its capacity is currently sufficient to meet the needs of the City. Hence, no improvements are recommended for this PS.

Table 7.9 Existing Pump Station Analysis
Water Master Plan
City of Oceanside

Discharge Pressure Zone	Existing Pump Station(s) [1,2]	Existing Capacity (gpm)	Existing MDD (gpm)	Total Required Capacity (gpm)	Existing Capacity Balance (gpm)	Proposed Pump Station	Proposed PS Capacity (gpm)	Proposed PS Capacity (hp)
Gravity Fed Zone through PRS without Gravity Storage								
Buddy Todd	Buddy Todd PS	1,200	261	469	731			
Fire Mountain	Fire Mountain PS	320	292	N/A	N/A	*City to Abandon*		
Rivertree	Rivertree (Mar Lado) PS	1,435	125	224	1,211			
San Francisco Peak 1	Lake Blvd (SF Peak) PS	1,800	1,797	5,835	-4,035	*Lake Blvd PS Upgrade*	3*1,400 gpm	100
Pumped Zone without Gravity Storage and Redundant Supply Source								
Morro Hills PS	Sleeping Indian PS	1,600	442	2,546	-946	Sleeping Indian PS Upgrade	2*500 gpm	100
Morro Hills PS	Morro Hills PS	900	442	1,896	-996	Morro Hills PS Upgrade	2*500 gpm	100
Back-Up								
Transmission	Wilshire PS	2,250	523	2,023	227			
Pumped Zone without Gravity Storage and Single Supply Source								
Mesa Loma	Mesa Loma PS	700	356	4,356	-3,656	*New PRS & Pipeline to Convey FF in lieu of PS Upgrade (CIP ID WC-8 & WF-4)*		
Poplar	Carey Road (Poplar Ridge) PS	625	50	4,050	-3,425	*New PRS & Pipeline to Convey FF in lieu of PS Upgrade (CIP ID WC 7 & WF-3)*		
Reliability								
Guajome				5,000	-5,000	Zone 800 PS	5*1,000 gpm	500
Total	**N/A**	**10,830**	**n/a**	**26,400**	**-15,890**	**N/A**	**11,200**	**800**

Note:
(1) The detailed pump station evaluation is included in Appendix G.
(2) A hydroelectric PS is located within the Leisure Hills Zone. However, the PS is only operated under emergency conditions, which is very undesirable.

- **Pumped Zone without Gravity Storage and Single Supply Source:** There are two pump stations within this category, which include the Mesa Loma PS and the Carey Road (Poplar Ridge) PS. Currently, the capacity of both pump stations are deficient to meet the MDD plus fire flow conditions within the Mesa Loma PZ and the Poplar PZ. In addition, the Carey Road PS has not been operated in the past 20 years. Therefore, to mitigate the deficiencies, it is recommended that two new PRSs at Carey Road (WF-3) and Avenida De La Plat (WF-4) be installed along with 8-inch diameter pipelines to convey fire flow demands to both the Mesa Loma PZ and Poplar PZ from upper zones in lieu of upgrading the existing pump stations.
- **Reliability Pump Stations:** There is one pump station within this category, which includes the Zone 800 PS.
  - The Zone 800 PS would pump water from the new Zone 800 Reservoir site to the Transmission PZ. The exact sizing of this 500 HP pump station with a capacity of 5,000 gpm would be dependent upon the final location of the reservoir. The City currently does not own any parcels of sufficient size near the Zone 800 Reservoir site. However, since the Zone 800 Reservoir is planned to be pumped storage into the two 24-inch diameter pipelines (Oceanside 2 and Oceanside 3), ground elevation is not critical in the site selection. Based upon the storage analysis identified in Section 7.3.5, approximately 73 percent of the capacity of the pump station would be for existing user benefit.

7.4 DISTRIBUTION SYSTEM REHABILITATION

Carollo's subconsultant, WachsWater Services, conducted internal inspection of water mains at 30 locations throughout the water distribution system. In-service water mains were inspected via available tapping points. The inspection report prepared by WachsWater Services contained still photos of the inspection accompanied by condition reports.

7.4.1 Pipeline Condition Assessment

The condition report contained 363 still images taken throughout the system inspection. On average, each of the 30 sites each had 12 associated images. However, some locations had as many as 23 images or as few as 7. The details of the assessment are listed in Appendix H.

Each image within the Wach's Repot was accompanied by comments from the CCTV technician. These comments pertained to the general layout of the pipe (material, diameter, presence of various valves), turbidity, and severity of sedimentation in the water or on the pipe. Finally, the comments quantified the degree of tuberculation, or the collection of deposits on the interior of the pipeline, level 1 for 1 to 2 percent deposit growth, level 2 for 3 to 4 percent deposit growth, or level 3 for 5 percent or more deposit growth.

Using these comments, two scores were assigned to each image, one based on sedimentation and the other based on degree of tuberculation. A value of 0, 1, or 2 was assigned based on sedimentation that was classified as absent (0), minor (1), or moderate (2). Similarly, the tuberculation score of 0 through 3 was based on zero sedimentation, level 1, level 2, or level 3. An average sedimentation score and tuberculation was developed for each sampling location by averaging the scores for all images at each location.

The average tuberculation and sedimentation by site are illustrated in Figure 7.7 and Figure 7.8.

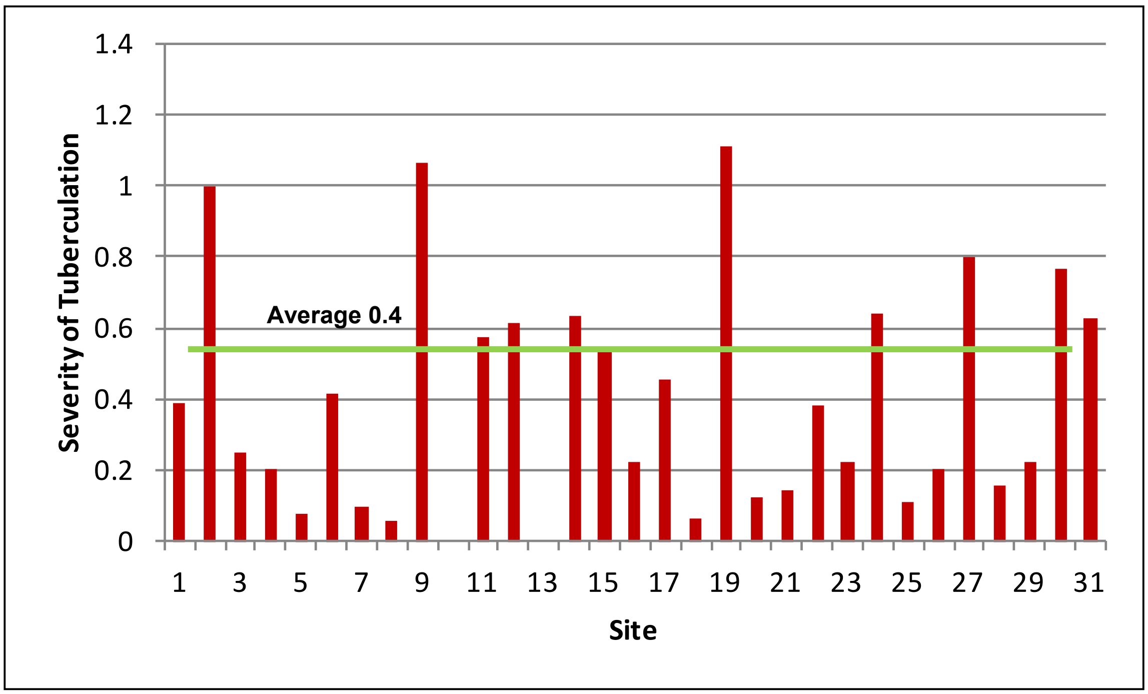


Figure 7.7 Tuberculation by Site

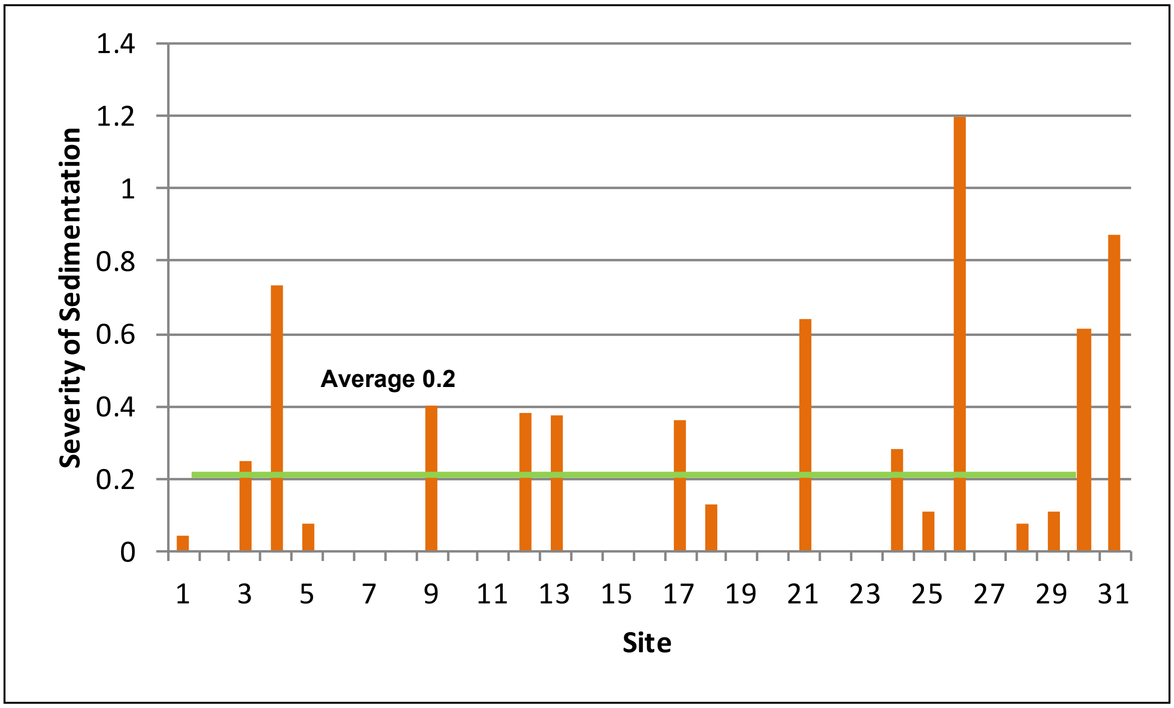


Figure 7.8 Sedimentation by Site

As shown in Figure 7.7 and Figure 7.8, there is a wide distribution of the severity of tuberculation and sedimentation throughout the system. Average tuberculation for each site ranged from 0 to 1.1. Average tuberculation for all sampled sites was 0.4, representing approximately 1 percent tuberculation. Average sedimentation for each site ranged from 0 to 1.2. Average sedimentation for all sampled sites was 0.2, representing less than minor sedimentation.

Based on the analysis completed, the tuberculation and sedimentation within the pipelines did not demonstrate any specific trends that can be used to prioritize pipeline rehabilitation and replacement (R&R) projects for the City's CIP. Therefore, age analysis was used as the primary indicator for projecting R&R needs in the CIP.

7.4.2 Pipeline Age Replacements

The existing potable water distribution system consists of approximately 574 miles of pipeline. Chapter 4 presents and discusses the distribution of pipeline materials, ages, and diameters. The approximate anticipated life span for pipelines of each material in the City's system are listed in Chapter 6. While the cost to replace pipelines of varying diameters is presented in Chapter 9.

By combining the material based pipeline lifespan with approximate costs per diameter, the future replacement costs for the City's entire system can be estimated. The total length of replacements along with replacement cost per decade through 2050 is presented in Figure 7.9.

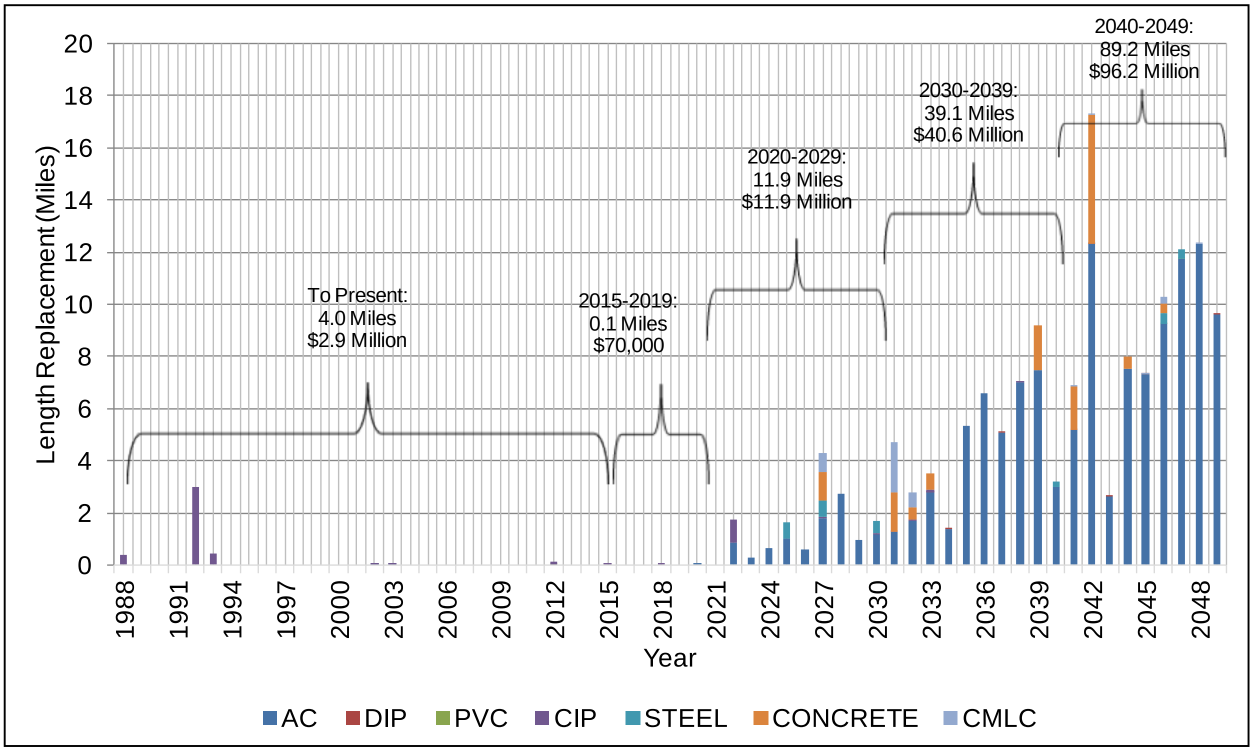


Figure 7.9 Projected Pipeline Replacement Costs

As shown in Figure 7.9 and Table 7.10, approximately 144 miles of pipeline within the City are anticipated to reach the end of their lifespan by year 2050. Starting in year 2020, approximately 4.1 miles of asbestos concrete pipeline, along with moderate amounts of steel and concrete pipeline, would require replacement. Then, approximately 11.9 miles of pipeline would require replacement between 2020 and 2029, approximately 39.1 miles of pipeline between 2030 to 2039 and approximately 89.2 miles of pipeline between 2040 to 2049. As shown in Table 7.10, the total estimated construction costs for replacement is approximately $151.6 million.

Table 7.10 Projected Pipeline Replacement Lengths and Costs
Water Master Plan
City of Oceanside

Year	Length (ft)	Length (mi)	Construction Costs ($M)
To Present	20,900	4.0	$2.9
2015 to 2019	300	0.1	<$0.1
2020 to 2029	62,300	11.9	$11.9
2030 to 2039	206,200	39.1	$40.6
2040 to 2049	470,700	89.2	$96.2
Total	**760,400**	**144.3**	**$151.6**

7.4.3 Storage Rehabilitation

Currently, the existing distribution system contains 12 reservoirs with a total capacity of 50.5 MG. As described in Chapter 4, the reservoirs were installed between 1956 and 1995. To help maintain the aging infrastructure, structural rehabilitation of all reservoirs, ongoing reservoir upgrades and the installation of new water quality monitoring sites are included in the CIP costs, which is discussed in Chapter 9. Since the distribution system is primarily reliant upon the operation of the reservoirs, it is imperative that the reservoirs are maintained to avoid potential outages.

For CIP planning purposes, it was assumed that structural rehabilitation or repairs would be needed at all 12 existing reservoirs within the near-term planning period (before year 2020) due to the age of the infrastructure, which is considered a major repair item. The City's current CIP budget for structural rehabilitation was utilized in the Master Plan CIP budget discussed in Chapter 9.

Ongoing reservoir upgrades are also included within the near-term and long-term planning period. For CIP planning purposes, the City's current CIP budget for reservoir upgrades was utilized in the Master Plan CIP budget discussed in Chapter 9. The installation of new water quality monitoring stations at the 12 existing reservoirs was also included within the CIP, which would be considered a minor improvement within the near-term planning horizon.

7.4.4 Pump Station Rehabilitation

The City currently has 9 pump stations with a total capacity of 10,830 gpm (or 15.6 mgd). As previously discussed, the system is primarily operated by utilizing gravity storage and a system of PRSs; while the majority of the pump stations are only operated under emergency or maintenance conditions. Back-up power generators are recommended for sites that currently do not have a back-up power source, such as, Morro Hills PS, Lake Boulevard PS, Wilshire PS, and Mesa Loma PS. This recommendation coincides with the recommendation provided in the 2006 Master Plan. In addition, ongoing pump station upgrades are included in the CIP, which is discussed in Chapter 9.

For CIP planning purposes, the City's current CIP budget was utilized for ongoing pump station upgrades within the near-term and long-term planning horizon. Back-up power at the four specified sites is recommended within the long-term planning horizon.

7.4.5 Rehabilitation Improvements at Weese WFP

A Needs Assessment was conducted for the Weese Filtration Plant (Carollo, 2012), which currently treats the raw or untreated water supply from the aqueducts. Based on the recommendations in the assessment, electrical and chemical system upgrades were proposed along with the installation of new solids lagoons and other miscellaneous projects. For CIP planning purposes, the City's current CIP budget was utilized for improvements within the near-term and long-term planning period.

7.4.6 Rehabilitation Improvements at MBGPF

A Needs Assessment was conducted at the Mission Basin Groundwater Purification Facility (Carollo, 2012), which currently treats groundwater from the local basin. Based on the recommendations in the Needs Assessment, major improvements were incorporated into the City's CIP budget, which was utilized in the Master Plan CIP budget. For CIP planning purposes, the major improvements were included within the near-term planning period.

7.5 SUMMARY OF RECOMMENDATIONS

The recommendations identified in this chapter are summarized in this section. Detailed cost estimates for each of these recommendations are included in the CIP of this Master Plan (see Chapter 9). Based on the analysis of the water system under existing demand conditions, the following improvements are proposed:

- **Pressure Improvements**:
  - Based on the analysis completed, minimum and maximum pressures were not an issue in the existing system. However, a PRS was recommended to resolve a hydraulic grade line drop in the east Guajome PZ (CIP ID: WF-1).
- **Velocities Improvements** (see Table 7.5):
  - Upgrade or replace 3 miles of 12-inch to 30-inch diameter pipeline as needed to maintain velocities below 7 fps (see Table 7.5) within the Morro Hills PS PZ, Guajome PZ, and Buddy Todd PS PZ, respectively. Approximately 1 mile of pipeline may be upgraded or replaced as part of the R&R pipeline replacements in the CIP.
- **Fire Flow Improvements** (see Table 7.6 and Table 7.7):
  - Replace approximately 10 miles of 4-inch diameter pipeline to 8-inch diameter pipeline (CIP ID: SDR-4).
  - Replace approximately 23 miles of 6-inch diameter pipeline to 8-inch diameter pipeline (CIP ID: SDR-6).
  - The remaining fire flow deficiencies were addressed with 16 fire flow improvement projects, which equated to 6 miles of pipeline (CIP IDs: FF-1 through FF-16).
  - All proposed fire flow projects are existing system improvements.

- **Transmission Main Capacity Improvements**
  - 6 miles of pipeline ranging from 8-inch to 36-inch in diameter to connect new facilities to the system (CIP IDs: WC-1, WC-2, WC-3, WC-7, WC-8, WC-9, WC-10, WC-11 and WC-16).
  - 4.7 miles of pipeline ranging from 12-inch to 36-inch in diameter to resolve headloss in transmission mains and improve minor pressure and velocity deficiencies (CIP ID's: WC-4, WC-5, and WC-6).
- **Storage Improvements** (see Table 7.8):
  - 4 new reservoirs with a combined capacity of 24 MG are proposed to mitigate existing deficiencies in storage, which are as follows:
    - 10 MG Zone 800 Reservoir (CIP ID: WS-1)
    - 7 MG Guajome Reservoir 3 (CIP ID: WS-2)
    - 4 MG Fire Mountain Reservoir 2 (CIP ID: WS-3)
    - 4 MG Wire Mountain Reservoir 2 (CIP ID: WS-4)
- **Pump Station Improvements**: (see Table 7.9):
  - Lake Boulevard PS upgrade with a proposed capacity increase of 4,200 gpm and 100 HP (CIP ID: WPS-1).
  - Sleeping Indian PS upgrade with a proposed capacity increase of 1,000 gpm and 100 HP (CIP ID: WPS-2).
  - Morro Hills PS upgrade with a proposed capacity increase of 1,000 gpm and 100 HP (CIP ID: WPS-3).
  - New pipeline and PRV in lieu of the Mesa Loma PS upgrade to provide additional supply for MDD plus fire flow conditions within the Mesa Loma PZ (CIP IDs: WC-8 and WF-4).
  - New pipeline and PRV in lieu of Carey Road PS upgrade to provide additional supply for MDD plus fire flow conditions within the Poplar PZ (CIP IDs: WC-7 and WF-3).
  - A new pump station and a pump station upgrade to improve reliability, which are as follows:
    - New 500 HP Zone 800 PS to pump water from the new Zone 800 Reservoir (CIP ID: WPS-4).

- **Pipeline Age Replacements** (see Figure 7.9 and Table 7.10):
  - 144.3 miles of pipeline will have to be replaced or rehabilitated by 2050 (CIP IDs WRP-1 through WRP-15).
  - 4.0 miles of pipeline need a condition assessment and/or replacement right away as these pipes already reached their calculated end of useful life.
  - 4.1 miles of pipeline need replacement or rehabilitation before year 2020.
  - 51.0 miles of pipeline need replacement or rehabilitation between the years 2020 and 2039.
  - 89.2 miles of pipeline need replacement or rehabilitation between the years 2040 to 2049.
- **R&R – Other Facilities**:
  - Existing Reservoirs:
    - Structural Rehabilitation of all existing reservoirs (CIP ID: WRS-1).
    - Ongoing reservoir upgrades (CIP ID: WRS-2).
    - Installation of new water quality monitoring stations (WRS-3).
  - Existing Pump Stations:
    - Add back-up power at select sites (CIP ID: WRPS-1).
    - Ongoing pump station upgrades (CIP ID: WRPS-2).
  - WFP:
    - WFP improvement costs are identified in the City's CIP (CIP ID: WTP-1)
  - MBGPF:
    - Major improvement costs identified in the City's CIP (CIP IDs: MBP-1).

-This Page Left Blank Intentionally-

FUTURE SYSTEM EVALUATION

8.1 INTRODUCTION

The goal of the future system analysis is to evaluate the water distribution system under various operating conditions utilizing the evaluation criteria summarized in Chapter 6 and the future demand projections described in Chapter 3.

The following analyses are described in this section:

1. Water Supply Analysis
2. Hydraulic System Analysis
3. Transmission Main Capacity Analysis
4. Storage Analysis
5. Pump Station Analysis

The future system analysis was conducted with the water demand projected for year 2050. As listed on the following page in Table 8.1, the future ADD and MDD projected for year 2050 are 31 mgd and 57 mgd, respectively. The future demands were added to the existing demands in the potable water hydraulic model. It was assumed that all existing system improvements identified in Chapter 7 are installed for the future system analyses described below. The hydraulic model was then used for some of the future system analysis and sizing of improvement projects described in the following subsections. A hydraulic profile of the future water system facilities recommended in the chapter is presented on Figure 8.1. The recommended system improvements required to meet the evaluation criteria under future demand conditions are summarized at the end of this chapter.

8.2 WATER SUPPLY ANALYSIS

As discussed in Chapter 7, the City utilizes imported water as the main source of water supply to meet demands within the service area. In the future, the availability of imported water may be reduced as a result of increasing demands in the southwestern states, continuation of the severe drought conditions, and climate change impacts. The City is planning to continue to receive water supplies from SDCWA and groundwater from the Mission Basin Groundwater Purification Facility (MBGPF). In addition, the City is planning to expand its local water supply with Indirect Potable Reuse (IPR), which would provide approximately 4.5 mgd of new supply to the system if implemented, according to current assumptions of an ongoing feasibility analysis (RMC, 2014). For long term planning purposes, implementation of an Ocean Desalination project has also proposed in the past, which could further expand local water supplies. More details regarding the ongoing IPR project and Ocean Desalination are described in Sections 8.2.1 and 8.2.2, respectively.

8.2.1 Indirect Potable Reuse

At this time, the City is actively pursuing the expansion of its recycled water program through an IPR project to increase water supply reliability. It is the City's goal to have this IPR project produce approximately 5,000 afy (or 4.5 mgd) of the City's potable water supply, which would reduce the reliance on imported water. The City is currently conducting a feasibility analysis to analyze the site locations for this project.

If IPR is implemented, advanced treated water would be stored into the Mission Basin for groundwater recharge through the use of a combination of injection and extraction. The recharged recycled water would help replenish the local groundwater basin, which would later be extracted for potable water usage. The MBGPF would be utilized to treat the additional supply, which would be pumped into the distribution system of the Guajome pressure zone. It is anticipated that the IPR project will provide approximately 2,500 afy (or 2.25 mgd) of additional supply by 2020 and 5,000 (or 4.5 mgd) afy of additional supply by 2050.

Although the detailed layout and project development of this IPR project is beyond the scope of this Master Plan, a placeholder capital cost of $41 million was assumed for CIP planning purposes. This would roughly equate to an average unit cost of $1,000 per acre-foot, including $500 per acre-foot for operations and maintenance in 2015 dollars. The actual capacity, size, and location of the future IPR facilities, as well as feasibility level cost estimates, are being developed by the City as part of a separate endeavor.

8.2.2 Ocean Desalination

For future planning purposes, a seawater desalination plant is being considered, which was evaluated in further detail in the previous Master Plan (Carollo, 2008). This would decrease the dependence on imported water This program would investigate emerging technologies that could result in cost reductions needed to make seawater desalination cost competitive with other water sources available.

If seawater desalination is implemented, water would be extracted from the ocean by a series of wells near the mouth of the San Luis Rey River. The design of the wells would need to be such that drawdown of the Mission Basin is prevented to avoid drawdown effects on the other City wells. The operation of the seawater barrier would also need to be considered in this analysis. The seawater would then be pumped from the extraction wells to the MBGPF site where the seawater reverse osmosis plant would be constructed.

Table 8.1 Future Demands by Pressure Zone
Water Master Plan
City of Oceanside

Zone Name	Future ADD[1] (mgd)	Future MDD[2] (mgd)	Demand (% of total)
Arrowood	0.47	0.88	1.5%
Buddy Todd	0.26	0.48	0.8%
Darwin	0.24	0.45	0.8%
Fire Mountain	0.23	0.43	0.8%
Guajome	7.97	14.74	25.8%
Henie Hills	1.11	2.06	3.6%
Hutchinson	0.29	0.54	1.0%
Intermediate Henie Hills	0.04	0.08	0.1%
Laurel	0.02	0.03	0.0%
Leisure Hills	0.99	1.83	3.2%
Mesa Loma	0.30	0.56	1.0%
Montamar	0.12	0.21	0.4%
Morro Hills	0.26	0.49	0.9%
Morro Hills PS	0.32	0.60	1.0%
North River	0.48	0.89	1.6%
Ocean Village Regulated	0.00	0.01	<0.1%
Palmer	0.08	0.15	0.3%
Peacock Hills	1.86	3.45	6.0%
Peacock Hills Reduced	0.07	0.12	0.2%
Poplar	0.09	0.16	0.3%
Rivertree	0.09	0.17	0.3%
San Francisco Peak 2	0.46	0.85	1.5%
Talone	13.89	25.70	45.0%
Transmission	0.38	0.71	1.2%
Wilmont Ranch	0.16	0.29	0.5%
Wilshire	0.66	1.23	2.2%
Total	**30.86**	**57.10**	**100%**

Notes:
(1) Future demand projections based on assumptions listed in Chapter 3.
(2) Future ADD multiplied by MDD SPF of 1.85.

Although the detailed layout and project development of Ocean Desalination is beyond the scope of this Master Plan, it was assumed that the City implement a 5.0 mgd desalination plant with a net production capacity of 4.5 mgd in the long-term planning period (between 2020 and 2050). Due to the uncertainty of this project at this time, the location and supply connection with the water system are not depicted on any maps or the hydraulic profile. For planning purposes, a placeholder capital cost of $75 million is included in the assumed for CIP. This would roughly equate to an average unit cost of $1,800 per acre-foot, including $1,000 per acre-foot for operations and maintenance in 2015 dollars.

8.2.3 Supply Analysis

Based on the current capacity of the imported water supply sources, the MBGPF and the anticipated future local supply sources, the projected future ADD and MDD for year 2050 within the City can be met under normal operating conditions. This section presents an analysis of the City's water supply balance under future MDD conditions for the following ten outage scenarios described below. For all scenarios, it is assumed that the primary pressure zones that are supplied by the main connections would still be able to feed into the connected subzones that are at a lower hydraulic grade line (HGL) during an outage. The water supply balance for these ten outage scenarios are presented in Table 8.2. The scenarios include:

- Scenario 1 - CWA Aqueduct 3 Outage
- Scenario 2 - CWA Aqueduct 5 Outage
- Scenario 3 - CWA Aqueduct 4 Outage
- Scenario 4 – Tri Agencies Pipeline Outage (FCF-4)
- Scenario 5 – MBGPF Outage
- Scenario 7 – City Pipelines 2 and 3 Outage
- Scenario 8 – CWA 3, 4 and 5 Outage
- Scenario 9 – Ocean Desalination
- Scenario 10 – New TM for Added Capacity

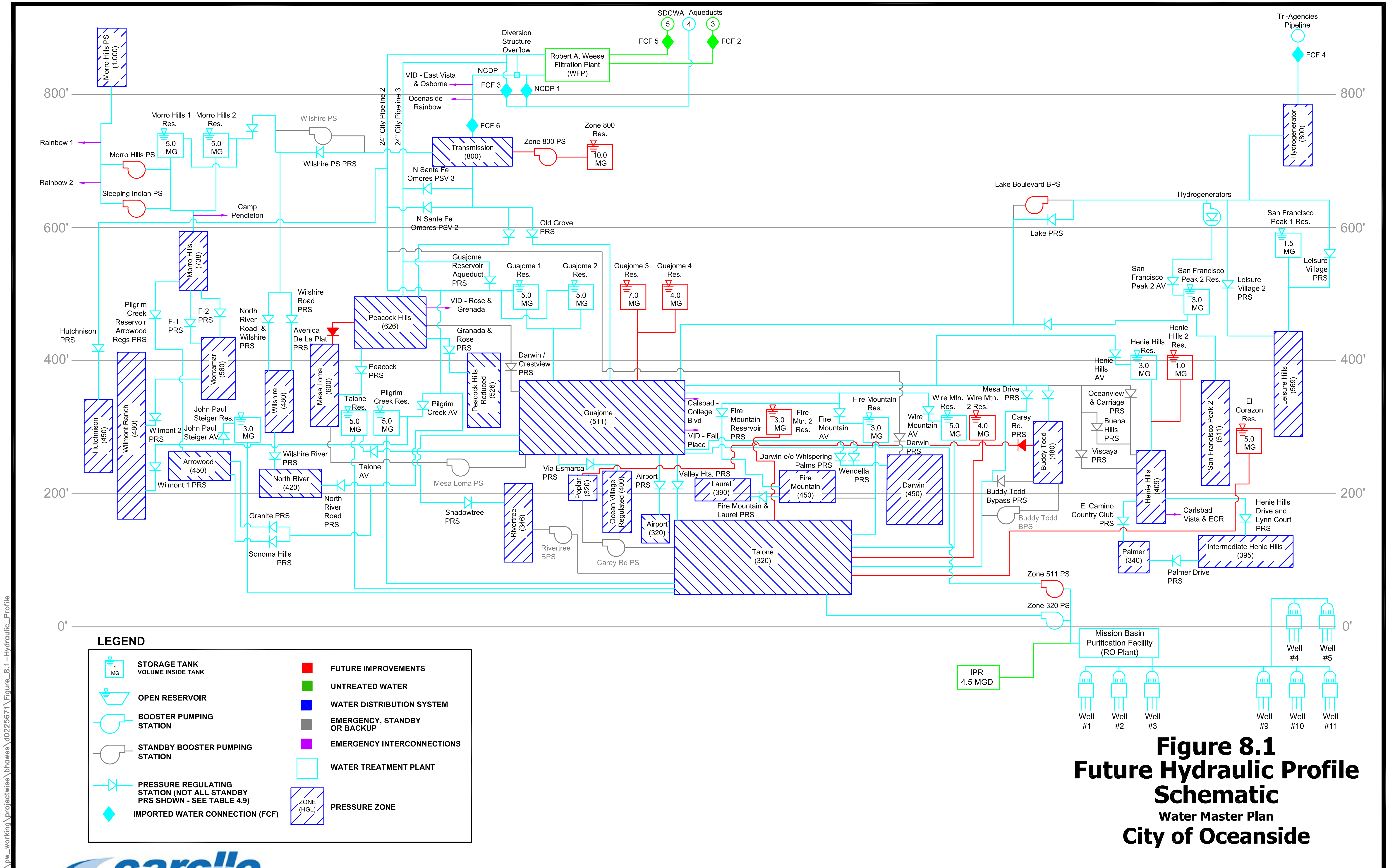


Figure 8.1
Future Hydraulic Profile Schematic

Water Master Plan

City of Oceanside

carollo

C:\pw_working\projectwise\bhowes\d0225671\Figure_8.1-Hydraulic_Profile

Table 8.2 Future Supply Analysis
Water Master Plan
City of Oceanside

		Assumptions					
Scenario No.	**Outage Scenario**	**Outage**	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)(1)**	**Balance (mgd)**
1	CWA Aqueduct 3 (untreated)	FCF-2	CWA 5 (untreated) to WFP(3) to FCF-6		25.0		
	(earthquake, pipeline		FCF-4 (tri-agencies pipeline)	11.6			
	failure or maintenance)		MBGPF(4)	4.5			
			CWA 4 (treated) to FCF-3 to two 24-inch pipelines(5)	25.2			
			IPR (future)(6)	4.5			
			Ocean Desal (future)	4.5			
		Total		***50.3***	***25.0***	***57.1***	***+18.2***
2	CWA Aqueduct 5 (untreated) (earthquake, pipeline	FCF-5	CWA 3 (untreated) to FCF-2 to WFP to two 24-inch pipelines		25.0		
	failure or maintenance)	FCF-3(2)	FCF-4 (tri-agencies pipeline)	11.6			
			MBGPF	4.5			
			CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
			IPR (future)	4.5			
			Ocean Desal (future)	4.5			
		Total		***65.4***	***25.0***	***57.1***	***+33.3***

Table 8.2 Future Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[(1)]**	**Balance (mgd)**
3	CWA Aqueduct 4 (treated)	FCF-3	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
	(earthquake, pipeline	NCDP-1	FCF-4 (tri-agencies pipeline)	11.6			
	failure or maintenance)		MBGPF	4.5			
			IPR (future)	4.5			
			Ocean Desal (future)	4.5			
		Total		***25.1***	***25.0***	***57.1***	***-7.0***
4	Tri-Agencies Pipeline (treated)	FCF-4	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
	(earthquake, pipeline		CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
	failure or maintenance)		MBGPF	4.5			
			IPR (future)	4.5			
			Ocean Desal (future)	4.5			
		Total		***53.8***	***25.0***	***57.1***	***+21.7***

Table 8.2 Future Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[(1)]**	**Balance (mgd)**
5	MBGPF (with IPR +Ocean Desal) (local earthquake, power outage or plant failure)	MBGPF	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
		IPR	CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
		Ocean Desal	FCF-4 (tri –agencies pipeline)	11.6			
		Total		***51.9***	***25.0***	***57.1***	***+19.8***
6	NCDP-1 (pipeline failure)	NCDP-1	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines or CWA 4 (treated) to FCF-3		25.0		
			FCF-4 (tri-agencies pipeline)	11.6			
			MBGPF	4.5			
			IPR (future)	4.5			
			Ocean Desal (future)	4.5			
		Total		***25.1***	***25.0***	***57.1***	***-7.0***

Table 8.2 Future Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[1]**	**Balance (mgd)**
7	City Pipelines 2 and 3 (local earthquake)	Pipeline 2	CWA 3 or 5 (untreated) to WFP to NCDP to FCF-6 (not in use due to capacity limitation of FCF-6		0		
		Pipeline 3	CWA 4 (treated) to NCDP-1 to FCF-6	40.3			
			FCF-4 (tri-agencies pipeline)	11.6			
			MBGPF	4.5			
			IPR (future)	4.5			
			Ocean Desal (future)	4.5			
		Total		***65.4***	***0.0***	***57.1***	***+3.8***
8	CWA Aqueducts 3, 4 & 5 (major earthquake)	FCF-2	FCF-4 (tri-agencies pipeline)	11.6			
		FCF-3	MBGPF	4.5			
		FCF-5	IPR (future)	4.5			
		FCF-6	Ocean Desal (future)	4.5			
		NCDP-1		0			
		Total		***25.1***		***57.1***	***-32.0***

Table 8.2 Future Supply Analysis
Water Master Plan
City of Oceanside

Scenario No.	Outage Scenario	Assumptions					
		Outage	**Connections In Service**	**Treated Supply (mgd)**	**Untreated Supply (mgd)**	**MDD (mgd)[1]**	**Balance (mgd)**
9	Ocean Desalination (plant failure)	Ocean Desal	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
			CWA 4 (treated) to NCDP-1	40.3			
			FCF-4 (tri –agencies pipeline)	11.6			
			MBGPF	4.5			
			IPR (future)	4.5			
		Total		***56.4***	***25.0***	***57.10***	***+28.8***
10	New TM (CIP ID: WC-13) (pipeline failure)	Ocean Desal	CWA 3 or 5 (untreated) to WFP to two 24-inch pipelines		25.0		
		IPR	CWA 4 (treated) to NCDP-1	40.3			
			FCF-4 (tri –agencies pipeline)	11.6			
			MBGPF	4.5			
		Total		***56.4***	***25.0***	***57.1***	***+24.3***

Notes:
(1) Existing demand includes 2012 ADD (24.9 mgd) multiplied by a peaking factor of 1.85.
(2) FCF-2 and FCF-5 cannot be used in combination.
(3) WFP has a total capacity of 25 mgd
(4) The permitted capacity of MBGPF is 6.3 mgd. However, the current operational capacity is approximately 4.5 mgd. With treatment plant upgrades, a reduction in constituents in wells, fully functional well sites and an increase in basin water levels water supply production could be maximized.
(5) The two 24-inch pipelines have a capacity of 25.2 mgd. The pipelines are labeled as City Pipeline 2 and City Pipeline 3 in Figure 8.2.
(6) The future IPR facilities are anticipated to provide approximately 2,500 afy (2.25 mgd) by 2020 and 5,000 afy (or 4.5 mgd) by 2050.

Scenario 1 - CWA Aqeduct 3 Outage: The untreated water supply from CWA 3 or flow control facility 2 (FCF-2) is out of service in this scenario. The remaining connections in service include:

- Untreated water from FCF-5, which is sent to the Weese Filtration Plant (WFP) for treatment. The treated water is then diverted through FCF-6 into the Transmission Zone.
- Treated water from the tri-agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from CWA 4 connection (or FCF-3), which is sent through the two 24-inch diameter City Pipelines that feed into Guajome Zone, Peacock Hills Zone and Hutchinson Zone.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 1 is 75.3 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 18.2 mgd in this scenario.

Scenario 2 - CWA Aqueduct 5 Outage: The untreated water supply from CWA 5 (or FCF-5) is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 connection (or FCF-2) is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated water from the tri-agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 2 is 90.4 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 33.3 mgd in this scenario.

Scenario 3 - CWA Aqueduct 4 Outage: The treated water from CWA 4 (or FCF-3) and the NCDP-1 pipeline is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 3 is 50.1 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply deficit of 7.0 mgd in this scenario.

Scenario 4 – Tri Agencies Pipeline Outage (FCF-4): The treated water from the tri agencies pipeline (or FCF-4) is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated Water from CWA 4 connection is diverted through the NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 4 is 78.8 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 21.7 mgd in this scenario.

Scenario 5 – MBGPF Outage: The treated water from the MBGPF is out of service along with the local supply from the IPR and Ocean Desalination projects in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone and Hutchinson Zone.

- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.

As shown in Table 8.2, the remaining supply capacity in Scenario 5 is 76.9 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 19.8 mgd in this scenario.

Scenario 6 – NCDP-1 Outage: The NCDP-1 pipeline diverting the treated water from the CWA 4 connection is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone. Another alternative would be to take the treated water from CWA 4 (or FCF-3) and divert it through the two 24-inch diameter City Pipelines in lieu of utilizing CWA 3 or CWA 5.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 6 is 50.1 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply deficit of 7.0 mgd in this scenario.

Scenario 7 – City Pipelines 2 and 3 Outage: The City Pipelines that divert treated water from the WFP and CWA 4 (or FCF-3) connection are out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connections are not in use due to the capacity limitation of FCF-6.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 7 is 60.9 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 3.8 mgd in this scenario.

Scenario 8 – CWA 3, 4 and 5 Outage: The main imported water connections CWA 3 (or FCF-2), CWA 4 (or FCF-3) and CWA 5 (FCF-5) are out of service in this scenario. The remaining connections in service include:

- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from IPR and Ocean Desalination would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 8 is 25.1 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply deficit of 32.0 mgd in this scenario.

Scenario 9 – Ocean Desalination Outage: The treated water from the Ocean Desalination Plant is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.
- Treated water from IPR would be fed from the MBGPF site into the Guajome Zone through a new 36-inch diameter transmission main (CIP ID: WC-13).

As shown in Table 8.2, the remaining supply capacity in Scenario 9 is 85.9 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 28.8 mgd in this scenario.

Scenario 10 –Transmission Main Outage (CIP ID: WC-13): The proposed 36-inch diameter pipeline diverting water from the Ocean Desalination Plant and the additional water supply from IPR is out of service in this scenario. The remaining connections in service include:

- Untreated water from the CWA 3 (or FCF-2) or CWA 5 (FCF-5) connection is sent to the WFP for treatment. The treated water is then diverted through the two 24-inch diameter City Pipelines, which feed into the Guajome Zone, Peacock Hills Zone, and Hutchinson Zone.
- Treated Water from CWA 4 connection is diverted through NCDP-1 and FCF-6, which feeds into the Transmission Zone.
- Treated water from the tri agencies pipeline (or FCF-4) connection, which feeds into the Hydrogenerator Zone.
- Treated water from MBGPF, which feeds into the Talone and Guajome Zones.

As shown in Table 8.2, the remaining supply capacity in Scenario 10 is 81.4 mgd, while the existing MDD is 57.1 mgd. Hence, there is a supply surplus of 24.3 mgd in this scenario.

8.2.4 Water Supply Balance Conclusion

As shown in Table 8.2, the City will have sufficient supply capacity to meet 100 percent of the future MDD under all but three scenarios. To help mitigate supply deficiencies, emergency storage can be utilized. The City's criteria for emergency storage is currently 100 percent of MDD; however, the City's future available emergency storage with existing deficiency improvements incorporated is approximately 54.5 MG. Under the following outage scenarios listed in Table 8.2, the deficiencies are as follows:

- In Scenario 3, the CWA Aqueduct (treated water) is out of service and the NCDP-1 is not utilized. The remaining five supply sources provide 50.1 mgd out of the 57.1 mgd of supply required, which creates a deficiency of 7.0 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions, 8 days of storage is available to offset supply deficiencies. Under MinDD conditions, a surplus of supply exists.
- In Scenario 6, the NCDP-1 is out of service. The remaining five supply sources provide 50.1 mgd out of the 57. 1 mgd of supply required, which creates a deficiency of 7.0 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions, 8 days of storage is available to offset supply deficiencies. Under MinDD conditions, a surplus of supply exists.
- In Scenario 8, CWA 3, 4 and 5 are out of service, which are the main imported water supply sources to the City. The remaining four supply sources provide 25.1 mgd out of the 57.1 mgd of supply required, which creates a deficiency of 32.0 mgd. To help mitigate the deficiency, emergency storage can be utilized. Under MDD conditions,

2 days of storage is available to offset supply deficiencies, respectively. Under MinDD conditions, a surplus of supply exists.

8.3 HYDRAULIC SYSTEM ANALYSIS

Based on the evaluation criteria listed in Chapter 6, the distribution system was evaluated under future demand conditions. The hydraulic model was used to identify pressure, velocity, transmission main, capacity, and fire flow deficiencies.

8.3.1 Pressure Analysis

The City's system pressures were evaluated using the hydraulic model to identify areas with maximum pressures above 80 psi for service laterals without pressure regulators and 150 psi for service laterals with pressure regulators. Minimum pressures below 40 psi under PHD and 20 psi under MDD and fire flow conditions were also analyzed. Based on the modeling analysis under 2050 ADD and MDD conditions, no new areas with either high or low pressure deficiencies were identified.

8.3.2 Pipeline Velocity Analysis

The hydraulic model was used to evaluate pipeline velocities in the future system with future system demands. It was concluded that the velocity deficiencies identified in Chapter 7 continued to occur, which are presented in Figure 7.1. Based on the pipeline age of velocity improvements WV-1, WV-2, and WV-4 pipelines, it is assumed that these pipelines may be replaced as part of the pipeline repair and rehabilitation effort. The combined length of these 3 projects is approximately 1 mile as listed in Table 7.5. However, the majority of the WV-3 pipeline would not reach the end of its useful life by 2050 and may require replacement in the long-term planning period.

8.3.3 Fire Flow Analysis

The hydraulic model was used to evaluate the conveyance capacity of the future distribution system to meet the fire flow requirements listed in Chapter 6 with a minimum residual pressure of 20 psi assuming that the City has implemented all existing system fire flow improvements listed in Chapter 7.

As the future system expansions in the hydraulic model is limited to a backbone system of new developments, no additional fire flow deficiencies and improvements were identified. It is also assumed that the distribution systems of the future developments will be adequately sized to the land use based fire flow criteria listed used in the Master Plan. Hence, no future fire flow improvements projects are recommended.

8.4 TRANSMISSION MAIN CAPACITY ANALYSIS

In addition to the transmission main improvements identified in Chapter 7, eight (8) new transmission mains with a combined length of nearly 8 miles are recommended to accommodate new developments and connect future system storage improvements. The recommended future transmission mains are presented on Figure 8.2 and described below.

8.4.1 WC-12 – Reservoir Connection TM for El Corazon Reservoir

This 24-inch diameter transmission main connects the proposed El Corazon Reservoir to the Talone Zone distribution system. The pipeline initiates at the El Corazon Reservoir site and is located along Mesa Drive, Mission Gate Drive and connects to a pipeline along Mission Avenue. For CIP planning purposes, the pipeline is estimated to be 9,800 feet (or 1.9 miles) in length.

8.4.2 WC-13 – IPR TM to Guajome Zone

This transmission main connects the expanded MBGPF to accommodate increased flows from the future IPR project that would supply 4.5 mgd to the Guajome Zone. The proposed 20-inch diameter pipeline would parallel the existing 16-inch diameter pipeline in Foussat Road since the MBGPF Zone 511 Pump Station is predicted to experience excessive headloss with the addition of 4.5 mgd. Velocities and associated headloss in the 24-inch diameter pipeline in Foussat Road were not predicted to be excessive. This likely occurred because of the large filling demand of Wire Mountain Reservoir northwest of the point of connection, splitting flow in two directions in the 24-inch diameter pipeline. The pipeline initiates at the MBGPF and is located along Foussat Road and extends into the Guajome Zone. For CIP planning purposes, the pipeline is estimated to be 1,800 feet (or 0.3 miles) in length.

8.4.3 WC-14 – Reservoir Connection TM for Guajome 2 Reservoir

This 24-inch diameter transmission main connects the Guajome 2 Reservoir to the adjacent WC-2 TM along San Luis Rey Avenue. For CIP planning purposes, the pipeline is estimated to be 500 feet (or 0.1 miles) in length.

8.4.4 WC-15 – Reservoir Connection TM for Henie Hills Reservoir 2

This 12-inch diameter transmission main connects the Henie Hills Reservoir 2 to the Henie Hills Zone. For CIP planning purposes, the pipeline is estimated to be 500 feet (or 0.1 miles) in length.

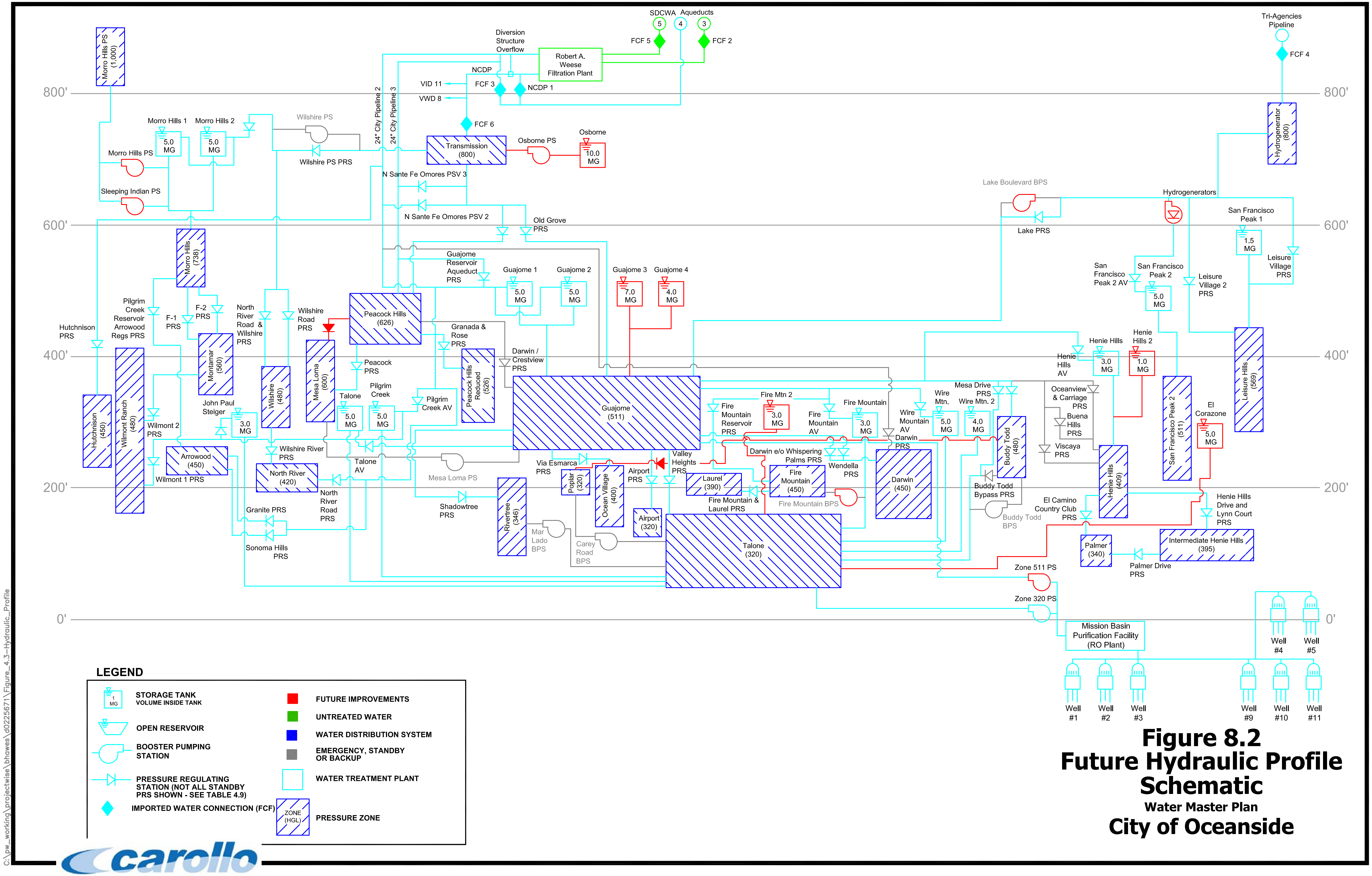


Figure 8.2
Future Hydraulic Profile Schematic

Water Master Plan

City of Oceanside

8.4.5 DEV-1 – El Corazon Development

This 12-inch diameter transmission main connects the future El Corazon Development to the future El Corazon Reservoir transmission main, which ties into an existing pipeline along Ocean Boulevard and El Camino Real. As the future system in the hydraulic model is limited to a backbone system, no additional pipelines were identified. For CIP planning purposes, the pipeline is estimated to be 15,400 feet (or 2.9 miles) in length.

8.4.6 DEV-2 – Ocean Pointe Development

This 12-inch diameter transmission main connects the future Ocean Pointe Development to the existing distribution system within the Guajome Zone along San Ramon Drive. As the future system in the hydraulic model is limited to a backbone system, no additional pipelines were identified. For CIP planning purposes, the pipeline is estimated to be 1,100 feet (0.2 miles) in length.

8.4.7 DEV-3 – Spring Creek Development

This 12-inch diameter transmission main connects future developments to the existing distribution system within the northeastern portion of the Talone Zone just north of Highway 76. As the future system in the hydraulic model is limited to a backbone system, no additional pipelines were identified. For CIP planning purposes, the pipeline is estimated to be 10,500 feet (or 2.0 miles) in length.

8.4.8 DEV-4 – Pacific Coast Business Park Development

This 12-inch diameter transmission main connects future developments to the existing distribution system within the Peacock Hills Zone. As the future system in the hydraulic model is limited to a backbone system, no additional pipelines were identified. For CIP planning purposes, the pipeline is estimated to be 1,000 feet (or 0.2 miles) in length.

8.5 STORAGE ANALYSIS

With the implementation of the improvements recommended in Chapter 7, the distribution system would contain sixteen (16) storage reservoirs with a total storage volume of 75.5 MG. A summary of the required and available storage volumes under future demand conditions is presented in Table 8.3. As noted in the existing system analysis discussion, the City’s distribution system includes significant connectivity between pressure zones due to the presence of 54 PRSs. Therefore, surplus storage in the City’s upper pressure zones can often count towards the storage deficit in lower pressure zones, if gravity flow through PRS is available.

Table 8.3 Future Storage Analysis
Water Master Plan
City of Oceanside

Pressure Zone	Future MDD (mgd)	Required Storage (MG)	Available Storage(1) (MG)	Zone Balance (MG)	Proposed Facility	Proposed Capacity (MG)	PZ Group Balance with New Storage (MG)
Morro Hills PZ Group							
Arrowood	0.88	1.10	0.0	-1.1			
Hutchinson	0.54	0.68	0.0	-0.7			
Montamar	0.21	0.27	0.0	-0.3			
Morro Hills	0.49	1.57	10.0	+8.4			
Morro Hills PS	0.60	0.74	0.0	-0.7			
Wilmont Ranch	0.29	0.36	0.0	-0.4			
Subtotal Morro Hills PZ Group	***3.01***	***4.72***	***10.00***	***5.28***	***N/A***	***0.0***	***+5.28***
Guajome PZ Group							
Buddy Todd	0.48	0.60	0.0	-0.6			
Darwin	0.45	0.57	0.0	-0.6			
Guajome	14.74	19.39	17.0	-2.4	Guajome Res 4	4.0	
Ocean Village Regulated	0.02	0.03	0.0	-0.0			
Rivertree	0.17	0.22	0.0	-0.2			
Subtotal Guajome PZ Group	***15.87***	***20.80***	***17.00***	***-3.80***		***4.0***	***+0.20***
Talone PZ Group							
Fire Mountain	0.43	0.54	0.0	-0.5			
Laurel	0.03	0.03	0.0	-0.0			
Talone (includes Poplar)	25.86	33.28	29.0	-4.3	El Corazon Res	5.0	
Subtotal Talone PZ Group	***26.31***	***33.85***	***29.00***	***-4.85***	***N/A***	***5.0***	***+0.15***

Table 8.3 Future Storage Analysis
Water Master Plan
City of Oceanside

Pressure Zone	Future MDD (mgd)	Required Storage (MG)	Available Storage[1] (MG)	Zone Balance (MG)	Proposed Facility	Proposed Capacity (MG)	PZ Group Balance with New Storage (MG)
Henie Hills PZ Group							
Henie Hills	2.06	3.53	3.0	-0.5	Henie Hills Res 2	1.0	
Intermediate Henie Hills	0.08	0.10	0.0	-0.1			
Palmer	0.15	0.18	0.0	-0.2			
Subtotal Henie Hills PZ Group	***2.28***	***3.82***	***3.00***	***-0.82***	***N/A***	***1.0***	***+0.18***
San Francisco Peak 2 PZ Group							
San Francisco Peak 2	0.85	2.02	5.0	+3.0			
Subtotal San Francisco Peak 2 PZ Group	***0.85***	***2.02***	***5.00***	***2.98***	***N/A***	***0.0***	***+2.98***
Leisure Hills PZ Group							
Leisure Hills	1.83	3.25	1.5	-1.8			
Subtotal Leisure Hills PZ Group	***1.83***	***3.25***	***1.50***	***-1.75***	***N/A***	***0.0***	***-1.75***
FCF 6 PZ Group							
Mesa Loma	0.56	0.70	0.0	-0.7			
North River	0.89	1.12	0.0	-1.1			
Peacock Hills	3.45	4.31	0.0	-4.3			
Peacock Hills Reduced	0.12	0.15	0.0	-0.2			
Transmission	0.71	1.84	10.0	+8.2			
Wilshire	1.23	1.54	0.0	-1.5			
Subtotal FCF 6 PZ Group	***6.95***	***9.65***	***10.00***	***0.35***	***N/A***	***0.0***	***+0.35***
Total	**57.11**	**78.11**	**75.50**	**-10.88**	**N/A**	**10.0**	**-1.75**

Note:
(1) Includes Near-Term improvements per Table 7.8.

A summary of the required and available storage volumes is presented in Table 8.3, while details of this analysis are presented in Appendix F. As shown in Table 8.3, the future storage analysis demonstrates that the City would have a storage deficit of approximately 11 MG if no additional improvements were implemented in the long-term planning period. The deficiencies and recommended storage improvements are as follows (see Figure 8.2 and Figure 8.1):

- The Guajome PZ group contains the zones Buddy Todd, Darwin, Guajome, Ocean Village Regulated and Rivertree. With a combined demand of 15.87 mgd, the required storage is 20.80 MG. However, only 17 MG is currently available resulting in a storage deficit of 3.80 MG. To resolve this deficit, a new 4 MG storage tank (Guajome 4 Reservoir) is proposed at a parcel east of San Luis Rey Avenue, which is northeast of the Guajome Zone. With this improvement in place, there is a 0.20 MG storage surplus under future demand conditions in the Guajome PZ group. Based on the ratio of existing versus future customer benefit, 11 percent of the proposed reservoir capacity is allocated to future users.
- The Talone PZ group contains the zones Fire Mountain, Laurel, Poplar, and Talone. With a combined demand of 26.31 mgd, the required storage is 33.85 MG. However, only 29.00 MG is currently available resulting in a storage deficit of 4.85 MG. To resolve this deficit, a new 5 MG storage tank (El Corazon) is proposed on Mesa Drive, West of Pacifica Way. With this improvement in place, there is a 0.15 MG storage surplus under future demand conditions in the Talone PZ group. Since this reservoir would primarily serve a future development, 100 percent of the proposed reservoir capacity is allocated to future users.
- The Henie Hills PZ group contains the zones Henie Hills, Intermediate Henie Hills, and Palmer. With a combined demand of 2.28 mgd, the required storage is 3.82 MG. However, only 3.00 MG is currently available resulting in a storage deficit of 0.82 MG. To resolve this deficit, a new 1 MG storage tank (Henie Hills 2) is proposed. Based on the ratio of existing versus future customer benefit, 80 percent of the proposed reservoir capacity is allocated to future users. The Leisure Hills PZ is the only pressure zone within this pressure zone group. With a combined demand of 1.83 mgd, the required storage is 3.25 MG. However, only 1.50 MG is currently available resulting in a storage deficit of 1.75 MG. To resolve this deficit, the surplus storage within the San Francisco Park 2 pressure can be utilized, which requires the Lake Boulevard pump station upgrade to move water from the San Francisco Peak 2 Reservoir to the Leisure Hills Zone.
- The FCF-6 PZ group contains the zones Mesa Loma, North River, Peacock Hills, Peacock Hills Reduced, Transmission, and Wilshire. With a combined demand of 6.95 mgd, the required storage is 9.65 MG. However, 10 MG of storage is available within the FCF-6 resulting in a storage surplus of 0.35 MG. Based on the ratio of

existing versus future customer benefit, 27 percent of the proposed reservoir capacity is allocated to future users.

As shown in Table 8.3, there are not any storage deficiencies or improvements identified for the Morro Hills and San Francisco Peak 2 pressure zone groups.

8.6 PUMP STATION ANALYSIS

With the implementation of the improvements recommended in Chapter 7, the distribution system would contain 10 pump stations (PS) with a combined capacity of nearly 22,030 gpm (or 31.7 mgd). A summary of the required and available pump station capacities is presented in Table 8.4, while details are presented in Appendix G. Based on the analysis described in Chapter 7, recommendations were made to upgrade and add pump stations to the system to mitigate existing system deficiencies or provide supply reliability. A percentage of the existing capacity upgrades included future user benefit, which is discussed below. As shown in Table 8.4, the future pump station analysis demonstrates that one pump station upgrade is recommended to provide additional supply reliability to the Guajome Zone. The recommended improvements are as follows (Figure 8.1 and Figure 8.2):

- **Gravity Fed Zone through PRS without Gravity Storage:** There are four existing pump stations within this category, which include the Buddy Todd PS, Fire Mountain PS, Rivertree (Mar Lado) PS and the Lake Boulevard (SF Peak) PS. With the existing system improvements from Chapter 7 incorporated into the future pump station analysis, the four pump stations within this category are sufficient to meet future demands. The existing versus future user benefit for the improvements include:
  - The Lake Boulevard PS has a current capacity of 6,000 gpm, which satisfies the future capacity requirement of 5,951 gpm. Based on the projected growth within the City's service area, 10 percent of the proposed pump station capacity is allocated for future user benefit.
  - As shown in Table 8.4, there are no pump station deficiencies or improvements identified for the Buddy Todd PS and the Rivertree (Mar Lado) PS. The Fire Mountain PS is currently non-operational and is planned for abandonment by the City within the near future.
- **Pumped Zone without Gravity Storage and Redundant Supply Source:** There are two existing pump stations within this category, which include the Sleeping Indian PS and the Morro Hills PS. Since the existing demands remain relatively unchanged in the future, there is not a future user benefit associated with the proposed PS upgrades.

Table 8.4 Future Pump Station Analysis
Water Master Plan
City of Oceanside

Discharge Pressure Zone	Existing Pump Station(s)[1,2]	Existing Capacity (gpm)	Future MDD (gpm)	Total Required Capacity (gpm)	Future Capacity Balance (gpm)	Proposed Pump Station	Proposed PS Capacity (gpm)	Proposed PS Capacity (hp)
Gravity Fed Zone through PRS without Gravity Storage								
Buddy Todd	Buddy Todd PS	1,200	347	604	596			
Fire Mountain	Fire Mountain PS	320	309	N/A	N/A	*City to Abandon*		
Rivertree	Rivertree (Mar Lado) PS	1,435	132	218	1,217			
San Francisco Peak 1	Lake Blvd (SF Peak) PS	6,000	1,884	5,951	49			
Pumped Zone without Gravity Storage and Redundant Supply Source								
Morro Hills PS	Sleeping Indian PS	2,600	424	2,537	63			
Morro Hills PS	Morro Hills PS	1,900	424	1,887	13			
Back-Up								
Transmission	Wilshire PS	2,250	502	1,991	259			
Pumped Zone without Gravity Storage and Single Supply Source								
Mesa Loma	Mesa Loma PS	700	398	4,397	-3,687	*New PRS & Pipeline to Convey FF in lieu of PS Upgrade (CIP ID WC-8 & WF-4)*		
Poplar	Carey Road (Poplar Ridge) PS	625	121	4,110	-3,485	*New PRS & Pipeline to Convey FF in lieu of PS Upgrade (CIP ID WC 7 & WF-3)*		
Reliability								
Guajome	Zone 800 PS	5,000		5,000	0			
Guajome				6,000	-6,000	IPR (future)	5*1,200 gpm	540
Total	**N/A**	**22,030**	**N/A**	**32,685**	**-10,975**	**N/A**	**6,000**	**540**

Notes:
(1) Includes recommended improvements from Chapter 7. The detailed pump station evaluation is included in Appendix G.
(2) A hydroelectric PS is located within the Leisure Hills Zone. However, the PS is only operated under emergency conditions, which is very undesirable.

- **Pumped Zone without Gravity Storage and Single Supply Source:** There are two pump stations within this category, which include the Mesa Loma PS and the Carey Road (Poplar Ridge) PS. It is assumed that deficiencies were mitigated with the two proposed PRSs (WF-3 and WF-4) and pipelines (WC-7 and WC-8) that would convey fire flow demands to both the Mesa Loma PZ and Poplar PZ from upper zones in lieu of upgrading the existing pump stations.
- **Back-Up Pump Stations:** The Wilshire PS is not typically operated. Its capacity is currently sufficient to meet the needs of the City. Hence, no improvements are recommended for this PS.
- **Reliability Pump Stations:** There are two pump stations within this category, which include the Zone 800 PS and the MBGPF PS expansion for the IPR project.
  - The Zone 800 PS was initially sized at 500 HP with a capacity of 5,000 gpm to meet both existing and future demands. Based upon the storage analysis described in Section 8.5, approximately 27 percent of the capacity of the pump station would be for future user benefit.
  - A pump station upgrade has been added to this category for the future IPR project. This 540 HP pump station upgrade at the MBGPF is intended to have a capacity of 6,000 gpm to accommodate 4.5 mgd of additional flow from IPR. The exact sizing would be dependent upon the availability of water for IPR. Based on the ratio of existing versus future user benefit, 20 percent of the 511 PS upgrade is allocated for future user benefit.

8.7 SUMMARY OF RECOMMENDATIONS

The recommendations identified in this chapter are summarized in this section. Detailed cost estimates for each of these recommendations are included in the CIP of this Master Plan (see Chapter 9). Based on the analysis of the water system under future demand conditions, the following improvements are proposed:

- **Transmission Main Capacity Improvements**
  - 5.3 miles of 12-inch diameter pipeline to connect future developments to the system (CIP IDs: DEV-1, DEV-2, DEV-3, and DEV-4).
  - 2.4 miles of pipeline ranging in diameter from 12-inch to 24-inch to connect new facilities and accommodate facility upgrades within the system (WC-12, WC-13, WC-14 and WC-15).
- **Storage Improvements** (see Table 8.3):
  - 3 new reservoirs with a combined capacity of 10 MG are proposed to mitigate future deficiencies in storage, which are as follows:
    - 4.0 MG Guajome Reservoir 4 (CIP ID: WS-7)
    - 5.0 MG El Corazon Reservoir (CIP ID: WS-5)

        - 1.0 MG Henie Hills Reservoir 2 (CIP ID: WS-6)

- **Pump Station Improvements**: (see Table 8.3):
  - MBGPF pump station upgrade for to accommodate the future IPR flow with a proposed capacity increase of 6,000 gpm and 540 HP (CIP ID: WPS-5).
- **Future IPR Facilities** (CIP ID: WO-6 and WO-7):
  - Based on discussions with City staff, the IPR project would provide approximately 2,500 afy of supply by 2020 and approximately 5,000 afy of supply by 2050. The estimated costs are included in Chapter 9.
- **Future Ocean Desalination Facilities** (CIP ID: WO-3):
  - To provide additional supply reliability, ocean desalination facilities are included, which would provide approximately 5,000 afy by 2050. The estimated costs for the future facilities are included in Chapter 9.

CAPITAL IMPROVEMENT PLAN

This chapter presents the recommended capital improvement plan (CIP) for the City's water system and a summary of the capital costs. The proposed CIP presents improvements based on the water system evaluations described in Chapters 7 and 8 of this Water Master Plan (WMP). The planning horizon of this master plan is year 2050. This CIP is divided into two phases, the near-term CIP through year 2020, and a long-term CIP for the remaining 30-year period.

9.1 PROJECT PRIORITIZATION

The capital projects identified are sized to meet the water system evaluation criteria discussed in Chapter 6 under the projected water demands for year 2050. The improvement projects were divided into the following project categories:

- Water System Capacity Improvements
  - Transmission Mains
  - Fire Flow Improvements
  - Pressure Regulating Stations
  - Booster Pumping Stations
  - Storage Reservoirs
- Repair and Rehabilitation Projects
  - Distribution System Pipelines
  - Storage Reservoirs
  - Booster Pump Stations
  - Pressure Regulating Stations
  - Weese Filtration Plant Improvements
  - MBGPF Improvements
- Other CIP Items

Within each category, each improvement project was prioritized as either a "near-term" or "long-term" project. Near-term projects are targeted for implementation by year 2020. For capacity improvements, majority of "existing" improvements are categorized as near-term Improvements, which was based on the proposed significance or level of deficiency. Long-term projects are targeted for implementation between year 2021 and 2050.

In general, the following project prioritization considerations were used when deciding if a project should be categorized as near-term or long-term improvement project:

- Small Diameter Pipeline Replacements (4-inch and 6-inch) were given a high priority and were primarily scheduled as near-term confirm the City's budget
- Storage reservoirs and associated transmission mains were initially phased based on the forecasted demands. Project improvements addressing existing system deficiencies were initially included the near-term CIP, while the new storage reservoirs required for growth were included in the long-term CIP. However, to avoid large upfront expenditures before year 2020, all storage projects were phased in the long-term CIP. As it would take several years to purchase land, design, and bid the project, it is also unlikely that the majority of these project costs that are associated with the construction phase would be incurred by the City before year 2020.
- Fire flow improvements were phased based on priority. All Priority 1 improvements address deficiencies where the available fire flow is less than 60 percent of the required flow or impacting a school site. These Priority 1 project were included in the near-term CIP, while all remaining fire flow improvements were categorized as Priority 2 and included in the long-term CIP.
- PRS projects addressing existing system deficiencies were included the near-term CIP, while the PRS for the future El Corozon reservoir was included in the long-term CIP.
- Pipeline replacements due to age were prioritized based on the estimated end-of-useful life (EUL). Pipelines that will reach their EUL by 2020 are included in the near-term CIP, while pipelines that are predicted to reach their EUL between 2021 and 2020 are included in the long-term CIP.
- Water facility rehabilitation projects were phased based on the City's CIP Budget provided in January 2015, with the exception of long-term R&R that are categorized as on-going improvements.
- Other CIP projects that are currently on-going, such as the SCADA upgrade and IPR feasibility study, are included in the near-term CIP. The expansion of the MBGPF, the IPR wells, and the Ocean Desalination Plant are all included in the long-term CIP.

9.2 CAPITAL IMPROVEMENT PROJECT COSTS

The capacity upgrades set the foundation for the City's related water system CIP. The cost estimates presented in this study are opinions developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo Engineers, Inc. (Carollo) experience on other projects. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) 10,756 (Los Angeles, December 2014).

9.3 COST ESTIMATING ACCURACY

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. 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.

The Association for the Advancement of Cost Engineering (AACE) defines an Order of Magnitude Estimate, deemed appropriate for master plan studies, as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within plus 50 percent to minus 30 percent. This section presents the assumptions used in developing order of magnitude cost estimates for recommended facilities.

9.4 CONSTRUCTION UNIT COSTS

The construction costs are representative of water system facilities under normal construction conditions and schedules. Costs have been estimated for public works construction.

9.4.1 Pipeline Unit Costs

New transmission mains and pipeline improvements range in size from 8-inches to 42-inches in diameter in this WMP. Unit costs for the construction of pipelines are shown in Table 9.1. The construction cost estimates are based upon these unit costs. The unit costs are for “typical” field conditions with construction in stable soil at a depth ranging between 10 feet to 15 feet.

9.4.2 Pump Station Unit Costs

This Master Plan includes pump station improvement projects, projects to increase the pumping capacity and projects associated with rehabilitation of the pump stations for the next 35 years. The estimated costs for projects to increase the pumping capacity assume upgrades to the existing facility. Costs were generated by inputting the appropriate capacity and calculating the corresponding construction costs. Unit costs are shown in Table 9.2.

Table 9.1 Unit Construction Costs - Pipelines Water Master Plan City of Oceanside	
Pipe Size (inches)	**Unit Construction Cost[(1)] ($/LF)**
Potable Water Mains	**New Construction**
4"	$105
6"	$160
8"	$170
10"	$210
12"	$220
16"	$295
18"	$330
20"	$370
24"	$420
30"	$440
36"	$525
42"	$630
48"	$695

Note:
(1) Costs are based on ENR CCI 10,756 (Los Angeles, December 2014)

Table 9.2 Unit Construction Costs – Pump Stations Water Master Plan City of Oceanside	
Station Size (HP)	**Unit Construction Cost ($/HP)**
100 hp	$5,000
200 hp	$4,000
250 hp	$4,000
300 hp	$4,000
350 hp	$3,000
400 hp	$3,000
500 hp	$3,000
650 hp	$3,000
700 hp	$2,000
750 hp and larger	$2,000
Backup Power Generator	$250,000 per PS
Pump Station Upgrade[(1)]	$5,300,000 (Lump Sum)

Note:
(1) Based on the City's CIP Budget.

9.4.3 Pressure Regulating Station Unit Costs

The recommended pressure regulating stations proposed for this WMP were based on proposed projects to improve headloss and provide supply reliability by installing additional pipeline connections with PRSs to feed lower zones. Unit costs are shown in Table 9.3.

Table 9.3 Unit Construction Costs – Pressure Regulating Stations
Water Master Plan
City of Oceanside

Type	Unit Construction Cost ($/PRS)
Small (1-2 valves <8")	$100,000
Medium (2-3 valves 8" and up)	$200,000
Large (3-4 valves 12" and up)	$300,000
Ongoing Rehab and Repair	$75,000/Year

9.4.4 Storage Reservoirs Unit Costs

Storage improvement projects for this WMP were suggested to improve capacity deficiencies in the existing and future distribution system. Other rehab and repair projects were also suggested to assist in structural rehabilitation of existing reservoirs, to add water quality monitoring sites and to perform ongoing maintenance for the next 35 years. Unit costs are shown in Table 9.4.

Table 9.4 Unit Construction Costs – Reservoir Storage
Comprehensive Facilities Master Plan
Padre Dam Municipal Water District

Volume (MG)	Unit Construction Cost ($/MG)
<1	$2.00
1 to 3	$1.50
3 to 5	$1.25
5 to 10	$1.00
Structural Rehab and Repair(1)	$22,927,000 (Lump Sum)
Water Quality Monitoring Sites	$50,000 per Site
Reservoir Upgrades(1)	$16,576,000 (Lump Sum)

Note:
(1) Based on the City's CIP Budget.

9.4.5 Other CIP Costs

In addition to the unit costs listed above, improvement projects are proposed for the Weese Filtration Plant, the MBGPF treatment facilities, and other projects. The estimated cost were obtained from the City's CIP Budget provided in January 2015 and are listed in Table 9.5.

Table 9.5 Other CIP Costs
Water Master Plan
City of Oceanside

Project Description	Capital Costs ($ million)[1]
Weese Filtration Plant Improvements	$12.0
MBGFP - Major Plant Upgrades	$6.0
MBGFP - Plant Expansion (for IPR)	$30.0
IPR - Injection Wells - Phase 1	$11.0
SCADA System	$2.5
Ocean Desalination Study	$0.5
Ocean Desalination Facility[2]	$75.0
IPR Feasibility Study	$0.7
IPR Feasibility IPR/PDR	$1.0

Notes:
(1) Rounded values based on City's CIP budget (January 2015).
(2) Estimated future project costs.

9.5 PROJECT COSTS AND CONTINGENCIES

Project cost estimates are calculated based on elements, such as the project location, size, length, land acquisition needs, and other factors. Allowances for project contingencies consistent with an "Order of Magnitude" estimate are also included in the project costs prepared as part of this study, as outlined in this section.

9.5.1 Baseline Construction Cost

This is the total estimated construction cost, in dollars, of the proposed improvement projects. Baseline construction costs were calculated by multiplying the estimated number of units by the unit cost, such as length of pipeline times the average cost per lineal foot of pipeline. The majority of unit construction cost used for this WMP is presented in Section 9.4.

9.5.2 Estimated Construction Cost

Contingency costs must be reviewed on a case-by-case basis because they will vary considerably with each project. Consequently, it is appropriate to allow for uncertainties associated with the preliminary layout of a project. Such factors as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are a few of the items that can increase project costs for which it is wise to make allowances in preliminary estimates. To assist the City in making financial decisions for these future construction projects, contingency costs will be added to the planning budget as percentages of the total construction cost, divided into two categories: Estimated Construction Cost and Capital Improvement Cost.

Since knowledge about site-specific conditions of each proposed project is limited at the master planning stage, a 30 percent contingency was applied to the Baseline Construction Cost to account for unforeseen events and unknown conditions. This contingency accounts for unknown site conditions such as poor soils, unforeseen conditions, environmental mitigations, and other unknowns and is typical for master planning projects. The Estimated Construction Cost for the proposed water system improvement consists of the Baseline Construction Cost plus the 30 percent construction contingency.

9.5.3 Capital Improvement Cost

Other project construction contingency costs include costs associated with project engineering, construction phase professional services, and project administration. Engineering services associated with new facilities include preliminary investigations and reports, Right of Way (ROW) acquisition, foundation explorations, preparation of drawings and specifications during construction, surveying and staking, sampling of testing material, and start-up services. Construction phase professional services cover such items as construction management, engineering services, materials testing, and inspection during construction. Finally, there are project administration costs, which cover such items as legal fees, environmental/California Environmental Quality Act (CEQA) compliance requirements, financing expenses, administrative costs, and interest during construction.

The cost of these items can vary, but for the purpose of this study, it is assumed that the other project contingency costs will equal approximately 27.5 percent of the Estimated Construction Cost.

As shown in the following sample calculation of the capital improvement cost, the total cost of all project construction contingencies (construction, engineering services, construction management, and project administration) is 65.8 percent of the baseline construction cost. Calculation of the 65.8 percent is the overall mark-up on the baseline construction cost to arrive at the capital improvement cost. It is not an additional contingency.

Example:

Baseline Construction Cost	**$1,000,000**
Construction Contingency (30%)	$300,000
Estimated Construction Cost	**$1,300,000**
Engineering Cost (10%)	130,000
Construction Management (10%)	130,000
Project Administration (7.5%)	$97,500
Capital Improvement Cost	**$1,657,500**

A summary of the capital project costs is presented in Table 9.6. This table identifies the projects, provides a brief description of the project, identifies facility size (e.g., pipe diameter and length), and the capital improvement cost. The table also shows the phase in which the project has been targeted for implementation. The implementation timeframe was based on the priority of each project to correct existing deficiencies or to serve future users.

9.5.4 Capital Improvement Implementation

The proposed capital improvements are prioritized based on their urgency to mitigate existing deficiencies and condition issues and for servicing future growth. The implementation phases are separated into two phases, near-term and long-term. As mentioned previously, the near-term phase extends from 2015 through 2020, while the long-term phase begins in 2021 and continues until 2050. The location and phasing of the proposed CIP projects is shown on Figure 9.1.

Each project is itemized by phase in Table 9.6, which is summarized by facility type and planning phase in Table 9.7. As shown in Table 9.7, the total estimated CIP cost is $622.4 million, with $102.8 million allocated in the near-term planning period and $519.6 million in the long-term planning period. This equates to about $17.8 million per year.

Table 9.6 Water System Capital Improvement Program
Water Master Plan
City of Oceanside

Improv. ID	Facility Type	Type of Improvement	Project Description	Description/ Street	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost(2),(3) ($)	Phasing: Phase 1 Near Term 2015-2020 ($)	Phase 2 Long Term 2021-2050 ($)	Future Users Benefit (%)	Reimbursement Category: Existing Improvements ($)	Future Improvements ($)
Water System Capacity Improvements																
Transmission Mains																
DEV-1	Pipe	Capacity	El Corazon Development	In vacant lot to the north of Ocenside Blvd. and the east of El Camino Real. In Guajome Zone.	n/a	12"	New	15,400	$ 220	$ 3,388,000	$ 5,616,000		$ 5,616,000	100%	$ -	$ 5,616,000
DEV-2	Pipe	Capacity	Ocean Pointe Development	From the east end of the 10" pipe on San Ramone Dr.; south to tie into the 14" pipe between the end of Vista Bella and S St. In Guajome Zone.	n/a	12"	New	1,100	$ 220	$ 242,000	$ 401,000		$ 401,000	100%	$ -	$ 401,000
DEV-3	Pipe	Capacity	Spring Creek Development	In vacant land to the north of Mission Highway Ave. and east of Melrose Dr. In Talone Zone.	n/a	12"	New	10,500	$ 220	$ 2,310,000	$ 3,829,000		$ 3,829,000	100%	$ -	$ 3,829,000
DEV-4	Pipe	Capacity	Pacific Coast Business Park Development	From the 10" pipe on the corner of Meadowbrock Dr. and Eastview Ct.; to the east into the vacant lot. In the Peacock Hills Zone.	n/a	12"	New	1,000	$ 220	$ 220,000	$ 365,000		$ 365,000	100%	$ -	$ 365,000
WC-1	Pipe	Capacity	Osborne Reservoir TM	Onsite piping at new 10 MG Storage for Zone 800 and below (Osborne Site at 350 ft msl)	n/a	36"	New (on-site piping)	1,000	$ 525	$ 525,000	$ 870,000		$ 870,000	20%	$ 696,000	$ 174,000
WC-2	Pipe	Capacity	Guajome Reservoirs TM	2.3 miles of 36" Transmission main to new 4 MG and 7 MG Storage Reservoirs in Zone 511 (Guajome)	n/a	36"	New (TM to site)	12,300	$ 525	$ 6,458,000	$ 10,704,000		$ 10,704,000	79%	$ 2,247,800	$ 8,456,200
WC-3	Pipe	Capacity	Fire Mountain Reservoir 2 TM	1 mile of 24" Transmission main upgrade to Fire Mountain Reservoir 2 Site (3+4 MG) for Zone 320 (Talone)	18"	24"	Replace 18" (1950)	4,600	$ 420	$ 1,932,000	$ 3,202,000		$ 3,202,000	47%	$ 1,697,100	$ 1,504,900
WC-4	Pipe	Capacity	Golf Course Reservoir TM Replacement	2.5 miles of 18" Transmission Main from Morro Hills Golf Course to Reservoir (replace 14")	14"	18"	Replace 14" (1948; 1976)	8,000	$ 330	$ 2,640,000	$ 4,376,000		$ 4,376,000	0%	$ 4,376,000	$ -
WC-5	Pipe	Capacity	TM to Resolve Pressure Deficiencies	1.5 miles of 12" pipeline to resolve low pressure deficiciencies in south east Guajome Zone	n/a	12"	New	7,800	$ 220	$ 1,716,000	$ 2,844,000		$ 2,844,000	0%	$ 2,844,000	$ -
WC-6	Pipe	Capacity	TM to Resolve Pressure Deficiencies	0.8 miles of 20" pipeline to resolve headloss in transmission mains to accommodate flow replacing FCF4	n/a	20"	Parallel 27" (1988)	4,200	$ 370	$ 1,554,000	$ 2,576,000		$ 2,576,000	0%	$ 2,576,000	$ -
WC-6	Pipe	Capacity	TM Upgrade to Resolve Headloss	0.2 miles of 30" pipeline to resolve headloss in transmission mains to accommodate flow replacing FCF4	27"	30"	New	1,200	$ 440	$ 528,000	$ 875,000		$ 875,000	0%	$ 875,000	$ -
WC-6	Pipe	Capacity	TM Upgrade to Resolve Headloss	0.8 miles of 36" pipeline to resolve headloss in transmission mains to accommodate flow replacing FCF4	27"	36"	New	3,800	$ 525	$ 1,995,000	$ 3,307,000		$ 3,307,000	0%	$ 3,307,000	$ -
WC-7	Pipe	Capacity	Secondary Supply TM	Pipeline from Buddy Todd PZ to Poplar PZ in lieu of PS upgrade	n/a	8"	New	2,100	$ 170	$ 357,000	$ 592,000		$ 592,000	0%	$ 592,000	$ -
WC-8	Pipe	Capacity	Secondary Supply TM	Pipeline from Peacock Hills PZ to Mesa Loma PZ in lieu of PS upgrade	n/a	8"	New	5,700	$ 170	$ 969,000	$ 1,606,000		$ 1,606,000	0%	$ 1,606,000	$ -
WC-9	Pipe	Capacity	Wire Mountain Reservoir 2 TM	Connection from new Wire Mountain Reservoir 2 to transimission main	n/a	24"	New	500	$ 420	$ 210,000	$ 348,000		$ 348,000	12%	$ 306,200	$ 41,800
WC-10	Pipe	Capacity	Sleeping Indian PS TM Upgrade	Upsize pipeline downstream of Sleeping Indian PS with increased PS capacity	8"	16"	Replace	1,300	$ 295	$ 384,000	$ 636,000		$ 636,000	0%	$ 636,000	$ -
WC-11	PIpe	Capacity	Morro Hills PS TM Upgrade	Upsize pipeline downstream of Morro Hills PS with increased PS capacity	10"	16"	Replace	3,200	$ 295	$ 944,000	$ 1,565,000		$ 1,565,000	0%	$ 1,565,000	$ -
WC-12	Pipe	Capacity	El Corazon Reservoir TM	1.5 miles of 24" Transmission main to new 4 MG Storage at El Corazon Site for Zone 320 (Talone)	n/a	24"	New	9,800	$ 420	$ 4,116,000	$ 6,822,000		$ 6,822,000	100%	$ -	$ 6,822,000
WC-13	Pipe	Capacity	TM from IPR PS to Guajome Zone	0.5 miles of 20" Transmission Main for IPR Project into Guajome	n/a	36"	New	1,800	$ 525	$ 945,000	$ 1,566,000		$ 1,566,000	20%	$ 1,252,800	$ 313,200
WC-14	Pipe	Capacity	Guajome 4 Reservoir Connection to WC-2	Connection from new 4 MG Guajome 4 reservoir to 36" transmission main	n/a	24"	New	500	$ 420	$ 210,000	$ 348,000		$ 348,000	100%	$ -	$ 348,000
WC-15	Pipe	Capacity	Henie Hills Reservoir 2 TM	Connection from new Henie Hills 2 Reservoir to transmission main	n/a	12"	New	500	$ 220	$ 110,000	$ 182,000		$ 182,000	80%	$ 36,400	$ 145,600
WC-16	PIpe	Capacity	Lake Blvd Water Intertie TM	Connection from Lake Blvd PS to Pump from San Francisco Peak 2 Reservoir to Peak 1 Reservoir		16"	New	500	$ 295	$ 603,000	$ 1,000,000	$ 1,000,000		10%	$ 900,000	$ 100,000
Subtotal								**96,800**		**$ 32,356,000**	**$ 53,630,000**	**$ 1,000,000**	**$ 52,630,000**	**n/a**	**$ 25,513,300**	**$ 28,116,700**
Fire Flow Improvements																
SDR-4"	Pipe	Capacity	Small Diameter Pipeline Replacements (4")	Upsize all 4" diameter pipelines to 8" (10 mi)	4"	8"	Replace	55,200	$ 206	$ 11,379,000	$ 18,861,000	$ 11,317,000	$ 7,544,000	0%	$ 18,861,000	$ -
SDR-6"	Pipe	Capacity	Small Diameter Pipeline Replacements (6")	Upsize all 6" diameter pipelines causing fire flow deficiencies to 8" (22.8 mi)	6"	8"	Replace	120,400	$ 206	$ 24,820,000	$ 41,139,000	$ 24,683,000	$ 16,456,000	0%	$ 41,139,000	$ -
FF-1	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the corner of Lee Dr. and North Ave. to the 12" pipe at Oceanside Blvd. In Peacock Hills Zone.	n/a	8"	New	900	$ 170	$ 153,000	$ 254,000		$ 254,000	0%	$ 254,000	$ -
FF-1	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From North Ave. to the end of the cul de sac on Vista Pacific Dr. In Peacock Hills Zone.	n/a	12"	New	1,500	$ 220	$ 330,000	$ 547,000		$ 547,000	0%	$ 547,000	$ -
FF-2	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the end of the 8" pipe on South Coast Hwy. to the end of the 8" pipe on Withery St. In Talone Zone.	n/a	8"	New	300	$ 170	$ 51,000	$ 85,000		$ 85,000	0%	$ 85,000	$ -
FF-3	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the corner of Zeiss St. and Loretta St.; along Loretta St. to the 12" pipeline, between Wynn St. and 75 Hwy. In Talone Zone.	n/a	12"	Replace	1,300	$ 220	$ 286,000	$ 474,000		$ 474,000	0%	$ 474,000	$ -
FF-4	Pipe	Capacity	Fire Flow Enhancements - Priority 1	On Acacia Ave.; south to Willow Ave.; east to complete the loop. In the Poplar Zone.	n/a	8"	Replace	700	$ 170	$ 119,000	$ 197,000		$ 197,000	0%	$ 197,000	$ -
FF-4	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the Poplar Pump Station; north to Poplar Rd. In the Poplar Zone.	n/a	12"	Replace	800	$ 220	$ 176,000	$ 292,000		$ 292,000	0%	$ 292,000	$ -
FF-5	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the end of the 8" pipe on Soto St.; south to the 8" pipe, on the corner of Soto St. and Krim Pl. In Talone Zone.	n/a	8"	New	300	$ 170	$ 51,000	$ 85,000		$ 85,000	0%	$ 85,000	$ -
FF-6	Pipe	Capacity	Fire Flow Enhancements - Priority 2	On Dunstan St. from the 14" pipe coming from the south; to the east; north on Eldean Ln.; tie into the north-most hydrant. In Talone Zone.	n/a	8"	Parallel	700	$ 170	$ 119,000	$ 197,000		$ 197,000	0%	$ 197,000	$ -
FF-7	Pipe	Capacity	Fire Flow Enhancements - Priority 1	On San Diego St from Laurel St. to Dubuque St. In Talone Zone.	n/a	8"	Replace	700	$ 170	$ 119,000	$ 197,000		$ 197,000	0%	$ 197,000	$ -
FF-7	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the 12" pipe on the corner of Holly St. and Dubuque St.; down Dubuque St.; and on the corner of San Diego St and Laurel St., down to corner of Holly St. and Laurel Street. In Talone Zone.	n/a	12"	Replace	900	$ 220	$ 198,000	$ 328,000		$ 328,000	0%	$ 328,000	$ -
FF-8	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the 16" pipe on Mesa Dr. to corner of Edgewood Dr. and Mesa Dr.; tie into the hydrants along Mesa Dr. In Talone Zone.	n/a	12"	New	600	$ 220	$ 132,000	$ 219,000	$ 219,000		0%	$ 219,000	$ -
FF-9	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the 12" pipe on the corner of Oceanside Blvd. and Garrison St.; south to Industry St. In Talone Zone.	n/a	8"	Parallel	400	$ 170	$ 68,000	$ 113,000		$ 113,000	0%	$ 113,000	$ -
FF-9	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the pipe on the corner of Oceanside Blvd. and Garrison St.; north on Garrison St. to the corner of Garrison St. and Mesa Dr. and from Garrison St. and Industry St.; East to the end of Industry St. In Talone Zone.	n/a	12"	Parallel	4,800	$ 220	$ 1,056,000	$ 1,750,000		$ 1,750,000	0%	$ 1,750,000	$ -
FF-10	Pipe	Capacity	Fire Flow Enhancements - Priority 1	From the 16" pipe on the corner of Seagaze Dr. and Brooks St.; south to Division St.; east to Country Club Ln. north to Maxon St.; west to Brooks St. to complete the loop. Second segment from the corner of Country Club Ln. and Maxon St.; east to Canyon Drive. In Talone Zone.	n/a	8"	Replace	7,000	$ 170	$ 1,190,000	$ 1,972,000		$ 1,972,000	0%	$ 1,972,000	$ -
FF-11	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 10" pipe on the corner of Olive Dr. and Bradley St.; south throught easment between houses on Bradley and Marcella St.; to the last hydrant on Hope St. In the Guajome Zone.	n/a	8"	Parallel	1,500	$ 170	$ 255,000	$ 423,000		$ 423,000	0%	$ 423,000	$ -

Table 9.6 Water System Capital Improvement Program
Water Master Plan
City of Oceanside

Improv. ID	Facility Type	Type of Improvement	Project Description	Description/ Street	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost(2),(3) ($)	Phase 1 Near Term 2015-2020 ($)	Phase 2 Long Term 2021-2050 ($)	Future Users Benefit (%)	Existing Improvements ($)	Future Improvements ($)
					Project Length/Size and Cost							Phasing			Reimbursement Category	
FF-12	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 10" pipe on the corner of Spur Ave. and Belmount Park Rd.; south to Serene Rd and from 8" pipe to last hydrant on Belmount Park Rd. In Hutchison Zone.	n/a	8"	Parallel	2,600	$ 170	$ 442,000	$ 733,000		$ 733,000	0%	$ 733,000	$ -
FF-12	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the the corner of Serene Rd. and Belmount Park Rd.; south to second fork in Belmount Park Rd. In Hutchison Zone.	n/a	12"	Parallel	700	$ 220	$ 154,000	$ 255,000		$ 255,000	0%	$ 255,000	$ -
FF-13	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 14" pipe on the corner of North River Rd. and Stallion Dr.; north to the corner of Stallion Dr. and Mare Rd. In North River Zone.	n/a	12"	Parallel	1,100	$ 220	$ 242,000	$ 401,000		$ 401,000	0%	$ 401,000	$ -
FF-14	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 10" on the corner of Lake Blvd. and Cannon Rd.; to the end of pipe segment past Melrose Dr. From the corner of Melrose Dr. and Cannon Rd.; north to the corner of the shopping center and Melrose Dr.; parallel hydrent loop in shoping center. In Leisure Hills Zone.	n/a	8"	Parallel	3,600	$ 170	$ 612,000	$ 1,014,000		$ 1,014,000	0%	$ 1,014,000	$ -
FF-15	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 10" pipe on the corner of Mesa Dr. and Rancho Del Oro Park; north-east on mesa drive to Avenida De La Plata. In the Guajome Zone.	n/a	12"	Parallel	1,300	$ 220	$ 286,000	$ 474,000		$ 474,000	0%	$ 474,000	$ -
FF-16	Pipe	Capacity	Fire Flow Enhancements - Priority 2	From the 14" pipe on the corner of Mystra Dr. and Cannon Rd.; south to the corner of Pirgos Way and Mystra Dr. In the Leisure Hills Zone.	n/a	12"	Parallel	1,100	$ 220	$ 242,000	$ 401,000		$ 401,000	0%	$ 401,000	$ -
Subtotal								**208,400**		**$ 42,480,000**	**$ 70,411,000**	**$ 36,219,000**	**$ 34,192,000**	**n/a**	**$ 70,411,000**	**$ -**
Pressure Regulating Stations/Valves						**Quantity**		**Unit**	**$/unit**							
WF-1	PRS	Capacity	PRS to Resolve HGL Drop	Recommended Mesa Loma PRS - Resolve HGL Drop in East Guajome		1	New	Small PRS	$ 100,000	$ 100,000	$ 166,000	$ 166,000		0%	$ 166,000	$ -
WF-2	AV	Capacity	Altitude Valve for Osborne Reservoir	Altitude Valve for Replenishing Osborne		1	New	AV	$ 100,000	$ 100,000	$ 166,000	$ 166,000		0%	$ 166,000	$ -
WF-3	PRS	Capacity	PRS for Additional Supply Connection to Zone	New PRS added to WC-7 in lieu of Carey Rd pump station upgrade.		1	New	Small PRS	$ 100,000	$ 100,000	$ 166,000	$ 166,000		0%	$ 166,000	
WF-4	PRS	Capacity	PRS for Additional Supply Connection to Zone	New PRS added to WC-8 in lieu of Mesa Loma pump station upgrade.		1	New	Small PRS	$ 100,000	$ 100,000	$ 166,000	$ 166,000		0%	$ 166,000	
WF-5	AV	Capacity	Altitude Valve for El Corazon Reservoir	Future El Corazon Reservoir Altitude Valve		1	New	AV	$ 100,000	$ 100,000	$ 166,000		$ 166,000	0%	$ 166,000	$ -
Subtotal										**$ 500,000**	**$ 830,000**	**$ 664,000**	**$ 166,000**	**n/a**	**$ 830,000**	**$ -**
Booster Pump Stations						**Quantity**		**Unit**	**$/unit**							
WPS-1	PS	Capacity	Lake Blvd PS Upgrade	Upgrade to Lake Blvd Pump PS to mitigate capacity and storage deficiencies within the San Francisco Peak 2 Zone and the Leisure Hills Zone		100	Upgrade	hp	$ 12,000	$ 1,200,000	$ 1,989,000	$ 1,989,000		10%	$ 1,790,100	$ 198,900
WPS-2	PS	Capacity	Sleeping Indian PS Upgrade	Upgrade to Sleeping Indian PS		100	Upgrade	hp	$ 5,000	$ 500,000	$ 829,000		$ 829,000	0%	$ 829,000	$ -
WPS-3	PS	Capacity	Morro Hills PS Upgrade	Upgrade to Morro Hills PS		100	Upgrade	hp	$ 5,000	$ 500,000	$ 829,000		$ 829,000	0%	$ 829,000	$ -
WPS-4	PS	Capacity	Zone 800 PS	New Zone 800 PS to pump into Transmission main Zone (350' msl to 800')		500	New	hp	$ 3,000	$ 1,500,000	$ 2,486,000		$ 2,486,000	27%	$ 1,814,800	$ 671,200
WPS-5	PS	Capacity	Zone 511' PS Upgrade for IPR	Zone 511' PS expansion for IPR		540	Upgrade	hp	$ 3,000	$ 1,620,000	$ 2,685,000		$ 2,685,000	20%	$ 2,148,000	$ 537,000
Subtotal										**$ 7,920,000**	**$ 8,818,000**	**$ 1,989,000**	**$ 6,829,000**	**n/a**	**$ 7,410,900**	**$ 1,407,100**
Storage Reservoirs						**Capacity**			**$/gallon**							
WS-1	Storage	Capacity	New Zone 800 Reservoir	10 MG Reservoir in 800' Zone (Zone 800' and below)	-	10 MG	New		$ 1.00	$ 10,000,000	$ 16,575,000		$ 16,575,000	27%	$ 12,099,800	$ 4,475,200
WS-2	Storage	Capacity	New Guajome 3 Reservoir	7 MG Reservoir to serve Guajome 3 (511')		7 MG	New		$ 1.00	$ 7,000,000	$ 11,603,000		$ 11,603,000	11%	$ 10,326,700	$ 1,276,300
WS-3	Storage	Capacity	New Fire Mtn Reservoir 2	4 MG Reservoir @ Fire Mtn. to serve Talone (320')	-	4 MG	New		$ 1.25	$ 5,000,000	$ 8,288,000		$ 8,288,000	12%	$ 7,293,400	$ 994,600
WS-4	Storage	Capacity	New Wire Mtn Reservoir	4 MG Reservoir @ Wire Mtn. to serve Talone (320')		4 MG	New		$ 1.25	$ 5,000,000	$ 8,288,000		$ 8,288,000	12%	$ 7,293,400	$ 994,600
WS-5	Storage	Capacity	New El Corazon Reservoir	5 MG Reservoir @ El Corazon to serve Talone (320')		5 MG	New		$ 1.25	$ 6,250,000	$ 10,359,000		$ 10,359,000	100%	$ -	$ 10,359,000
WS-6	Storage	Capacity	New Henie Hills Reservoir 2	1 MG Reservoir to serve Henie Hills (409')		1 MG	New		$ 2.00	$ 2,000,000	$ 3,315,000		$ 3,315,000	80%	$ 663,000	$ 2,652,000
WS-7	Storage	Capacity	New Guajome 4 Reservoir	4 MG Reservoir to serve Guajome 4 (511')		4 MG	New		$ 1.25	$ 5,000,000	$ 8,288,000		$ 8,288,000	100%	$ -	$ 8,288,000
Subtotal										**$ 40,250,000**	**$ 66,716,000**	**$ -**	**$ 66,716,000**	**n/a**	**$ 37,676,300**	**$ 29,039,700**
Capacity Improvements Total										**$ 123,506,000**	**$ 200,405,000**	**$ 39,872,000**	**$ 160,533,000**	**n/a**	**$ 141,841,500**	**$ 58,563,500**
Repair and Rehabiliation Projects																
Distribution System																
WRP-1	Pipe	R&R	Near Term Pipeline Replacements	6" diameter age replacement, remaining after fire flow deficient 6" replacements of Project [SDR-6"]	6"	8"	Replace	5,500	$ 170	$ 935,000	$ 1,550,000	$ 1,550,000		0%	$ 1,550,000	$ -
WRP-2	Pipe	R&R	Near Term Pipeline Replacements	Service Area	8"	8"	Replace	3,300	$ 170	$ 561,000	$ 930,000	$ 930,000		0%	$ 930,000	$ -
WRP-3	Pipe	R&R	Near Term Pipeline Replacements	Service Area	10"	10"	Replace	300	$ 210	$ 63,000	$ 104,000	$ 104,000		0%	$ 104,000	$ -
WRP-4	Pipe	R&R	Near Term Pipeline Replacements	Service Area	12"	12"	Replace	4,500	$ 220	$ 990,000	$ 1,641,000	$ 1,641,000		0%	$ 1,641,000	$ -
WRP-5	Pipe	R&R	Long Term Pipeline Replacements	6" diameter age replacement, remaining after fire flow deficient 6" replacements	6"	8"	Replace	110,900	$ 170	$ 18,853,000	$ 31,249,000		$ 31,249,000	0%	$ 31,249,000	$ -
WRP-6	Pipe	R&R	Long Term Pipeline Replacements	Service Area	8"	8"	Replace	273,800	$ 170	$ 46,546,000	$ 77,150,000		$ 77,150,000	0%	$ 77,150,000	$ -
WRP-7	Pipe	R&R	Long Term Pipeline Replacements	Service Area	10"	10"	Replace	80,800	$ 210	$ 16,968,000	$ 28,124,000		$ 28,124,000	0%	$ 28,124,000	$ -
WRP-8	Pipe	R&R	Long Term Pipeline Replacements	Service Area	12"	12"	Replace	84,700	$ 220	$ 18,634,000	$ 30,886,000		$ 30,886,000	0%	$ 30,886,000	$ -
WRP-9	Pipe	R&R	Long Term Pipeline Replacements	Service Area	14"	14"	Replace	56,800	$ 295	$ 16,756,000	$ 27,773,000		$ 27,773,000	0%	$ 27,773,000	$ -
WRP-10	Pipe	R&R	Long Term Pipeline Replacements	Service Area	16"	16"	Replace	13,400	$ 295	$ 3,953,000	$ 6,552,000		$ 6,552,000	0%	$ 6,552,000	$ -
WRP-11	Pipe	R&R	Long Term Pipeline Replacements	Service Area	18"	18"	Replace	25,600	$ 330	$ 8,448,000	$ 14,003,000		$ 14,003,000	0%	$ 14,003,000	$ -
WRP-12	Pipe	R&R	Long Term Pipeline Replacements	Service Area	20"	20"	Replace	4,500	$ 370	$ 1,665,000	$ 2,760,000		$ 2,760,000	0%	$ 2,760,000	$ -
WRP-13	Pipe	R&R	Long Term Pipeline Replacements	Service Area	24"	24"	Replace	6,400	$ 420	$ 2,688,000	$ 4,455,000		$ 4,455,000	0%	$ 4,455,000	$ -
WRP-14	Pipe	R&R	Long Term Pipeline Replacements	Service Area	27"	27"	Replace	4,000	$ 440	$ 1,760,000	$ 2,917,000		$ 2,917,000	0%	$ 2,917,000	$ -
WRP-15	Pipe	R&R	Long Term Pipeline Replacements	Service Area	42"	42"	Replace	3,100	$ 630	$ 1,953,000	$ 3,237,000		$ 3,237,000	0%	$ 3,237,000	$ -
Subtotal								**677,620**		**$ 138,224,000**	**$ 233,331,000**	**$ 4,225,000**	**$ 229,106,000**	**$ -**	**$ 233,331,000**	**$ -**
Storage/Reservoir						**Quantity**		**Unit**	**$/unit**							
WRS-1	Storage	R&R	Ongoing R&R Project for Reservoirs	Reservoir Structural Rehabilation of all reservoirs		12	Rehab	reservoirs	$ 1,153,000	$ 13,832,000	$ 22,927,000	$ 22,927,000		0%	$ 22,927,000	$ -
WRS-2	Storage	R&R	Ongoing R&R Project for Reservoirs	Reservoir Upgrades			Rehab			$ 10,001,000	$ 16,576,000	$ 829,000	$ 15,747,000	0%	$ 16,576,000	$ -
WRS-3	Storage	R&R	Ongoing R&R Project for Reservoirs	Installation of new water quality monitoring sites at each reservoir (12 reservoirs)		12	Rehab	reservoirs	$ 50,000	$ 600,000	$ 995,000	$ 995,000		0%	$ 995,000	$ -
Subtotal									**$ 4,585,400**	**$ 24,433,000**	**$ 40,498,000**	**$ 24,751,000**	**$ 15,747,000**	**n/a**	**$ 40,498,000**	**$ -**
Booster Pump Stations						**Quantity**		**Unit**	**$/unit**							
WRPS-1	PS	R&R	Ongoing R&R Project for PS	Back-Up Power Generators for Morro Hills, Wilshire, Lake Blvd, Mesa Loma PSs		4	New	generators	$ 250,000	$ 1,000,000	$ 1,658,000		$ 1,658,000	0%	$ 1,658,000	$ -
WRPS-2	PS	R&R	Ongoing R&R Project for PS	Ongoing Pump Station Upgrades			Rehab			$ 3,198,000	$ 5,300,000	$ 900,000	$ 4,400,000	0%	$ 5,300,000	$ -
Subtotal										**$ 4,198,000**	**$ 6,958,000**	**$ 900,000**	**$ 6,058,000**	**n/a**	**$ 6,958,000**	**$ -**
Pressure Reducing Stations						**Quantity**		**Unit**	**$/unit**							
WRWF-1	PRS	R&R	Ongoing R&R Projects for PRSs	Rehab of 1 station per year		35	Rehab	years	$ 75,000	$ 1,584,000	$ 2,625,000	$ 450,000	$ 2,175,000	0%	$ 2,625,000	$ -
Subtotal										**$ 1,584,000**	**$ 2,625,000**	**$ 450,000**	**$ 2,175,000**	**n/a**	**$ 2,625,000**	**$ -**
Ongoing Weese Improvements						**Quantity**		**Unit**	**$/unit**							
WTP-1	TP	R&R	Ongoing Improvements at Weese Filtration Plant	Weese Plant Improvements			Rehab			$ 7,216,000	$ 11,961,000	$ 10,961,000	$ 1,000,000	0%	$ 11,961,000	$ -
Subtotal										**$ 16,597,000**	**$ 11,961,000**	**$ 10,961,000**	**$ 1,000,000**	**n/a**	**$ 11,961,000**	**$ -**
Ongoing MBGPF Improvements																
MBP-1	TP	R&R	Ongoing Improvements at MBGPF	Treatment Plant Upgrades (major improvements)			Rehab			$ 3,596,000	$ 5,960,000	$ 5,960,000		0%	$ 5,960,000	$ -
Subtotal										**$ 3,596,000**	**$ 5,960,000**	**$ 5,960,000**	**$ -**	**n/a**	**$ 5,960,000**	**$ -**
R & R Total										**$ 188,632,000**	**$ 301,333,000**	**$ 47,247,000**	**$ 254,086,000**	**$ -**	**$ 301,333,000**	**$ -**

Table 9.6 Water System Capital Improvement Program

Water Master Plan

City of Oceanside

Improv. ID	Facility Type	Type of Improvement	Project Description	Description/ Street	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost ($)	Baseline Construction Cost ($)	Capital Improvement Cost[(2),(3)] ($)	Phasing: Phase 1 Near Term 2015-2020 ($)	Phase 2 Long Term 2021-2050 ($)	Future Users Benefit (%)	Reimbursement Category: Existing Improvements ($)	Future Improvements ($)
Other CIP Items																
WO-1	Other	Other	SCADA System Upgrades	Water SCADA System			Upgrade			$ 1,508,000	$ 2,500,000	$ 2,500,000		0%	$ 2,500,000	$ -
WO-2	Other	Other	Ocean Desal Study	Ocean Desalination Study		1	New	Study			$ 500,000	$ 500,000		20%	$ 400,000	$ 100,000
WO-3	TP	Other	Ocean Desal Treatment Facilities	Ocean Desalination Treatment Facilities		5 MG	New	Plant			$ 75,000,000		$ 75,000,000	20%	$ 60,000,000	$ 15,000,000
WO-4	Other	Other	IPR Feasibility Study	IPR Feasibility Study		1	New	Study			$ 700,000	$ 700,000		20%	$ 560,000	$ 140,000
WO-5	Other	Other	IPR PDR	IPR PDR		1	New	PDR			$ 1,000,000	$ 1,000,000		20%	$ 800,000	$ 200,000
WO-6	Other	Other	Injection Wells/Perc Ponds	Injection Wells/Perc Ponds - Phase 1		5 MG	New	Wells			$ 11,000,000	$ 11,000,000		20%	$ 8,800,000	$ 2,200,000
WO-7	TP	Other	Ongoing Improvements at MBGPF	Mission Basin Desalter Expansion (IPR)			TP			$ 18,100,000	$ 30,000,000		$ 30,000,000	0%	$ 30,000,000	$ -
Other Projects Total										**$ 19,608,000**	**$ 120,700,000**	**$ 15,700,000**	**$ 105,000,000**	**n/a**	**$ 103,060,000**	**$ 17,640,000**
Grand Total CIP										**$ 331,746,000**	**$ 622,438,000**	**$ 102,819,000**	**$ 519,619,000**	**n/a**	**$ 546,234,500**	**$ 76,203,500**

1. Weese and MBGPF projects marked up using ENR from 2012 to 2014
2. Project construction costs from the 2006 Master Plan reduced by 17% and then increased by the ENR, before being marked up by the assumptions for the 2014 CIP
3. City of Oceanside CIP costs from January 2015 spreadsheet.

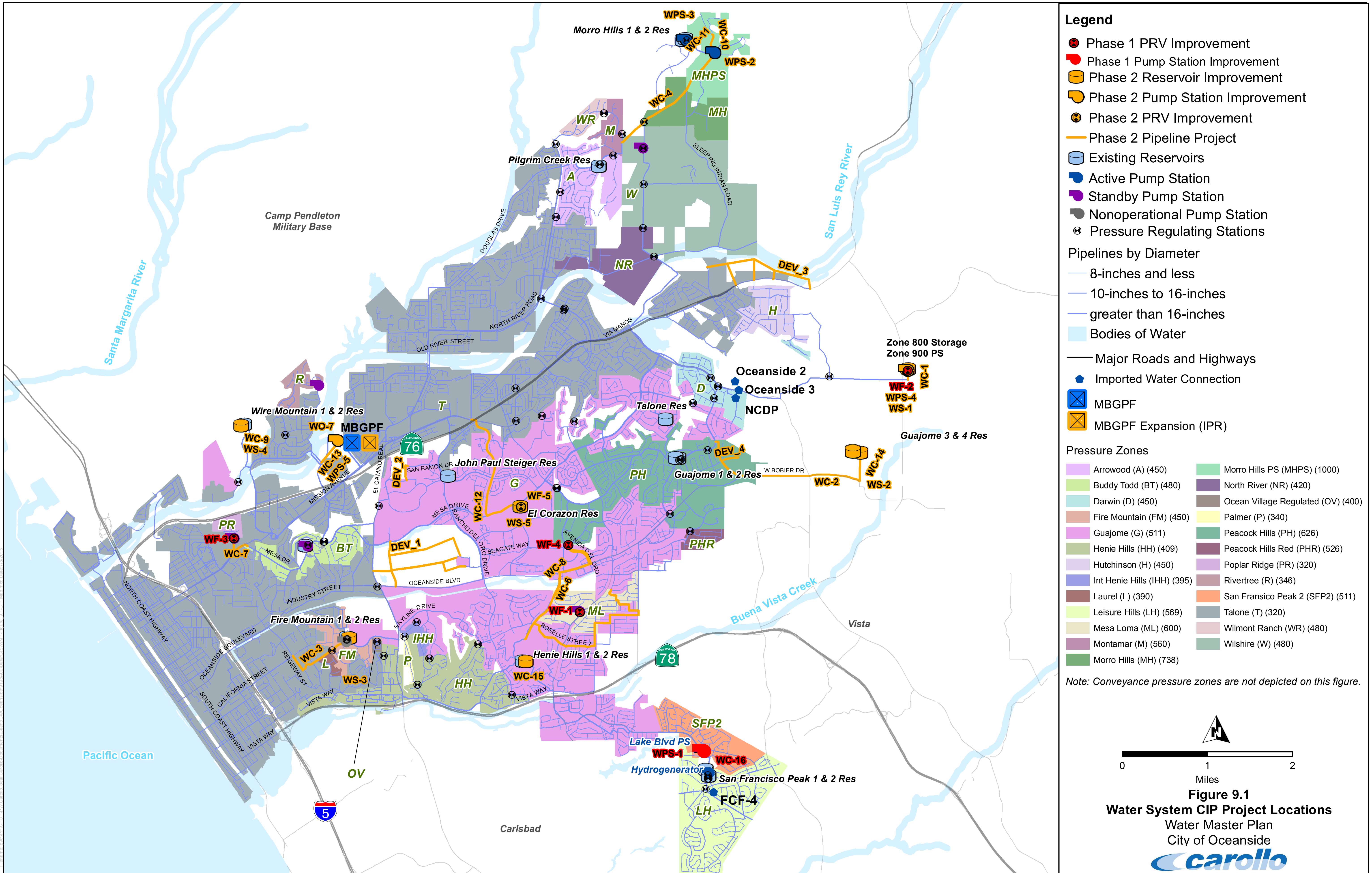


Figure 9.1
Water System CIP Project Locations
Water Master Plan
City of Oceanside

Table 9.7	Summary of Capital Improvement Costs by Facility Type Water Master Plan City of Oceanside			
	Implementation Phase			
Facility Category	**2015-2020 ($ Million)**	**2021-2050 ($ Million)**	**Total ($ Million)**	**Percentage (%)**
Pipelines	$41.4	$315.9	$357.4	57.4%
Pump Stations	$2.9	$12.9	$15.8	2.5%
Storage Reservoirs	$24.8	$82.5	$107.2	17.2%
PRSs	$1.1	$2.3	$3.5	0.6%
Treatment Plants	$16.9	$106.0	$122.9	19.7%
Other	$15.7	$ -	$15.7	2.5%
Total	**$102.8**	**$519.6**	**$622.4**	**100%**

Note:

(1) Costs are based on ENR CCI 10,756 (Los Angeles, December 2014).
(2) Numbers may vary slightly due to rounding.

As shown in Table 9.7 and Figure 9.2, pipeline projects account for the majority of future costs, which equate to approximately $357.4 million or 57.4 percent of the projected CIP cost. Treatment Plant projects, which include upgrades to Weese Filtration Plant, a MBGPF Expansion (IPR), and Ocean Desalination Plant account for approximately $122.9 million or 19.7 percent of the projected CIP cost. The remaining $142.2 million or 22.8 percent of the proposed CIP is comprised of pump stations, storage reservoirs, PRSs, wells and other miscellaneous projects.

9.5.5 Existing Versus Future Users Cost Share

The improvements proposed in this WMP CIP either benefit existing users or are required to service new development and future users. Some of the projects provide benefits to both existing and future users. An opinion of benefit to future users is included in Table 9.6. A summary of the existing and future user cost share for the proposed projects by phase is summarized in Table 9.8.

As shown in Table 9.8, the total estimated cost for water system improvements through the year 2050 is nearly $622.4 million. The vast majority of improvement projects ($546.2 million) are associated with existing system improvements. Near-term projects account for about $102.8 million, which equates to roughly $20.6 million per year through year 2020. Long-term projects account for approximately $519.6 million, which equates to about $17.3 million per year between 2020-2050. The average estimated capital cost for the 35-year planning horizon of this WMP is $17.8 million per year.

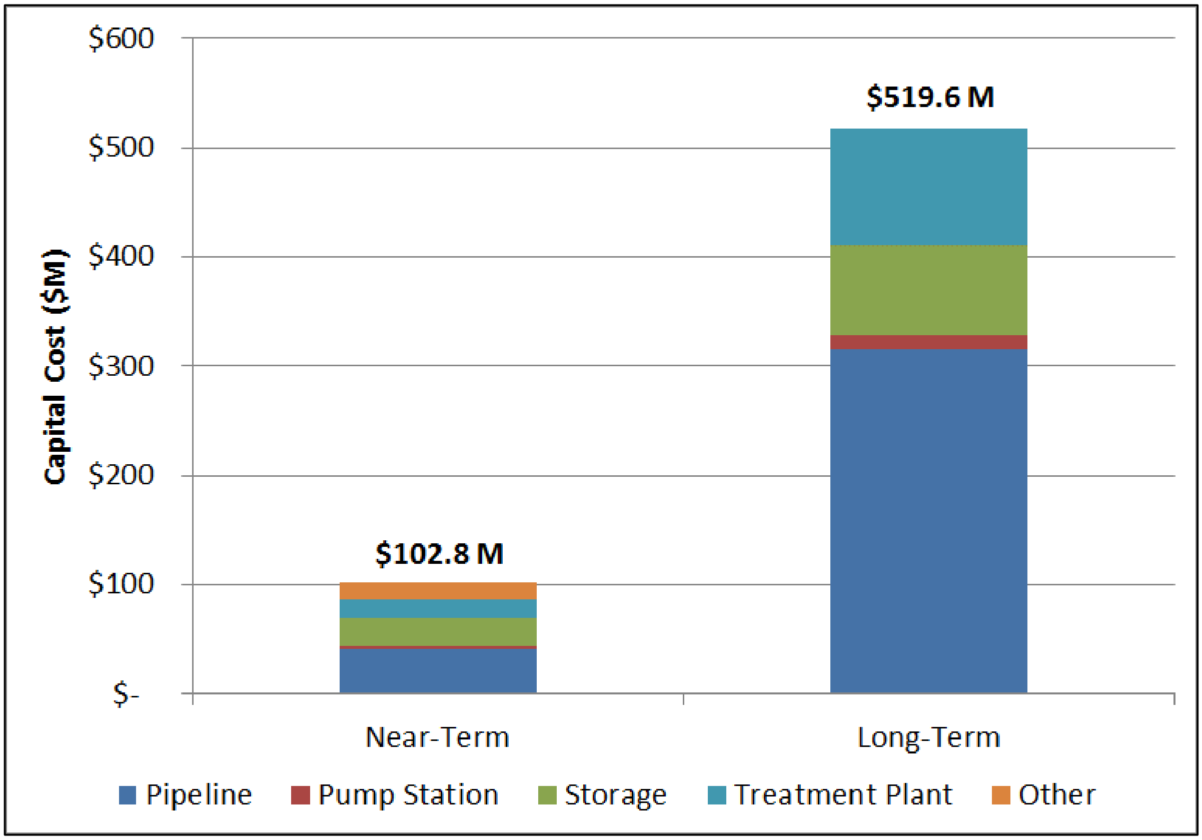


Figure 9.2 Existing and Future Cost by Facility Type

Table 9.8 Existing Versus Future User Costs
Water Master Plan
City of Oceanside

Reimbursement Category	Implementation Phase 2015-20 ($ Million)	Implementation Phase 2020-50 ($ Million)	Total ($ Million)
Cost to Existing Users	$90.2	$456.0	**$546.2**
Cost to Future Users	$12.6	$63.6	**$76.2**
Total	**$102.8**	**$519.6**	**$622.4**
Number of Years	5	30	35
Costs Per Year	**$20.6**	**$17.3**	**$17.8**

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

The distribution of project costs by project type is listed in Table 9.9.

Table 9.9 Summary of Capital Improvement Costs by Project Type
Water System Master Plan
City of Oceanside

Project Category	Implementation Phase 2015-2020 ($ Million)	Implementation Phase 2020-2050 ($ Million)	Total 2015 to 2050 ($ Million)	Percentage (%)
Capacity Improvements				
Pipelines	$1.0	$52.6	$1.0	8.6%
Fire Flow Pipelines	$36.2	$34.2	$36.2	11.3%
Storage Reservoirs	$ -	$66.7	$ -	10.7%
Pump Stations	$2.0	$6.8	$2.0	1.4%
PRSs	$0.7	$0.2	$0.7	0.1%
Capacity Subtotal	***$39.9***	***$160.5***	***$200.4***	**32.2%**
Repair & Rehabilitation Improvements				
Pipelines	$4.2	$229.1	$233.3	37.5%
Storage Reservoirs	$24.8	$15.7	$40.5	6.5%
Pump Stations	$0.9	$6.1	$7.0	1.1%
PRSs	$0.5	$2.2	$2.6	0.4%
Weese	$11.0	$1.0	$12.0	1.9%
MBGPF	$6.0	$ -	$6.0	1.0%
R&R Subtotal	***$47.2***	***$254.1***	***$301.3***	***48.4%***
Other	$15.7	$105.0	$120.7	19.4%
Grand Total	**$102.8**	**$519.6**	**$622.4**	**100%**

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

As listed in Table 9.9 and shown on Figure 9.3, the majority of the proposed improvements consist of rehabilitation projects. Pipeline rehabilitation and replacement (R&R) accounts for approximately 37.5 percent of the total CIP cost. Capacity projects account for approximately 32.2 percent of the recommended improvement projects, while the remaining 19.4 percent of CIP costs are associated with other projects, such as the future IPR and Ocean Desalination facilities and miscellaneous items.

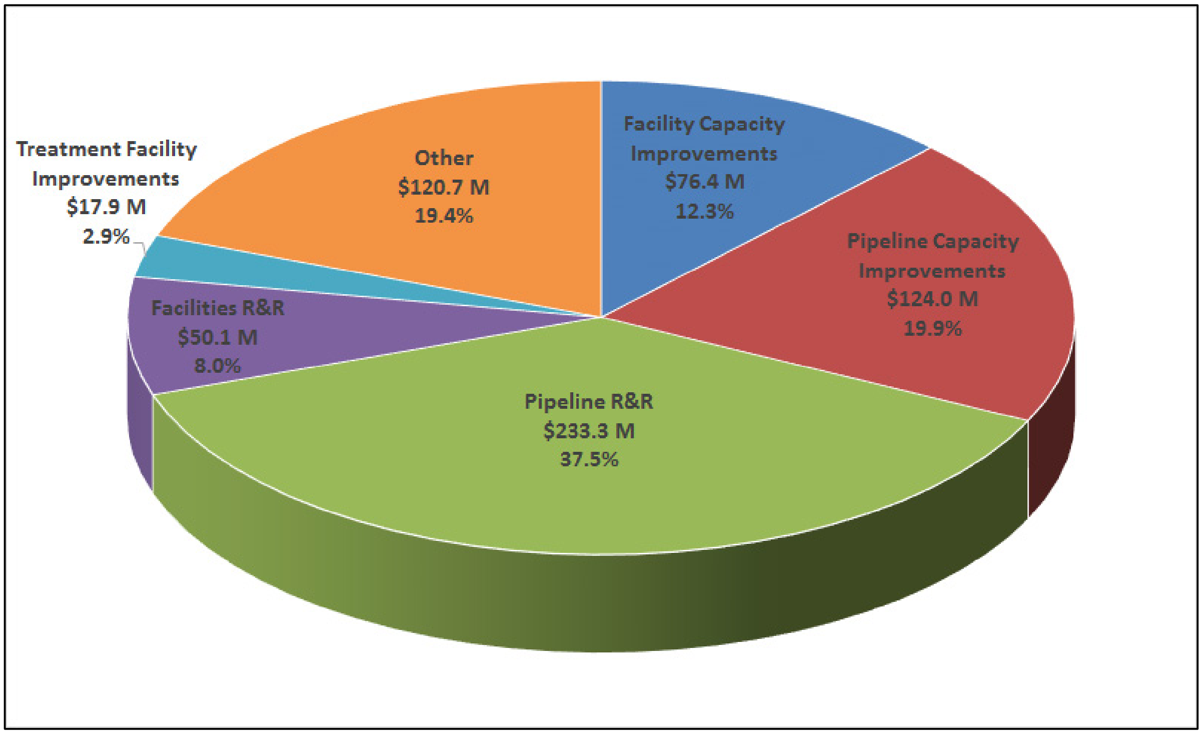


Figure 9.3 CIP Costs by Project Type