CITY OF OXNARD

PUBLIC WORKS
Integrated Master Plan
Summary Report

REVISED FINAL DRAFT • SEPTEMBER 2017

carollo

PUBLIC WORKS INTEGRATED MASTER PLAN

SUMMARY REPORT

City of Oxnard

REVISED FINAL DRAFT – September 2017

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CITY OF OXNARD
PUBLIC WORKS INTEGRATED MASTER PLAN

SUMMARY REPORT

TABLE OF CONTENTS

Page No.

CHAPTER 5 - WASTEWATER SYSTEM MASTER PLAN

CHAPTER 6 - RECYCLED WATER SYSTEM MASTER PLAN

CHAPTER 7 - STORMWATER SYSTEM MASTER PLAN

CHAPTER 8 - INTEGRATED AND COMMON SUPPORT ELEMENTS

CHAPTER 9 - RECOMMENDED CAPITAL IMPROVEMENT PLAN AND KEY OUTSTANDING PLANNING CONSIDERATIONS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AA	Average Annual
AACE	Association for the Advancement of Cost Engineering
AAD	average annual demand
ADD	average day demand
ADMM	Average Day Maximum Month
ADW	average dry weather
ADWF	average dry weather flow
AFY	acre feet per year
APCD	Air Pollution Control District
ASR	aquifer storage and recovery
AST	activated sludge tanks
AWPF	Advanced Water Purification Facility
BFP	belt filter press
BMP	best management practices
BOD_5	biochemical oxygen demand
BS	blending stations
CalRecycle	California Department of Resources Recycling and Recovery
CASA	California Association of Sanitation Agencies
CASQA	California Stormwater Quality Association
CCR	California Code of Regulations
CCT	chlorine contact tanks
CEC	compound of emerging concern
CEPT	Chemically Enhanced Primary Treatment
CIP	Capital Improvement Project

City	City of Oxnard
CMMS	Computerized Maintenance Management System
CMWD	Calleguas Municipal Water District
COS	Cost of Service
CP	cathodic protection
CWA	Clean Water Act
CWT	Centralized Waste Treatment
CWTF	Centralized Wastewater Treatment Facilities
DAFT	dissolved air flotation thickeners
DDW	Division of Drinking Water
DPR	direct potable reuse
EPA	Environmental Protection Agency
FCGMA	Fox Canyon Groundwater Management Agency
GIS	Geographic Information System
GPCD	gallons per day per capita
gpd	gallons per day
GREAT	Groundwater Recovery Enhancement and Treatment
GW	ground water
IPR	indirect potable reuse
LARWQCB	Los Angeles Regional Water Quality Control Board
LGS	Local Government Schema
LOS	level of service
MBR	membrane bioreactors
MC	measurable criterion
MDD	maximum day demand
MDD	Maximum Day

MG	million gallon
mgd	million gallon per day
MinHD	minimum hour demand
MT	million tons
MW	Maximum Week
NBVC	Naval Base Ventura County
NPDES	National Pollutant Discharge Elimination Systems
O&M	Operations and Maintenance
OP	overarching principle
OWTP	Oxnard Wastewater Treatment Plant
pcd	per capita daily
PHD	peak hour demand
PHWA	Port Hueneme Water Agency
PHWWF	peak hour wet weather flow
POTW	publicly owned treatment works
ppb	parts per billion
ppd	pounds per day
psi	pounds per square inch
R&R	repair and replacement
ROWD	report of waste discharge
ROWD	reverse osmosis
RW	recycled water
RWQCB	Regional Water Quality Control Board
SCADA	Supervisory Control And Data Acquisition
SMP	Salinity Management Pipeline
SST	secondary sedimentation basins

SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TSS	total suspended solids
UV/AOP	ultraviolet/advanced oxidation process
UV/AOP	ultraviolet light
UWCD	United Water Conservation District
VCWPD	Ventura County Watershed Protection District
VFD	Variable Frequency Drive
WAS	waste activated sludge
WDR	Waste Discharge Requirements

BRIEF HISTORY AND OVERVIEW OF THE CITY OF OXNARD PUBLIC WORKS DEPARTMENT'S INTEGRATED PLANNING EFFORTS

In May 2014, the City of Oxnard (City) Public Works Department began developing the Public Works Integrated Master Plan (PWIMP, or Plan). The Plan unfolded to address future planning needs for all major utilities within the City's jurisdiction: water, wastewater, recycled water, and stormwater. The Plan uses a coordinated methodology to allow the City to take full advantage of potential linkages and synergies among its four major water utility systems.

The Final Draft Plan was published in December 2015 as a seven-volume set of notebooks containing more than forty master planning Project Memorandums. This was followed shortly after in early 2016 with the publication of the Final Draft Master Plan Summary Report (April 2016), and the Final Draft Executive Summary Report (May 2016).

As typical in master planning, these initial planning reports were published as first drafts. This practice recognizes that the initial planning findings and reports are not considered 'final' until further environmental and financial studies are completed.

Consequently, these Final Draft master-planning documents served as the basis for the City to proceed with a Cost of Service Study to gain approval for the planned wastewater and water utility rate increases for the near-term capital projects, and to support a formal Proposition 218 process. The resulting Wastewater Treatment and Collection Cost of Service Study was approved in early 2017, and the Water Division Cost of Service Study was approved in Summer 2017.

Between the time of publication of the Final Draft master-planning documents in December 2015 and the final adoption of the Cost of Service Studies/Rates in early 2017, the City continued to review and to optimize the final master planning recommended policies, projects, and programs. Therefore, certain projects included in the Final Draft planning documents for the Oxnard Wastewater Treatment Plant (OWTP) have been refined and updated.

These refinements were made to incorporate the latest in recent findings from the advanced facilities planning conducted, in part, for the Cost of Service Studies, and as part of the preliminary designs proceeding concurrently for critically needed facilities. It should be noted that the refinements and optimizations were generally not related to capacity needs, but to achieve improved financial and implementation strategies, and to accommodate technology updates and global climate change strategies, as follows:

1. Project phasing and timing (but not for increased capacity), including: a phased primary treatment upgrade program, and a phased secondary treatment upgrade program.

2. Technology updates, including membrane bioreactors (MBR) to meet potential nutrient requirements, and to save costs related to advanced treatment for recycled water.

3. Global climate change, resiliency, and adaption projects to plan for increasing sea levels.

The Plan coordinates the need and timing of planned water utility facilities as related to the elements in the City's 2030 General Plan (and projections through 2030) with a forward projection through the year 2040. The recommended master planning projects, timing, and phased implementation are noted in the Capital Improvement Plan (CIP) for both the near-term projects (the next several years) as defined in the Cost of Service Studies, and the longer-term projects (extending through 2040) as defined in the Plan.

Further, the time horizon for the near-term CIP serves as the basis for the newly adopted rates, and does not extend to the end of the long-term planning period (thru 2040). This is in recognition of the flexible design and adaptive nature of the recommended Plan.

In summary, the refined and updated near-term projects that were identified and developed as part of the Cost of Service Studies were subsequently incorporated into the recommended Final Draft CIP and Master Plan. Nevertheless, it is the near-term CIP that is the basis for the newly adopted rates. The overall CIP and Master Plan recommended herein was developed by merging the related planning efforts: the Cost of Service Studies, the Preliminary Design of critically needed facilities, and the long-term master planning recommendations.

Chapter 1

INTRODUCTION

1.1 PROLOGUE

The City of Oxnard's (City) Public Works Department faces many challenges in managing its future water resources and utilities. These challenges include identifying the best response to immediate drought conditions while planning for long-term water needs, reducing dependence on costly imported water, addressing aging infrastructure and reliability concerns, pursuing aggressive goals for energy efficiency and sustainable solutions, and managing the ongoing loss of seasoned staff and personnel.

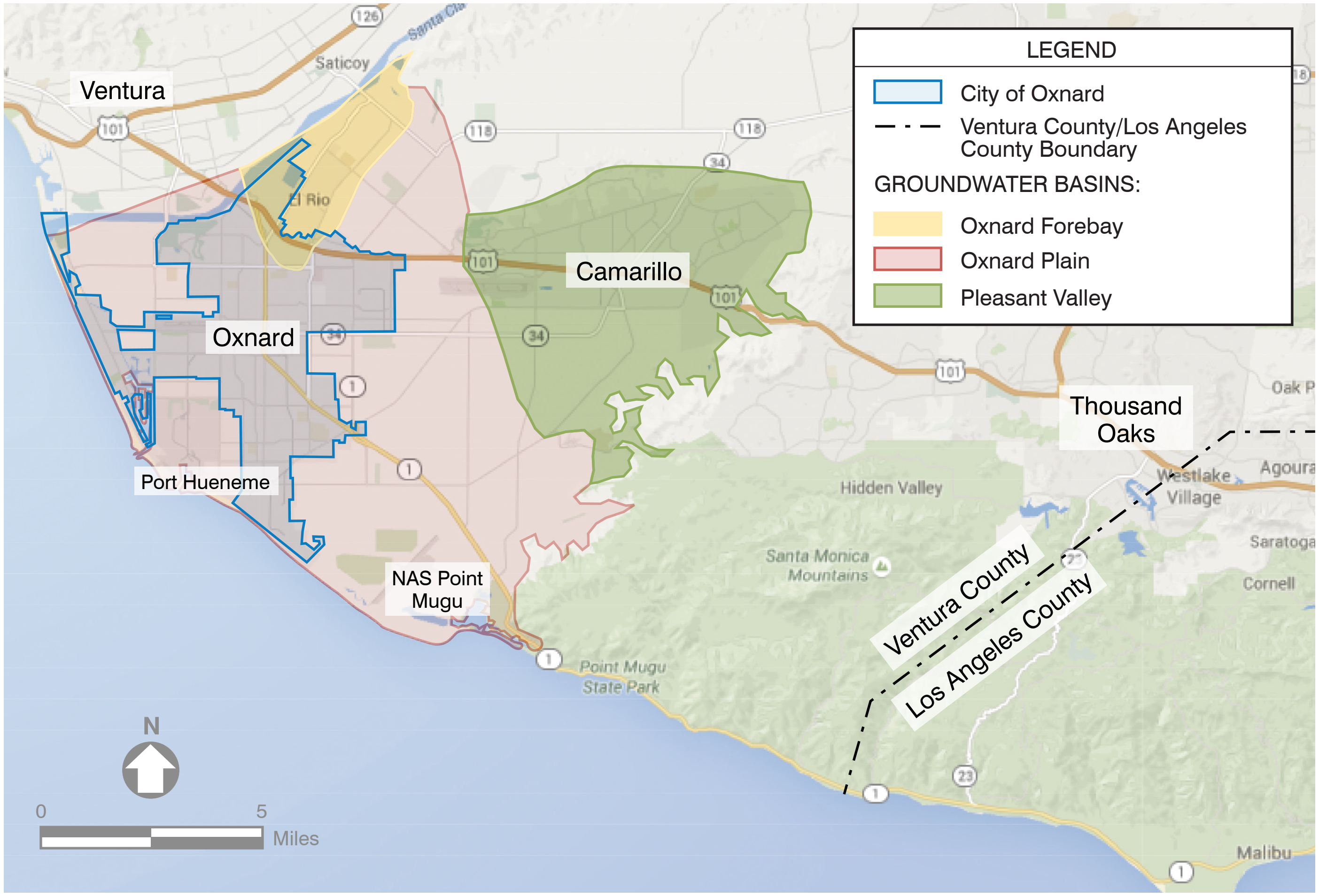
Opportunities to meet these challenges range from institutional and non-structural approaches (policies and programs) to technical and structural approaches (capital projects). Furthermore, because of the City's broad authority over utilities and streets, it has a unique opportunity to meet these challenges by optimizing both capital and operations and maintenance investments for all water utilities, street improvements, and other City infrastructure.

The City is located along the Pacific Ocean coastline in Southern California, just northwest of Los Angeles. Oxnard is the largest city in Ventura County and is at the center of a regional agricultural industry with a growing business center (see Figure 1.1). The City has jurisdictional authority to provide potable water, wastewater treatment, and stormwater services to its nearly 200,000 citizens and numerous industrial and commercial users.

To deliver these services, the City owns and operates the 31.7 million gallon per day (mgd) average dry weather (ADW) capacity Oxnard Wastewater Treatment Plant (OWTP), which discharges secondary treated effluent to the ocean. As part of the City's Groundwater Recovery Enhancement and Treatment (GREAT) program, the City also owns and operates a 6.25-mgd capacity Advanced Water Purification Facility (AWPF) that treats OWTP effluent for reuse throughout the City and region.

Given the City's challenges and opportunities to meet them, this Public Works Integrated Master Plan (Integrated Master Plan) develops long-term recommendations for policies, programs, and goals that successfully address the challenges and opportunities in a holistic and integrated way. In carrying out these goals, the Integrated Master Plan will help the City respond to planned population increase, challenges from new regulatory requirements, drought conditions, aging infrastructure, and reliability concerns.

In addition, the Integrated Master Plan documents the policy decisions, goals, and objectives to help protect public health while balancing the environmental, social, and financial impacts of the City's water resource management. This Plan also develops cost-effective strategies to address growth, regulatory compliance, environmental protection, and public and worker safety in ways that are consistent with the Plan's polices, goals, and objectives.



PROJECT AREA FOR INTEGRATED MASTER PLAN

FIGURE 1.1

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SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

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1.2 FACILITIES OVERVIEW

The City of Oxnard receives water by drawing it from the local Oxnard Plain groundwater basin and importing groundwater and surface water from United Water Conservation District (UWCD) and State Water Project via Calleguas Municipal Water District (CMWD), respectively. Before water enters the potable water distribution system, the City uses six blending stations throughout the City for hydraulic blending. One of these blending stations also treats the local groundwater for high levels of total dissolved solids (TDS).

In addition, the City owns and operates its own wastewater collection and treatment system, the OWTP, located on Perkins Road. Since its inception in the mid 1950's, the OWTP has grown from a capacity of approximately 5 mgd to its current capacity of 31.7 mgd.

The OWTP includes raw sewage pumping, influent screening and grit removal, primary sedimentation, an activated sludge secondary treatment process, effluent disinfection, and solids handling consisting of thickening, anaerobic digestion, and dewatering. Final effluent is routed to the City's AWPF or conveyed to the Pacific Ocean and discharged offshore.

To produce recycled water, the City uses the AWPF facility, dedicated in 2012, as part of the City's GREAT program. The AWPF facility provides advanced treatment of secondary treated wastewater effluent for recycled water use.

At the GREAT program's inception in 2009, its objectives were to:

- Increase water supply reliability during drought.
- Reduce water supply costs.
- Protect the water supply while trying to meet a growing water demand.
- Enhance local water supply stewardship through recycling and reusing a substantial portion of the region's wastewater.
- Maximize environmental benefits from developing and rehabilitating local saltwater wetlands.

Since the GREAT program's inception, the City shifted from its focus of using groundwater recharge as a sea water intrusion barrier to using the recycled water for an aquifer storage and recovery (ASR) operation. Because indirect potable reuse (IPR)/direct potable reuse (DPR) provides many benefits and is becoming more commonplace in the current regulatory climate, the City has renewed interest in it.

In addition to water, wastewater, and recycled water systems, the City operates a network of stormwater facilities consisting of collection piping and channels to convey stormwater to both the Santa Clara River and the ocean. Although Ventura County owns these facilities, the City maintains many of them.

1.3 MASTER PLAN PURPOSE AND DRIVERS

This Integrated Master Plan provides a phased program for constructing improvements to the City's infrastructure facilities that will accommodate planned growth while maintaining treatment reliability, meeting future regulatory requirements, and optimizing costs through the planning horizon (2040). Included with this document is the overall vision for the City's future infrastructure, the goals and objectives to achieve that vision, and an assessment of the City's existing facilities to meet those goals and objectives throughout the planning horizon.

In the first stages of the planning process, key planning drivers were identified that would direct the master planning efforts and evaluate and recommend necessary facilities, policies, and programs within the Integrated Master Plan. These drivers are described below.

- **Rehabilitation/Replacement (Condition)** – A condition trigger was assigned when the process or facility had reached the end of its economic useful life. This trigger is determined by the need to maintain a facility so it can operate reliably and meet performance requirements related to existing regulatory permits, worker and public safety, protection of the environment, and all other requirements.
- **Regulatory Requirement** – A regulatory trigger was assigned when local, state, or national regulatory requirements necessitated new facilities. Determining when the new facilities would be built depended on the amount of lead-time needed to plan, design, and construct the facilities according to the new requirements.
- **Economic Benefit** – An economic benefit trigger was assigned when life-cycle costs, consisting of capital costs and operations and maintenance costs, could be significantly reduced. For example, an economic benefit might be realized when an increase in initial capital investment achieves an ongoing reduction in labor, energy, or chemical usage.
- **Improved Performance Benefit** – An improved performance benefit trigger was assigned when improved operations and maintenance performance led to more reliability and/or reduced operational and safety-related risks. For example, this type of trigger would be applied when improving process control and automation or addressing an operational concern, such as adding flexibility/reliability or decreasing complexity, or reducing salts/ammonia going to the advanced facilities.
- **Growth Leading to Increased Demands/Flows/Loads** – A flow or pollutant load trigger was assigned when an increase in existing capacity was needed to accommodate future increases in demand or influent flows or loads to a facility. These increases are determined by population growth, industrial discharges, annexation, regionalization, or changes in wet weather operation.
- **Resource Sustainability** – A resource sustainability trigger was assigned when there was a desire to meet energy initiatives, include resource recovery opportunities, and / or consider sustainable design alternatives.

- **Policy Decision** – A policy trigger was assigned when policymakers made management and/or political decisions.

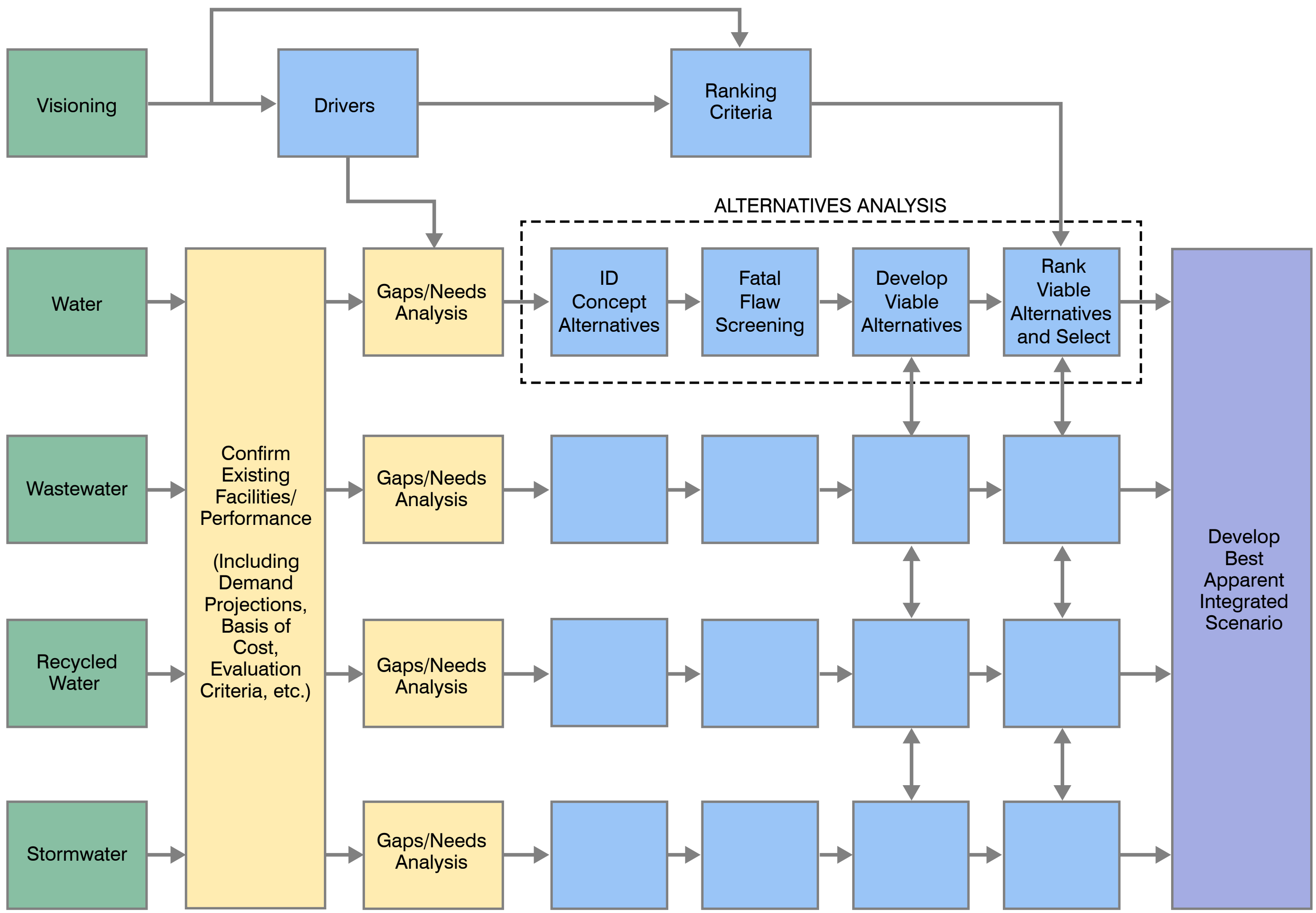
1.4 APPROACH TO THE INTEGRATED MASTER PLAN

The Integrated Master Plan addresses future planning needs for all major water utilities within the City's jurisdiction, which include water, wastewater, stormwater, and recycled water. The Plan builds on previous planning efforts using a coordinated methodology, allowing the City to take full advantage of potential linkages among the four water utility systems.

In addition, this Plan is coordinated with a Streets Master Plan to time future streets improvements with utility upgrades. This effort involved using the City's Geographic Information System (GIS) to identify large streets projects and upgrades to water infrastructure and then planning to complete these upgrades simultaneously to limit impacts on the City's streets. The City GIS staff/department will lead the effort to combine the Integrated Master Plan with the GIS planning system.

To develop this Integrated Master Plan, the following six major planning steps were completed. These steps are shown in Figure 1.2 and described below.

- **Confirm Existing Facilities/Performance.** Findings and conclusions of past studies and reports were assimilated to confirm existing facilities and their performance. Asset condition assessments were completed to assess facility's condition, criticality, and risk of failure.
- **Identify Gaps/Needs Analysis.** Gaps in required performance and utility capacity were identified by comparing the existing facilities' condition, performance, and capacity with the anticipated needs for repair and replacement (R&R), capacity, regulatory compliance, and other planning drivers. Future needs were identified based on pending regulatory requirements, planned capacity increases, R&R, cost-effectiveness, and performance improvements that drive the need for future facility improvements.
- **Analysis of Alternatives.** Viable alternatives were identified, evaluated, and developed to meet anticipated needs or to take advantage of new opportunities in resource recovery and/or technologies. A wide range of solutions were brainstormed, conceptual alternatives were identified, and screenings were conducted to select viable alternatives. The viable alternatives and their abilities were then selected to meet the overall goals and objectives.
- **Identify Linkages/Evaluate Alternatives.** Various water system plans that support utilities were coordinated to identify key linkages and critical implementation issues, to quantify costs and benefits, and to rank alternatives.



MASTER PLANNING PROCESS OVERVIEW

FIGURE 1.2

CITY OF OXNARD

SUMMARY REPORT

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CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

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- **Develop the Best Apparent Scenario.** The best combination of policies, projects, and ongoing programs across all utilities were evaluated and determined, and the best apparent integrated scenario was developed.
- **Develop Recommended CIP.** Estimated capital, operations, and maintenance costs were developed to the 25-year planning horizon (through 2040), and a financial evaluation and rate analysis were developed. A phased Implementation Plan was also developed to integrate the recommended improvements for all utilities for greater efficiency and cost-effectiveness.

This Integrated Master Plan is a high-level study that covers several areas within each infrastructure system. As such, this Plan will serve as the basis for future documentation, such as the environmental impact review and more detailed facilities planning and design. It will also be the basis for implementation steps, such as the implementation of planned projects and financial planning.

INTEGRATED MASTER PLAN OBJECTIVES, ASSUMPTIONS, AND CRITERIA

2.1 INTRODUCTION

This chapter establishes the overall master planning process by determining planning objectives and strategies, documenting key planning considerations and assumptions, and describing current and proposed regulatory requirements that apply to the Integrated Master Plan.

2.2 OBJECTIVES AND STRATEGIES

For this Integrated Master Plan, specific goals and objectives were developed considering the broad drivers established in Chapter 1. These goals and objectives provide a framework and boundaries for the City's planning process and can guide the development of alternatives and strategies as projects progress. Table 2.1 summarizes the Integrated Master Plan goals with corresponding objectives.

2.2.1 Water and Recycled Water

In addition to the goals and objectives included in Table 2.1, specific water supply goals that provide a framework for alternatives development and comparison were identified. These water supply goals include:

- Provide reliable/resilient supply to meet future conditions (i.e., changes to demand, regulations, and water quality).
- Meet City's water quality objectives.
- Protect existing water rights by maximizing use of groundwater allocation.
- Minimize future reliance on imported water by maximizing use of AWPF Facility.
- Attract industry and jobs.
- Keep rates affordable.

The Oxnard Plain Groundwater Basin's safe yield is a major constraint placed on the City's system. The Fox Canyon Groundwater Management Agency (FCGMA) protects the quantity and quality of the local groundwater by overseeing and managing all contractual withdrawals within the Oxnard Plain Groundwater Basin.

Table 2.1 Integrated Master Plan Goals and Objectives
Public Works Integrated Master Plan
City of Oxnard

Goal No	Planning Goals	Integrated Master Plan Objectives
1	Provide compliant, reliable resilient and flexible systems	• Improve system reliability consistent with industry standards. • Implement redundancy/backup systems for routine maintenance and repairs and for addressing security threats. • Implement innovative technology.
2	Integrate gray and green infrastructure with an emphasis on energy efficiency	• Optimize the systems' energy efficiency.(1) • Investigate green and gray infrastructure options, such as low impact development techniques for stormwater, or alternative energy sources.
3	Effectively manage assets (economic sustainability)	• Maximize the cost/benefit ratio. • Spend public money wisely.
	Integrate community interests and maximize public acceptance (social sustainability)	• Develop sustainable ongoing communication processes. • Minimize impacts to the public.
4	Mitigate and adapt to potential impacts of climate change	• Minimize potential climate change-related impacts to the system (e.g., sea level rise or changing rainfall patterns).
5	Protect environmental resources	• Maintain permit/regulatory compliance. • Position City for future regulatory changes.
	Enhance environmental sustainability	• Maximize water conservation. • Maximize wastewater reclamation and reuse. • Manage groundwater extraction. • Maximize the beneficial reuse of biosolids.

Notes:
(1) The City's Energy Action Plan sets a community-wide reduction in energy use of 10% by 2020, measured against a 2005 baseline.

2.2.2 Wastewater

While no goals specific to wastewater were identified, all projects proposed in this Integrated Master Plan are centered on the goals presented in Table 2.1. Key considerations for wastewater planning in Oxnard revolved around repairing and replacing (R&R) the existing system to maintain its reliability and safety as well as meeting or surpassing all regulatory requirements for wastewater effluent discharge.

2.2.3 Stormwater

In addition to the goals presented in Table 2.1, two stormwater specific objectives include maintaining the existing infrastructure and ensuring compliance with the Total Maximum Daily Load (TMDL). The Integrated Master Plan focuses on stormwater projects that will improve stormwater quality entering the environment and that can potentially harvest stormwater as an additional water supply. By including stormwater in the Integrated Master Plan, the integrated water utility system can become more robust, adaptable, and cost efficient.

2.3 KEY PLANNING CONSIDERATIONS AND ASSUMPTIONS

Although each utility (water, wastewater, recycled water, and stormwater) has its own set of specific design criteria based on each system's unique features, a common set of planning considerations and assumptions formed the basis for developing and evaluating each project. These key planning considerations are discussed in the following sections.

2.3.1 Population and Land Use

Population and land use projections help to determine the City's planned growth. With these projections, future water demands and wastewater flows can be calculated and used to determine additional water and wastewater infrastructure capacity required.

The Integrated Master Plan is flexible and sensitive to changes in the timing of future water utility infrastructure capacity. With this flexibility and sensitivity, constructing additional capacity can occur quickly when needed, providing for the least-cost future Capital Improvement Plan.

2.3.1.1 Land Use Projections

Land use projections were based on the City's 2030 General Plan and on conversations with the City's Planning Department. The future division between residential, commercial, and industrial users is assumed to remain largely the same as the current mix. As such, residential infill and mixed-use development are expected to form the largest population increase. Specific developments that will trigger significant growth include RiverPark, The Village, and potentially the South Shore and Teal Club Specific Plans.

2.3.1.2 Population Projections

A wide range of population projections were considered conceptually and three were evaluated in more detail. These three population projections are described below.

Two of the three projections were based on the City's 2030 General Plan, which was adopted in 2011 and extends through the year 2030. Using a variety of assumptions, this plan forecasted the 2030 population to be between 238,996 and 285,521. These two population forecasts are referred to as the low and high forecasts of the 2030 General Plan.

Because the 2030 General Plan population projections used data before the 2008 recession, the effects of the recession on population growth were not taken into account in these low and high forecasts. In response to this discrepancy, the City's Planning Department updated the 2030 General Plan population forecast in 2014 based on the 2010 Census and housing projections developed by Traffic Analysis Zone. The updated information formed the basis for the third projection, which projected a population below the low forecast of the 2030 General Plan.

As shown in Figure 2.1, the City's population forecasts vary significantly. The lowest population forecast (2014 Update) reflects an average growth rate of 0.5 percent per year, whereas the highest projection (2030 General Plan – High Forecast) reflects an average annual growth rate of 1.5 percent for the next 25 years.

The City's population is currently trending toward the General Plan's low forecast. Because of this, the Integrated Master Plan used the General Plan's low forecast to establish the planned needs and phasing of future capacity. These lower population projections were modified somewhat when combined with higher, more conservative per capita flows used to project water and wastewater flows.

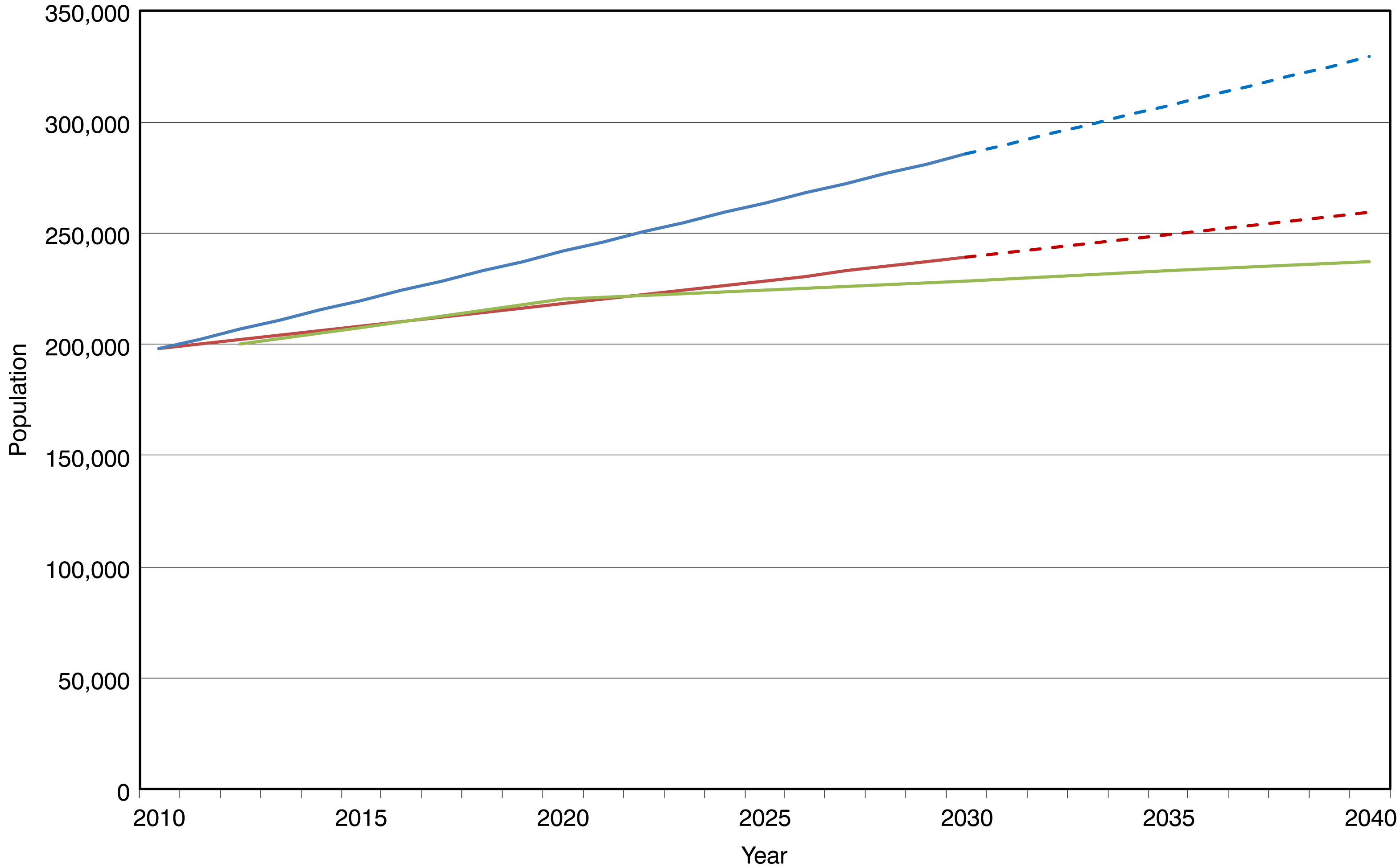
2.3.2 Climate Change

In addition to population, climate change can affect all utilities considered in the Integrated Master Plan. The chemistry and dynamics of atmospheric greenhouse gases, including water vapor, and carbon dioxide, hold heat in the atmosphere and create a natural greenhouse effect for the planet. Since the onset of the Industrial Revolution, data show that human-generated emissions of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons, have been accumulating in the atmosphere and are intensifying Earth's natural greenhouse effect more rapidly than expected (Rahmstorf, *et al.,* 2007).

Scientists predict that sea levels will rise and that more frequent and intense storms will occur. Thus, this Plan focuses on how rising sea levels might affect the wastewater system and how changes in precipitation patterns and the potential for drought might affect water supply and stormwater collection system capacity.

2.3.2.1 Sea Level Rise

Sea level is the ocean's elevation relative to a reference elevation. Data has shown that sea levels have increased over the last 100 years and are expected to accelerate at a faster rate in the future. Depending on the projection used, sea levels could rise anywhere from 7 to 18 feet by the year 2100. Since rising sea levels will affect the City's facilities, especially the OWTP, planning efforts incorporated these projections into the wastewater planning.



LEGEND

- 2030 General Plan Population (low)
- 2030 General Plan Population extrapolated (low)
- 2030 General Plan Population (high)
- 2030 General Plan Population extrapolated (high)
- 2014 Planning Department Population

HISTORICAL AND PROJECTED POPULATION

FIGURE 2.1

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

2.3.2.2 Rainfall

The City has experienced an increase in extreme precipitation events consistent with climatologist's' projections of a changing, warming climate. Although the amount of annual rainfall has increased only slightly, rainfall events are likely occurring more frequently and becoming more intense, with distribution patterns changing as well. Until regional climate models can provide more accurate projections for the Oxnard area, long-term planning should assume that more frequent and intense precipitation events and changing weather patterns will continue.

2.3.2.3 Drought

The number of dry days during summer months is also expected to increase, extending California's already long dry season. As such, longer, drier, and more frequent periods of drought are anticipated, with up to 2.5 times the number of critically dry years by the end of the century. Until more accurate scientific information and regional model results indicate otherwise, the California Department of Water Resources recommends that local agencies assume a 20 percent increase in the frequency and duration of future dry conditions to prepare for future droughts (DWR 2008h).

2.3.3 Sustainability

The City seeks to develop sustainable water solutions and infrastructure. As such, the Integrated Master Plan used the Envision® Sustainability Rating System as a framework for developing the evaluation criteria and metrics for strategies and alternatives. Each of the five Integrated Master Plan goals (shown in Table 2.1) were assessed through the lens of the Envision® tool to help further define these goals in a way that produces measureable metrics for comparing alternatives.

2.3.3.1 Envision®

The Envision® Rating System was developed through a joint collaboration between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure[1]. It provides a holistic framework for evaluating and rating the community, environmental, and economic benefits of all types and sizes of infrastructure projects. The Envision® Rating System evaluates, grades, and recognizes infrastructure projects that use transformational and collaborative approaches to assess the sustainability indicators throughout a project's life cycle.

The Integrated Master Plan used Envision® to make an initial assessment of sustainability at the "big picture" level. This assessment was informed by the City's overarching values and goals for sustainability as much as it was by the goals and objectives of the Integrated

[1] The Institute for Sustainable Infrastructure (ISI) is a 501 (c) (3) not for profit organization, structured to develop and maintain a sustainability rating system for civil infrastructure in the United States. ISI was founded by the American Council of Engineering Companies (ACEC), the American Public Works Association (APWA), and the American Society of Civil Engineers (ASCE) and is governed by a nine-member Board of Directors appointed by the founding organizations.

Master Plan. With the assessment, a minimum performance level for reducing greenhouse gas emissions was identified and stretch goals were established to show the range of sustainable principles that could be implemented. This assessment also helped to develop criteria used to evaluate and compare alternatives.

From the initial assessment, two types of evaluation tests emerged. The first type was termed an overarching principle (OP), which is the minimum threshold every alternative must meet to be considered viable. The second type was termed a measurable criterion (MC), which is a result that can be measured, quantified, and assigned (a "metric") to determine the relative performance of alternatives.

Table 2.2 summarizes the OP and MC associated with each of the five major goals of the Integrated Master Plan.

Table 2.2 Evaluation Criteria Established for Integrated Master Plan
Public Works Integrated Master Plan
City of Oxnard

Goal	Objective	Type of Criteria	Metric	Unit of Measure	Associated Envision® Credit
#1	**Provide Compliant, Reliable, Resilient and Flexible Systems**				
	Improve system reliability consistent with industry standard.	OP	--	--	
	Implement redundancy/backup for routine maintenance and repairs and address threats to security.	OP	--	--	
	Provide flexibility to respond to changes in regulatory requirements, and reuse water demand or technological advances.	MC	Project Cost Differential	Incremental cost to change from current conditions.	CR2.2 Avoid traps and vulnerabilities CR2.3 Prepare for long-term hazards.
	Provide the ability to implement in a timely manner for a given need.	MC	Implementation Time	Years	

Table 2.2 Evaluation Criteria Established for Integrated Master Plan
Public Works Integrated Master Plan
City of Oxnard

Goal	Objective	Type of Criteria	Metric	Unit of Measure	Associated Envision® Credit
#2	**Investigate Gray and Green Infrastructure with an Emphasis on Energy Efficiency**				
	Investigate gray and green infrastructure.	OP			NW2.1 Manage Stormwater (through LID).
	Maximize energy efficiency/sustainable energy use.	MC	Net non-renewable Energy Use (Energy use – Energy production – Renewable energy use/ purchase)	kWh/year	RA2.1 Reduce energy consumption. RA2.2 Use renewable energy.
#3	**Manage Assets Effectively (Economic Sustainability)**				
	Maximize cost/benefit ratio.	MC	Capital Costs O&M Costs Life-cycle Costs	Total Project Cost ($) Total O&M Cost ($/year) Annual Costs ($/year)	LD3.3 Extend Useful Life.
#4	**Mitigate and Adapt to Potential Impacts of Climate Change**				
	Minimize impacts to system due to events related to climate change.	OP			CR2.1 Assess climate threat. CR2.2 Avoid traps and vulnerabilities. CR2.3 Prepare for long-term adaptability.
	Minimize contribution to climate change factors through reducing/minimizing GHG emissions.	MC	Greenhouse Gas Emissions	Metric tons of CO2 equivalent emissions per year	RA1.1 Reduce net embodied energy. CR1.1 Reduce greenhouse gas emissions.
	Maintain regulatory/permit compliance.	OP			QL2.1 Protect public health.
	Maximize sustainable water use.	MC	Potable Water Offset	MG per year	RA3.1 Protect fresh water availability.

Table 2.2 Evaluation Criteria Established for Integrated Master Plan Public Works Integrated Master Plan City of Oxnard

Goal	Objective	Type of Criteria	Metric	Unit of Measure	Associated Envision® Credit
					RA3.2 Reduce potable water consumption.
		MC	Groundwater Replenishment	MG per year	RA3.1 Protect fresh water availability.
	Maximize beneficial reuse of solids.	MC	Solids Reused	Tons per year	RA1.5 Divert waste from landfills.

Notes:
OP = Overarching Principle
MC = Measured Criteria
QL = Quality of Life
RA = Resource Allocation
LD = Leadership
NW = Natural World
CR = Climate & Risk

2.3.3.2 Energy

Although the City has a broad interest in applying sustainable solutions, it specifically aims to reduce energy use and increase energy efficiency throughout the system. As part of this effort, the City completed an Energy Action Plan in April 2013 and committed to pursuing the "Gold Level" as defined in Southern California Edison's Energy Leadership Partnership Program.

This goal targets a 10 percent reduction in energy use for City Government facilities. Oxnard's Energy Plan expands this 10 percent reduction to the community at large, calling for a 10 percent citywide reduction in electricity and natural gas use. By implementing all recommended Energy Plan programs, State programs, and programs implemented since 2005, Oxnard is expected to decrease its greenhouse emissions by 114,000 million tons (MT) of CO_2 equivalent, which is an 8 percent reduction.

As part of the planning efforts for the Integrated Master Plan, the Energy Plan's recommendations were incorporated into the recommended CIP. The following three main recommendations were applicable:

- **Incorporate Greening Guidelines:** Incorporate green strategies by constructing new facilities that reduce energy consumption.
- **Increase Onsite Electricity Generation at City Wastewater Treatment and Materials Recovery Facility:** Investigate increasing the fats, oil, and grease collected for bio-gas electricity generation at the wastewater treatment plant.
- **Recycled Water Outreach and Education Program:** Expand use of the AWPF facility and educate the public on the energy savings associated with it.

2.3.4 Basis of Costs

Cost estimates were also coordinated across each utility to ensure comparable and consistent estimates. These estimates are described below.

The Association for the Advancement of Cost Engineering International (AACE International, formerly known as the American Association of Cost Engineers) has suggested levels of accuracy for five estimate classes. These five estimate classes are presented in the AACE International Recommended Practice No. 17R-97 (Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries). For projects in the Integrated Master Plan, cost estimates were developed following the AACE International Recommended Practice No. 17R-97 estimate Classes 4 and 5. Class 4 and 5 estimates are appropriate for master planning purposes and are derived from previous project costs and factored estimates where the former were not available.

Additionally, due to the differing nature of projects that occur within a treatment plant and for a collection or distribution system, two approaches were taken to estimate costs. The first approach, outlined in Table 2.32.3, is the method used for all projects recommended within the fence line of the OWTP and AWPF. The second approach, also outlined in Table 2.3, is the method used for all other capital improvement projects recommended for the Integrated Master Plan, including the water blending stations.

Table 2.3 Basis for Estimating Project Costs for the Integrated Master Plan
Public Works Integrated Master Plan
City of Oxnard

Item	Estimated Cost at OWTP and AWPF(1)	Estimated Cost for All Other Projects(2)
Base Construction Cost from Carollo Cost Curves and past projects (Bid Tabs)(3):	"A"	"A"
• Adjust base construction cost for field piping(4)	15% of "A"	--
• Adjust base construction cost for electrical/instrumentation(4)	20% of "A"	--
• Adjust base construction cost for sheeting/shoring/piles and painting(4)	10% of "A"	--
Subtotal ("B")	**145%**	**100%**
Construction Contingency	15% of "B"	30% of "B"
Subtotal Construction Cost ("C")	**167%**	**130%**
Add 24% of Construction Cost to Cover Project Cost Factor(5)	24% of "C"	24% of "C"
Total Estimated Project Cost ("D")	**207%**	**161%**

Table 2.3	Basis for Estimating Project Costs for the Integrated Master Plan Public Works Integrated Master Plan City of Oxnard

Notes:
(1) Used to estimate all costs considered within the fence line of the treatment facilities.
(2) Used to estimate all costs considered outside the fence line (i.e., pipelines, well pumps, booster pumping, and storage).
(3) Adjust this cost to 20-City Index ENR CCI of 9962 (February 2015) and needed city location adjustment factors.
(4) Costs are adjusted based on site-specific conditions.
(5) Includes all "soft" costs: engineering, administration, legal, and construction management.

The main difference in these approaches is that the OWTP and AWPF projects use a construction contingency of 15 percent, whereas all other projects use a construction contingency of 30 percent. The different contingencies reflect the type of work being done and the more detailed nature of the OWTP and AWPF projects.

Table 2.4 presents the economic criteria used to estimate annual costs for all projects. When developing annual costs, these criteria are applied to capital and Operations and Maintenance (O&M) costs.

Table 2.4 Economic Criteria
Public Works Integrated Master Plan
City of Oxnard

Item	Assumption
Costs in Time and Place(1)	Costs are based on Oxnard costs in February 2015
Inflation Rate(2)	Annual inflation rate is assumed to be 3 percent
Interest Rate(2)	5 percent for amortization purpose
Amortization Period	20 years

Note:
(1) 20-City Average Index ENR CCI of 9,962 was used for February 2015. A R.S. Means Location Factor of 106.6 for Oxnard was used (ENR, 2015) (RSMeans, 2015).
(2) The inflation and interest rate are based on past experience with and an understanding of the economic climate of this industry.

2.4 REGULATORY REQUIREMENTS

2.4.1 Water

Water treatment and supply facilities must meet all state and federal water quality guidelines. The Environmental Protection Agency (EPA) establishes federal regulations in the form of the Safe Drinking Water Act, and the California Division of Drinking Water (DDW) administers state guidelines. Because the City's drinking water supply is a blend of surface water and groundwater, regulations apply to both.

2.4.1.1 Current

Local groundwater wells are a major source of the City's water, making groundwater regulations the most relevant. Since wholesalers providing surface water to the City must meet treatment regulations before the water enters the system, surface water regulations related to treatment are not summarized in this chapter. In this case, the CMWD is responsible for meeting all applicable surface water treatment regulations. The City, however, must meet any distribution-related regulation related to water quality. Table 2.5 summarizes current regulations focused on water quality within groundwater and distribution systems.

In addition to regulations related to groundwater quality, the quantity of groundwater use is managed by the FCGMA, an organization created by the California Legislature in 1982 to oversee Ventura County's vital groundwater resources. As an independent, special district separate from the County of Ventura or any city government, the FCGMA manages and protects both confined and unconfined aquifers within several groundwater basins beneath the southern portion of Ventura County.

The FCGMA establishes a set of ordinances directed at groundwater extraction. The most recent ordinance, Emergency Ordinance E, limits extractions from groundwater extraction facilities, including the City, due to the drought's impacts on underlying aquifers.

An additional consideration is that the Sustainable Groundwater Management Act (SGMA) was passed through the California state legislature in September 2014. The goal of this act is to have a sustainable management of groundwater by the year 2042. The full implications of SGMA are not known at the time of publication of this updated Plan but should be considered as projects move forward.

2.4.1.2 Future Potential Regulations

Future regulations that could potentially affect the City's system are also summarized in Table 2.5.

2.4.2 Wastewater

2.4.2.1 Water Quality

2.4.2.1.1 *Current*

Wastewater discharges are governed by both federal and state requirements. The primary laws regulating water quality are the Clean Water Act (CWA) and the California Water Code. Under the CWA, the EPA or a delegated State agency regulates discharging pollutants into waterways through the issuance of National Pollutant Discharge Elimination Systems (NPDES) permits. NPDES permits set limits on the amount of pollutants that can be discharged into the waters of the United States. Since the OWTP is located in the Los Angeles Region, the Los Angeles Regional Water Quality Control Board (LARWQCB) has authority to issue permits for wastewater discharge and waste discharge requirements for recycled water use.

Currently, the OWTP discharges to the Pacific Ocean under existing NPDES permit (CA0054097), which was adopted by the LARWQCB on July 26, 2013. This permit establishes discharge limits for conventional constituents, nutrients, metals, and organics. The aim of these limits is to protect aquatic life and other beneficial uses of the receiving water. Table 2.6 lists conventional constituents and metals with their permit limits.

2.4.2.1.2 *Future (Potential)*

As analytical techniques for detecting toxic compounds improve and detection limits drop, additional parameters might exceed California ocean plan objectives. As such, effluent limits might be added to the OWTP NPDES permit.

2.4.2.2 Air Quality

2.4.2.2.1 *Current*

At a local level, the Ventura County Air Pollution Control District (APCD) is primarily responsible for controlling air pollution from the OWTP. Beyond the local level, air quality permits are required by State and Federal laws as part of doing business in Ventura County. The OWTP currently holds permits from the District for the following sources:

- Two effluent pump natural gas engines.
- Three electrical generator waste gas engines.
- Two waste gas burners.
- One odor reduction tower.
- One odor control system (headworks).
- One odor reduction station (solids processing building).
- Six standby diesel engines for electricity generators.
- One emergency standby diesel engine for air compressor.

The APCD also regulates the emission of certain odorous substances, such as sulfur dioxide and hydrogen sulfide. Improvements and changes to the wastewater process and discharge location are likely to require revised air quality permits. Table 2.7 summarizes these concentration levels.

Table 2.5 Overview of Relevant Drinking Water Regulations
Public Works Integrated Master Plan
City of Oxnard

Regulation	Compliance Date	Requirements and Maximum Contaminant Level (MCL)
Current Applicable Regulations		
Safe Drinking Water Act and National Primary Drinking Water Regulations	Ongoing	Maximum contaminant levels (MCLs), maximum contaminant level goals (MCLGs), and/or treatment techniques set for 83 contaminants, including turbidity, seven microorganisms (two of which are indictors), four radionuclides, 16 inorganic contaminants, and 57 organic contaminants.
Stage 1 Disinfectants and Disinfection Byproducts Rule	1/1/01 – monitoring 1/1/02 – MCL compliance	Reduced total trihalomethanes (TTHM) limit from 0.1 to 0.080 milligrams per liter (mg/L); reduced haloacetic acids (HAA5) limit from 0.08 to 0.060 mg/L. Established an MCL for bromate of 0.010 mg/L; Established an MCL for chlorite of 1.0 mg/L Compliance for TTHMs & HAA5 based on a running annual average.
Stage 2 Disinfectants and Disinfection Byproducts Rule	10/1/06 – first provision 1/1/13 – all provisions	Perform Initial Distribution System Evaluation to identify new DBP compliance locations. Change compliance calculations from RAA to Locational Running Annual Averages.
Radionuclides Rule	12/31/07	Updated standards: Combined radium 226/228: 5 pCi/L. Total beta particles and photon emitters: 4 mrem/yr. Gross alpha particles (excluding U and Rn): 15 pCi/L. Uranium MCL: 30 µg/L.
Arsenic Rule	1/23/06	Arsenic MCL: 0.010 mg/L.
Secondary Drinking Water Regulations	Ongoing	Non-enforceable standards for aesthetic parameters.
Partnership for Safe Water	Ongoing	Voluntary standards and practices to minimize risk of microbial contamination of treated water.
Inorganic Chemicals	Various	Existing National Primary Drinking Water Regulations (NPDWRs) set standards for a number of different metals and other inorganic chemicals, including aluminum and nitrate.
Synthetic and volatile organic chemicals	Various	Existing NPDWRs for a number of different herbicides, pesticides, solvents, and other organic chemicals. Monitoring and reporting requirements.
Lead and Copper Rule and 2007 Revisions	1993 - 4/10/2008	Requires water suppliers to optimize their treatment system to control corrosion in a customer's plumbing. If lead action levels are exceeded, the suppliers are required to educate their customers about lead and suggest actions to reduce their exposure through public notices and public education programs.
Revisions Cr(VI)	CA MCL - 4/2014	DDW established MCL of 10 µg/L.

Table 2.5 Overview of Relevant Drinking Water Regulations
Public Works Integrated Master Plan
City of Oxnard

Regulation	Compliance Date	Requirements and Maximum Contaminant Level (MCL)
Future Regulations		
New “lead free” standard under the SDWA	1/4/14	Amends SDWA Section 1417 – Prohibition on Use and Introduction into Commerce of Lead Pipes, Solder, and Flux: Changes the definition of “lead-free” by reducing lead content from 8 percent to a weighted average of no more than 0.25 percent in the wetted surface material. This change primarily affects brass/bronze.
Combined Volatile Organic Compounds	Projected 10/14 proposal, 6/15 final	Efforts to define a VOC Rule are ongoing. The novel “group risk” approach focuses on total public health as opposed to each chemical. This may be combined using a common analytical method, treatment, or MCLG.
Revised trichloroethylene and tetrachloroethylene MALss	Unknown	These may be regulated separately from other VOCs.
Revised Lead and Copper Rule	Projected 2017	The EPA is evaluating all aspects of the current rule.
Nitrosamines	Unknown	The EPA is collecting data for possible future group MCL for nitrosamines (byproduct of chloramines). California Notification Level of 0.01 µg/L for NDMA.
Revised Total Coliform Rule	April 2016	Requires that MCL for Total Coliforms (including fecal coliform and E. coli) are no more than 5 percent of samples total coliform-positive.

Table 2.6 OWTP NPDES Permit Limits
Public Works Integrated Master Plan
City of Oxnard

Constituent	Units	Effluent Limitations[1]				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	--	--	--
	lbs/day	7,960	11,900	--	--	--
Total Suspended Solids (TSS)	mg/L	30	45	--	--	--
	lbs/day	7,960	11,900	--	--	--
pH	standard units	--	--	--	6.0	9.0
Oil and Grease	mg/L	25	40	--	--	75
	lbs/day	6,630	10,600	--	--	19,900
Settleable Solids	ml/L	1.0	1.5	--	--	3.0
Turbidity	NTU	75	100	--	--	225
Chronic Toxicity	TUc	--	--	99	--	--
Gross alpha	PCi/L	--	--	15	--	--
Gross beta	PCi/L	--	--	50	--	--
Combined Radium-226 & Radium-228	PCi/L	--	--	5.0	--	--
Tritium	PCi/L	--	--	20,000	--	--
Strontium-90	PCi/L	--	--	8.0	--	--
Uranium	PCi/L	--	--	20	--	--
Benzidine[2]	ug/L	0.0068	--	--	--	--
	lbs/day	0.0018	--	--	--	--
Heptachlor epoxide[2]	ug/L	0.002	--	--	--	--
	lbs/day	0.00053	--	--	--	--
Polychlorinated biphenyls (PCBs)[2]	ug/L	0.0019	--	--	--	--
	lbs/day	0.0005	--	--	--	--
Tetrachlorodibenzo-p-dioxin (TCDD) Equivalents[2]	ug/L	0.00000039	--	--	--	--
	lbs/day	0.0000001	--	--	--	--

Notes:
(1) From the 2013 NPDES Permit No. CA0054097.
(2) The reasonable potential analysis' result is inconclusive. Therefore, limitations are carried over from Order No. R4-2007-0029, as amended by Order No. R4-2010-0048, to avoid backsliding.

Table 2.7	Hydrogen Sulfide and Sulfur Dioxide Ground Level Concentrations - Emission Limits Public Works Integrated Master Plan City of Oxnard	
Substance	**Limit Ground Level Concentration (ppm)**	**Duration**
Hydrogen Sulfide[1]	0.06 or	Averaged over 3 consecutive minutes
	0.03	Averaged over 60 consecutive minutes
Sulfur Dioxide[1]	0.25 or	Averaged over 60 consecutive minutes
	0.04	Averaged over 24 hour period

Notes:
(1) Source: Ventura County Air Pollution Control District Regulation 4, Rule 54, (July 1994).
(2) http://www.vcapcd.org/Rulebook/Reg4/RULE%2054.pdf.

2.4.2.2.2 *Future (Potential)*

A recent amendment to the APCD's air quality regulations may affect the OWTP in the near future. This amendment, called Rule 54, was amended in January 2014 to limit sulfur dioxide emissions to 75 parts per billion (ppb) at or beyond the property line. Although existing sources do not need to demonstrate compliance, all sources must meet the combustion emission limit on a dry basis using a revised calculation to account for percent oxygen content.

In addition to this amendment, a draft amendment to Rule 74.15.1 regarding boilers, steam generators, and process heaters might also affect regulations. This rule would limit nitrogen oxide emissions for new or replacement units rated greater than 2 million BTU/hr and less than 5 million BTU/hr. These new limits would be based on similar standards adopted by the San Joaquin Valley in Rule 4307.

2.4.2.3 Biosolids

Currently, the OWTP disposes of its screenings, grit, and dewatered anaerobically digested solids (biosolids) by hauling it to a nearby landfill. To best use the energy and nutrient content, alternatives to landfilling biosolids were considered in the Integrated Master Plan.

2.4.2.3.1 *Current*

The EPA's 40 CFR 503 regulations are the main federal regulations of biosolids. The 40 CFR 503 regulations establish metal concentration limitations, pathogen density reduction requirements, vector attraction reduction requirements, and site management practices for the land application of biosolids. The 40 CFR 503 regulations also establish requirements for the surface disposal and incineration of biosolids.

In California, State regulations of biosolids land application are more stringent than federal regulations. The State Water Resources Control Board (SWRCB) has adopted General Waste Discharge Requirements for the Discharge of Biosolids to Land for use as a Soil

Amendment in Agricultural, Silvicultural, Horticultural, and Land Reclamation Activities (Biosolids General Order).

The Biosolids General Order goes beyond the requirements of 40 CFR 503 by requiring additional biosolids testing, soil testing, groundwater sampling, and wind and dryness limitations. Regulations for biosolids reuse and disposal in landfills in California are also more stringent and fall under the jurisdiction of the California Department of Resources Recycling and Recovery (CalRecycle). In addition to regulating the co-disposal of biosolids in landfills and the use of biosolids for alternative daily cover, CalRecycle also regulates facilities that compost biosolids.

2.4.2.3.2 *Future (Potential)*

Using or disposing of biosolids is becoming increasingly difficult in California. Many California utilities are restricting the land application of biosolids, and fewer landfills are accepting them. Furthermore, the State of California has passed several bills that directly affect the ability to send biosolids to landfills in the future.

Two bills in particular affect the land application of biosolids: Assembly Bill 341 and Assembly Bill 1594. In 2013, California passed Assembly Bill 341, which requires a 75 percent reduction of solid waste sent to landfills by 2020. (It is expected that by 2025, a 90 percent reduction of solid waste sent to landfills will be required.) In September 2014, Assembly Bill 1594 was passed, requiring that green waste no longer qualifies for diversion credit when used as alternative daily cover at a landfill. When this bill is fully implemented January 1, 2020, the diversion credits that utilities currently receive will be eliminated.

Approximately 30 percent of the solid waste stream sent to landfills is organic, which CalRecycle is working to eliminate from landfills in support of the Air Resources Board Assembly Bill 32 Scoping Plan’s target to reduce greenhouse gas emissions to 1990 levels by 2020. Although the Assembly Bill 32 Scoping Plan does not explicitly state that organic waste streams are or will be prohibited from use as alternative daily cover, it does state that opportunities for phasing out landfilling organic material are being pursued, and that legislation could be developed as early as 2016.

2.4.3 Recycled Water

2.4.3.1 <u>Current</u>

The City has served urban irrigation uses since 2015 and agricultural uses since 2016. The City also plans to use recycled water for aquifer storage and recovery (ASR) and groundwater recharge for potable reuse. The permitting process for potable reuse occurs on a case-by-case basis.

Based on the uses of recycled water being considered by the City, the following regulations and policies apply:

- Urban/Agricultural Reuse – California Code of Regulations (CCR), Title 22, Division 4, Chapter 3, Section 60301 et seq. (Title 22) & the Recycled Water Policy (SWRCB Res No. 2009-0011, recycled water (RW) Policy).

- IPR/Groundwater Recharge – DDW's Groundwater Recharge Regulations and SWCRB's Recycled Water Policy and Anti-Degradation Policy.

The applicable recycled water regulations noted above are summarized in the following sections. In addition to the above regulations, the City's GREAT program is currently permitted under Waste Discharge Permit, Order No. R4-2011-0079-A01, which was recently amended in July 2015. This permit covers non-potable reuse within the GREAT program.

2.4.3.1.1 *Non-Potable*

The DDW is now California's primary agency responsible for protecting public health, regulating drinking water, and developing uniform water recycling criteria appropriate for particular water uses.

The DDW published the Title 22 recycled water regulations (CDPH, 2014a). Based on the level of treatment the AWPF will provide, per Title 22, non-potable uses of the City's recycled water include surface irrigation of food crops, parks, playgrounds, school yards, residential and freeway landscaping, unrestricted access golf courses, and some construction uses. The RW can also be used in industrial or commercial cooling or boiler operations as well as recreational impoundments.

2.4.3.1.2 *Indirect/Direct Potable Reuse*

The primary State agencies responsible for regulating an IPR project include DDW, LARWQCB, and the SWRCB. Because the purpose of IPR is to discharge to the existing Oxnard Plain Groundwater Basin and withdraw for potable reuse, several regulations apply. All of the applicable regulations that pertain to the installation and operation of IPR are summarized in Table 2.8.

2.4.3.2 <u>Future (Potential)</u>

For recycled water, endocrine-disrupting chemicals and other compounds of emerging concern (CECs) are most likely to be regulated. The RW Policy highlights CECs as a potential issue for recycled water.

While there are no current regulations for these constituents in recycled water, in accordance with the Recycled Water Policy, the State Water Board convened a science advisory panel (Panel) to guide the future monitoring of CECs in recycled water. The Panel developed a report that recommended ways to monitor for specific CECs in recycled water used for groundwater recharge reuse.

Table 2.8	Summary of All Applicable Regulatory Requirements for Recycled Water Systems Public Works Integrated Master Plan City of Oxnard	
Governing Agency	**Applicable Regulation/Policy**	**Regulatory Concept/Objective**
DDW	Title 22, Division 4, Chapter 3 of the California Code of Regulations	Stipulates criteria for both non-potable uses of recycled water and groundwater recharge for subsequent potable use, with the most recent version updated as of June 2014 (CDPH, 2014).
	60320.208	Requires that specific pathogen reduction targets must be met through multiple treatment processes. The log reduction requirements for viruses, *Giardia,* and *Cryptosporidium* are 12, 10, and 10, respectively.
	60320.210	Requires that a total nitrogen standard of ≤10 mg/L must be met at all times.
	60320.218	Requires a minimum TOC value of ≤0.5 mg/L is required.
	60320.226	Requires that, before operation, monitoring wells are placed in appropriate locations to monitor the movement and water quality of the injected water.
LARWQCB	Update WDRs Permit	Requires an amendment to the existing permit or a reissuance of a WDRs/WRR will be necessary prior to discharge.
SWRCB	Recycled Water Policy	Include Salt Nutrient Management Plans (SNMPs), Recycled Water Groundwater Recharge Projects (GRPs), anti-degradation, and monitoring constituents of emerging concern (CECs).
	SNMPs	Manages salts and nutrients from all sources "… on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses."
	GRPs	Requires compliance with regulations adopted by CDPH (now DDW) for groundwater recharge projects (CDPH, 2014).
	Anti-Degradation Policy (Resolution 68-16)	"… [Ensures that (a) pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."
	CEC Monitoring	Requires implementation of a monitoring program for CECs and priority pollutants, consistent with recommendations from DDW.

2.4.4 Stormwater

2.4.4.1 <u>Water Quality</u>

In cooperation with the federal EPA, the SWRCB has issued stormwater permits under the NPDES program. The City is a co-permittee, along with nine other cities and the Ventura County Watershed Protection District (VCWPD), for the MS4 NPDES permit issued by the California Regional Water Quality Control Board (RWQCB). The current MS4 permit was issued on July 8, 2010 (Permit CAS004002, Order No. R4-2010-0108). Pursuant to the permit, VCWPD has developed a countywide Stormwater Quality Management Plan that includes management measures/best management practices (BMPs).

Ventura County, through the use of a stormwater ordinance, also regulates stormwater quality in the County. The Ventura County Stormwater Ordinance (Ordinance No. 4142) prohibits non-stormwater discharges into County stormwater facilities and seeks to reduce pollutants in stormwater to the maximum extent practicable. Each co-permittee is responsible for adopting and enforcing stormwater pollution prevention ordinances, implementing self-monitoring programs and BMPs and conducting applicable inspections.

2.4.4.1.1 *Total Maximum Daily Load (TMDLs)*

Within Ventura County are a number of water bodies with TMDLs. The City of Oxnard is a participating party in the Santa Clara River Bacteria TMDL and implements the Harbor Beaches TMDL on its own.

Santa Clara River Bacteria TMDL went into effect in March 2012. The TMDL Implementation Plan is currently being developed through an agreement among the County of Ventura and the cities of Fillmore, Oxnard, Santa Paula, and Ventura (VCWPD, 2015). In addition, the same parties have developed the receiving water monitoring plan.

The Harbor Beaches TMDL went into effect in December 2008, and dry and wet weather implementation plans were submitted in 2009 and 2010. The City has implemented, and continues to implement, BMPs aimed at reducing sources and transporting bacteria into the receiving waters at Kiddie and Hobie Beaches.

2.4.4.1.2 *Water Quantity*

The Federal Emergency Management Agency administers the National Flood Insurance Program. To ensure compliance with the National Flood Insurance Program, communities must adopt a floodplain management ordinance addressing construction and habitation in flood zones. Ventura County adopted their Flood Plain Management Ordinance (Ordinance 3741) in 1985. Since then, several revisions have been made, with the latest ordinance adopted in 1990 (Ordinance 3954). The ordinance addresses the risks of development within the floodplain and includes a list of prohibited discharges, exemption procedures, and requirements for construction and permitting.

2.4.4.2 <u>Future (Potential)</u>

In January 2015, the VCWPD submitted their report of waste discharge (ROWD), which applies the renewal of waste discharge requirements set forth in the current order (Order No. R4-2010-0108). While the provisions of the next permit are unknown, the VCWPD is anticipating that it will be based on the MS4 Permit for Los Angeles County. The VCWPD ROWD includes proposed recommendations for changing or modifying specific provisions of the Los Angeles County Permit (VCWPD, 2015), and the justification for these recommendations for the purpose of the VCWPD permit renewal process.

At the statewide level, California Stormwater Quality Association (CASQA) (2015) outlined their strategic visions and goals for stormwater management to achieve the goals of the Clean Water Act. For future regulations, CASQA identified the need for stormwater to be considered a non-point source rather than a point source and for regulations related to stormwater capture and use as a resource.

INTEGRATION AND LINKAGE OPPORTUNITIES

3.1 INTRODUCTION

This Integrated Master Plan addresses future planning needs for all major water utilities under the City's jurisdiction, including water, wastewater, recycled water, and stormwater. Although these utility systems are integrally linked because of their positions in the water cycle, the City seeks to take full advantage of potential linkages and synergies among the systems. As such, this Plan builds on previous planning efforts by creating a single master plan that incorporates all planning efforts.

Through the planning process, additional opportunities for integration and linkages were identified. These opportunities are illustrated in Figure 3.1 and are described in this chapter.

3.1.1 Integration Workshops

Throughout the planning process, the project team met with the City for several integration workshops to review analyses and recommendations, identify common elements and linkages, coordinate project timing, and adjust the alignment of recommended projects and programs. While some of these workshops focused on specific systems and their connections to the broader plan, other workshops looked at the Master Plan's various projects and initiatives as a whole. The workshops allowed key team members from each utility to come together and provide input, coordination, and feedback on many elements of the Integrated Master Plan.

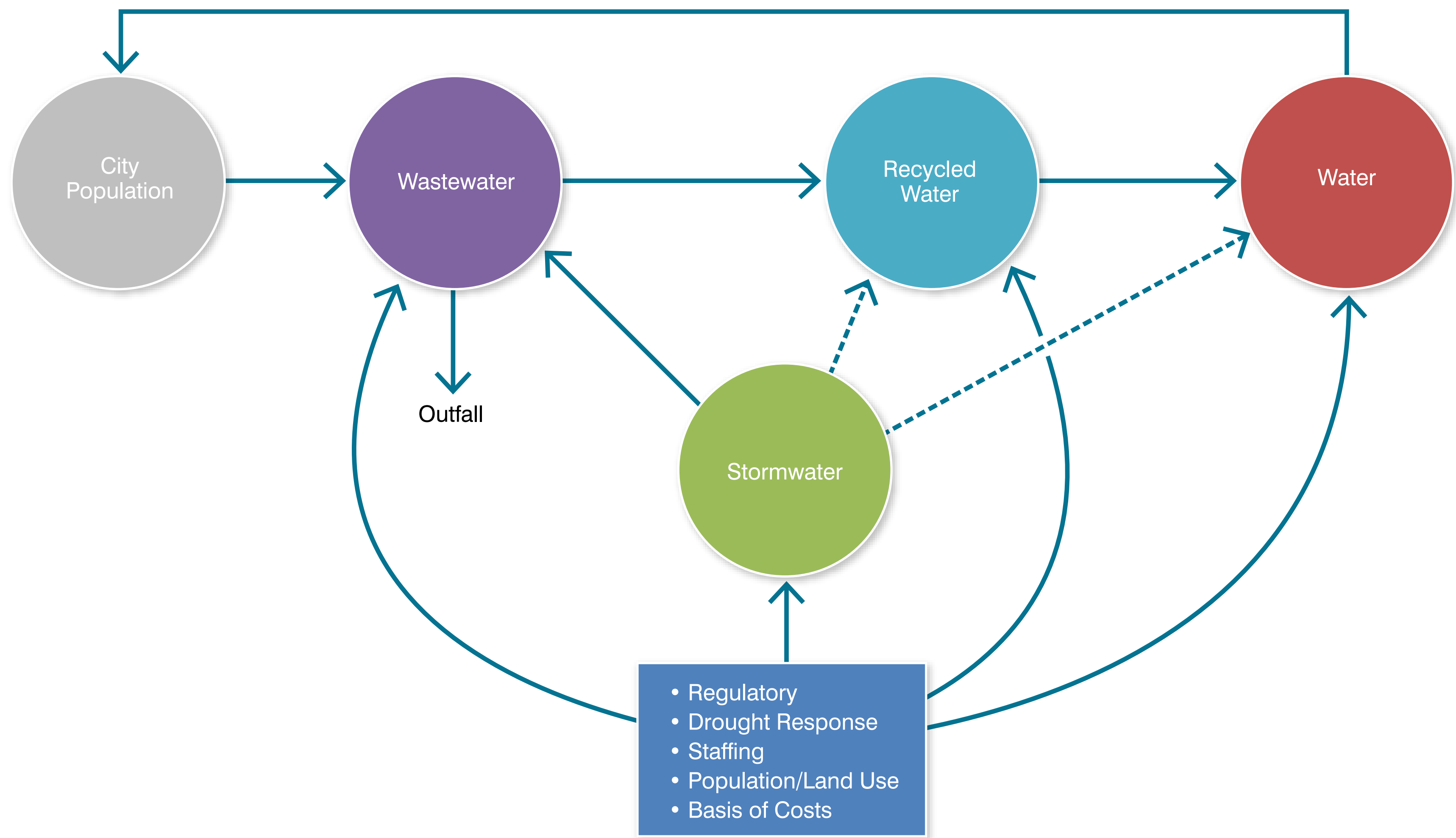
3.2 KEY LINKAGES AND INTEGRATION OPPORTUNITIES

Early on in the planning process, the project team identified several key issues, including the impact of population and land use projections on each system, the potential regulatory cross connections among systems, and the importance of using the same cost basis throughout the planning efforts. Below are brief summaries of the significance of each issue.

3.2.1 Population/Land Use

Population and land use direct the planning efforts for all water systems. For example, historical use and projected population can determine water demands and future wastewater flows, and land use can determine the amount of stormwater generated in an area. Thus, the ability to review population and land use data was an important part of this Master Plan.

Ideally, water system plans should be coordinated to keep system needs consistent. When water plans are performed separately, the basis for projected population differs, eliciting separate results for a system's demands, flows, and loads. Given the benefits of a coordinated plan, a significant part of the Integrated Master Plan involved coordinating the planning efforts for all four systems.



POTENTIAL INTEGRATION OPPORTUNITIES AND LINKAGES

FIGURE 3.1

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

ox1115f14-9587(SumRepFIG3-1).ai

3.2.2 Agreements and Contracts

As part of the Integrated Master Plan, Carollo was asked to organize the City's current contracts and agreements and provide recommendations and modifications at the City's request. To organize existing and future contracts and agreements, Carollo worked with City staff to form a Microsoft Access 2007 database that provided a comprehensive and convenient organizational structure that would be fully scalable for future build-out.

3.2.3 Basis of Costs

For the entire Integrated Master Plan, the recommended construction and project costs were based on the same cost-estimating levels and contingencies. This provided consistent cost estimates throughout the project, which rarely happens when plans are drafted separately. These cost estimates were then used in the City's Cost of Service (COS) Studies (Carollo, 2017) to explore and recommend future utility rates and rate increases as a whole. With this consistency, the City had a complete understanding of the water infrastructure needs and, more importantly, the costs and financial impacts of the projects recommended for all four systems.

3.2.4 Regulations

Not only did the project team review and summarize the impacts of regulations governing each specific water system, but it also looked at the ways regulations will affect all four water systems as a whole. For example, the Integrated Master Plan coordinated its recommendations with a Salt Nutrient Management Plan. Because the City plans on using recycled water for surface irrigation and sub-surface injection, this coordination is critical to ensuring that the increased use of recycled water doesn’t adversely affect the watershed.

In addition to the Salt Nutrient Management Plan (Carollo, 2016), a Title 22 Engineers Indirect Potable Reuse (IPR) Permit Report (Carollo, 2016) and Report of Waste Discharge (ROWD) (Carollo, 2016) were developed alongside the Integrated Master Plan so the City could obtain a permit to operate its Aquifer Storage and Recovery (ASR) Demonstration Well. The ASR Demonstration Well is an important project to determine the feasibility of conducting an IPR operation within the City, which is necessary to provide a future sustainable water supply.

3.2.5 Water Resources/Supply

The City of Oxnard seeks to secure a sustainable water supply for its community through the GREAT program. This program proposes using recycled water treated at the AWPF and through IPR operations as an additional water source as well as using recycled water conveyed to nearby agricultural users for pump-back allocation so the City can expand its groundwater pumping and treatment operations equally. By planning the potable and recycled water systems together in the Integrated Master Plan, several alternatives, including ASR of recycled water and additional groundwater pumping and treatment, could be combined in one integrated system.

3.2.6 Source Control

Source water for the OWTP and AWPF is directly affected by the Local Limits Study (Carollo, 2017) and the Best Management Practices (BMPs) for Centralized Waste Treatment (CWT) Facilities. Both are described in further detail below.

The Local Limits Study sets limits on the level of pollutants that industrial dischargers within the City's service area can discharge into the OWTP influent wastewater. Because these limits shape the quality of wastewater entering the OTWP, they also determine the treatment capacity and requirements for the water that leaves it. Thus, this particular Local Limits Study considered not only the information necessary for limits at the OWTP, but also the linkage between the OWTP and the AWPF. With this Study, the City can further understand the possible effects of discharging brine to the OWTP outfall under current and future flow scenarios. Ultimately, the study recommended 21 constituent limits.

Centralized Wastewater Treatment Facilities (CWTFs) treat hazardous and nonhazardous materials such as industrial tank residuals, called "tank bottoms," and oil field operations wastes. They are regulated under 40 CRF 437 and are mandated by publicly-owned treatment works (POTWs) through the POTWs' industrial pretreatment programs.

Because CWTFs can send harmful materials into the public drinking water, POTWs will not always accept discharge from CWTFs, especially Subcategory D facilities that accept multiple waste streams. To address this issue, Carollo designed BMPs that protect POTWs' waste treatment processes and conveyance systems, ensuring that the processes comply with regulations for treated effluent, water reuse, biosolids disposal/reuse, and air emissions. The BMPs also protect the environment and worker and public safety. Carollo's BMPs were endorsed by several major California POTWs that accept CWT waste discharges and were shared and endorsed by the California Association of Sanitation Agencies (CASA) and the WateReuse Association.

3.2.7 Outfall Considerations

Another key integration issue is the connection between the OWTP outfall and the AWPF capacity. As the AWPF capacity increases and more water is treated, less wastewater is discharged to the City's ocean outfall. With less water to dilute the effluent, the effluent becomes more concentrated.

To assess the impacts of increasing the AWPF's capacity, an analysis was conducted. This analysis revealed that the City might have difficulty meeting all of its NPDES permit limits with the increased capacity. As a result, potential linkages between the OWTP and the AWPF were explored to the fullest extent.

Possible mitigation measures include changing regulatory compliance points and/or dilution studies, changing treatment processes at the OWTP, and adding concentrate to the outfall to "dilute" the discharge. This potential impact on effluent was also considered when planning the recycled water and potable water supply alternatives. However, in this case, the project team considered how a reduction in AWPF capacity (less than the previously planned 25 mgd ultimate capacity) could be managed and put to best use.

3.2.8 Drought Considerations

As the severe drought continues in California and much of the West, the City faces many challenges, including reduced surface water import and local groundwater pumping (via the Fox Canyon Groundwater Management Agency) as well as mandatory reductions in potable water use. In response, the City has tried to find ways to deliver recycled water to its users.

Although the AWPF is operational and designed to produce 6.25 mgd of high quality advanced treated reverse osmosis (RO) recycled water, the City lacks the infrastructure required to deliver all of the recycled water it produces. Thus, the City has initiated plans to design and construct a distribution pipeline along Heuneme Road to deliver water to agricultural customers in the Oxnard Plain. However, it will take several years for this pipeline to be constructed and operational.

Since the CMWD Salinity Management Pipeline's route (SMP) runs parallel to the City’s planned pipeline and the SMP was underutilized at the time, the City saw an opportunity to use the CMWD SMP to temporarily deliver water to agricultural customers in the Oxnard Plain. In response, the Los Angeles Regional Water Quality Control Board (RWQCB) amended the City’s waste discharge requirements (WDRs), Order No. R4-2011-0079-A01 and Monitoring and Reporting Program R4-2008-A01, in July of 2015 to allow temporary use of the SMP to deliver AWPF water to farmers. Delivery of recycled water via the SMP began in early 2016.

<u>Metropolitan Water District Conservation and Retrofit Grants</u>:

The Metropolitan Water District offers recycled water retrofit grants to its retail customers. To take advantage of this program, the City applied for several grants, receiving one for its River Ridge golf courses. The City also plans to apply for grants for its other urban use customers as they show interest and in and commitment to utilizing recycled water and eventually use it as a water source.

<u>Recycled Water Retrofits</u>:

When the recycled water retrofit program began in 2010, emphasis was on retrofitting urban projects such as golf courses, parks, school yards, cemeteries, and other commercial facilities. Once the urban project began to identify and interview potential users for these retrofits, agricultural users' interest in and acceptance of recycled water grew. As a result, by 2012, the project emphasized urban reuse less and reuse for agricultural purposes more.

Currently, the City delivers recycled water to the two adjacent River Ridge golf courses and has made plans to deliver recycled water to the RiverPark development and the adjacent paper company. The City has also committed to serving the agricultural community, with user agreements already in place. In addition, in 2015, the City expanded an initiative to connect other urban irrigation users along the recycled water backbone pipeline. These projects help with the drought-mandated water use reductions and were coordinated with the long-term projects recommended in this Integrated Master Plan.

3.2.9 Staffing

Through these planning efforts, the City could review staffing needs throughout the Public Works Department. The City also conducted a salary survey from January 2015 through March 2015. For this survey, the following tasks were performed:

- Job descriptions for 92 total classifications were reviewed to understand each classification's duties and responsibilities; the survey's appropriate classification benchmarks for all classifications were then identified.
- Organization, classification, and salary data/material were gathered from ±18 comparable agencies relevant to the department’s competitive labor market.
- Job comparability analyses were conducted for the benchmark classes in each survey agency.
- Internal relationship analyses were conducted for department positions within the department and for classifications across other City departments to determine commonalities and linkages.
- The external market survey data and the results of an internal job content relationship analysis were used to develop specific salary range slotting recommendations within the City’s current salary grade/range structure for all Utilities & Engineering Department positions.

Through this analysis, the following five priority positions were deemed necessary for the City:

- Environmental Compliance and Water Supply Management Division Manager.
- Technical Services/Water Quality Manager.
- Wastewater Division Manager.
- Wastewater Operations Manager/Chief Operator.
- Water Division Manager.

For each position, a subconsultant for Carollo worked to evaluate staffing needs and helped the City develop and implement strategies for recruiting and advertising for the positions.

3.2.10 Streets

A final key point of integration for the Integrated Master Plan involves the City's Streets Master Plan. To minimize overall disruption to the community, planned improvements recommended for the Master Plan must be coordinated with street upgrades.

Existing documents that outline current and future street planning efforts were reviewed and summarized for the Integrated Master Plan. The specific planning documents reviewed include:

- Pavement Management Plan.
- Oxnard Bicycle and Pedestrian Facilities Master Plan.
- Intelligent Transportation Systems Master Plan.
- City of Oxnard Green Alleys Plan.
- Oxnard Transportation Demand Management Plan.
- Santa Clara River Trail Master Plan.
- Oxnard 2030 General Plan.

Based on the findings in these documents, a Streets Master Plan was developed. A large component of the Streets Master Plan involves integrating the Integrated Master Plan's recommended capital improvement projects across all disciplines into one living Geographic Information Systems (GIS) database that also houses existing infrastructure information. This database will provide the City with a dynamic management tool that explicitly optimizes the timing of water infrastructure related projects to minimize construction projects' impact on affected communities and coordinate such projects with street improvement projects and the projects recommended in the summarized reports.

WATER SYSTEM MASTER PLAN

4.1 INTRODUCTION

The City provides a blend of surface and groundwater through its water distribution system, which consists of six blending stations (BS) that take water from each of the City's water sources and combine it before distributing it throughout the City.

In addition to the overall Integrated Master Plan goals established in Chapter 2, planning efforts identified specific goals for the water supply. These goals are as follows:

- Goal 1: Provide reliable/resilient supply to meet future conditions (i.e., changes to demand, regulations, and water quality).
- Goal 2: Meet the City’s water quality objectives.
- Goal 3: Protect existing water rights by maximizing use of groundwater allocation.
- Goal 4: Minimize future reliance on imports by maximizing use of AWPF-produced water.
- Goal 5: Attract industry and jobs.
- Goal 6: Keep rates affordable.

This chapter will provide an overview of the existing water system and its strengths and vulnerabilities, as well as the regulatory requirements and climate change issues the system will face. This chapter also makes recommendations for meeting the defined goals.

The analysis and evaluations contained in this Summary Report are based on data and information available at the time of the original date of publication of the Project Memos (PMs), December 2015. After development of the December 2015 Final Draft PMs, the City continued to move forward on two concurrent aspects: 1) advancing the facilities planning for the water, wastewater, recycled water, and stormwater facilities; and 2) developing Updated Cost of Service (COS) Studies (Carollo, 2017) for the wastewater/collection system and the water/distribution system. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The complete updated CIP based on the near-term and long-term projects is contained in Appendix B.

4.2 DESCRIPTION OF EXISTING FACILITIES

4.2.1 Source of Supply

To serve its constituents, the City of Oxnard gets water from the following sources:

- *Groundwater* from local wells that draw from the Oxnard Plain Groundwater Basin (some of which are treated through reverse osmosis).

- *Groundwater* from the United Water Conservation District (UWCD), which draws from the Oxnard Plain Forebay.
- *Surface Water* imported from the State Water Project via the Calleguas Municipal Water District (CMWD).
- *Recycled Water* from the Advanced Water Purification Facility (AWPF) (discussed in detail in Chapter 6 - Recycled Water System).

4.2.2 Treatment/Blending

Although the exact ratio of the blend at the City's blending stations varies, the City stated that future blending will be in a 1:1 (surface water to groundwater) ratio. This ratio produces water with a total dissolved solids (TDS) level between 600 and 700 mg/L, which meets the upper limit of the secondary drinking water standards (1,000 mg/L) at a fairly cost-effective unit rate.

Figure 4.1 is a schematic of the City's water system, showing how the six blending stations are linked together. Figure 4.2 is a map of the City's water system facilities, including the locations of the blending stations. Table 4.1 summarizes the major characteristics of each blending station. The City's individual facilities are all described in the following sections.

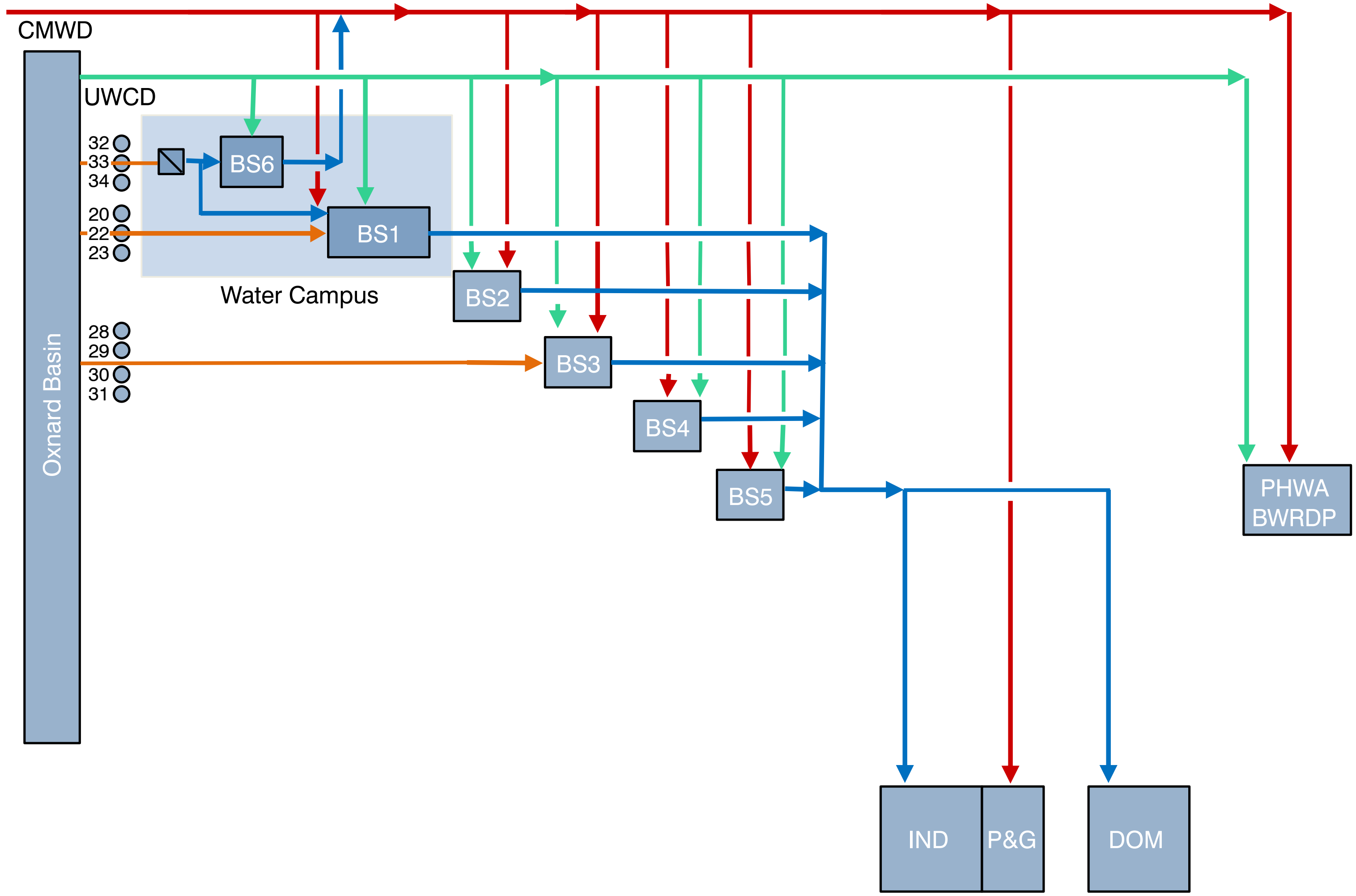
4.2.3 Distribution System

To reflect the system's ongoing growth, the City's transmission and distribution system consists of a variety of pipe types and sizes. To manage these pipes, the City has implemented an infrastructure management system (GIS database) that it continually populates with pipe attributes (diameter, material, year installed, etc.).

Based on the 2013 March GIS database, the distribution system includes nearly 613 miles, or 3.25 million linear feet, of pipe, the majority of which is between 6 to 12 inches in diameter. Figure 4.3 illustrates the City's existing water distribution system.

The City's water system currently operates in one pressure zone. However, some areas of the City have difficulties with pressures higher than the 80 pounds per square inch (psi) maximum pressure desired for the system while other areas need to be augmented to meet the minimum pressure targets.

The only above-ground engineered storage facilities within the system are the 600,000 gallons of permeate storage at Blending Stations (BS) No. 1 and No. 6, which are located adjacent to each other and referred to collectively as BS Nos. 1/6. The City also uses 70 percent of the 18.0 million gallon (MG) Springville Reservoir owned by CMWD. In total, the City has 12.5 MG of above-ground storage.



OVERALL WATER SYSTEM SCHEMATIC

FIGURE 4.1

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

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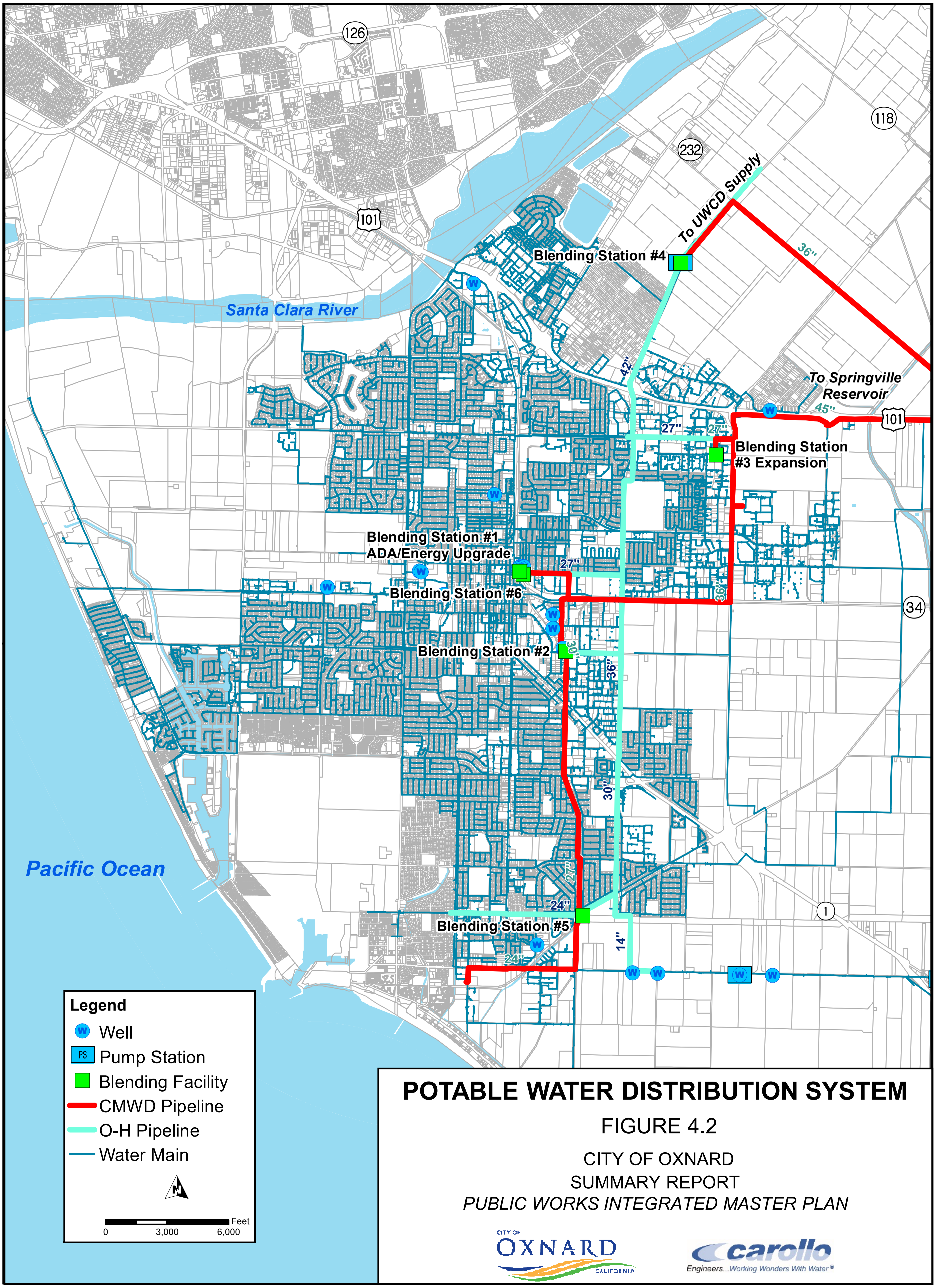

POTABLE WATER DISTRIBUTION SYSTEM

FIGURE 4.2

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

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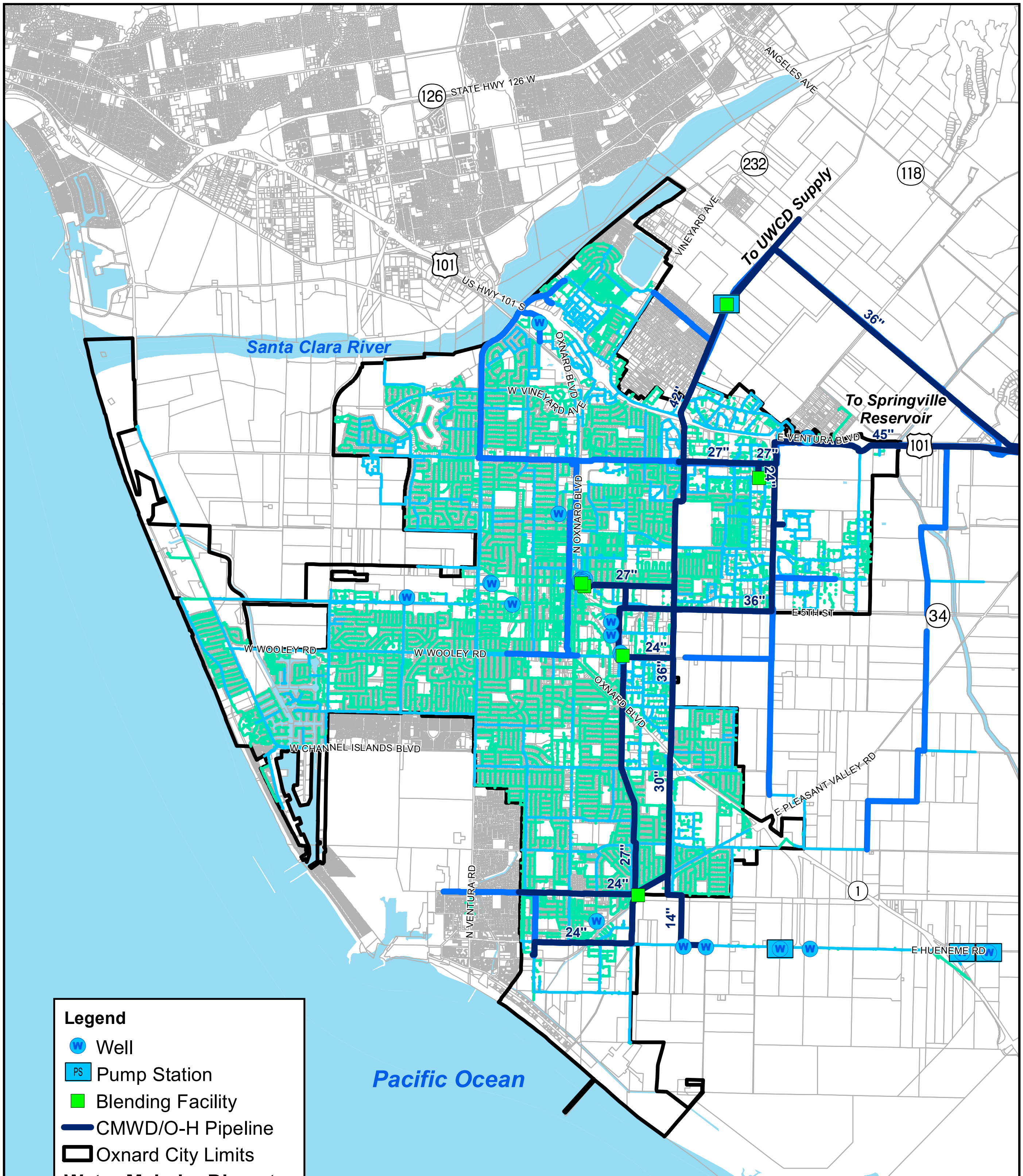
Table 4.1 Blending Station Facility Summary
Public Works Integrated Master Plan
City of Oxnard

	BS No. 1	**BS No. 2**	**BS No. 3**	**BS No. 4**	**BS No. 5**	**BS No. 6**
Location	Third Ave. & Hayes	E Wooley & Richmond Rd	Southwest of Gonzales Rd and Rice Ave.	N Rose Ave South of Central Ave.	Pleasant Valley Rd East of Saviers Rd.	Co-Located with BS No. 1
Status	Operational	Stand-By	Operational	Operational	Operational	Operational
Construction Date	1900 Updates in 1965, 1986, 2008	1971	1975 Update in 2006	1994	2007	2010
Local Wells Available	**Yes**	**No**	**Yes**	**No**	**No**	**Yes**
Well No. - Capacity gallons per minute (gpm)	20 – 2,900 22 – 3,000 23 – 2,800	--	28 – 2,000 29 – 3,000 30 – 2,000 31 – 2,000	--	--	32 – 2,000[1] 33 – 3,000[1] 34 – 2,500[1]
Total Well Capacity, mgd	12.5	--	13	--	--	10.8
Imported Water Available						
CMWD Capacity, mgd	29.5	18.7	42	27.8	8	--
UWCD Capacity, mgd	29.5	27.8	29.5	30.2	8	--
Treatment	**Yes**	**No**	**Yes**	**No**	**No**	**Yes**
Type	Desalting [reverse osmosis(RO)] & Chloramination	--	Chloramination	--	--	Desalting [reverse osmosis(RO)] & Chloramination
Capacity, mgd	--	--	--	--	--	7.5 (permeate)
Permeate Storage, gallons	--	--	--	--	--	600,000
Backup Generator	Yes 3 @ 750 kW	No --	Yes 1 @ 1,000 kW	Yes 1 @ 500 kW	No --	No --

Notes:

(1) These wells are fed directly to the desalter at BS No. 6. Due to water quality, the wells are not able to blend directly into the City's distribution system.



WATER DISTRIBUTION SYSTEM

FIGURE 4.3

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

4.2.4 Condition Assessment

A condition assessment was conducted to identify rehabilitation and replacement (R&R, or renewal) needs for the City's water system. For this effort, asset management methodology was used to identify existing water assets and to conduct a visual condition assessment of above-ground assets. The effort also included an evaluation of structures, a desktop evaluation of below-ground assets, and a cathodic protection system evaluation.

To prioritize the R&R needs, a risk assessment was also conducted that examined the vulnerability (likelihood of failure) and criticality (consequence of failure) for each asset. Consistent risk scoring methodology was applied to both above- and below-ground assets to prioritize each asset type.

4.2.4.1 Above Ground Assets

In total, 165 above-ground assets were assessed, including structures and equipment owned and operated by the City. Specifically, Carollo observed approximately 11 building structures, 41 pumps, 16 wells, and a variety of other assets, with the recorded age of each asset varying from 1965 to the present. Each asset was placed into an inventory and categorized according to its asset type and discipline.

Table 4.2 lists the assets with the highest above-ground risk, which was determined from the assessment. The results of the condition assessment analysis are as follows:

- Water Campus BS No. 1/6 – fair to good condition with a few exceptions noted in Table 2.
- BS No. 2 – fair to poor condition.
- BS No. 3 – fair to very good condition, with two wells (Well Nos. 30 and 31) in need of minor rehabilitation.
- BS No. 4 – fair to poor condition, with three Variable Frequency Drives (VFDs), two pumps, electrical equipment, and a central valve train in disrepair.
- BS No. 5 – fair to good condition.
- Wells – fair to good condition, except as noted in Table 4.2.

**Table 4.2 Highest Above-Ground Risk Assets
Public Works Integrated Master Plan
City of Oxnard**

Site/Asset	Risk[(1)]
Blend Station 2	
Supervisory Control and Data Acquisition (SCADA) System	2.01
Water Campus (BS1 and BS6)	
RO Building RO Filter (#1-3)	0.48
RO Building Cartridge Filter (#1-4)	0.48
Chemical Building Lab PLC	0.33

Table 4.2 Highest Above-Ground Risk Assets Public Works Integrated Master Plan City of Oxnard	
Site/Asset	**Risk(1)**
Well 18	
Motor Control Center (MCC) Single Box	0.40
Pump	0.36
Well 27	
MCC Cabinet	0.40
Pump	0.36
Blend Station 4	
Standby Generator	0.30
MCC	0.30
Switchboard	0.30

Note:
(1) Risk = Criticality x Vulnerability; Criticality = consequence of failure; Vulnerability = likelihood of asset failure.

4.2.4.2 Below-Ground Assets

Using GIS data of the Oxnard distribution system, a desktop evaluation was conducted on the City's below-ground water system assets. The dataset included information on the diameters and materials used for 30,632 of the 39,341 segments. The year of installation for each asset was available for 38,065 of the 39,341 segments.

A pipe's useful life will vary based on several factors, with pipe age and material the easiest to quantify. The majority (72 percent) of the City's distribution piping is of two types: asbestos cement pipe and polyvinyl chloride, which have relatively long useful lives of 65 and 85 years, respectively. However, approximately 87 percent of the asbestos cement pipe installed in the City is more than 30 years old. The polyvinyl chloride piping is relatively newer, with the majority installed within the last 20 years.

4.2.5 Cathodic Protection

A survey was conducted on the City's water infrastructure to assess the existing level of cathodic protection. From this assessment, the following improvements were identified:

- Several Key Pipelines: Install new test stations and replace rectifiers and anode-ground beds (Del Norte Pipeline, Oxnard Conduit, Wooley Road/United, 3rd Street Lateral, Industrial Lateral).
- Water Treatment Facility at BS No. 1/6: Investigate requirements of electrical isolation and cathodic protection (CP) of buried piping; design and install as needed.

- 600,000 Gallon Steel Water Tank at the Water Treatment Facility: Install internal CP system.

In addition to these projects, conducting an annual cathodic protection survey, providing a report for all City facilities, and bi-monthly rectifier monitoring is also recommended in the Integrated Master Plan.

4.2.6 Electrical Systems Protection

A study of the electrical systems for the existing six blending stations was performed. The study included a short circuit study, a protective device coordination evaluation, and an arc flash evaluation.

These evaluations were performed for distinct reasons. The short circuit study determined the short circuit current available at each piece of electrical equipment and identified underrated equipment. The protective device coordination evaluation identified protective devices (circuit breakers, fuses, etc.) that were not coordinated in the electrical system and might not minimize disruption of electrical power during a short circuit. The arc flash evaluation determined the maximum arc flash incident energy at each piece of electrical equipment and identified appropriate personnel protective equipment to be worn if work is performed on the equipment while it is being energized.

The results of the electrical systems investigation were then used to develop the electrical system study for each site. Study results identified pieces of existing electrical distribution equipment not sufficiently rated for the worst-case short circuit current and showed the arc flash incident energy at each piece of electrical equipment based on the existing protective device settings.

Concerns and code violations in the existing electrical equipment installations were observed and documented. Obsolete equipment and equipment nearing the end of its useful life were identified, as were equipment in need of repair and possible changes in the existing installation from code violations, such as equipment needing painting or relocation or incorrectly labeled equipment.

4.2.7 Operational Approach and Strategy of Existing System

Generally, the blending stations are operated to provide a target blended water quality and to meet system pressures. Table 4.3 shows the overall production breakdown by blending station as well as the approximate blend of the three major sources at each blending station.

Table 4.3	Operational Approach to Blend Station Source Breakdown[1] Public Works Integrated Master Plan City of Oxnard					
	BS No. 1	**BS No. 2**	**BS No. 3**	**BS No. 4**	**BS No. 5**	**Desalter Permeate Flow[2]**
Overall Annual Production[3]	23%	0.1%	30%	13%	3%	13%
Production by Source						
CMWD	22%	39%	47%	53%	46%	0%
UWCD	60%	61%	26%	47%	54%	0.5%
Local Wells	18%		27%			99.5%

Notes:
(1) Based on annual average production data provided by the City from 2009-2012.
(2) Based on permeate from the BS No. 6 desalter.
(3) For these to add up to 100 percent, contributions to industrial from UWCD (4 percent) and CMWD (13 percent) need to be added.

4.3 WATER SUPPLY

As noted, the City obtains drinking water from three primary sources: local groundwater, groundwater from the UWCD, and water imported from the CWMD. A thorough analysis of the City's water supply is included in the *2010 Urban Water Management Plan* (Kennedy/Jenks, 2012). Relevant information from that study was summarized and updated, as necessary, for use in this Plan.

4.3.1 Historical/Existing Supply

Table 4.4 summarizes the City's historical and current water supply allocations. This information was derived from the 2010 Urban Water Management Plan and was updated throughout the Integrated Master Plan development process with the most current information known at the time of development.

Table 4.5 presents the historical water production from 2002 through 2013 according to water supply source. As shown in the table, the City's total water supply has remained relatively constant between 2002 and 2013, fluctuating only between 26,919 and 28,826 acre feet per year (AFY). The annual water supply in 2013 was 28,443 AFY, or 25.4 mgd.

Table 4.4 Current Water Supply Allocations
Public Works Integrated Master Plan
City of Oxnard

Source	Type of Source	Transport Facility Details	Historical Source Allocation	Current Source Allocation
Local Wells	Groundwater	10 wells	• Baseline: 936 AFY(1) • Historical Pumping: 11,205 AFY(1) • One-Time Ferro Pit Credit: 11,000 AFY + 1,000 AFY per year (2012 – 2019)(1) • 700 AFY Transfer from Port Hueneme Water Agency (PHWA) (2002 Three-Party Agreement)(1)	• 7,186 AFY(2) • 700 AFY Transfer from (PHWA) (2002 Three-Party Agreement)
Calleguas Municipal Water District	Surface Water	Treated State Water Project water via Springville Reservoir and the Oxnard and Del Norte Conduits (36 inch)	Tier 1 Entitlement of 17,379 AFY(3)	Tier 1 Entitlement of 13,826 AFY(4)
United Water Conservation District	Groundwater	Oxnard-Hueneme Pipeline (42 inch)	• 9,378 AFY(5)	• 7,328 AFY(1)

Notes:

(1) Based on historical pumping.
(2) Groundwater pumping allocations have been reduced due to Emergency Ordinance E, Temporary Emergency Allocation.
(3) Tier 1 water (from Metropolitan Water District of Southern California) corresponds to the amount “contracted for” by the City. It is in essence a capacity reservation and includes the water being delivered to PHWA.
(4) Based upon current planning efforts for 2015 Urban Water Management Plan.
(5) Based upon "new" historical pumping (from Jan 1, 2003, to Dec 31, 2012) as noted in the Emergency Ordinance E.

According to Table 4.4 and Table 4.5, the City generally uses less water than allocated from the three main uses, with some exceptions. Historic use is factored into water supply availability in the future.

Table 4.5 Historical Annual Water Supply by Source
Public Works Integrated Master Plan
City of Oxnard

Year	Groundwater[1] (AFY)	UWCD Water (AFY)	CWMD Water (AFY)	System Total (AFY)
2002	6,971	7,067	13,170	**27,208**
2003	6,784	8,834	11,302	**26,919**
2004	12,743	3,820	11,717	**28,279**
2005	12,933	3,159	11,262	**27,354**
2006	14,056	4,001	9,964	**28,021**
2007	440	16,660	11,453	**28,552**
2008	4,245	9,863	13,573	**27,681**
2009	7,478	13,036	8,311	**28,826**
2010	7,172	10,852	9,769	**27,793**
2011	10,731	6,372	10,549	**27,652**
2012	5,174	9,828	12,538	**27,539**
2013	5,748	9,424	13,271	**28,443**

Note:
Source: Production data provided by the City.
(1) Includes water lost to brine from the City's desalter.

4.3.2 Historical/Existing Supply Quality

As noted in Section 4.2.7, the water quality of the blended sources dictates the amount of water drawn from each source, making it central to the water system's operation.

TDS is the primary driver for water quality. For TDS, the system produces a blended water quality of less than 700 mg/L. Although hardness is not currently a driver, it will likely be in the future. Table 4.6 summarizes the water quality of the various sources available to the City.

Table 4.6 Water Quality of Existing and Potential Sources of Water Public Works Integrated Master Plan City of Oxnard			
Source	**TDS, mg/L**	**Hardness, mg/L**	**Nitrate, mg/L**
CMWD(1)	350	120	10-60
UWCD(2)	1,000	530	22-50
Local Wells(3)	1,200	700	31
AWPF Effluent	50(4)	80(5)	--
Current Blended Distribution System(6)	700	350	<45

Notes:
(1) Based on CMWD's 2013 Annual Water Quality Report.
(2) Based on UWCD historical water quality data from 2009-2014.
(3) Based on local well water quality data from 2013-2104 and the City of Oxnard's 2013 Annual Water Quality Report.
(4) Based on AWPF 2015 monitoring data.
(5) Based on AWPF pilot performance.
(6) Based on the City of Oxnard's Annual Report Data.

4.3.3 Projected Supply

The City's available water supply was projected from 2015 to 2040, which is the end of the planning horizon. This projection was predicated on the following assumptions:

- Imported surface water from CMWD remains equal to the historical allocation.
- Groundwater pumping is restricted to between 50 and 75 percent of historical allocation by the Fox Canyon Groundwater Management Agency (FCGMA).
- Future additional groundwater credits are not reliable and are therefore not included.
- Pump-back allocation for any recycled water (RW) supplied to agricultural users will be at a 1:1 ratio, with a maximum of 5,200 AFY available.

Table 4.7 and Table 4.8 summarize the existing and projected available water supply for the two groundwater pumping restriction assumptions: low (75 percent) and high (50 percent), respectively.

Table 4.7 Summary of Projected Supply (assuming Low Groundwater Pumping Restriction[(1)])
Public Works Integrated Master Plan
City of Oxnard

Supply	Historical Allocation	Projected Supply/Demand (AFY)					
		2015	2020	2025	2030	2035	2040
Local Groundwater[(2)]	12,456	7,348[(11)]	9,581	9,581	9,581	9,581	9,581
Baseline	*954*	--	*954*	*954*	*954*	*954*	*954*
Historical Use	*11,502*	--	*8,627*	*8,627*	*8,627*	*8,627*	*8,627*
UWCD[(3)]	9,070	7,161[(11)]	6,803	6,803	6,803	6,803	6,803
CMWD[(4)]	12,500	13,826	13,826	13,826	13,826	13,826	13,826
Ag Development Re-Allocation[(5)]		0	149	376	603	830	1,057
Subtotal Supply		**28,335**	**30,359**	**30,586**	**30,813**	**31,040**	**31,267**
Recycled Water Offset[(6)]		--	1,475	1,475	1,475	1,475	1,475
Loss (Brine)[(7)]		(800)	(1,890)	(1,890)	(1,890)	(1,890)	(1,890)
Total Firm Supply		**27,535**	**29,944**	**30,171**	**30,398**	**30,625**	**30,852**
Other Potential Supplies							
PHWA Exchange[(8)]		700	700	700	700	700	
RW Pump Back Allocation[(9)]		--	3,620	3,620	3,620	3,620	3,620
Good Deeds Trust[(10)]		1,000					
Total Potential Supply		**29,235**	**34,264**	**34,491**	**34,718**	**34,945**	**34,472**

Notes:
(1) A restriction in the groundwater pumping of 75 percent of historical allocation (regulated by the FCGMA) is assumed on all groundwater sources, unless otherwise noted.
(2) The City's groundwater allocation is made up of a baseline and historical use allocation. The assumed FCGMA restriction on groundwater pumping is applied to the historical allocation only.
(3) The assumed FCGMA restriction is applied to the historical UWCD allocation.
(4) CMWD projection Tier 1 allocation as of Jan 1, 2015. It does not include 4,700 AFY allocated to PWHA.
(5) Estimate for ag reallocation is based on planned ag conversion acreage through 2040 and on using a reallocation factor of 1 AFY per acre converted.
(6) Based on contracts as of 2015; does not account for future urban or ag uses at this time. For details, see PM 4.2.
(7) Based on an existing (as of 2015) desalting capacity of 7.5 mgd (8,400 AFY).
(8) Annual transfer of FCGMA credits from PWHA, per 2002 Three Party Water Supply Agreement.
(9) Based on a 1:1 pump-back allocation ratio of RW supplied to ag users (Southland, Houweling, Reiter, and River Ridge Golf Course).
(10) Only through 2019. UWCD has not transferred the allocation since 2013, and the City has requested a refund for payments made.
(11) Based on Emergency Ordinance E, Temporary Allocations.

Table 4.8 Summary of Projected Supply (Assuming High Groundwater Pumping Restriction[1])
Public Works Integrated Master Plan
City of Oxnard

Supply	Historical Allocation	Projected Supply/Demand (AFY)					
		2015	2020	2025	2030	2035	2040
Local Groundwater[2]	12,456	7,348[11]	6,705	6,705	6,705	6,705	6,705
Baseline	*954*	--	*954*	*954*	*954*	*954*	*954*
Historical Use	*11,502*	--	*5,751*	*5,751*	*5,751*	*5,751*	*5,751*
UWCD[3]	9,070	7,161[11]	4,535	4,535	4,535	4,535	4,535
CMWD[4]	12,500	13,826	13,826	13,826	13,826	13,826	13,826
Ag Development Re-Allocation[5]		0	149	376	603	830	1,057
Subtotal Supply		**28,335**	**25,215**	**25,442**	**25,669**	**25,896**	**26,123**
Recycled Water Offset[6]		--	1,475	1,475	1,475	1,475	1,475
Loss (Brine)[7]		(800)	(1,890)	(1,890)	(1,890)	(1,890)	(1,890)
Total Firm Supply		**27,535**	**24,800**	**25,027**	**25,254**	**25,481**	**25,708**
Other Potential Supplies							
PHWA Exchange[8]		700	700	700	700	700	
RW Pump Back Allocation[9]		--	1,810	1,810	1,810	1,810	1,810
Good Deeds Trust[10]		1,000					
Total Potential Supply		**29,235**	**27,310**	**27,537**	**27,764**	**27,991**	**27,518**

Notes:
(1) A restriction in the groundwater pumping of 50 percent of historical allocation (regulated by the FCGMA) is assumed on all groundwater sources, unless otherwise noted.
(2) The City's groundwater allocation is made up of a baseline and historical use allocation. The assumed FCGMA restriction on groundwater pumping is applied to the historical allocation only.
(3) The assumed FCGMA restriction is applied to the historical UWCD allocation.
(4) CMWD projection is based on Tier 1 allocation as of Jan 1, 2015. It does not include 4,700 AFY allocated to PWHA.
(5) Estimate for ag re-allocation is based upon planned ag conversion acreage through 2040 and using a re-allocation factor of 1 AFY per acre converted.
(6) Based on contracts as of 2015; does not account for future urban or ag uses at this time. For details, see PM 4.2.
(7) Based on existing (as of 2015) desalting capacity of 7.5 mgd (8,400 AFY).
(8) Annual transfer of FCGMA credits from PWHA, per 2002 Three Party Water Supply Agreement.
(9) Only through 2019. UWCD has not transferred the allocation since 2013 and the City has requested a refund for payments made.
(10) Based on a 0.5:1 pump-back allocation ratio of RW supplied to ag users (Southland, Houweling, Reiter, and River Ridge Golf Course).
(11) Based on Emergency Ordinance E, Temporary Allocations.

4.4 WATER DEMANDS

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

4.4.1 Historical Water Demands

The City has provided historical customer billing records per account for 2002 through 2012. These records are summarized in Table 4.9 and Figure 4.4.

As shown in Table 4.9, residential is the largest category of the City’s demands, with the combined single- and multi-family water demand comprising 53 percent of the City's total demand. This percentage is relatively low because industrial users have high demands, with Proctor and Gamble alone generating 8.5 percent of demand. Other users make up 5.8 percent.

Figure 4.4 illustrates the seasonal demand categorized according to use type. Since most commercial and multi-family residential sites will also include a separate irrigation meter, commercial and multi-family residential demands are fairly consistent throughout the year. Seasonal peaking is most pronounced in the single family residential, industry (other than Proctor and Gamble) irrigation, and agricultural use types.

4.4.2 Projected Water Demands

Typically, water demand based on land use is projected from a combination of General Plan information, specific plans, vacant land information, aerial photography, and water demand factors. The City's projected water demands are made up of two main components:

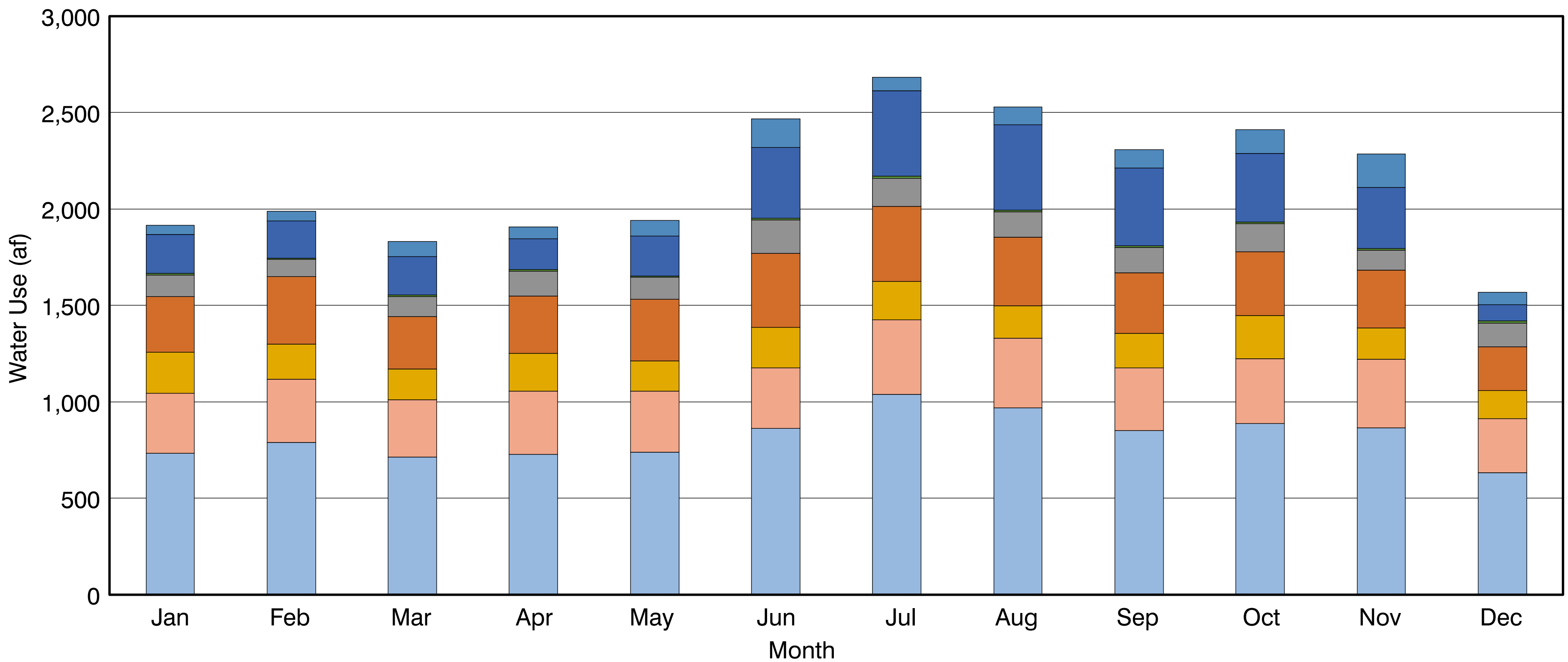
- Residential Development: Future demand estimated using three main factors: 1) projected population increase reported in number of new dwelling units, 2) the population density of the dwelling units (set at 4 persons per dwelling unit), and 3) the water use target (per person).
- Commercial/Industrial Development: Future demand estimated using the City’s plans for near-term (through 2020) and long-term (through 2040) developments.

Though residential demand has steadily declined in recent years from drought conditions and a robust conservation program, a water usage target of 132.4 gallons per day per capita (gpcd) was used to estimate future demand. There are two reasons for this. First, the City may see water usage rebound since the recession has ended and the State has enacted mandatory use restrictions because of drought. Second, for the year 2020, the Water Conservation Act of 2009 (Senate Bill X7-7) target is 132.4 gpcd.

Table 4.9 Historical Annual Consumption by Customer Class
Public Works Integrated Master Plan
City of Oxnard

Calendar Year	Annual Demand by Customer Class (AFY)								Total Annual Demand (AFY)
	Single Family Residential	Multi-Family Residential	Commercial	Industrial	Proctor & Gamble	Government	Irrigation	Agriculture	
2002	10,753	4,317	4,089	1,750	2,331	140	2,911	1	26,291
2003	10,694	4,274	3,904	1,791	2,370	152	2,712	1	25,898
2004	11,327	4,339	3,938	1,809	2,309	142	3,396	2	27,262
2005	10,886	4,212	4,040	1,704	2,386	141	3,003	2	26,373
2006	11,153	4,152	4,237	1,689	2,207	155	3,143	2	26,738
2007	11,478	4,114	4,216	1,708	1,618	146	3,529	2	26,811
2008	10,893	4,128	4,083	1,624	1,593	110	3,693	441	26,565
2009	10,608	4,097	3,654	1,225	1,481	88	3,458	1,155	25,766
2010	9,794	3,969	3,459	1,395	3,482	94	3,090	850	26,133
2011	9,679	3,918	3,582	1,319	2,142	95	3,037	1,069	24,842
2012	9,805	3,936	3,834	1,505	2,193	101	3,374	1,086	25,833
% of Total	**38.0%**	**15.2%**	**14.8%**	**5.8%**	**8.5%**	**0.4%**	**13.1%**	**4.2%**	

Note:
Source: Data for January 2002 through December 2012 provided by the City, excluding recycled water demand. Meters are read on a monthly basis. Customer classification was consolidated from the 21 billing classifications the City uses for its billing system.



LEGEND

- Single Residential (LS, S, SH)
- Multi Residential (M, MH)
- P&G (I1)
- Commercial (C, C1, CC, CM)
- Industrial (I, I2, I3)
- Government (CS, GB, SS)
- Irrigation (CI, GI, II)
- Agriculture (A)

HISTORICAL SEASONAL USE CATEGORIZED BY TYPE

FIGURE 4.4

CITY OF OXNARD
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Population is another key variable in forecasting residential demand. As a result, a sensitivity analysis was developed for the City based on three population forecasts: a high and low population estimate from the City's 2030 General Plan and a 2014 estimate provided by the City's planning department. After discussions with the City, the 2030 General Plan low population estimate was chosen as the appropriate forecast for the water demand estimates, which resulted in a moderately conservative projected demand.

To determine the water usage for the proposed commercial/industrial developments, a water demand factor had to be assigned to each land use type, expressed in gallons per day (gpd)/acre. These were then summarized by near- and long-term developments and added to the residential demand estimates, which resulted in the average annual (AAD) and average day (ADD) water demand projections summarized in Table 4.10.

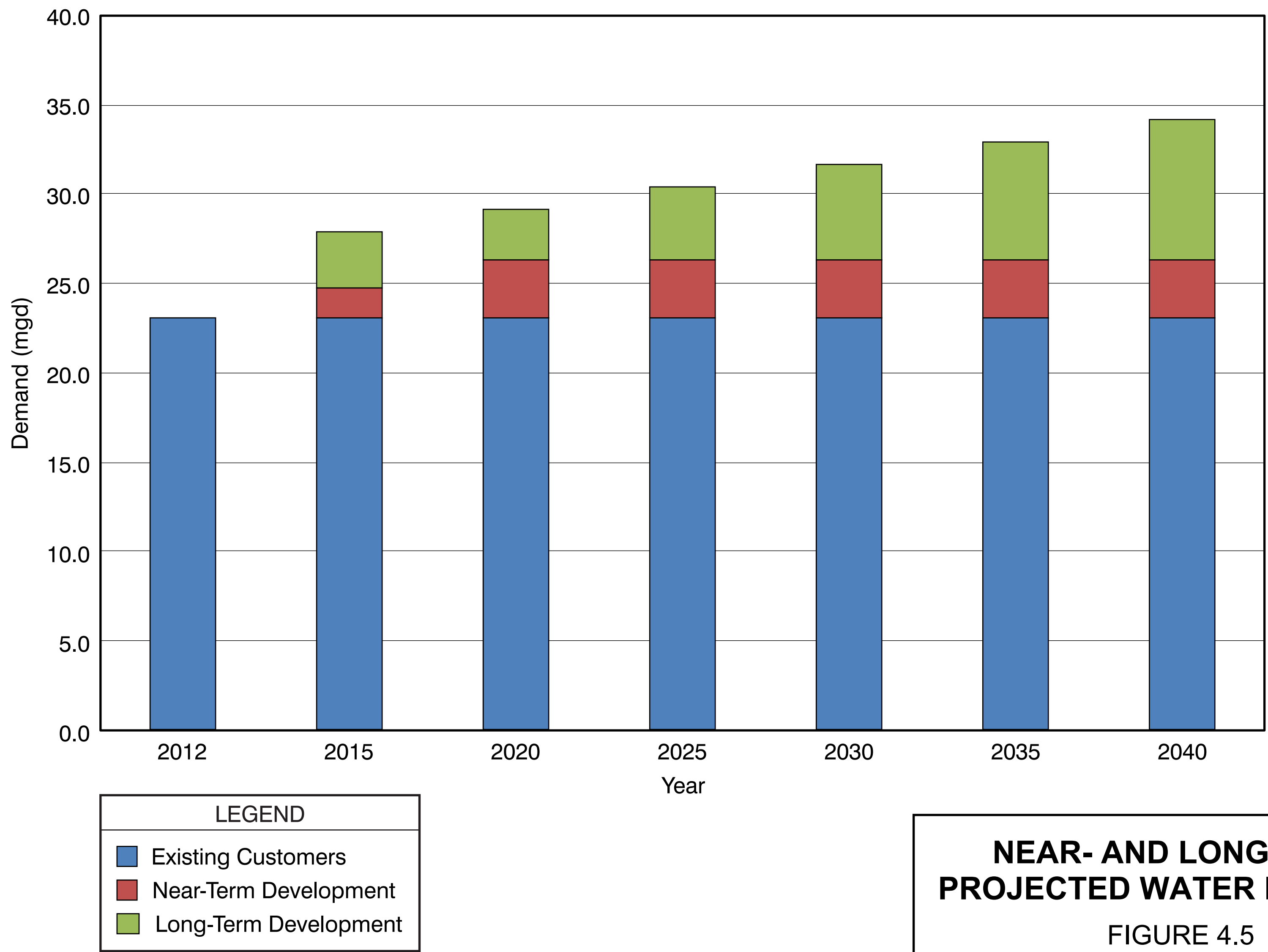
Table 4.10 Water Demand Projections
Public Works Integrated Master Plan
City of Oxnard

Year	2030 GP Population[(1)]	Per Capita Water Use (gpcd)	AAD[(2)] (AFY)	ADD (mgd)	MDD[(3)] (mgd)	PHD[(4)] (mgd)
2015	210,873	132	31,274	27.9	41.9	62.9
2020	220,248	132	32,664	29.2	43.7	65.6
2025	229,622	132	34,054	30.4	45.6	68.4
2030	238,996	132	35,445	31.6	47.5	71.2
2035	248,370	132	36,835	32.9	49.3	74.0
2040	257,744	132	38,225	34.1	51.2	76.8

Notes:
(1) This is the 2030 GP low population projection.
(2) Average annual demand forecast including residential, commercial, and industrial.
(3) Maximum Day Demand (MDD) estimated using an assumed MDD/ADD factor of 1.5.
(4) Peak Hour Demand (PHD) estimated using an assumed PHD/MDD factor of 1.5.

Peaking factors account for fluctuations in average water demand caused by seasonal or hourly conditions. The peaking factors defined for the Integrated Master Plan include maximum day demand (MDD) and peak hour demand (PHD) periods determined from the historical water system demand data for a select period and by dividing the quantity by the ADDs. Table 4.10 shows the resulting flows for MDD and PHD.

Figure 4.5 graphically shows the contributions of existing near- and long-term development customers to the total forecasted water demands. Approximately 11 mgd is associated with new developments, which equates to about 30 percent of the total 2040 demand.



NEAR- AND LONG-TERM PROJECTED WATER DEMANDS

FIGURE 4.5

CITY OF OXNARD

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CITY OF OXNARD CALIFORNIA

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4.5 MASTER PLAN/DESIGN CRITERIA

Table 4.11 summarizes the key planning and design criteria used to evaluate the existing water system's ability to meet the future demand needs. These criteria were then used to evaluate alternatives and plan for future system improvements.

Table 4.11 Planning/Design Criteria for Water System
Public Works Integrated Master Plan
City of Oxnard

Description	Value	Units
Source Water Use Priority		
Local Groundwater	1	--
Recycled Water (AWPF Effluent)	2	--
UWCD	3	--
CMWD	4	--
Groundwater Allocation Assumptions		
FCGMA Pumping Allocation	50-75% of historical(1)	--
FCGMA Pump-Back Allocation	1:1	--
Groundwater credits	None	--
Blended Water Quality Objectives/Targets		
TDS	500	mg/L
Hardness	100	mg/L
Nitrate	45	mg/L
All Public Health Goals	Meet	--
Distribution System Pressure Criteria		
Max, without Service Lateral Pressure Regulator	80	psi
Max, Triggering Potential Improvements(2)	200	psi
Min, under PHD conditions	50	psi
Min, under MDD + Fire Flow conditions	20	psi
Pipeline Criteria		
Maximum Velocity at PHD	7	fps
Maximum Velocity at MDD + Fire Flow	10	fps
Design Velocity for New Pipelines	7	fps
Hazen-Williams C-factor	130	--
Minimum Size for Pipeline Replacement	8	inches

**Table 4.11 Planning/Design Criteria for Water System
Public Works Integrated Master Plan
City of Oxnard**

Description	Value	Units
Fire Fighting Requirements		
Open Space / Single Family Residential / Multi-Family Residential	1,000/1,500/2,500	gpm for 2 hours
Commercial; Mixed Use	3,000	gpm for 4 hours
Industrial; Agricultural	4,500	gpm for 4 hours
Storage Volume Criteria		
Operational	25% of MDD	MG
Fire Fighting	Highest fire flow requirement of pressure zone	
Emergency	100% of MDD(3)	MG

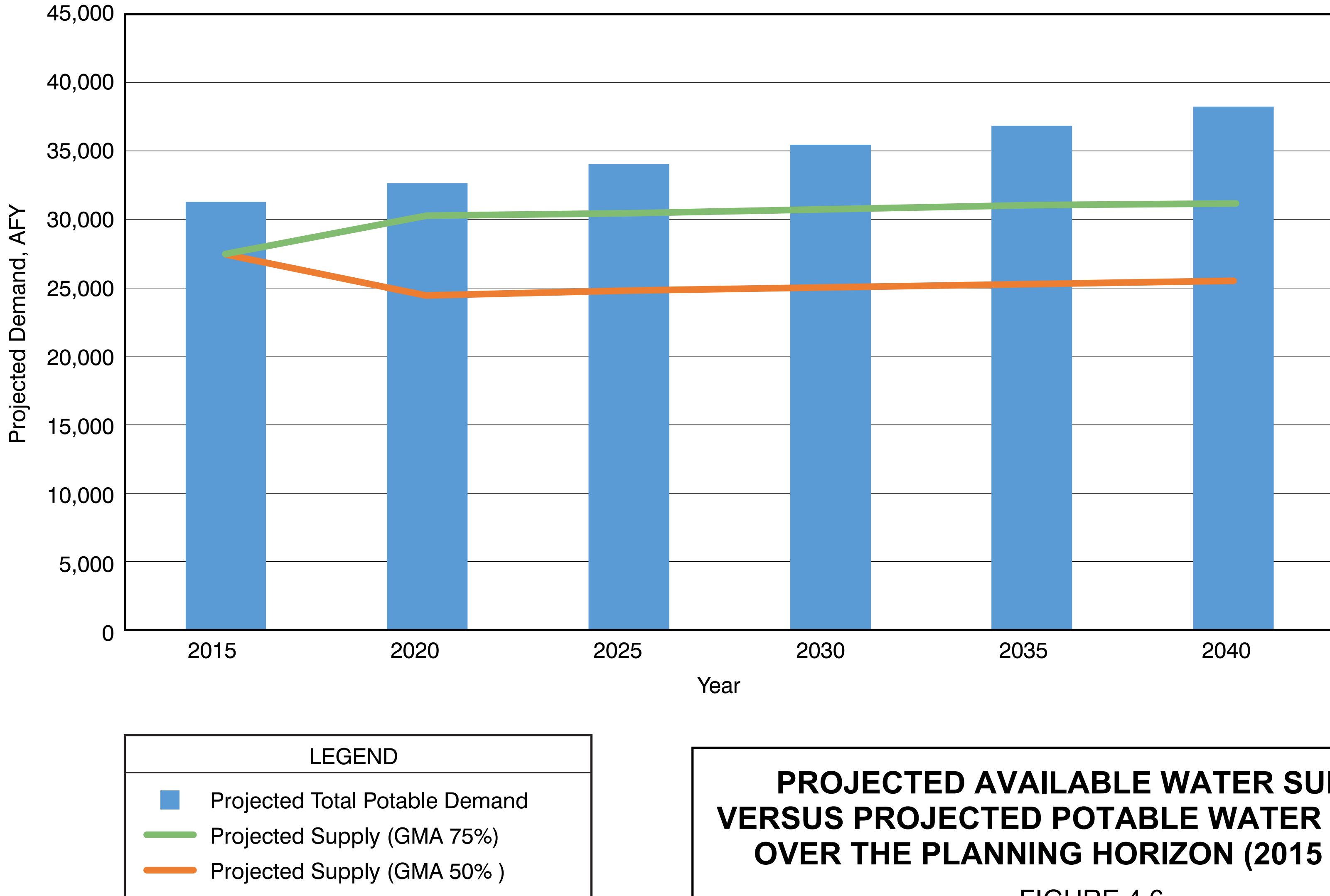
Notes:
(1) 75 percent of historical allocation was used for the alternative supply analysis; 50 percent was used to develop the recommended projects for water supply.
(2) Maximum pressures evaluated under ADD conditions.
(3) The emergency storage is assumed to be stored as groundwater.

4.6 FUTURE FACILITY NEEDS

The existing water system's capacity and performance were compared with the above criteria to identify existing shortfalls in the system. Although the system generally has adequate capacity to meet current demand conditions, it does so with little reliability. Thus, if key components, such as pumps, wells, and/or treatment processes, are in disrepair, meeting demand requirements would be a challenge.

4.6.1 Water Supply

Volume of Supply – Though the City currently meets water demand requirements, projections for the Integrated Master Plan show a potential supply gap of between 3,800 and 10,700 AFY. This gap is based on quantity and groundwater pumping restrictions, which are expected to be between 50 and 75 percent of historical in the long-term. Figure 4.6 graphically compares the projected available supply with demand over the planning horizon.



PROJECTED AVAILABLE WATER SUPPLY VERSUS PROJECTED POTABLE WATER DEMAND OVER THE PLANNING HORIZON (2015 - 2040)

FIGURE 4.6

CITY OF OXNARD
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CITY OF OXNARD CALIFORNIA

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Quality of Supply – From a water quality and regulatory standpoint, the system meets current regulations for drinking water quality. However, the City wishes to improve its taste and odor parameters.

Due to hardness in the water, many of the City's customers use point-of-use softeners that return salt to the wastewater system. As a result, the City aims for a more acceptable hardness level in the blended drinking water that would reduce or eliminate the need for point-of-use softeners.

Because the groundwater (both local and UWCD) sources have relatively high hardness levels, the City's desire for a more acceptable hardness level directly affects the water supply analysis. However, the City can use low hardness water from the AWPF through indirect potable reuse (IPR) / direct potable reuse (DPR), which has a hardness of approximately 10 mg/L.

4.6.2 Water Distribution

Although the above discussion focuses solely on water supply, the conveyance (distribution) system was also evaluated for its ability to meet future water demands, and assessing the system's capacity and performance. As with any water distribution system, conducting regular routine maintenance is imperative for maintaining a reliable system for the long term. Routine maintenance includes flushing the water lines, exercising the valves, and also conducting an active leak detection program. These actions along with other required maintenance help to routinely rehabilitate the pipelines thereby extending the useful life of the system. For this evaluation, four major areas were assessed in addition to the R&R needs identified. These areas are as follows:

Capacity Improvements – Pipeline capacity improvements are needed to meet level of service criteria (LOS) and to accommodate growth that requires additional demands to serve new customers. To estimate growth projections, the hydraulic model was run for existing conditions and the years 2020, 2030, and 2040. Pressure and velocity results were also investigated, and when either pressure or velocity exceeded LOS criteria (see Table 4.11), improvements were included to accommodate the demands.

Pressure Zone Separation – Meeting system pressure targets with a single pressure zone is a challenge and is expected to worsen with increased demands. As a result, a pressure zone analysis was conducted using the updated and calibrated system hydraulic model to assess whether the City would benefit from being split into two or three pressure zones.

Hydraulic modeling was conducted under two conditions: PHD conditions to identify minimum system pressures and minimum hour demand (MinHD) conditions to identify maximum system pressures. During PHD conditions, the modeling found pressures under 40 psi in the City's northeastern portion. However, during MinHD conditions, pressures in excess of 80 psi were seen in the City's southern portion. Thus, when considering the

City's target minimum and maximum pressures, pressure zone separation seems warranted.

Fire Flow Requirements – The fire flow analysis tool was used in the system hydraulic model to calculate the available pressure and flow at each fire flow node on a case-by-case basis. Based on this analysis, when each respective fire flow demand was applied, 100 of the 980 fire flow nodes resulted in residual pressures of less than 20 psi. To correct the fire flow conditions for these 100 nodes, 39 projects were identified.

Storage Needs – The City currently has only 600,000 gallons of above-ground engineered storage reservoirs and in addition, relies on the Springville Reservoir (owned by CMWD) for its distribution system storage, with rights to 12.5 MG of the 18 MG reservoir's capacity. As such, an analysis was conducted to determine whether the existing storage is sufficient for operational, fire, and emergency needs. Although the storage requirements used for the analysis were based on MDD, they do vary based on the type of storage considered.

Based on the analysis, by 2040, an additional 1.5 MG of above-ground storage is recommended to meet fire and operational needs. It is assumed that groundwater pumping can provide water under emergency conditions as long as the appropriate redundancy for backup power and sufficient well capacity are provided.

4.6.3 Summary of Needs

Given the water system capacity and performance summary, future facility needs fell within four major categories:

- **Water Supply/Quality** – Includes system improvements needed to help the City maintain a sustainable water supply, meet projected demands, and sustain acceptable water quality through the planning period.
- **R&R** – Includes R&R of both the above- and below-ground assets deemed critical for reliable operation. Additional redundancy and reliability are also needed to provide a sustainable supply.
- **Operations Optimization** – Includes optimization projects that the City and AECOM identified for the City's water system operation.
- **Pressure Zone Separation** – Includes system improvements needed to separate the existing system into four distinct pressure zones.

4.7 ALTERNATIVES ANALYSIS

Although R&R and Operations Optimization are slightly more straightforward, providing a sustainable supply for the City over the planning period is more nuanced. As such, several alternatives were considered in concert with the City's GREAT program, which began nearly a decade ago but was revised based on future needs and projections. These alternatives are briefly described in the following sections.

To reduce the supply gap, the same key sources of the GREAT program (recycled water and groundwater treatment) were the first primary sources considered for the Integrated Master Plan. Although desalination was also considered as another primary source, it was not cost effective at the time compared to other available sources. In addition, some secondary sources/offsets (e.g., conservation, recycled water for irrigation, stormwater, and intertie with Ventura) were considered. However, none were reliable as a primary source.

Given the layout of the City's current water system facilities, the locations of any new facilities, such as additional potable pumps, IPR wells and facilities, and blending stations, were also important to consider. As such, a fatal flaw analysis was conducted of viable locations throughout the City for either groundwater treatment (desalting) or IPR via ASR or groundwater recharge. Table 4.12 summarizes the results of this analysis.

Table 4.12 Priority Locations for Additional Water System Facilities Public Works Integrated Master Plan City of Oxnard

Site	Phase	Suitable For?	Reason
Water Campus (BS No. 1/6)	1	ASR and Desalting	Significant existing infrastructure Additional land nearby for purchase.
Campus Park	2	ASR Only	ASR Demonstration Well Site Close proximity to Water Campus.
BS No. 3	3	ASR and Desalting	Significant existing infrastructure Additional land nearby for purchase.
College Park	4	ASR Only	Relatively near to AWPF, less piping needed.
Community Park	4	ASR Only	Located along Recycled Water Backbone System pipeline.
AWPF	Alt.(1)	DPR	Ideally located next to AWPF and connection to potable system.

Notes:
(1) DPR could be an alternative to any of the first 4 sites.

Using the location priorities as a guide and considering the planning criteria established in Table 4.11, the following three main alternatives for a reliable water supply were considered:

- **Alternative 1: Groundwater Treatment Focused** – The premise of this alternative is to maximize groundwater pumping by distributing AWPF effluent to agricultural uses and then pumping an equivalent amount of local groundwater through pump-back allocations to meet potable demand. For this alternative, more potable wells would be needed to increase the overall local groundwater pumping capacity to meet potable demand, and additional desalting capacity would be needed to meet hardness objectives.
- **Alternative 2: Combination of Groundwater and ASR/IPR** – This alternative seeks to add flexibility and resiliency to Alternative 1 by combining the use of additional groundwater pumping and treatment with the use of recycled water by expanding the

IPR/ASR. As part of this alternative, facilities will be needed (in addition to groundwater pumping) to distribute recycled water to meet potable demands to IPR/ASR wellfields. These facilities will then send excess AWPF effluent to agricultural uses for irrigation.

Using AWPF effluent through IPR/DPR will dramatically improve the overall blended water quality related to TDS and hardness. However, because local groundwater pumping will increase, this alternative would also require adding desalting capacity to meet the hardness objectives.

- **Alternative 3: ASR/IPR Focused** – Alternative 3 seeks to maximize use of the AWPF by sending as much effluent to IPR/ASR wells and using the IPR to meet all additional potable water demands. For this alternative, groundwater pumping/treatment would still be utilized and expanded but not to the degree of the other alternatives. Water from the IPR/ASR wells would serve to meet additional potable demands and hardness objectives.

Each alternative was developed to include major conveyance and treatment facilities needed for complete operation and was projected to supply an equivalent blended water quality that would meet the target water quality objectives (shown in Table 4.11).

In addition, the three alternatives were evaluated for their lifecycle cost estimates, energy comparisons, water quality considerations, and other non-economic factors. Table 4.13 summarizes the lifecycle costs of the alternatives, and Table 4.14 contains the results of the overall alternative comparison, including non-economic considerations.

Table 4.13 Comparison of Water Supply Alternative Costs[1]
Public Works Integrated Master Plan
City of Oxnard

Cost ($ M)	Alt 1 – GW Treatment Focused	Alt 2 – Combined GW /IPR-ASR	Alt 3 – ASR-IPR Focused
Water System Improvements	$40	$23	$10
Recycled Water System Improvements	$74	$113	$158
Concentrate Conveyance	$20	$20	$20
Total Construction Cost	**$134**	**$156**	**$188**
Total Project Cost[2]	**$175**	**$201**	**$243**
Annual Costs ($ M/yr)			
Annualized Project Cost[3]	$14	$16	$20
Incremental O&M[4]	$19	$19	$19
Total Annual Cost	**$33**	**$35**	**$39**

Notes:
(1) Costs derived using the methodology outlined in Chapter 2.
(2) Project costs include project cost factor (as outlined in Chapter 2) as well as costs for land acquisition.
(3) Annualized at 5 percent over 20 years.
(4) O&M costs include energy, maintenance, and chemicals but do not include labor costs.

According to the economic comparison in Table 4.13, providing water supply through the recycled water system appears to be more costly than through groundwater alone. However, the costs do not necessarily reflect the risks involved with heavy reliance on the local groundwater supply, especially given the FCGMA's recent cutbacks on groundwater pumping. The relative energy use and blended water quality of the three alternatives was not estimated to be significantly different.

Given the overall comparison of alternatives shown in Table 4.14, Alternative 2: Combination of Groundwater (GW) and ASR / IPR might be an advantage. This alternative seems to offer the most reliability and resiliency for addressing future impacts from regulations or climate change while minimizing the risk to future supply. Alternative 2 also allows the City to maintain significant local control of the AWPF, its best water source, while still working with farmers to provide much needed water for irrigation.

Table 4.14 Overall Comparison of Water Supply Alternatives(1)
Public Works Integrated Master Plan
City of Oxnard

No.	Goal	Alt 1 – GW Treatment Focused	Alt 2 – Combined GW /ASR-IPR	Alt 3 – ASR/IPR Focused
PWIMP Overall Goals(2)				
#1	Reliability/Redundancy	+	+++	++
#3	Lifecycle Costs	+++	++	+
#2/4	Energy Use/GHGs	+	++	++
#5	Potable Water Offset	+++	++	+
#5	Groundwater Replenishment	+	++	+++
Water Supply Specific Goals				
	Water Quality	+++	+++	+++
	Maximize GW Pumping	+++	+++	+++
	Minimize Imported Water	++	++	++
	Local Control of Water Supply	+	++	+++
Total		**18+**	**21+**	**20+**

Notes:
(1) "+" = good, "++" = better, "+++" = best.
(2) As summarized in Chapter 2.

4.8 RECOMMENDED PROJECTS

After discussing the results of the above analysis with the City, Alternative 2: Combination of Groundwater and ASR / IPR was chosen as the recommended project for the water system plan. However, given the unknown future of groundwater pumping within the Oxnard Basin, a groundwater pumping allocation of 50 percent of historical was assumed over the long-term (rather than the 75 percent used in the alternative analysis).

This means that approximately 12,000 AFY of additional supply is needed to cover the supply gap projected by 2040. Furthermore, it was assumed that a cap of 5,200 AFY could be presented to farmers with the hope of receiving pump-back groundwater credit. This means that more ASR wells will be needed to take full advantage of the AWPF effluent for IPR use.

Summarized in the following sections are the recommended projects for the water system's Capital Improvement Plan (CIP), which are based on the existing system condition assessment and capacity as well as the performance needs for meeting projected future demands and water quality objectives. These projects cover the needs through the planning period (2015-2040) and are summarized in Table 4.15 according to the project type or driver. Figure 4.7 illustrates the locations of the recommended water supply projects.

The projects were split into phases that loosely follow the project timing: 1) Phase 1 – Immediate Needs (First 2 years); 2) Phase 2 – Near-Term Needs (Years 2 to 10); and 3) Phase 3 – Long-Term Needs (Beyond 10 years).

The phases presented here are what are recommended based upon the technical needs identified within this assessment. However, the actual timing of implementation may defer when compared and balanced against the financial considerations of total implementation of the Integrated Master Plan. Costs and timing for these projects is summarized under Chapter 9 as well as in the Cost of Service (COS) Rate Study (Carollo, 2015a).

Recycled water projects related to meeting water supply needs (e.g., AWPF expansion, ASR wells, etc.) are summarized in Chapter 6.

4.8.1 Water Supply/Quality

New potable water supply wells are needed to maintain the reliability of the City’s local groundwater pumping operation and to add system reliability. These new wells will replace and bolster the City’s current local groundwater pumping capacity. Because BS No. 1/6 and BS No. 3 are the most favorable locations for potable groundwater pumping and have significant infrastructure in place, these were the two sites identified to build new additional potable wells.

In general, most of the City's distribution system can handle current and future demand flows, with the exception of some pipes in the immediate vicinity of the blending stations where velocities exceeded LOS criteria. The list of recommended projects involves replacing these pipes; however, the exact year for replacement still needs to be determined after detailed year-by-year coordination with the other master plans included in the Integrated Master Plan.

Additional desalting of the groundwater will be needed in the future to meet the hardness objective of 100 mg/L. The existing 7.5 mgd desalter located at BS No. 1/6 is built to be expanded to a total permeate capacity of 15 mgd; therefore, expanding the desalter is more cost effective than building desalting capacity at another location.

Table 4.15 Recommended Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
Water Supply/Quality - Treatment					
BS No. 1/6	Add potable water wells	2	5	wells	2,000 gpm (ea.)
BS No. 3	Add potable water well (stainless steel)	2	1	wells	2,000 gpm
BS No. 1/6	Expand existing desalter by 7.5 mgd (split into 2 phases at 3.75 mgd each)	2/3	1	--	Total: 15 mgd
BS No. 1/6	Construct a new permeate storage tank for operational storage	2	1	tank	2.0 MG
BS No. 1/6	Expand existing disinfection	2	1	--	--
BS No. 1/6	New connection to Oxnard-Hueneme (O-H)/UWCD Pipeline	2	--	--	--
Concentrate Conveyance	Construct brine line from OWTP to BS No. 1/6 (14 and 24 inch)	2	32,100	lf	--
Water Supply – Distribution System (Capacity Improvements)					
(Location Varies)	Replace 8" Pipeline	1	322	lf	--
	Replace 12" Pipeline	1	238	lf	--
	Replace 14" Pipeline	1	164	lf	--
	Replace 30" Pipeline	1	3,804	lf	--
	Replace 6" Pipeline	2	69	lf	--
	Replace 8" Pipeline	2	391	lf	--
	Replace 10" Pipeline	2	1,101	lf	--
	Replace 12" Pipeline	2	2,447	lf	--
	Replace 6" Pipeline	3	32	lf	--
	Replace 8" Pipeline	3	233	lf	--
	Replace 10" Pipeline	3	1,243	lf	--
	Replace 12" Pipeline	3	997	lf	--
	Replace 14" Pipeline	3	2,453	lf	--
	Replace 24" Pipeline	3	937	lf	--

Table 4.15 Recommended Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
R&R – Blending Stations/Treatment					
BS No. 1/6	Replace Mechanical, Electrical, and AUX Equipment[1]	1	--	--	--
BS No. 2	Replace Mechanical, Electrical, and AUX Equipment[1]	1	--	--	--
Varies	Make Water SCADA System Improvements	1	--	--	--
BS No. 3	Replace Mechanical, Electrical, and AUX Equipment[1]	2	--	--	--
BS No. 4	Replace Mechanical, Electrical, and AUX Equipment[1]	2	--	--	--
BS No. 5	Replace Mechanical, Electrical, and AUX Equipment[1]	2	--	--	--
BS No. 1/6	Install electrical isolation at all steel and cast iron water risers [2]	2	--	--	--
BS No. 1/6	Add Cathodic Protection System for Steel Storage Tank[2]	2	--	--	--
R&R – Distribution System					
Varies	Replace Automatic Meter Reader (AMR) Devices	1	--	--	--
Del Norte Forced Main	Cathodic Protection - Install 20 missing test stations Replace rectifiers and anodes; resurvey[2]	1	--	--	--
Oxnard Conduit	Cathodic Protection - Replace deep anode beds and rectifiers #1, #2, and #3 [2]	1	--	--	--
Wooley Road/United	Cathodic Protection - Replace 5 test stations Replace rectifier and anode; resurvey[2]	1	--	--	--

Table 4.15 Recommended Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
3rd Street Oxnard Extension	Cathodic Protection - Replace deep anode bed and rectifier; bond UWCD pipeline to Oxnard extension at rectifier [2]	1	--	--	--
Freemont North Neighborhood	GREAT Program Pipeline Replacements[3]	1	--	--	--
Bryce Canyon South Neighborhood	GREAT Program Pipeline Replacements[3]	1	--	--	--
Redwood Neighborhood	GREAT Program Pipeline Replacements[3]	1	--	--	--
La Colonia Neighborhood	GREAT Program Pipeline Replacements[3]	1	--	--	--
Well 23 & 31 Rehab	Rehabilitate Wells[4]	1	--	--	--
Varies	Electrical and VFD Replacement[4]	1	--	--	--
(Location varies)	Fire Flow Improvements	1			
	Add 8 inch-diameter pipeline		18,500	feet	--
	Add 12 inch-diameter pipeline		13,500	feet	--
	Add 14 inch-diameter pipeline		250	feet	--
Industrial Lateral	Cathodic Protection - Replace all test stations; resurvey[2]	2	--	--	--
Del Norte Force Main	Cathodic Protection - 48" & 36" CMCL PL - Locate and repair discontinuity near the ease end of Del Norte Pl[2]	2	--	--	--
3rd Street Oxnard Extension	Cathodic Protection - Locate and repair discontinuity near Chemical Building at BS No. 1/6[2]	2	--	--	--
Gonzales 36" Pipeline	Replace test station lids and test cathodic protection[2]	2	--	--	--

Table 4.15 Recommended Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
Oxnard Conduit	Install new test stations, conduct CIS, and locate/excavate/bond across approx. Add 3 points of electrical isolation.(2)	2	--	--	--
Del Norte Force Main	Cathodic Protection - Replace rectifiers and anodes; resurvey(2)	3	--	--	--
Del Norte Force Main	Cathodic Protection - Install new test stations and leads(2)	3	--	--	--
Wooley Road/United	Cathodic Protection - Replace test stations and install 2 additional stations(2)	3	--	--	--
Wooley Road/United	Cathodic Protection - Replace rectifier and anode; resurvey(2)	3	--	--	--
(Location Varies)	Age-Based Pipeline Replacements Replace 6" Pipeline	3	109,100	lf	--
	Replace 8" Pipeline		47,000	lf	--
	Replace 10" Pipeline		55,000	lf	--
	Replace 12" Pipeline		24,000	lf	--
	Replace 14" Pipeline		2,300	lf	--
	Replace 16" Pipeline		4,000	lf	--
	Replace 24" Pipeline		3,700	lf	--
	Replace 36" Pipeline		5,000	lf	--
	Replace 42" Pipeline		5,300	lf	--
	Replace 48" Pipeline		3,800	lf	--
Varies	Replace AMR Devices	1	--	--	--
Operations Optimization					
Well Nos. 30, 32, 33 & 34	Electrical Rehabilitation(4)	1	--	--	--
BS No. 1/6	Sodium Hypochlorite Piping Replacement(4)	1	--	--	--
BS No. 1/6	Emergency Turnouts Service(4)	1	--	--	--
BS No. 1/6	Generator and ATS Service(4)	1	--	--	--

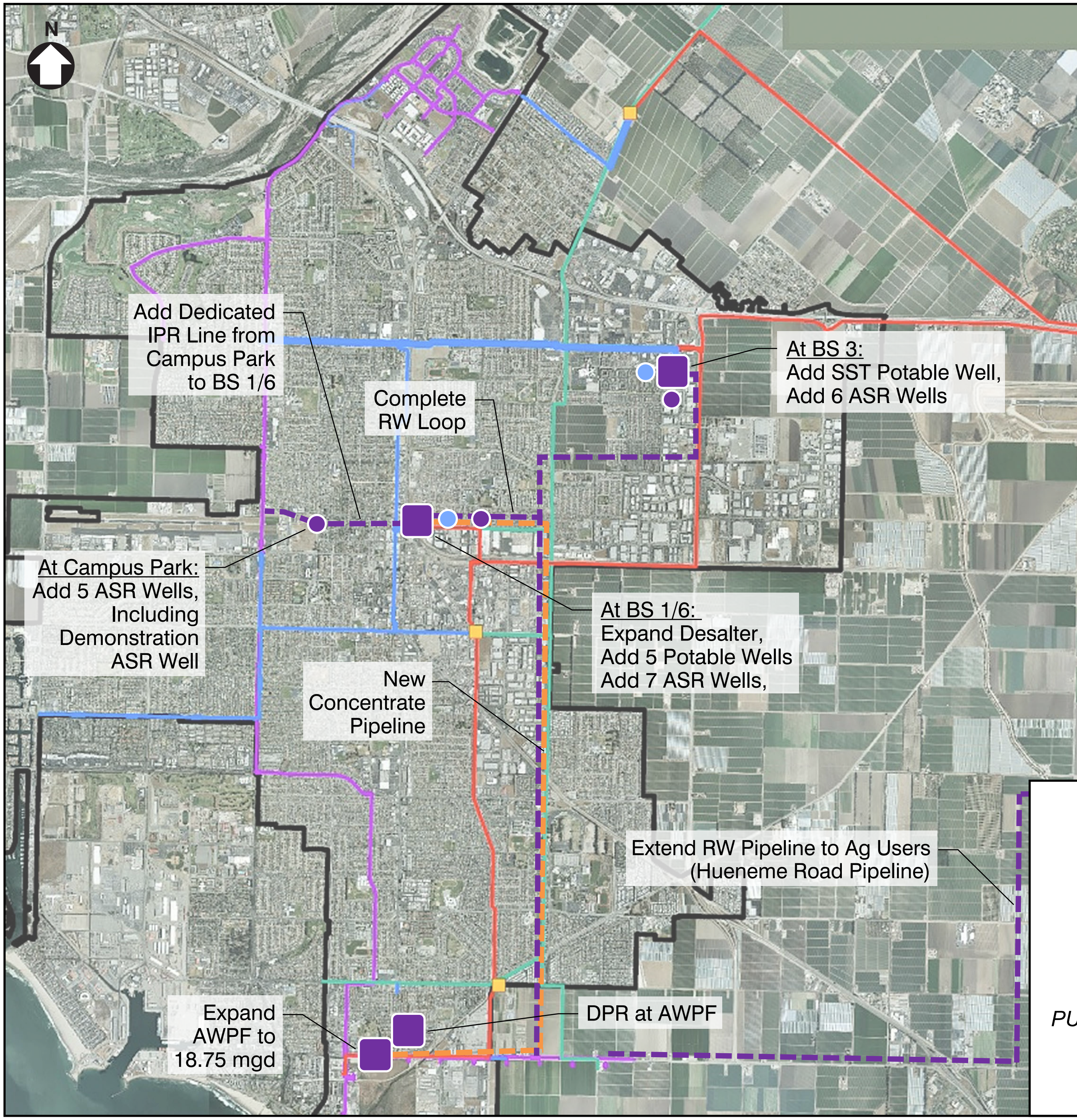
Table 4.15 Recommended Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
Pressure Zone Separation					
<u>North Zone Modification</u>					
Three (3) locations on Gonzalez Road	Rehab 3 Pressure Reducing Station (PRS)	1	3	Valves	--
From BS#3 up Solar Road to Gonzalez Road	BS#3 Reconfigure 24" Pipeline to feed North Zone	1	--	--	--
Along Gonzalez Road	Make Minor Piping Modification	1	--	--	--
<u>Coastal Zone Modification</u>					
Three (3) locations on S. Victoria Avenue	Add 3 new PRS	1	3	Valves	--
S. Victoria Avenue	Add New 8" Parallel Pipeline	1	3,000	lf	--
Along S. Victoria Avenue	Make Minor Piping Modifications	1	--	--	--
<u>South Zone Modifications</u>					
Three (3) locations on E. Pleasant Valley Road	Add 3 new PRS	1	3	Valves	--
E. Pleasant Valley Road	Add New 8" Parallel Pipeline	1	6,000	lf	--
Along E. Pleasant Valley Road	Make Minor Piping Modification	1	--	--	--

<u>Notes:</u>

*General Note: For the pipeline replacement projects, see the hydraulic models developed as part of this integrated master plan to identify the exact pipeline locations. Project costs, schedules, and phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) – December 2015.

(1) Projects based on R&R recommendations done through the Condition Assessment.
(2) Projects developed from the Cathodic Protection Assessments.
(3) As documented in the City's GREAT program CIP, February 18, 2015.
(4) Projects provided by AECOM.



RECOMMENDED WATER/RECYCLED WATER PROJECTS

FIGURE 4.7

CITY OF OXNARD

SUMMARY REPORT

PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

ox1115f3-9587(SumRepFIG4-7).ai

To avoid taking brine from the desalter back to the OWTP, which would then affect the AWPF effluent and cost of operation, a dedicated concentrate line is recommended. This concentrate line could be routed from the Water Campus (BS No. 1/6) to the City’s ocean outfall from the OWTP. However, the use of the City's outfall is predicated on the RWQCB's permit of policy. A possible option to the dedicated concentrate line is a connection to the Salinity Management Pipeline (SMP) and agreement with CMWD.

Figure 4.7 illustrates the locations of the water system improvements recommended for securing the City’s water supply. These are also shown in conjunction with the recycled water improvements, since they work in concert with one another.

4.8.2 R&R

A number of R&R related projects were identified through the efforts of this Plan and City staff. These improvements are broken into the two broad categories: above-ground assets (blending station/treatment) and below-ground assets (distribution system piping).

The blending station/treatment R&R includes routine repair and replacement of elements identified through the condition assessment effort and staff input. Replacing the cathodic protection systems is needed for the desalter and steel permeate storage tank, and the water Supervisory Control and Data Acquisition (SCADA) system is slated for complete replacement and upgrade.

In addition, distribution system piping improvements are needed to meet reliability and redundancy and to protect public health. For these improvements, methodically replacing pipes by size and age is proposed. New piping is also recommended to provide adequate fire flow water, and cathodic protection was identified for several key water mains throughout the City. Also, conducting required routine maintenance such as flushing water lines, exercising valves, and leak detection is imperative to continually help to rehabilitate the system and extend its useful life.

4.8.3 Operations Optimization

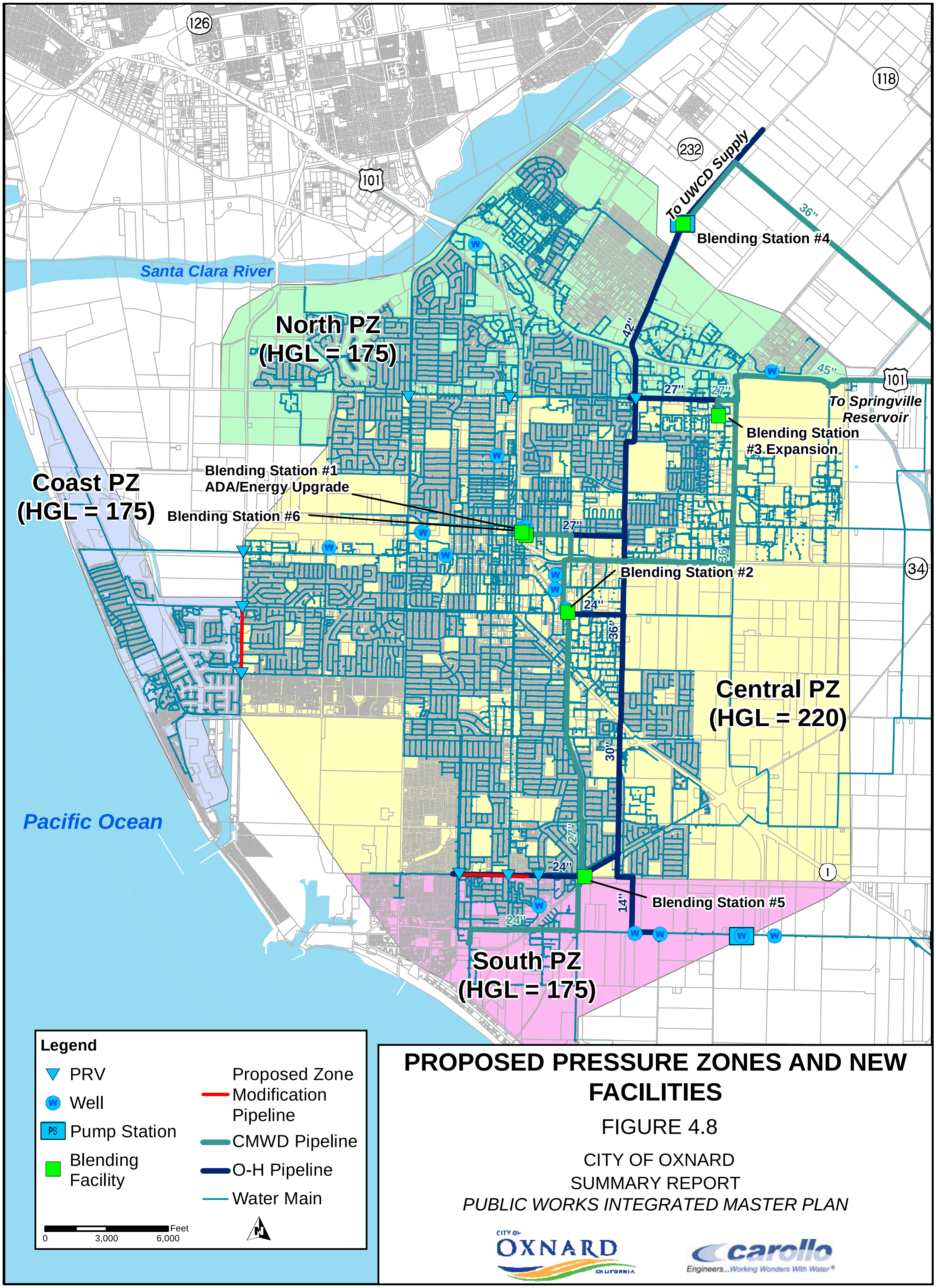
The City is working on several optimization projects for its water system operation. These projects were identified and included as recommended projects in the CIP.

4.8.4 Pressure Zone Separation

Based on the pressure zone analysis, it is recommended that the City reduce service pressures that exist outside of its established delivery pressure criteria by breaking the single pressure zone distribution system into four zones: the North, Coast, Central, and South. Figure 4.8 shows these pressure zone areas. The recommended improvements necessary for this conversion are summarized in Table 4.15.

4.8.5 Implementation Schedule

Figure 4.9 shows the implementation schedule for these water projects in the three phases previously described. Costs for the recommended water projects are summarized in Chapter 9.



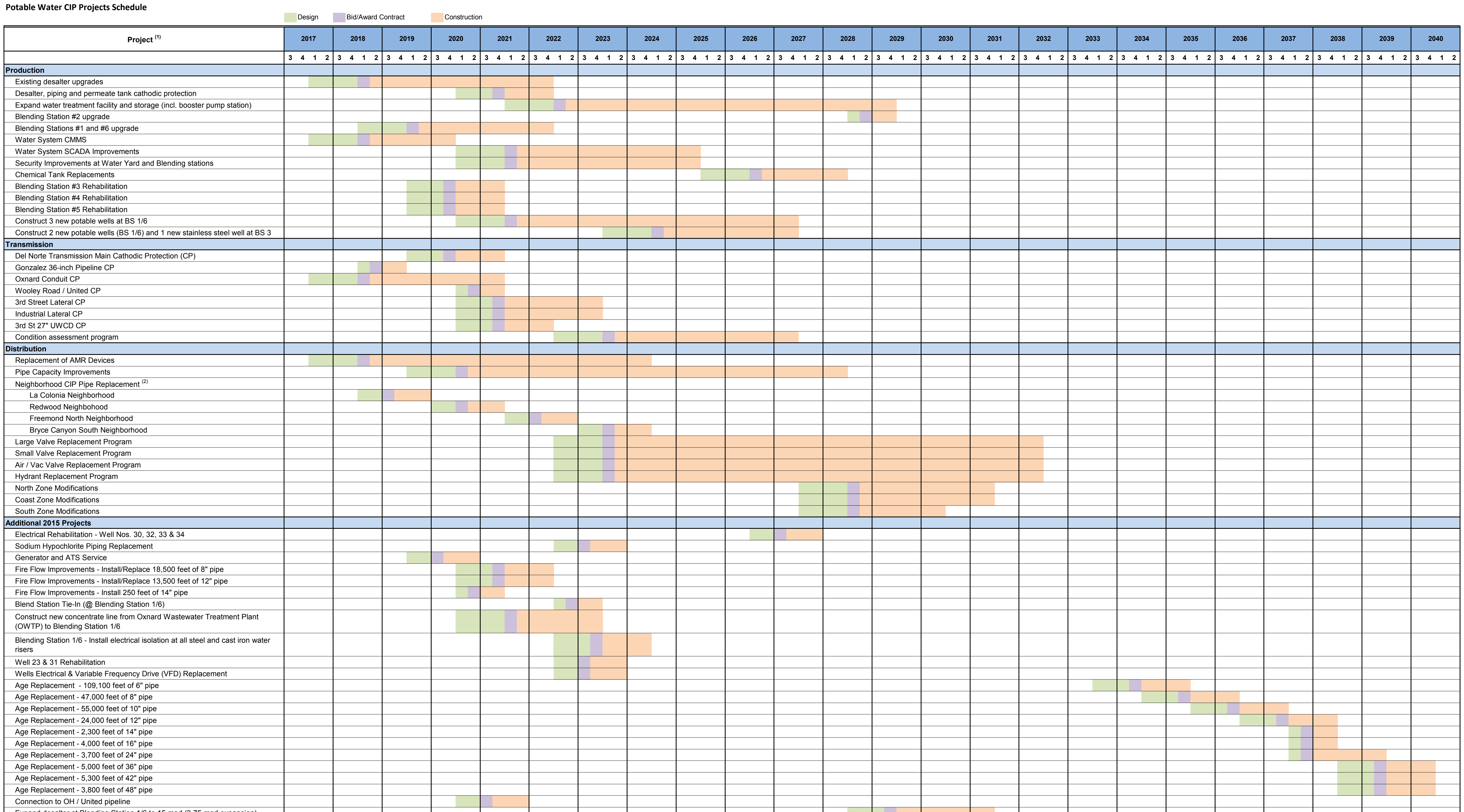
PROPOSED PRESSURE ZONES AND NEW FACILITIES

FIGURE 4.8

CITY OF OXNARD

SUMMARY REPORT

PUBLIC WORKS INTEGRATED MASTER PLAN



Notes:
(1) Project start years correspond to refinements and updates provided by City after Dec. 2015 publication date.
(2) Neighborhood CIP Replaement projects (La Colonia, Redwood, Freemont North, and Bryce Canyon South neighborhoods) combined into single project.

RECOMMENDED WATER PROJECTS SCHEDULE

FIGURE 4.9

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

ox0817f1-9587(SumRepFIG4-9).ai

WASTEWATER SYSTEM MASTER PLAN

5.1 INTRODUCTION

The City owns and operates the Oxnard Wastewater Treatment Plant (OWTP) and the associated wastewater collection system. Through the OWTP, the City provides wastewater treatment to Oxnard and several surrounding communities (the City of Port Hueneme, the Port Hueneme Water Agency, the Naval Base Ventura County facilities at Port Hueneme and Point Mugu, Ventura Regional Sanitation District, Crestview Mutual Water Company, Nyeland Acres, and Las Posas Estates) and is permitted to discharge treated wastewater to the Pacific Ocean. In addition, a portion of the treated wastewater is used as recycled water after additional treatment through the City’s Advanced Water Purification Facility (AWPF).

While considering improvements to the OWTP, a number of goals were established to help develop possible improvement scenarios. Consistent with the overall Master Plan goals established in Chapter 1, the five main goals for the City's wastewater facilities are as follows:

- Goal 1: Provide a compliant, reliable, resilient, and flexible system.
- Goal 2: Manage assets effectively (economic sustainability).
- Goal 3: Mitigate and adapt to the potential impacts of climate change.
- Goal 4: Protect and enhance environmental and resource sustainability.
- Goal 5: Investigate green and gray infrastructure with an emphasis on energy efficiency.

This chapter will provide an overview of the existing wastewater system as well as its strengths and vulnerabilities and the regulatory requirements and climate change issues the system will face. This chapter also provides recommendations for ways to meet the defined goals.

The analysis and evaluations contained in this Summary Report are based on data and information available at the time of the original date of publication of the Project Memos (PMs), December 2015. After development of the December 2015 Final Draft PMs, the City continued to move forward on two concurrent aspects: 1) advancing the facilities planning for the water, wastewater, recycled water, and stormwater facilities; and 2) developing Updated Cost of Service (COS) Studies (Carollo, 2017) for the wastewater/collection system and the water/distribution system. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The complete updated CIP based on the near-term and long-term projects is contained in Appendix B.

5.2 DESCRIPTION OF EXISTING FACILITIES

5.2.1 Wastewater Collection System

The City's existing sanitary sewer collection system is comprised of roughly 384 miles of gravity collection system pipe ranging from 4 to 60 inches in diameter. As is typical for a community this size, most of the sewers (67 percent) are 8 inches in diameter and most (70 percent) are made of vitrified clay pipe. The rest (22 percent) are made of polyvinyl chloride.

The City currently operates and maintains 15 lift stations located throughout the City. Except for the Patterson & Hemlock Wastewater Lift Station, which has a wet well configuration, all of the lift stations utilize a submersible pump configuration. All of the pump stations have a duty and a standby pump.

The force mains associated with the wastewater lift stations consist of approximately 4.7 miles of pressurized pipe ranging from 4 to 20 inches in diameter. The majority (67 percent) are 6 and 10 inches in diameter. Force main pipe are between 6 and 46 years old.

Figure 5.1 shows the existing wastewater collection system infrastructure.

5.2.2 Wastewater Treatment Plant

The City's existing OWTP has a permitted capacity of 31.7 mgd and treats wastewater for discharge to the existing ocean outfall. The OWTP provides preliminary, primary, and secondary treatment, which are described below.

Preliminary treatment includes bar screens, screenings conveyance, grit removal, and grit conveyance to remove solids that might damage downstream equipment. After preliminary treatment, flow is gravity fed to the influent pump station wet well, which includes six dry-pit submersible pumps. Three of the six pumps are on duty during normal operations.

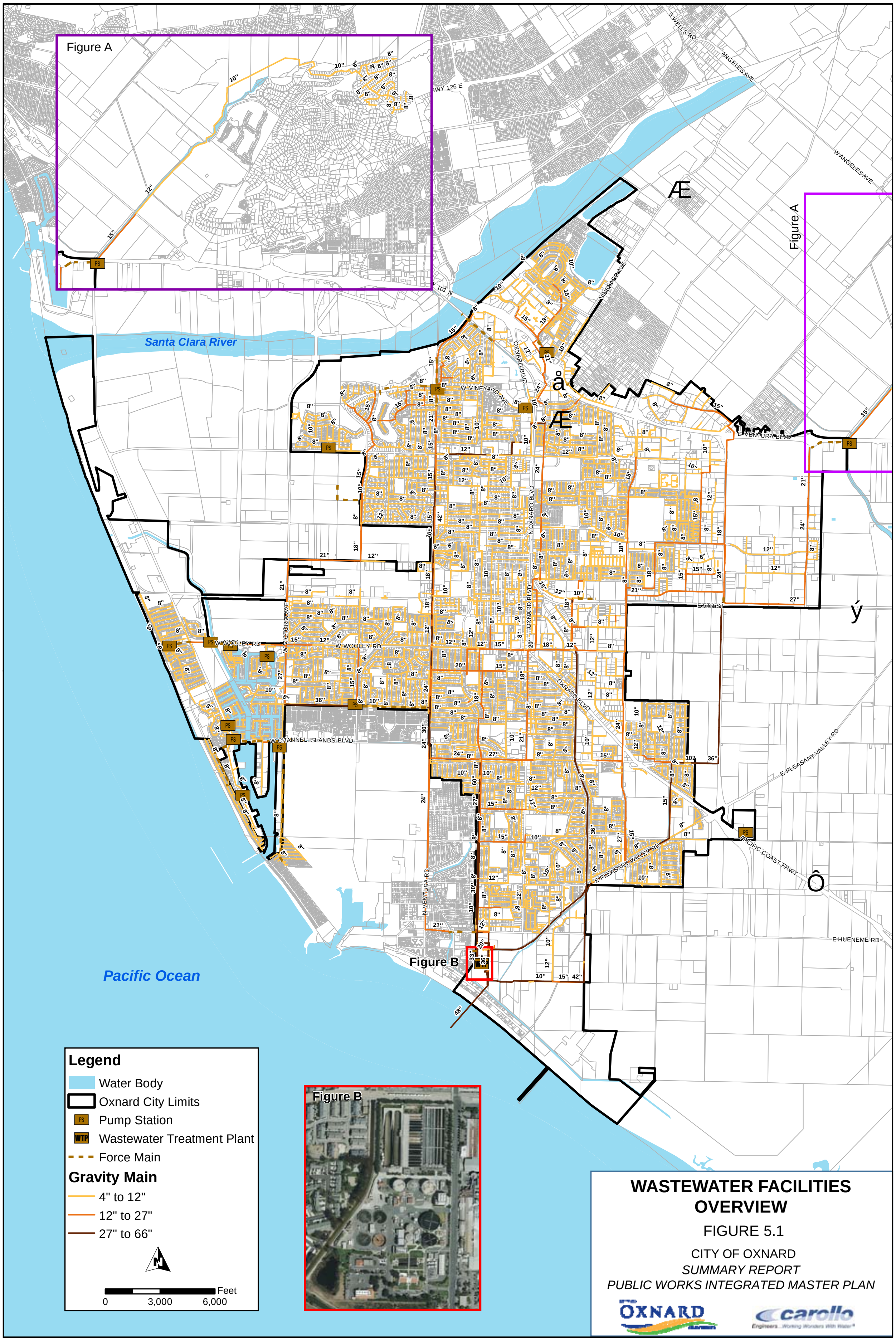
From the influent pump station wet well, raw wastewater flows to four primary sedimentation basins for primary treatment. The primary treatment process includes facilities in which ferric chloride are added to enhance sedimentation. A polymer storage and feed system is planned to further enhance primary treatment performance.

After primary treatment, flow enters the secondary treatment system, which uses a fixed-film secondary treatment process followed by an air-activated sludge process to remove organic material. The City’s discharge permit for the facility does not currently require nitrogen or phosphorus removal.

The secondary treatment system is comprised of two biotowers, two three-pass activated sludge tanks (ASTs), and 18 secondary sedimentation basins (SSTs). A plant utility water pumping station is provided downstream of the secondary sedimentation basins.

The maximum hydraulic capacity of the ocean outfall is 50 mgd, so two 2.5-million gallon (MG) secondary effluent equalization basins (EQ Basins) were included as part of the activated sludge facilities to equalize the portion of secondary effluent flows greater than 50 mgd during wet weather events. (Currently, plant staff also operates the EQ Basins during the dry weather season to equalize secondary effluent during the peak power cost period of the day to minimize the cost of final effluent pumping to the ocean outfall.)

Secondary effluent leaving the SSTs and/or EQ Basin either flows by gravity or is pumped through a 48-inch secondary effluent line to two three-pass chlorine contact tanks (CCTs).



WASTEWATER FACILITIES OVERVIEW

FIGURE 5.1

CITY OF OXNARD

SUMMARY REPORT

PUBLIC WORKS INTEGRATED MASTER PLAN

Each pass is 145 feet long. Disinfected effluent is then pumped to the 6,800-linear feet (1.3 mile) ocean outfall from the effluent pump station, which has two engine-driven pumps, two electric motor variable frequency drive (VFD) pumps, and an additional motor-driven pump.

The solids handling facilities consist of 2 gravity thickeners for primary sludge thickening, two dissolved air flotation thickeners (DAFTs) for waste activated sludge (WAS) thickening, three anaerobic digesters, and 4 belt filter presses (BFPs) for dewatering.

Table 5.1 summarizes basic design criteria for the OWTP and Figure 5.2 provides a process flow schematic.

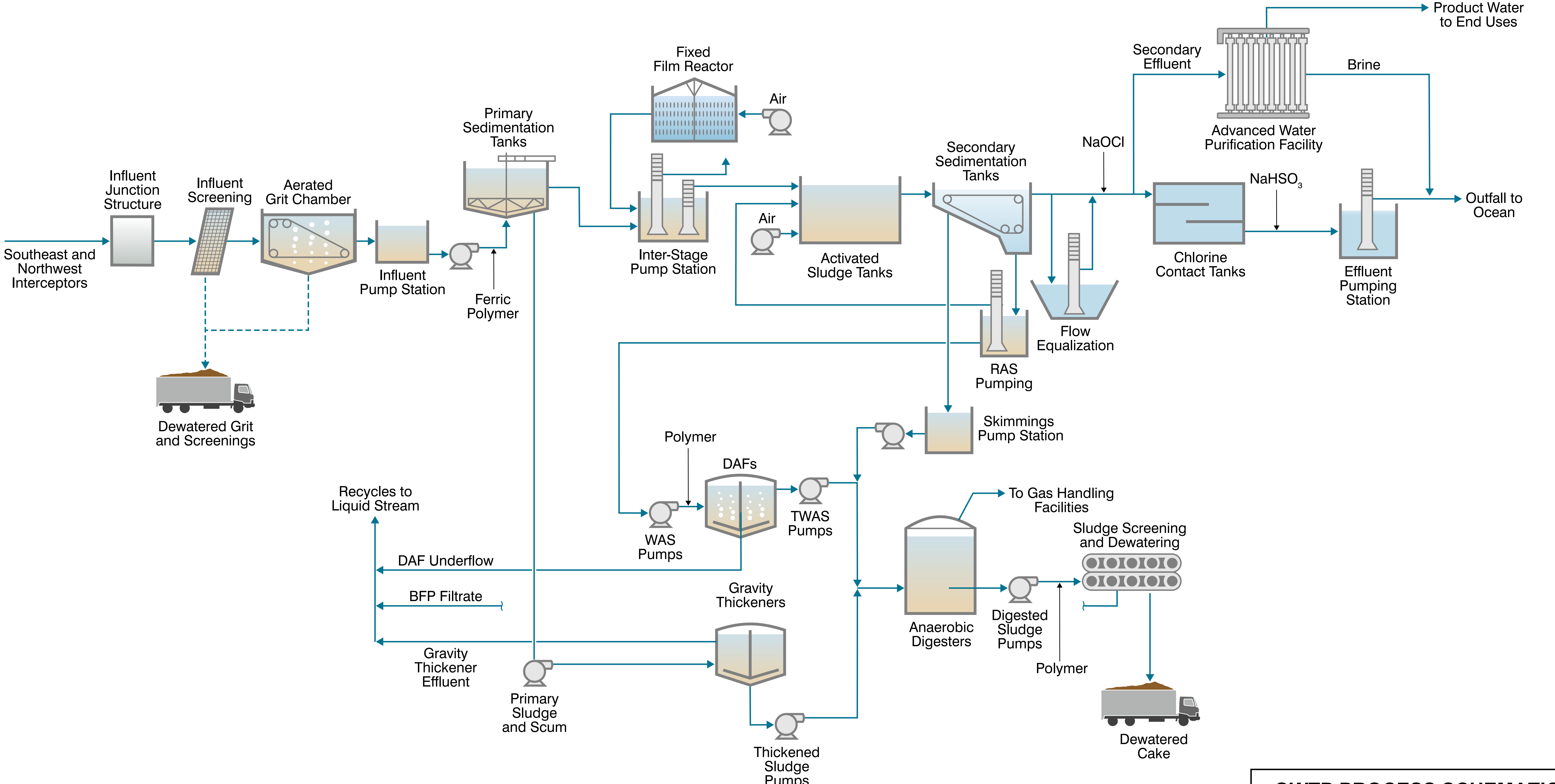
Table 5.1 Design Criteria for the Existing OWTP
Public Works Integrated Master Plan
City of Oxnard

Criteria	Main Equipment	Ancillary Equipment	Year Installed
Preliminary Treatment			
Bar Screens	4 mechanical screens (1/4-inch openings) 2 manual screens (1/2-inch opening)	Screenings Conveyor/Compactor	2008
Aerated Grit	2 chambers, each with 4 hoppers	4 Grit pumps / 3 separators	2008
Influent Pumps	6 – 18,000 gpm 450-hp pumps		2008
Primary Treatment			
Sedimentation	4 circular 105-foot diameter basins	Sludge scrapers, transfer pumps, scum ejector, optional polymer	4 basins – 1972
Interstage Pumping Station	3 variable-speed vertical mixed-flow pumps 2,800 – 21,500 gpm each 8 -21 ft TDH 250 HP each		1975
Secondary Treatment			
Biofiltration	2 – one 140-foot dia., and one 100-foot dia. Filters	4 feed and recirculation pumps, ventilation system 4 blowers, each tower	2 filters – 1975
Activated Sludge	2 tanks, each with 3 passes, 3 step-feed channels per pass. Fine air diffusers fixed on floor.	6 – single-stage blowers, return activated sludge pumps	1990

Table 5.1 Design Criteria for the Existing OWTP
Public Works Integrated Master Plan
City of Oxnard

Criteria	Main Equipment	Ancillary Equipment	Year Installed
Sedimentation	18 rectangular sedimentation basins	4 Return Activated Sludge (RAS) pumps 3 WAS pumps	1990
Flow Equalization	1 – 5-MG storage tank with 2 sections	Pump station and recirculation tubes	1990
3W Pumping Station	3 vertical turbine pumps 1,880 gpm each 185 ft TDH 125 HP each	Strainer	1988
Disinfection			
Chlorination/ Dechlorination	6 pass contact tank	Hypochlorite and bisulfite feed systems	6 passes – 1980
Effluent Pump Station	1 variable-speed mixed-flow pump 17,400 gpm @ 900 rpm 30 ft TDH		1975
	4 variable-speed engine driven mixed-flow pumps 12,000 gpm each @ 1,200 rpm 146 ft TDH		prior to 1975
Solids Handling			
Gravity Thickening (for primary solids)	2 – 59-foot diameter thickeners	Polymer and ferric chloride system for thickening, thickened primary sludge pump	2 GT – 1980
Dissolved Air Flotation (for secondary solids thickening)	2 – 25-foot diameter thickeners	Polymer system for thickening, thickened waste activated sludge pumps	2 units – 1990
Anaerobic Digestion	3 digesters, 2 at 90-foot diameter and 1 at 110-foot diameter	Heat exchanger, mixer, recirculation pumps, fixed cover, gas collection system, digested sludge pumping	90-foot dia.– 1980 110-foot dia. – 1990
Belt Filter Press (Dewatering)	4 – 2.2-m units	Polymer system for sludge conditioning	4 BFPs – 1990
Cogeneration	3 – 500-kW generators	Waste heat recovery system	1980

Note:
(1) Source: OWTP, Operation and Maintenance Manuals, and comments from Mark Moise.



OWTP PROCESS SCHEMATIC

FIGURE 5.2

CITY OF OXNARD

SUMMARY REPORT

PUBLIC WORKS INTEGRATED MASTER PLAN

5.2.3 Condition Assessment

To identify the City's wastewater system's R&R needs, a condition assessment was conducted. This effort involved using asset management methodology to identify existing water assets and conduct a visual condition assessment of above-ground assets, a seismic evaluation of structures, a desktop evaluation of below-ground assets, and a cathodic protection system evaluation.

To prioritize the R&R needs, a risk assessment was also conducted to examine the vulnerability, or likelihood of failure, and criticality, or consequence of failure, for each asset. Consistent risk scoring methodology was applied to both above- and below-ground assets to prioritize each asset type.

5.2.3.1 Above Ground Assets

Above-ground assets included structures and equipment owned and operated by the City. To assess and value all above-ground assets, a consistent approach was used regardless of whether they were in the treatment system or collection system. The above-ground asset inventory included approximately 26 structures, 160 pumps, 15 wet wells, and a variety of other assets across the OWTP and collection system. The recorded age of each asset varied from 1955 to the present.

Several tables summarize the results of the condition assessment analysis. Table 5.2 lists the OWTP's assets, including the highest above-ground risk determined from this assessment. Table 5.3 lists the assets at the collection system Lift Stations, including the highest above-ground risk determined from the assessment.

Below are the findings of the condition assessment for above-ground assets:

- Headworks – The headworks is in fair to good condition, with some concrete deterioration noted.
- Primary Clarification – Structurally, the primary sedimentation building and clarifier basins were found to be in fair to poor condition. Mechanical and electrical assets were in poor to very poor condition.
- Biofilters – The biofilters were in poor to very poor condition.
- Interstage Pumping Station – The pumps were found to be in fair to poor condition. The structure itself is in fair condition.
- Secondary Treatment – The structures were found to be in fair to poor condition. The equipment was found to be in very poor condition.
- Disinfection Facilities – These facilities are in fair condition; concrete repairs are needed.

- Effluent Pumping – Structurally, this facility is in poor condition. Mechanical assets were rated from fair to poor condition. Electrical assets were in very poor condition.
- Thickening – The facilities are in poor to very poor condition.
- Digestion – The facilities are in poor to very poor condition, and Digester 2 is currently non-operational.
- Dewatering – The facilities are in fair to poor condition.
- Cogeneration – The facilities are in fair to poor condition.
- Electrical Facilities – The facilities are in good to very poor condition. The emergency power facility is aging.

Table 5.2 High-Risk Assets at the OWTP
Public Works Integrated Master Plan
City of Oxnard

Process/Asset	Risk[1]
Primary Treatment	
Primary Clarifiers (1-4) Collector Drive, Walkways, and Launders	4.48
Sludge Pump Tanks (1-4)	3.85
MCCs-DPIA, DPIB, DP2B, EDPIA	3.85
Scum Ejectors	3.22
Primary Clarifiers (2 & 4)	1.7
Large Isolation Valves	1.04
Biofilters	
Recirculation Pumps Mag Drive 1 and 2	3.4
Distributors and Drives	2.17
Biofilter Tanks 1 and 2	1.7
Biofilter Media Tanks (1 & 2)	0.8
Secondary Treatment	
Collector, Skimmer, and Drives (17-18)	1.54
Effluent Pump Station	
MCCs	3.85
Gravity Thickening	
MCCs-DP3C, DP3D	3.85
Thickened Sludge Pumps (1-3)	0.51

Table 5.2 High-Risk Assets at the OWTP
Public Works Integrated Master Plan
City of Oxnard

Process/Asset	Risk[1]
Digestion	
Digester Heat Exchanger No. 2	3.22
Digester No. 2 Tank	1.52
Digested Sludge Pumps (1-3)	0.51
Digester Control Building	1.46
Digester Hot Water Pump 1	0.51
Digester Mixing Equipment and Draft Tubes Nos. 1-3	0.51
MCCs (DP2C, EDPIC, GF)	0.46
Dewatering	
Conveyors	2.8
Belt Filter Press 1-4	2.8
Dewatering Feed Pump 5	0.51
Washwater Booster Pumps (1-4)	0.51
Electrical	
Effluent Electrical Building Switchgear	5.11
Main Electrical Building Large Standby Generators	4.69
Effluent Electrical Building (DP2A, EBPIB)	3.85
Main Electrical 500 kW Generator	0.7
Older Transformers (1 & 2)	0.51
Main Electrical Building MCCs (DP4, DP4B, GB, GC, GD)	
Administration Building MCCs (DP2D, DP3A, EDPIE, HG)	
Buildings	
Main Switchgear Building	(1.46) Seismic[2]
Plant Control Center Building	(1.46) Seismic[2]
Vacuum Filter	(1.46) Seismic[2]
Blower Building	(1.1) Seismic[2]

Note:
(1) Risk = Criticality x Vulnerability; Criticality = consequence of failure; Vulnerability = likelihood of asset failure
(2) Indicates a seismic deficiency that requires concrete testing, further Tier 2 evaluation, or replacement.

Table 5.3 High Risk Assets at Lift Stations Public Works Integrated Master Plan City of Oxnard	
Site/Asset	**Risk(1)**
Lift Station 23 Wagon Wheel	
Submersible Pumps (1-2)	4.27
MCC	3.85
Wet Well Structure	2.56
SCADA Panel	2.25
Valve Vault	0.68
Lift Station 6 Canal	
Submersible Pumps (1-2)	0.51
MCC	0.46
Lift Station 04 Mandalay & Wooley	
SCADA Panel	0.51
MCC	0.46

Note:

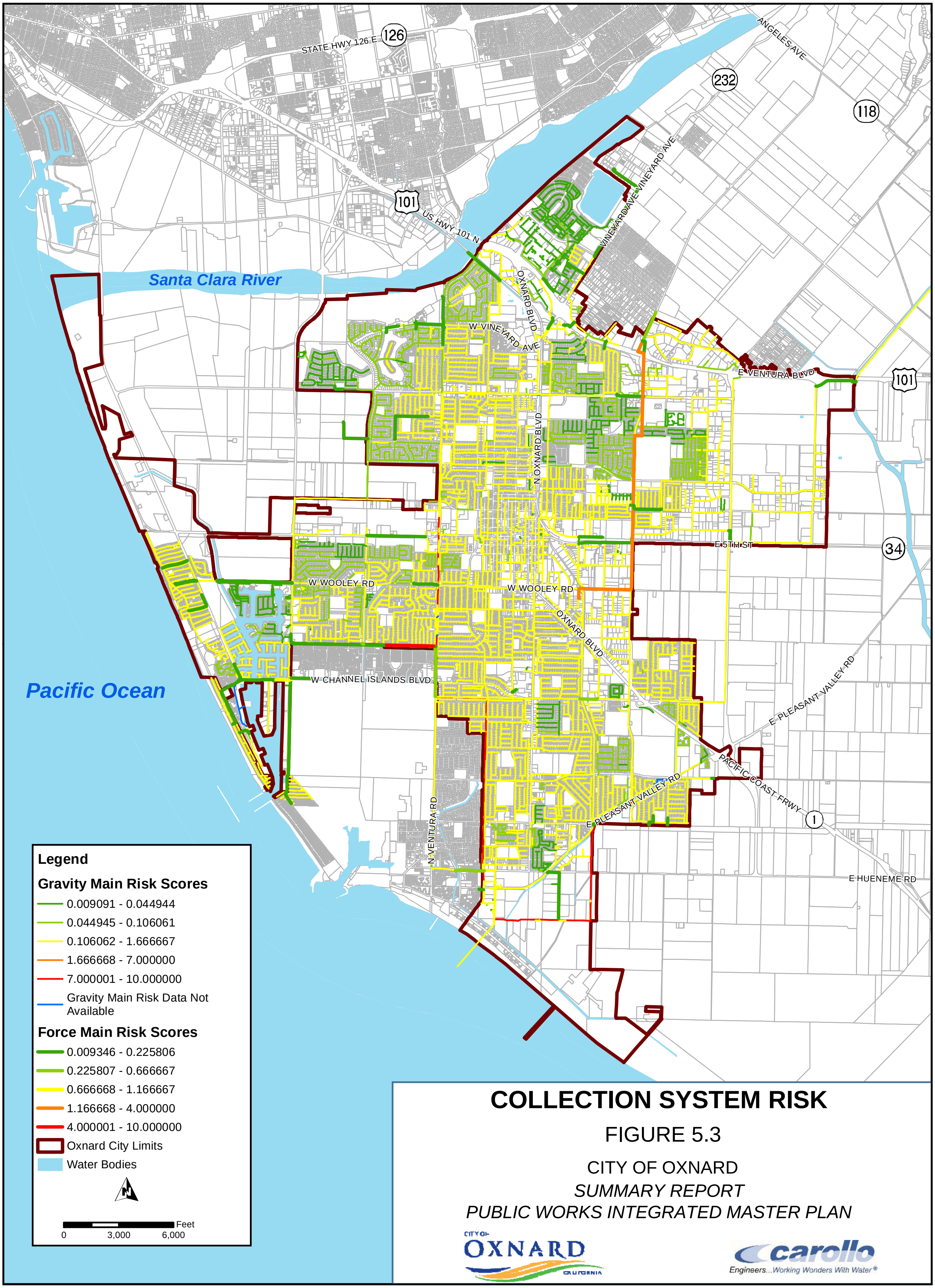
(1) Risk = Criticality x Vulnerability; Criticality = consequence of failure; Vulnerability = likelihood of asset failure.

5.2.3.1 Below Ground Assets

For the City's below-ground wastewater system assets, a desktop evaluation relying on GIS data from the Oxnard collection system was conducted. Collectively, only 18 percent of the collection system piping had a known installation year, with no year available for 206 of the 263 segments for sewer force mains and 7,123 of the 8,686 segments for sewer gravity mains. Because so few installation years were available, an installation year of 1965, which was based on a conservative estimate of development in the area, was assumed.
Figure 5.3 shows the risk scores of the Oxnard collection system.

5.2.4 Seismic Assessment

Performing a seismic assessment of the OWTP structures established each structure's anticipated performance level during a seismic event and recommended retrofit strategies to meet established performance objectives for deficiencies identified. With Tier 1 screening, Tier 2 assessments of the buildings, and a seismic assessment of the water-retaining structures at the OWTP, structural and non-structural seismic vulnerabilities could be identified and evaluated. A seismic assessment was completed for a total of 18 buildings and eight water-retaining structures. The results of this analysis can be found in Table 5.4.



COLLECTION SYSTEM RISK

FIGURE 5.3

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Table 5.4 Summary of Seismic Assessment and Preliminary Screening Public Works Integrated Master Plan City of Oxnard

Structure	Recommendations	
Tier 1 Evaluation		
Primary Sedimentation	Replace	
Main Electrical/Main Switchgear Building	Replace	
Digester Control Building	Replace	
Operations Center/Plant Control Center Building	Replace	
Effluent Pumping Station	Replace	
Generator/Co-Generation Building	Replace	
Storage-Vacuum Filter Building	Replace	
Storage-Butler Building	Replace	
Tier 2 Evaluation		
	Structural Components	**Non-Structural Components**
Headworks Building	No Deficiencies	Retrofit Needed
Grit Screenings Building	No Deficiencies	Retrofit Needed
Blower Building	No Deficiencies	Retrofit Needed
North Area Electrical Building	No Deficiencies	Retrofit Needed
Solids Processing Building	No Deficiencies	Retrofit Needed
Maintenance Building	Retrofit Recommended: wall-to-diaphragm connection	Retrofit Needed
Collection System Maintenance Building	Retrofit Recommended: wall-to-diaphragm connection	Retrofit Needed
Chemical Handling Facilities	Retrofit Recommended: wall-to-diaphragm connection	Retrofit Needed
16 kW Switchgear/Effluent Electrical Building	Replace structure based on condition assessment and plant considerations.	--
Administration Building	No Deficiencies	Retrofit Needed

Table 5.4	**Summary of Seismic Assessment and Preliminary Screening Public Works Integrated Master Plan City of Oxnard**
Structure	**Recommendations**
Concrete Testing and Assessment	
Activated Sludge Tanks/Aeration Basin	Repair/seal cracks
Secondary Sedimentation Basin	Repair/seal cracks
Flow Equalization Basin	Repair areas of damaged/cracked concrete; apply corrosion inhibitor to concrete surfaces
Primary Clarifier Tanks	Repair areas of damaged/cracked concrete; coat interior surfaces of tank with 100 percent epoxy or polyurethane coating
Gravity Thickeners	Replace
Digester Nos. 1, 2 and 3	Replace structure based on condition assessment and plant considerations.
DAF Tanks	Replace structure based on condition assessment and plant considerations.
Chlorine Contact Tank	Remove and replace existing coating in the next 10 years.

5.2.5 Cathodic Protection

A survey was conducted on the City's wastewater infrastructure to assess the existing level of cathodic protection. From this survey, the following needed improvements were identified:

- General Wastewater Treatment Plant: Almost all piping tested did not meet National Association of Corrosion Engineers Criteria for protection related to pipe-to-soil potentials. Thus, immediately replacing the entire cathodic protection system plantwide is recommended.
- Clarifiers and Digesters: Currently, no cathodic protection exists at these facilities. Thus, cathodic protection for the submerged surfaces of metallic components is recommended.

In addition to these projects, the project team recommends conducting an annual cathodic protection survey and report for all City facilities as well as bi-monthly rectifier monitoring.

5.2.6 Arc Flash Assessment

An electrical system study was also conducted for the existing OWTP. This study was comprised of a short-circuit study, a protective device coordination evaluation, and an arc flash evaluation.

Each analysis was performed for a particular reason. The short circuit study determined the available short circuit current at each piece of electrical equipment and identified underrated equipment. The protective device coordination evaluation identified protective devices (circuit breakers, fuses, etc.) not coordinated in the electrical system and not likely to minimize disruption of electrical power during a short circuit. The arc flash evaluation determined the maximum arc flash incident energy at each piece of electrical equipment and identified appropriate personnel protective equipment to be worn if working on the equipment while it is energized.

The results of the electrical systems investigation were used to develop the electrical system study for each site. With these results, pieces of existing electrical distribution equipment (e.g., the main breaker for PNL DP4) not sufficiently rated for the worst-case short circuit current could be identified. The results also showed the arc flash incident energy at each piece of electrical equipment based on the existing protective device settings.

Concerns (e.g., equipment that is damaged, scratched, rusty or not functioning, such as a broken indicator light) and code violations (e.g., insufficient working space around electrical equipment) in the existing electrical equipment installations were observed and documented in Section 5 of Project Memorandum 3.8. Obsolete equipment (approximately 40 percent) and equipment nearing the end of its useful life (approximately 30 percent) and in need of repair were identified, and possible changes in the existing installation from code violations were noted as well. For example, electrical equipment installed prior to 1989 was identified and recommended for replacement due to obsolescence and poor condition.

5.3 FLOW AND LOAD PROJECTIONS

5.3.1 Historical Wastewater Flows and Loads

Historical influent wastewater flows and loads were analyzed from 2009 through 2013, as shown in Tables 5.5 and 5.6. These influent flows and loads include residential and commercial users as well as industrial dischargers.

Table 5.5	**Historical Wastewater Flows to OWTP (in mgd) Public Works Integrated Master Plan City of Oxnard**					
	Historical Data					
Flow Condition	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Average**
Average Dry Weather Flow(1)	21.7	21.4	20.1	19.9	19.5	20.5
Average Annual(2)	22.4	22.2	21.6	20.5	19.7	21.3
Average Day Maximum Month(3)	24.2	24.1	24.3	21.4	20.3	22.9
Maximum Week(4)	24.6	26.9	26.0	21.9	20.7	24.0
Maximum Day(5)	26.9	30.5	31.6	25.5	23.5	27.6

Notes:

(1) Average Dry Weather (ADW) Flow = Lowest 90 day running average flow.
(2) Average Annual (AA) = Average for a 365 consecutive day period.
(3) Average Day Maximum Month (ADMM) = Highest 28 day running average flow.
(4) Maximum Week (MW) = Highest 7 day running average flow.
(5) Maximum Day (MD) = Highest observed daily flow.

Table 5.6	**Historical Wastewater Loads to OWTP Public Works Integrated Master Plan City of Oxnard**					
	Historical Data					
Flow Condition	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Average**
BOD_5(1)						
ADW, klb/d(2)	53.3	50.5	45.1	45.8	48.8	48.7
ADW, mg/L(3)	295	283	269	276	299	284
AA, klb/d	61.4	53.7	49.7	53.1	52.5	54.1
MM, klb/d	67.9	59.1	56.3	59.7	61.4	61.3
MW, klb/d	85.3	64.7	59.4	62.7	66.9	67.8
MD, klb/d	108	88.2	94.2	76.6	92.5	91.9
TSS						
ADW, klb/d	46.4	44.4	41.6	41.5	45.1	43.8
ADW, mg/L	257	249	248	250	277	256
AA, klb/d	49.5	49.2	48.7	46.0	47.8	48.2
ADMM, klb/d	60.5	59.5	65.5	53.1	56.5	59.0
MW, klb/d	89.8	76.5	81.8	64.5	70.7	76.7
MD, klb/d	142	211	190	104	173	164

Table 5.6 Historical Wastewater Loads to OWTP Public Works Integrated Master Plan City of Oxnard						
	Historical Data					
Flow Condition	**2009**	**2010**	**2011**	**2012**	**2013**	**2009-2013 Average**
NH3-N						
ADW, klb/d	6.53	6.26	5.97	6.22	6.30	6.26
ADW, mg/L	36.1	35.1	35.6	37.5	38.7	36.6
AA, klb/d	6.85	6.51	6.63	6.80	6.47	6.65
ADMM, klb/d	7.88	7.51	7.64	7.99	6.83	7.57
MW, klb/d	9.63	8.33	8.24	10.2	7.77	8.83
MD, klb/d	9.63	8.33	8.24	10.2	7.77	8.83

Notes:

**For flow condition definitions, see Table 5.5.

(1) These higher BOD_5 values are likely due to high soluble BOD_5 from the canning and food processing industry.
(2) ADW = Influent load during ADW flow period.
(3) ADW, mg/L calculated as ADW Load (lb/d)/average dry weather flow (ADWF) (mgd)/8.34.

5.3.2 Future Wastewater Flow and Load Projections

For domestic (residential and commercial) uses at the OWTP, flow and load projections were developed using a combined population-based per capita method. A land use-based projection method was used for industrial uses.

Residential and commercial wastewater flow and load projections were estimated using a per capita daily flow of 71.6 gallons per day (gpd)/capita, a per capita daily biochemical oxygen demand (BOD_5) load of 0.20 pounds per day (ppd)/capita, and a per capita daily (pcd) total suspended solids (TSS) load of 0.17 ppd/capita in conjunction with population projections outlined in Chapter 2.

Industrial flows and loads were projected for existing and new industries. Flows and loads for both industry types are described below.

For existing industries, the 30 significant industrial units that currently discharge at or above their permitted flow were assumed to continue discharging at 2013 flows and loadings through the planning horizon. It was assumed that the six remaining industries that currently discharge less than their permitted flow would discharge at their permitted flow through the planning horizon. The additional flow projected was assumed to have BOD_5 and TSS concentrations consistent with overall average industry concentrations. This approach was used for a conservative estimate of future flows and loads from existing industry.

New industry wastewater flow projections were estimated using projected industrial water demand projections. These demands were calculated using future land use, discussed in Chapter 2, and were allocated for 2020 and 2040. As a conservative estimate, it was assumed that the wastewater generation coefficient for the demand is 1.0, and that new industry would grow linearly from 0 to the 2020 water demand projections and then linearly again to the 2040 water demand projections.

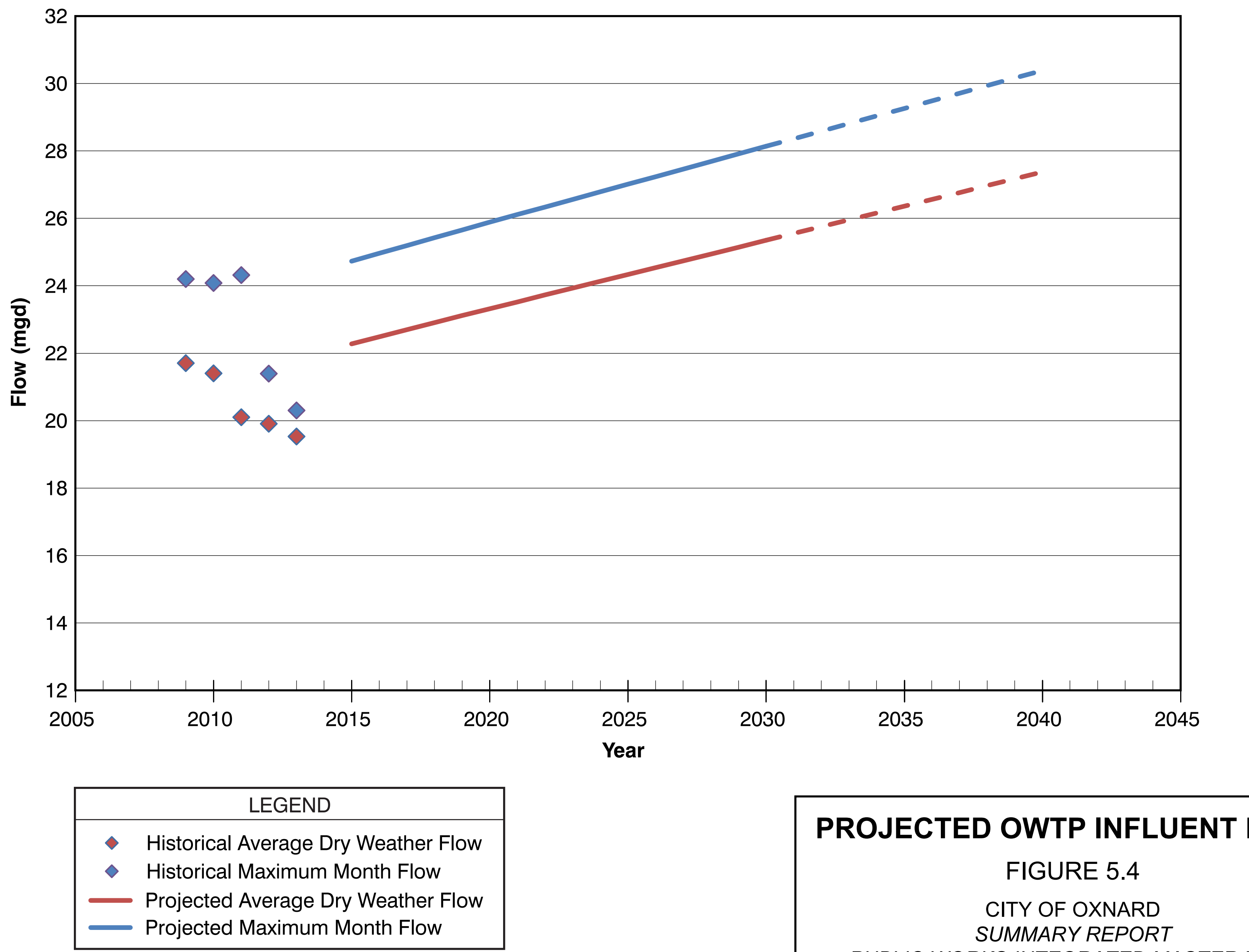
Similar to the industrial flow and load projections, both Naval Base Ventura County (NBVC) at Point Mugu and NBVC at Port Hueneme were assumed to discharge at their permitted limits throughout the planning period. It was also assumed that the incremental flow projected for these NBVCs - between their current and permitted flows - would have BOD_5 and TSS concentrations consistent with the average residential/commercial concentrations.

Projected desalter concentrate flows and loads from the Oxnard desalter and Port Hueneme Water Agency (PHWA) desalter were not included in the flow projections to the OWTP headworks. Concentrate flow from the PHWA desalter is planned to be discharged to the Calleguas Municipal Water District (CMWD) regional brine pipeline. In addition, in the future, the Oxnard desalter (located at Blending Station No. 1/6) concentrate will be discharged directly to the outfall through a separate concentrate line, bypassing the OWTP.

Flow, BOD_5, and TSS projections are shown in Figures 5.4, 5.5, and 5.6 respectively.

5.4 MASTER PLAN/DESIGN CRITERIA

Key planning and design criteria were used to evaluate the existing wastewater system's ability to meet the future needs. Table 5.7 shows the OWTP criteria, and Table 5.8 shows criteria for the collection system. The criteria were used for future system improvement planning.



PROJECTED OWTP INFLUENT FLOW

FIGURE 5.4

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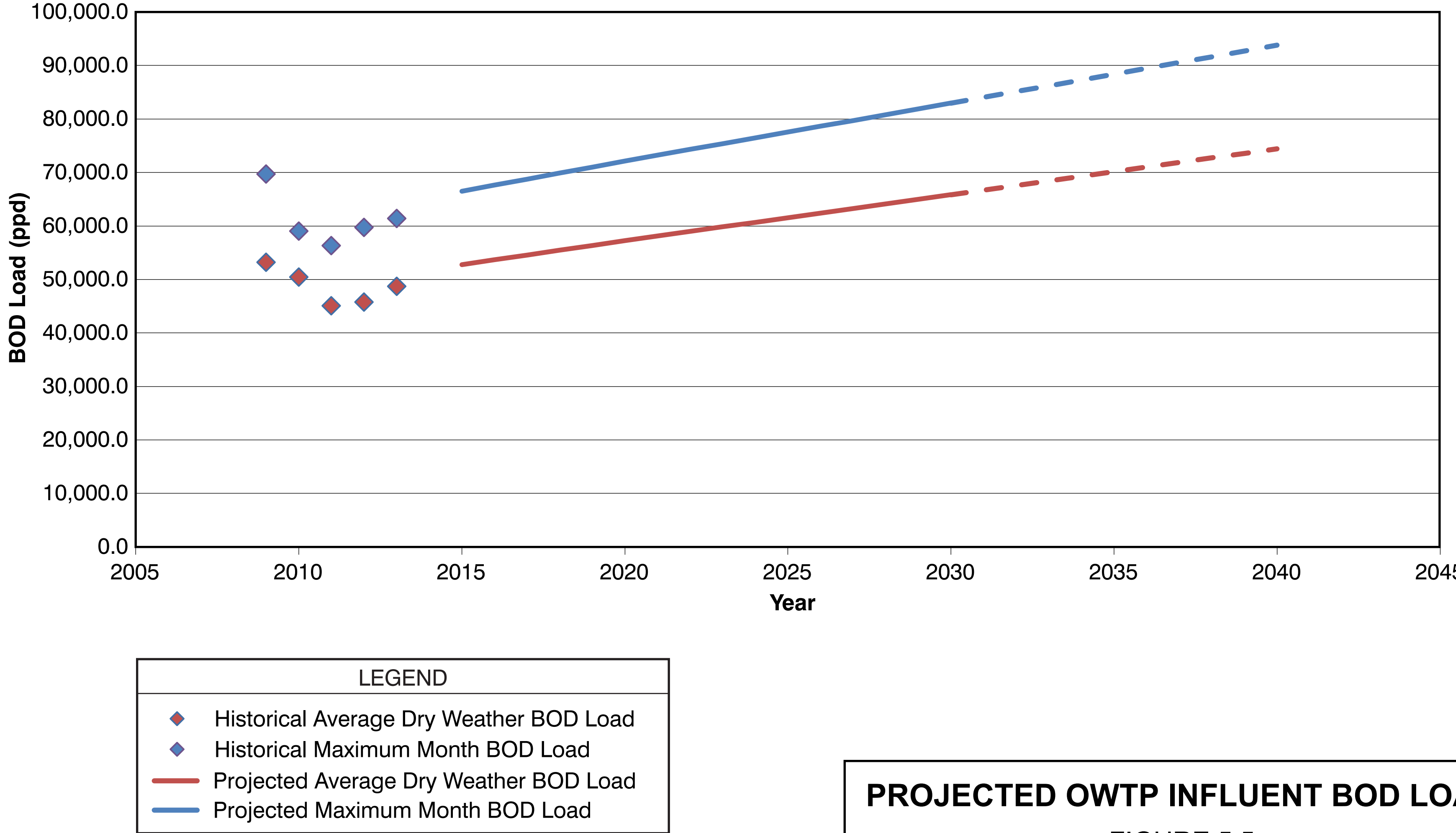

PROJECTED OWTP INFLUENT BOD LOAD

FIGURE 5.5

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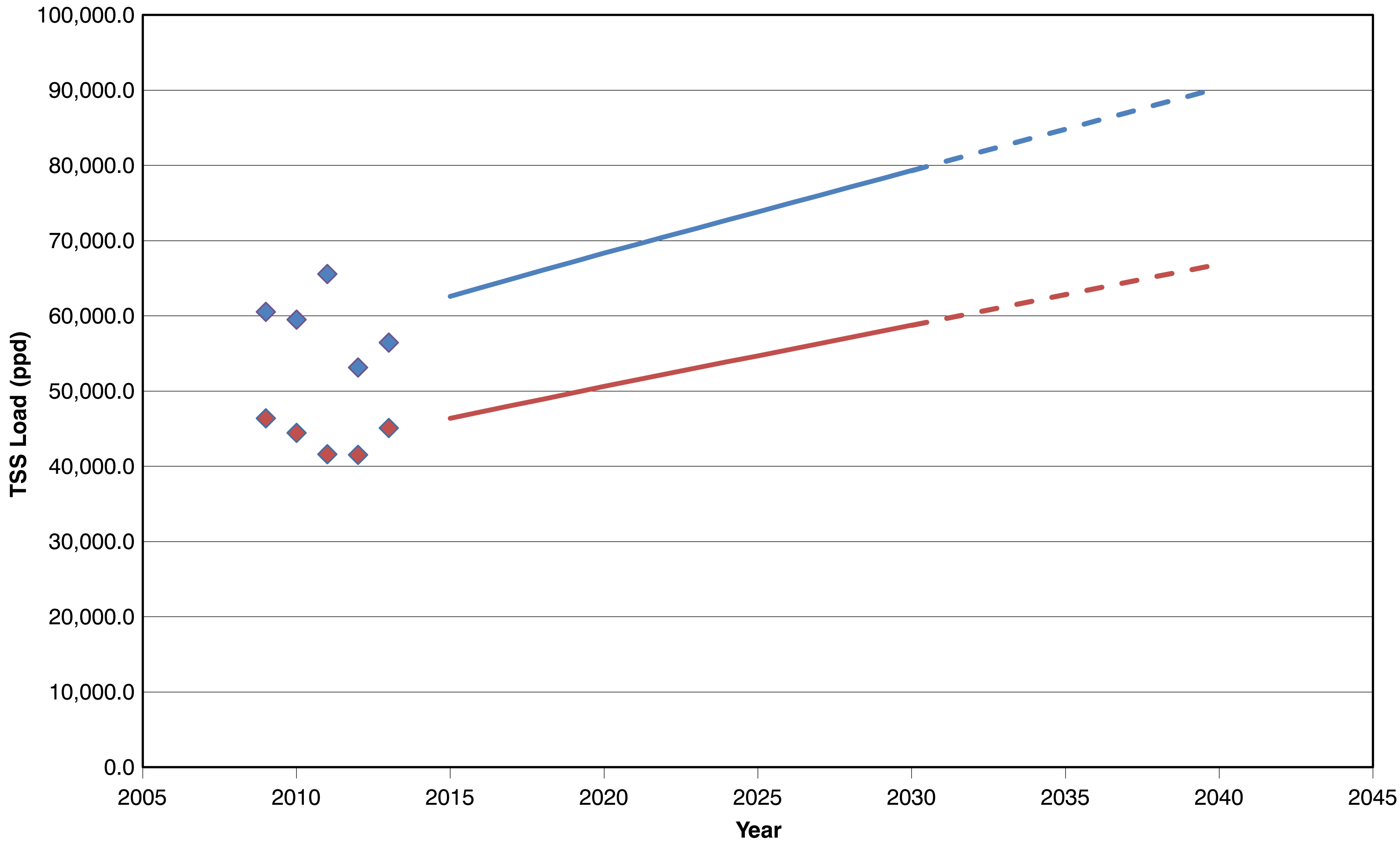

LEGEND

- Historical Average Dry Weather TSS Load
- Historical Maximum Month TSS Load
- Projected Average Dry Weather TSS Load
- Projected Maximum Month TSS Load

PROJECTED OWTP INFLUENT TSS LOAD

FIGURE 5.6

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Table 5.7 OWTP Process Performance and Criteria Summary Public Works Integrated Master Plan City of Oxnard						
Process/ Design Parameter	**Design Parameter**	**Units**	**Original Design(1)**	**Historical Performance (2010 – 2013)**	**MOP-8(2) or Typical Values(3)**	**Recommended Criteria for Capacity Analysis**
Grit Chambers	Overflow Rate at PWWF	gpd/sf	42,315	23,056	20,000 - 50,000	42,315
	Detention Time at PWWF	min	2.8	5.1	2 to 5(4)	2.8
Primary Sedimentation Tanks	Overflow Rate:	gpd/sf				
	ADWF		1,270	809(5)	800 - 1,200(2)	1,270
	PWWF		2,200	1,598(5)	2,000 - 3,000(2)	2,220
	% BOD_5 Removal	%	35	46	25 - 40(2)	35
	% TSS Removal	%	65	70	50 - 70(2)	65
Biofiltration Units	Hydraulic Load:					
	Average	gpm/sf	0.50	--	0.9(2)	1.00
	Peak		1.50	--	2.9(2)	1.50
	Volumetric Load at ADMML	lb BOD_5/ 1,000 ft^3/d	47(6)	55	100-220(2)	100
	% BOD_5 Removal	%	--	23	40-70(2)	24
	% Soluble BOD_5 Removal	%	--	63	40-70(2)	69
Aeration Basins	Solids Retention Time (SRT)	days	--	2.0 (7)	Variable	2.5
	Hydraulic Detention Time (HRT)	hrs	--	4.3 (7)	Variable	Variable
	MLSS	mg/L	--	1002	2,000 - 4,000(2)	Depends on Peak Week Load, SVI, and Sec Sed Basin Capacity
	Sludge Volume Index (SVI) 90 Percentile	mL/g	--	177	150(3)	150
	Temperature	°C	--	19 - 27	Variable	20 - 27

Table 5.7	OWTP Process Performance and Criteria Summary Public Works Integrated Master Plan City of Oxnard					
Process/ Design Parameter	**Design Parameter**	**Units**	**Original Design(1)**	**Historical Performance (2010 – 2013)**	**MOP-8(2) or Typical Values(3)**	**Recommended Criteria for Capacity Analysis**
Secondary Sedimentation Tanks	Peak Solids Loading	lb/sf/day	--	28.7(8)	40 - 50(2)	28.7(9)
	Overflow Rate at ADWF	gpd/sf	600	341(10)	400 - 700(2)	Depends on SVI and MLSS concentration
	Overflow Rate at PWWF	gpd/sf	1,100	699(10)	1,000 - 1,600(3)	Depends on SVI and selected MLSS concentration
Chlorine Contact Basins	Detention Time: ADWF	min	20	46	30 - 60(2)	30
	PWWF		--	23	15 - 30(2)	15
Dissolved Air Floatation Thickeners	Solids Load (Peak 14-day Average)	lb/sf/hr	--	1.78(11)	0.4 - 1(2)	1.6
	Hydraulic Load (Peak 14-day Average)	gpm/sf	--	1.06(11)	0.5 - 2(2)	1.0
	Thickened Waste Activated Sludge (TWAS) Concentration	% TS	--	5.5	3.5 - 4(2)	--
Gravity Thickeners	Solids Load (Peak 14-day Average)	lb/sf/hr	1.0	1.5 (11)	1.2	1.2
	Hydraulic Load (Peak 14-day Average)	gpd/sf	700	842 (11)	700	700
	Percent Solids Capture	%	--	--	85 - 90	--
	Thickened Sludge Concentration	% TS	--	--	3.5 - 4.0	--

Table 5.7 OWTP Process Performance and Criteria Summary
Public Works Integrated Master Plan
City of Oxnard

Process/ Design Parameter	Design Parameter	Units	Original Design(1)	Historical Performance (2010 – 2013)	MOP-8(2) or Typical Values(3)	Recommended Criteria for Capacity Analysis
Anaerobic Digesters	Volatile Solids Load at ADMML	lbs VS/ CF/ day	0.1	0.10 (12)	0.1 - 0.4(2)	0.15
	HRT	days	25	25.4(12)	10 - 20(2)	15
	VS Reduction	%	55	55	50 - 65%(2)	55
	Volatile Acids	mg/L	50 - 500	194	< 300	< 300
	Alkalinity	mg/L as $CaCO_3$	2,000 - 4,000	3,378	> 1,000	> 1,000
	Volatile Acids/Alkalinity	--	0.03 - 0.13	0.06	< 0.10	< 0.10
	pH	-	6.8 - 7.4	--	6.8 - 7.4	6.8 - 7.4
Belt Filter Press	Solids Feed Rate per unit	lb/hr	820	984(13)	700 - 900	820
	Dewatered Sludge % Solids	%	18 - 22	19.6	15 - 25	20

Notes:
(1) From OWTP O&M Manuals (Brown and Caldwell, 1980) (Camp Dresser McKee Inc., 1991).
(2) Source: Water Environment Federation / American Society of Civil Engineers, 2010.
(3) Typical values based on Carollo experience.
(4) (Metcalf and Eddy, 2014).
(5) Calculated assuming 3 of 4 in service.
(6) Based on 1.73 lb BOD_5/d/sf media. 604 kcf of media at 27 sf/cf results in max BOD_5 load of 28,213 lb/d.
(7) Based on 1 of 2 in service.
(8) Peak flow rate of 74.5 mgd, return activated sludge (RAS) flow rate of 29.0 mgd, all secondary clarifiers in service, and an SVI of 150 mL/g.
(9) Given the shallow surface water depth of the OWTP primary clarifiers, a higher solids loading rate is not recommended.
(10) Assume all in service.
(11) Based on 1 of 2 in service.
(12) Digester 1 and 3 in service only.
(13) Based on all four in service for 16 hours per day.

Table 5.8	Collection System Level of Service Criteria Summary Public Works Integrated Master Plan City of Oxnard
Design Parameter	**Recommended Criteria for Analysis**
Wet Weather Level of Service Goals	
Hydraulic Grade Line	3 ft below manhole rim elevation
Peak Wet Weather Flow	Existing: 38.5 mgd 2040: 49.6 mgd
Design Storm	10-year 24-hour storm
Dry Weather Level of Service Goals	
Depth to Diameter (d/D)	less than 75% to 85%
Peak Dry Weather Flow	Existing: 22.9 mgd 2040: 34.8 mgd

5.5 FUTURE FACILITY NEEDS

The existing wastewater system's capacity and performance were compared with the above criteria (Table 5.7) to locate system shortfalls. In general, the system has adequate capacity to meet current demand conditions but with little reliability. Much of the existing OWTP is in need of major rehabilitation and repair and is reaching the end of its remaining useful life. This means that without substantial investment into the existing treatment system, the City has a high risk of treatment failure and regulatory fines.

5.5.1 Wastewater Collection System

5.5.1.1 Capacity

To determine the necessary collection system capacity, the existing collection system model was recalibrated with recent wastewater flow data and included both dry and wet weather flow monitoring. Dry weather flow monitoring occurred from August 2, 2014, to August 24, 2014, and wet weather flow monitoring occurred from December 9, 2014, to February 25, 2015.

The collection system capacity was assessed during existing and projected dry and wet weather flow conditions. According to this assessment, the existing system can adequately convey both peak dry and wet weather flow conditions using the level of service (LOS) criteria defined in Table 5.8. However, as flows increase over time, the system will require upgrades to meet capacity restrictions. By 2040, certain sewers are expected to surcharge during peak dry weather flow conditions, which is not acceptable per the LOS criteria. Therefore, pipelines in these areas that exhibited potential capacity deficiencies should be upsized to convey peak dry weather flow without surcharge.

The collection system was also evaluated under peak wet weather flow conditions. Using the LOS criteria in Table 5.8, the analysis indicated that no improvements are needed through 2040 based on the 10-year design storm event. Surcharging does occur throughout the system during these conditions. However, the peak hydraulic grade line is more than 3 feet above the manhole's rim elevation, meaning it does not violate the LOS criteria. Thus, since no sewers violated the peak wet weather flow criteria, no sewers require upgrades.

The pump stations within the system were also evaluated to determine if upgrades were necessary for projected flows. The City provided pump curves for the pump stations but could not provide the start and stop elevations within the wet wells for the pump operation. In general, the pump stations appear able to adequately convey future flows. However, without the actual stop and start elevations, it is difficult to definitively assess this.

5.5.1.2 <u>R&R</u>

Because of the limited information available on the existing condition and age of the collection system piping, a detailed system rehabilitation program could not be practically developed for the Integrated Master Plan. Instead, the CIP recommendations for rehabilitation projects are based on the City's understanding of project needs.

5.5.2 Wastewater Treatment Plant

5.5.2.1 <u>R&R</u>

As discussed in the condition assessment section, a large portion of the OWTP is in poor condition and reaching the end of its useful life. Because of this, major investment in R&R is needed in the near future for reliable plant operations and plant safety concerns.

Replacement is recommended for a number of process facilities, namely the primary clarifiers, DAFTs, digesters, interstage pump station, effluent pump station, and cogeneration facility. All of these facilities are nearing the ends of their useful lives. Additionally, due to safety concerns, demolishing the biotowers is recommended as soon as possible.

5.5.2.2 <u>Process Performance</u>

The performance assessment of the OWTP assessed the following:

- The plant's overall treatment performance for meeting discharge limits and other effluent requirements.
- Each unit process' historical loading and performance.

Approximately 1 to 3 years of daily operating data were reviewed to characterize the OWTP's overall performance. During the review period, the OWTP complied with all regulated conventional pollutants. However, while the OWTP met all the limits for conventional pollutants, there was one violation for benzidene cited in the fact sheet

(Attachment F) of the 2013 NPDES permit because the reported detection limit was greater than the discharge limit.

In general, the unit processes at the OWTP have operated at loading rates well within their original design values or typical operating ranges. In addition, performance has been adequate and there are a sufficient number of units in some of the unit processes to maintain a standby unit out of service for maintenance.

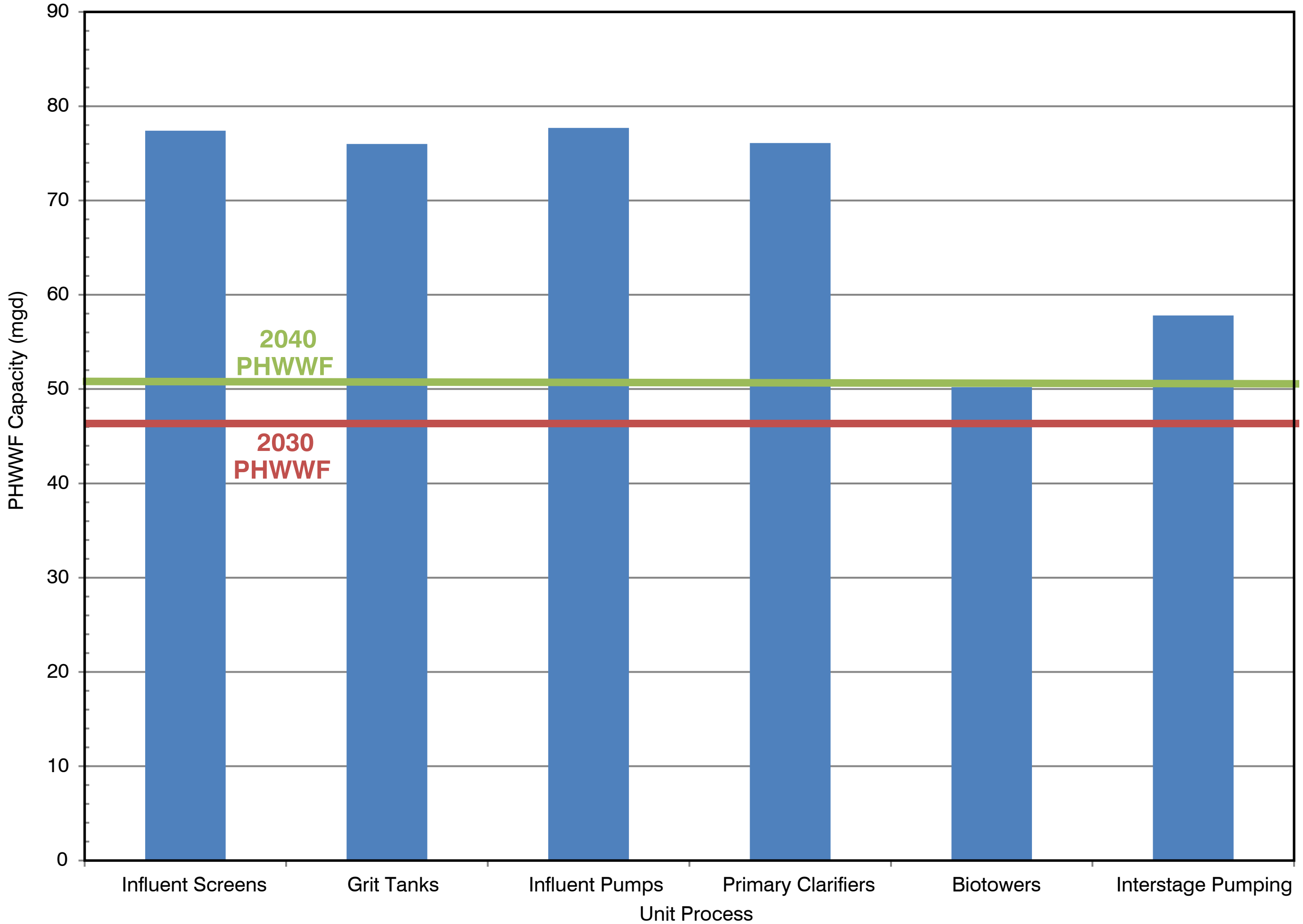
Removing the biotowers because they are a safety hazard will change the OWTP's treatment train configuration. The biotowers were originally designed to provide secondary treatment in the 1970s. In the 1980s, they were retained as part of the activated sludge system to reduce the organic load to the downstream aeration tanks. Currently, a significant portion of the biotower influent is untreated because of seal failures within the biotower itself. With the removal of the biotowers, the existing aeration tanks need to be modified to accommodate the incremental organic load. As most of the incremental organic load will be soluble BOD_5, it is recommended to add submerged baffle walls to create a biological selector zone in each aeration tank. The selector zone would be mechanically mixed, but unaerated, to maintain good sludge settling characteristics. Step feed capabilities, included as part of the original aeration basin design, can be used together with these recommended modifications to operate in a sludge reaeration (step feed) configuration to limit secondary clarifier sludge loading rates during periods of high wet weather flows and low sludge settleability. With these minor alterations, the aeration basins can treat higher loadings without expanding their footprint.

5.5.2.3 <u>Capacity</u>

As part of the Integrated Master Plan, the capacity of each unit process at the OWTP was assessed. This assessment considered a range of parameters, including flow, influent wastewater characteristics, treatment objectives, process configurations and limitations, and desired redundancy.

The peak hour wet weather flow (PHWWF) capacity was estimated for facilities that use peak flow to establish sizing. These facilities include the headworks, influent pumping, primary clarifiers, biotowers, and interstage pumping. Whereas pumping capacities are determined with the largest unit out of service, peak capacities for process units are determined with all units in service. Figure 5.7 summarizes the PHWWF capacity for each process.

Figure 5.8 illustrates the required EQ basin volume needed for the design storm based on flow rate treated at the OWTP. At the permitted capacity of 31.7 mgd, approximately 4.95 MG of storage will be needed in 2040, which is just under the available storage capacity. Historically, the EQ basins have never been filled to capacity. However, in 2040, the EQ basin capacity will approach its limit. Thus, determining whether additional capacity is needed will depend on how the EQ basins are operated as well as the needs of both the AWPF and the outfall.



OWTP PEAK HOUR WET WEATHER FLOW CAPACITY BAR GRAPH

FIGURE 5.7

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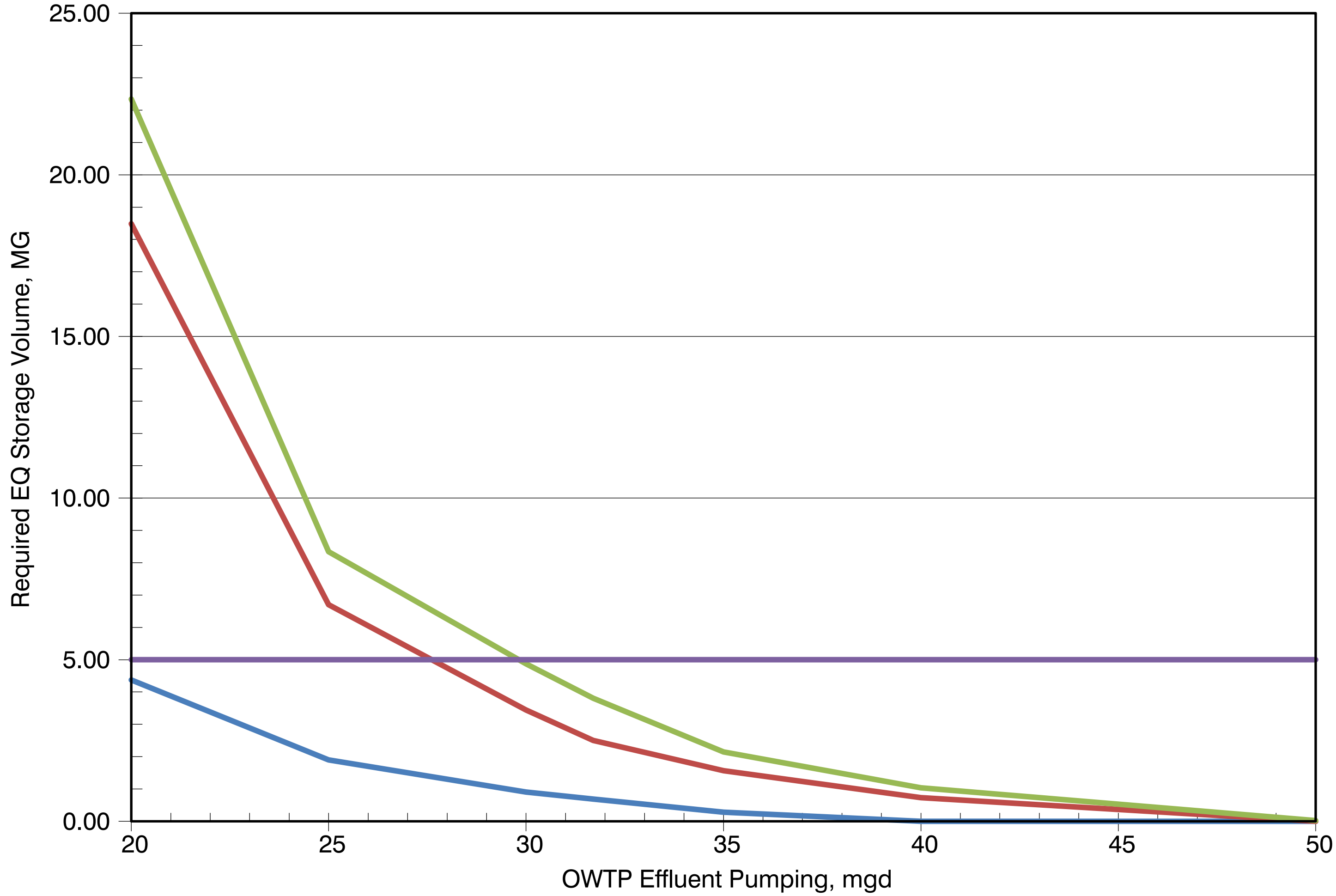

LEGEND

Current 2030 2040 Current EQ Basin Volume (5 MG)

REQUIRED EQUALIZATION (EQ) STORAGE FOR PEAK WET WEATHER FLOWS

FIGURE 5.8

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ox1115f20-9587(SumRepFIG5-8).ai

The ADWF capacity was estimated for facilities using average flows or influent BOD_5 and TSS loading to establish sizing. To estimate this capacity, a plant process model was developed and calibrated to historical operating data from 2013. Figure 5.9 summarizes the capacity for each process.

As shown in Figure 5.9, all of the liquid treatment processes have sufficient capacity for projected flows through 2040. However, although the existing secondary treatment process has sufficient treatment capacity to meet the City's NPDES BOD_5 limits through the planning horizon, it does not have sufficient capacity to nitrify with or without denitrification. The City's existing NPDES permit is not expected to require nitrification/denitrification in the near future, but increased recycled water production by the AWPF will increase constituent concentrations, particularly ammonia, above those in the secondary effluent.

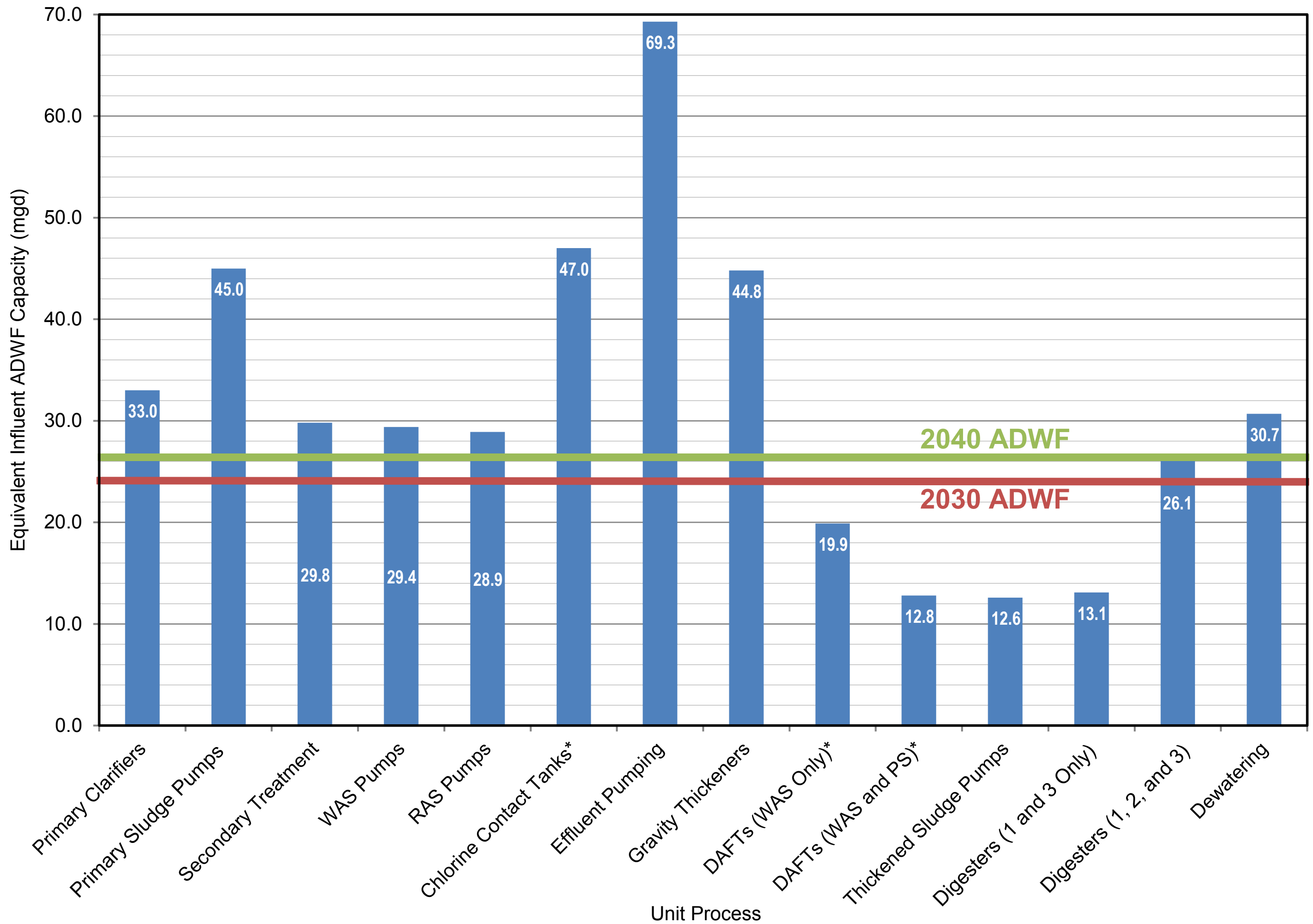
One way to address the insufficient capacity is to nitrify and denitrify in the secondary treatment process. To accommodate this, the OWTP may need to consider expanding the secondary treatment capacity or switching to an alternative process configuration such as membrane bioreactors (MBR), should the conversion be necessary with AWPF expansion.

According to Figure 5.9, the solids handing facilities do not have sufficient capacity. OWTP sludge production is expected to increase, in part because the biotowers will need to be removed and an anaerobic selector will need to be added in the ASTs. Because of the anticipated changes to sludge production, additional DAFT units, digesters, and dewatering units are needed.

5.6 ALTERNATIVES ANALYSIS

Based on the future facilities needs outlined, several alternative scenarios were considered for upgrading the OWTP facilities to meet future capacity and reliability needs. Of those scenarios, three were developed for the recommended CIP. Although each scenario has a different area of focus, it is important to recognize that these scenarios are not mutually exclusive and are instead compatible with one another, allowing for increasing levels of treatment to better address the overarching goals of this Master Plan. These three scenarios are further described below:

- **Scenario 1: Plant Reliability -** Scenario 1 includes all projects needed to meet existing and anticipated level of treatment requirements. Projects to optimize operations and maintenance as well as projects that adopt newer technologies in place of aging equipment are both included in this scenario. Because of the OWTP's age and state of repair, the majority of OWTP projects recommended in this Master Plan are related to repair and replacement required for continued plant operation. As a result, this baseline scenario includes a majority of the proposed projects.



**All unit processes assume the largest unit is out of service except for those starred.*

OWTP AVERAGE DRY WEATHER FLOW CAPACITY BAR GRAPH

FIGURE 5.9

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

- **Scenario 2: Energy Efficiency -** Scenario 2 focuses on projects that promote energy efficiency at the OWTP. This scenario includes all projects discussed under Scenario 1. However, Scenario 2 also includes projects to reduce energy use at the OWTP.
- **Scenario 3: Resource Recovery -** Scenario 3 focuses on projects that maximize water reuse and nutrient mining. This scenario includes all projects discussed under Scenario 1 and Scenario 2. However, Scenario 3's focus is to protect and enhance resource sustainability.

A comparative evaluation of these three scenarios was conducted, which included lifecycle cost estimates, energy comparisons, water quality considerations, and other non-economic factors. Table 5.9 summarizes the lifecycle costs of the three alternatives considered, and Table 5.10 contains the results of the overall alternatives comparison, including non-economic considerations.

For each scenario, relative energy use was also compared. Although all scenarios include energy savings from recommended small equipment replacement projects, some larger CIP projects differentiate one scenario from another. Table 5.11 compares the energy use of the larger CIP projects.

After comparing each scenario, the City selected Scenario 2: Energy Efficiency. Although Scenario 1 provides the lowest overall cost, the non-economic comparison showed a slight advantage to Scenarios 2 and 3 because they indicate moderate to high goal achievement. Since Scenario 2 costs less than Scenario 3, Scenario 2 was chosen.

5.6.1 New OWTP Location

As part of the Integrated Master Plan, relocating most of the OWTP facilities to another location near the AWPF was considered, for several reasons:

- the inefficiency of the current plant layout,
- the need to replace/rehabilitate much of the existing site, and
- the need to address the potential for rising sea levels from climate change and the current facility's low elevation (relative to mean sea level).

Although considerable work would be needed to assess the feasibility of moving the OWTP, this option had no fatal flaws and was therefore considered at the City's request.

Table 5.9 Comparison of Scenario Costs[1] Public Works Integrated Master Plan City of Oxnard			
Cost ($ M)	**Scenario 1 Plant Reliability**	**Scenario 2 Energy Efficiency**	**Scenario 3 Resource Recovery**
Headworks	$14.9	$14.9	$14.9
Primary Treatment	$20.9	$20.9	$20.9
Secondary Treatment	$100.3	$100.3	$100.3
Disinfection/Effluent Pumping/Outfall	$24.5	$24.5	$24.5
Sludge Thickening	$13.4	$13.4	$13.4
Digestion	$34.4	$34.4	$34.4
Dewatering and Sludge Post Processing	$27.6	$27.6	$88.1
Cogeneration/FOG	$13.8	$16.5	$16.5
Electrical	$18.3	$18.3	$18.3
Non-Process Buildings	$25.1	$25.1	$25.1
Other	$33.6	$34.8	$38.3
Total Construction Cost	**$327**	**$331**	**$395**
Total Project Cost[2]	**$405**	**$410**	**$489**
Annual Costs ($ M/yr)	$20.3	$20.5	$24.5
Annualized Project Cost[3]	$33	$33	$39
Incremental Annual O&M[4]	$5.0	$5.4	$6.5
Total Annual Cost	$37.5	$38.3	$45.8

Notes:
(1) Costs derived using the methodology outlined in Chapter 2.
(2) Project costs include project cost factor (as outlined in Chapter 2).
(3) Annualized at 5 percent over 20 years.
(4) O&M costs include only additional O&M costs from new capital improvement projects.

Table 5.10 Non-Economic Consideration of Water Supply Alternatives
Public Works Integrated Master Plan
City of Oxnard

	Scenario 1 - Plant Reliability	Scenario 2 - Energy Efficiency	Scenario 3 - Resource Recovery
Goal 1: Compliant, reliable, flexible system	Moderate	High	High
Goal 2: Economic sustainability	Moderate	High	Moderate
Goal 3: Mitigate/adapt to climate change	Moderate	Moderate	Moderate
Goal 4: Resource sustainability	Low	Moderate	High
Goal 5: Energy efficiency	Low	High	High
Benefits	• Has a lower overall cost • Focuses on rehabilitating the existing plant as the highest priority • Provides a seawall to protect against potential sea level rise from climate change	• Has a moderate cost • Has a more flexible system to address potential future changes in the cost of energy • Provides a seawall to protect against potential sea level rise from climate change	• Has more flexibility in sludge handling and resource recovery • Has a more flexible system to address potential future changes in the cost of energy • Provides a seawall to protect against potential sea level rise from climate change
Drawbacks	• Does not directly address goal 4 or goal 5 • Is less able to adapt to potential future increases in the cost of energy • Does little to take advantage of resources produced onsite	• Does not focus on recovering nutrients and sludge onsite	• Has a high cost

Table 5.11 Potential Energy Savings
Public Works Integrated Master Plan
City of Oxnard

Recommendation	Potential Relative Energy Savings		
	Scenario 1	**Scenario 2**	**Scenario 3**
Biotower Removal and Interstage Pump Reconfiguration	Included in All Scenarios	Included in All Scenarios	Included in All Scenarios
AST Blower Replacement	Included in All Scenarios	Included in All Scenarios	Included in All Scenarios
Cogen Replacement	Included in All Scenarios	Included in All Scenarios	Included in All Scenarios
FOG Receiving Station	NA	+	+
Solar or Alternative Energy Facility	NA	+	+
Incineration	NA	NA	+
Total Potential Energy Savings	+	++	+++

Note:
(1) Only projects that could produce energy savings are included in this analysis.

One reason to move many of the OWTP facilities is that much of the existing infrastructure is nearing the end of its useful life and should be repaired or replaced within the next 15 years. Because of this, it would be beneficial to place the new facilities in an optimal location.

Another reason is that the current plant layout is inefficient and requires pumping between processes, which increases operation and maintenance costs. A new location would allow for a new efficient layout that would eliminate the need for pumping, which would lower costs.

Finally, Federal Emergency Management Agency predicts that portions of the OWTP could experience significant flooding within the next fifty years because of its low elevation. Moving most of the OWTP facilities to a new location at a higher elevation would reduce this risk.

To assess the costs of relocating the OWTP, a preliminary master planning-level cost estimate was developed. Based on the comparative cost of building OWTP facilities in the two locations discussed, there is no significant difference between the two options, assuming similar levels of treatment. Because space is theoretically not limited at a new site, conventional secondary treatment could be utilized and was thus assumed. Alternatively, a higher level of treatment could be implemented at additional cost. Table 5.12 shows the results of the cost comparison.

Table 5.12 Cost Comparison Between Upgrading the Existing Plant and Constructing a New Plant in a New Location
Public Works Integrated Master Plan
City of Oxnard

Components	Existing Plant ($ M)	New Plant ($ M)
Total Construction Cost	$331	$258
Total Project Cost	**$410[(1)]**	**$411[(2)]**
Constructability and Protection of electrical and major equipment from Sea Level Rise	$50	--
Additional O&M for Old Plant (15% of Construction Cost)	$77	--
Immediate Needs	--	$30
Additional civil/site work/inter-process piping needed with new plant (15% of Construction Cost)	--	$39[(3)]
Demolish and Reclaim old site	--	$10
Land Acquisition	--	$22
CEQA/Permitting (2% of Construction Cost)	--	$5
Total[(4)]	**$540**	**$520**

Notes:

(1) Engineering, legal, administration, and construction management (ELAC) is 24% of construction cost, consistent with other recommended projects in the Integrated Master Plan.
(2) ELAC is 35% of construction cost for those projects originally estimated for the existing site, but now moved to new site with this scenario, due to new site uncertainties; ELAC is 75% of construction cost for those projects based on cost curves.
(3) Spread over all the projects implemented at the new site.
(4) Totals are rounded up to the nearest $5 M.

5.7 RECOMMENDED PROJECTS

This section summarizes the recommended projects for the wastewater system. These projects are based on the existing system condition assessment, capacity, and performance needs for meeting projected future demands and discharge requirements through the Integrated Master Plan's planning period (2015-2040).

The projects were each assigned a phase that loosely follows when they will be implemented. These phases include Phase 1 – Immediate Needs; Phase 2 – Near-Term Needs; and Phase 3 – Long-Term Needs. The phases were recommended based on the technical needs identified from the condition assessment.

Note that the actual timing of implementation may differ when compared with and balanced against the financial considerations for the Integrated Master Plan's total implementation. For more detail on the costs and timing of these projects, consult Chapter 9 and the Cost of Service (COS) Studies (Carollo, 2017).

5.7.1 Wastewater Collection System

Collection system improvements focused on capacity needs were based on collection system modeling, R&R needs, and conversations with the City. Using the capacity, three main capacity projects and fifteen R&R and performance-based projects were identified. Each project is summarized in Table 5.13.

5.7.2 Wastewater Treatment Plant

The City has two options for implementing improvements needed at the OWTP. The first is to invest in the existing plant, and the second is to relocate most facilities. Both options require investing in a different set of wastewater treatment-related improvement projects. If the City chooses to invest in the existing plant, the recommended improvement projects will focus on rehabilitating aging infrastructure. If the City chooses to relocate the plant, the recommended improvement projects will focus on investing in new facilities. The recommended projects for each option are outlined below.

Table 5.13 Recommended Collection System Projects
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID(1)	2015 Project ID	Project	Location	Driver	Start Year	Years to Implement
C-1	WW-P-6	Central Trunk Manhole Rehabilitation Phase 1	Rehabilitate 47 existing manholes	R&R	2018	1
C-17	WW-P-5	Headworks Meter Vault/Vortex Structure Coating Rehabilitation		R&R	2018	1
C-3	WW-P-8	Harbor Blvd Manhole Rehabilitation	Rehabilitate 12 existing manholes	R&R	2019	1
C-4		Pleasant Valley Manhole Rehabilitation	Rehabilitate 14 existing manholes	R&R	2019	1
C-5	WW-P-9	Redwood Tributary Manhole Rehabilitation	Rehabilitate 38 existing manholes	R&R	2019	1
C-10	WW-P-7	Existing asbestos concrete pipe (ACP) Replacement	Various locations throughout the collection system	R&R	2019	8
C-11		Annual Existing Pipe Repair	Various locations throughout the collection system based on sewer inspection	R&R	2019	8
C-12		Collection System Chemical Addition	Various locations throughout the collection system	Performance	2019	2
C-13	WW-P-10 WW-P-18	Devco Development Lift Station	Devco development, Village (Wagon Wheel) developments.	R&R, Performance	2019	1
C-14	WW-P-12	Existing Lift Station #4 (Mandalay & Wooley) Rehabilitation	Lift Station #4	R&R	2019	1
C-15	WW-P-11	Existing Lift Station #6 (Canal) Rehabilitation	Lift Station #6	R&R	2019	1
C-16		Existing Lift Station #20 (Beardsley) Rehabilitation	Lift Station #20	R&R	2019	1
C-2	WW-P-13	Central Trunk Manhole Rehabilitation Phase 2	Rehabilitate 27 existing manholes	R&R	2020	1

Table 5.13 Recommended Collection System Projects
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID(1)	2015 Project ID	Project	Location	Driver	Start Year	Years to Implement
C-7	WW-P-16	Rice Avenue Sewer Improvement	Rice Avenue from Latigo to Camino Del Sol	R&R	2020	2
C-8	WW-P-1	Existing Sewer Deficient Capacity Replacement	Ventura Road Trunk Sewer from Doris Avenue to Oxnard Airport	Capacity	2020	2
			Conduit 4943	Capacity	2020	2
			Conduit 4956	Capacity	2020	2
			Conduit 1429	Capacity	2020	2
			Conduit 1431	Capacity	2020	2
			Conduit 1432	Capacity	2020	2
			Conduit 1443	Capacity	2020	2
			Conduit 4276	Capacity	2020	2
			Conduit 1460	Capacity	2020	2
			Conduit 1461	Capacity	2020	2
			Conduit 1462	Capacity	2020	2
			Conduit 1463	Capacity	2020	2
C-9	WW-P-2	Existing Sewer Deficient Capacity Replacement	Sewers in the La Colonia Neighborhood, Third Street & Navarro Street	Capacity	2021	1
			Conduit 2888	Capacity	2021	1
			Conduit 2889	Capacity	2021	1

Table 5.13 Recommended Collection System Projects
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Location	Driver	Start Year	Years to Implement
C-6		Annual Existing Manhole Rehabilitation	Various locations throughout the City based on sewer inspection	R&R	2022	5
	WW-P-3	Project 3: S Victoria Ave and W Hemlock St	Sewers in the Channel Islands Neighborhood	Capacity	2027[2]	2
			Conduit 501	Capacity	2027[2]	2
			Conduit {74B96752-98B2-4F5D-AF2A-21B06EE4909C}	Capacity	2027[2]	2
			Conduit P-2471	Capacity	2027[2]	2
	WW-P-14	Phase 1 Central Trunk Replacement		R&R	2033[3]	2
	WW-P-15	Phase 2 Central Trunk Replacement		R&R	2036[3]	2

Notes:

(1) 2017 Project ID's were arbitrarily assigned for Project ease. C = Collection System Project. These are the projects from the approved Cost of Service Studies (Carollo, 2017).
(2) Project start year corresponds to refinements and updates provided by City after December 2015 publication date.
(3) Project start year was adjusted by City at August 7, 2017 meeting, based on recent CCT Inspection.

General Note: For the pipeline replacement projects, see the hydraulic models developed as part of this integrated master plan to identify the exact pipeline locations.

5.7.2.1 Existing Site

Recommended projects to keep the existing OWTP operational include R&R projects for almost every unit process. This includes replacing equipment and making structural repairs. Facilities that are unsafe or are at the end of their useful lives, including the primary clarifiers, DAFTs, digesters, interstage pump station, effluent pump station, and cogeneration facility, will also need to be replaced. Presented herein is one process treatment option for replacing the OWTP aged facilities. Several options should be considered and screened during the facilities predesign phase.

In addition to these recommendations, a major electrical system overhaul is recommended to provide more reliable backup power and to replace many plant MCCs, SCADA, and electrical buildings. A new dewatering facility, a new operations center and administration building, a non-hazardous liquid receiving station, a FOG receiving station, and a water quality early warning system are also recommended. Furthermore, in the future, the City should consider switching to MBR, adding an ultraviolet/advanced oxidation process (UV/AOP), constructing a solar facility, and adding a sea wall as needed. Figure 5.10 illustrates a layout of the recommended projects color-coded by phase.

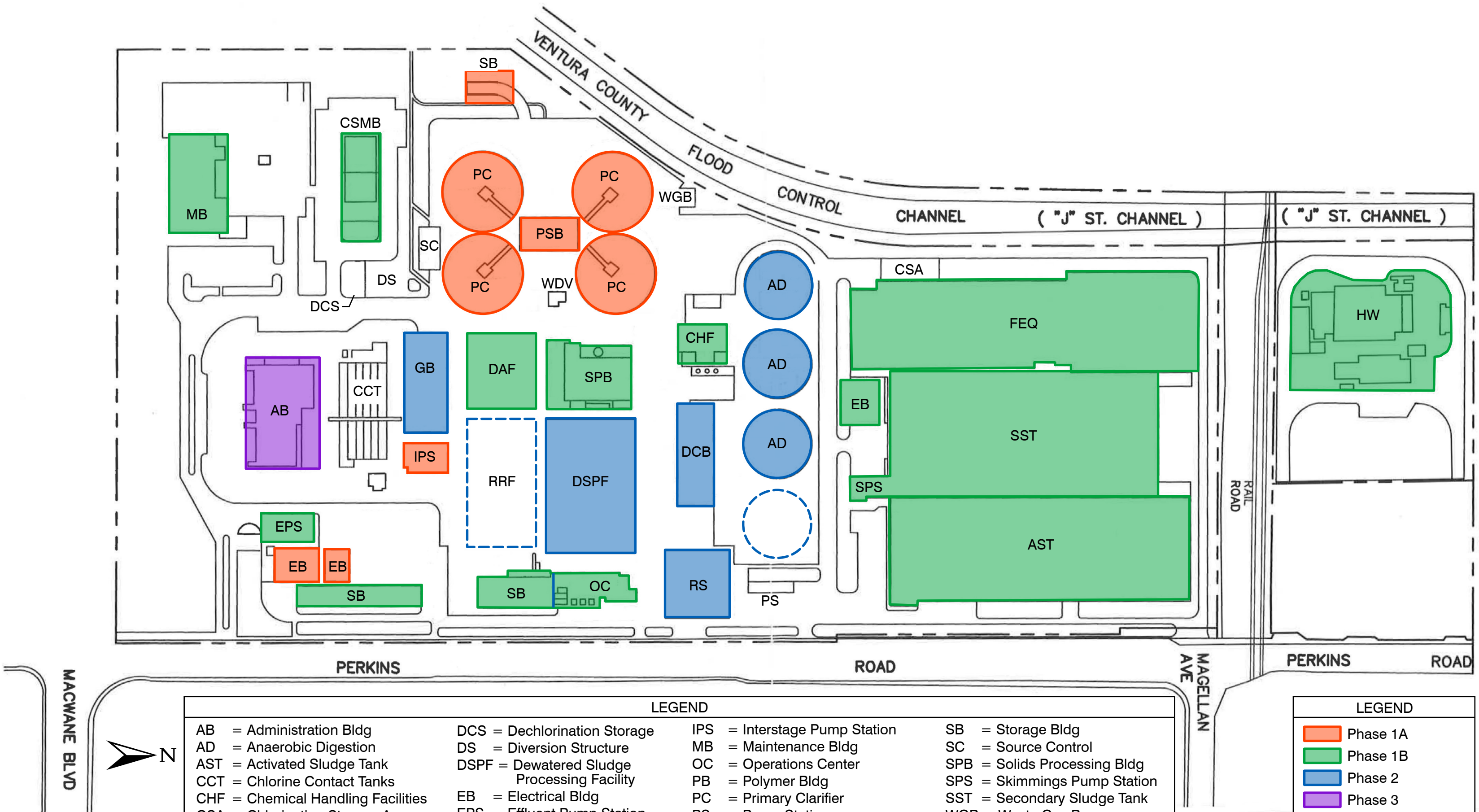
Table 5.14 lists the details of these projects. Figures 5.11A and 5.11B presents a schedule for the recommended projects.

5.7.2.2 New Location

To move many of the OWTP facilities to a new location, the City would need to consider the move's feasibility, taking into account the regulatory, timing, and financial needs. It is estimated that this upfront work could take approximately five to ten years to complete.

Given this timeframe and the condition of many of the existing OWTP facilities, a number of critical improvement projects at the OWTP will need to occur regardless of whether the OWTP will be relocated. Estimates are that these projects will cost around $20 million to $30 million. Table 5.15 shows a list of the projects requiring immediate attention.

For relocating the plant, a phased approach would be recommended. The City would start Phase 1 after implementing the projects with immediate needs. Phase 1 would involve moving all primary treatment, solids handling, and support facilities to the new site as well as rehabilitating facilities remaining in their existing location until Phase 2. These facilities include secondary treatment, disinfection, and effluent pumping facilities. The biotowers and gravity thickeners should also be demolished and the headworks rehabilitated. Assuming that the permitting and the environmental process takes five to ten years, Phase 1 could start around 2023, and Phase 2 could start around 2035.



LEGEND

AB = Administration Bldg
AD = Anaerobic Digestion
AST = Activated Sludge Tank
CCT = Chlorine Contact Tanks
CHF = Chemical Handling Facilities
CSA = Chlorination Storage Area
CSMB = Collection System Maintenance Bldg
DAF = Disolved Air Flotation
DCB = Digester Control Bldg
DCS = Dechlorination Storage
DS = Diversion Structure
DSPF = Dewatered Sludge Processing Facility
EB = Electrical Bldg
EPS = Effluent Pump Station
FEQ = Flow Equalization Basins
GB = Generator Bldg
GT = Gravity Thickening
HW = Headworks
IPS = Interstage Pump Station
MB = Maintenance Bldg
OC = Operations Center
PB = Polymer Bldg
PC = Primary Clarifier
PS = Pump Station
PSB = Primary Sedimentation Bldg
PST = Propane Storage Tank
RRF = Resource Recovery Facility
RS = Receiving Station (FOG)
SB = Storage Bldg
SC = Source Control
SPB = Solids Processing Bldg
SPS = Skimmings Pump Station
SST = Secondary Sludge Tank
WGB = Waste Gas Burner
WDV = Wastewater Distribution Valve Box

Note: Some facilities require work in multiple phases. The phase indicated here is when the majority of the work is planned.

LEGEND

- Phase 1A
- Phase 1B
- Phase 2
- Phase 3

Plant-wide Improvements:

- Upgrade of electrical/SCADA
- Add solar or alt. energy
- Potential Additonal of Seawall

RECOMMENDED WASTEWATER TREATMENT PLANT PROJECTS BY PHASE

FIGURE 5.10

CITY OF OXNARD

SUMMARY REPORT

PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

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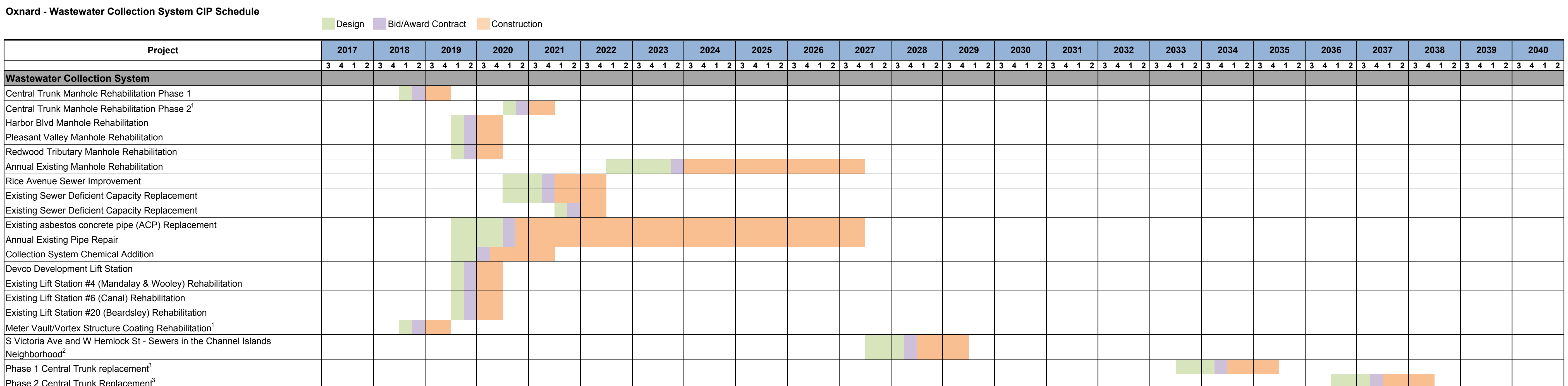

Notes:

(1) Projects correspond to refinements and updates provided by City after Dec. 2015 publication date.

(2) Projects start year correspond to refinements and updates provided by City after Dec. 2015 publication date.

(3) Projects start year was adjusted by City at 8/7/17 meeting, based on recent CCT inspection.

RECOMMENDED COLLECTION SYSTEM PROJECTS SCHEDULE

FIGURE 5.11A

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo Engineers...Working Wonders With Water®

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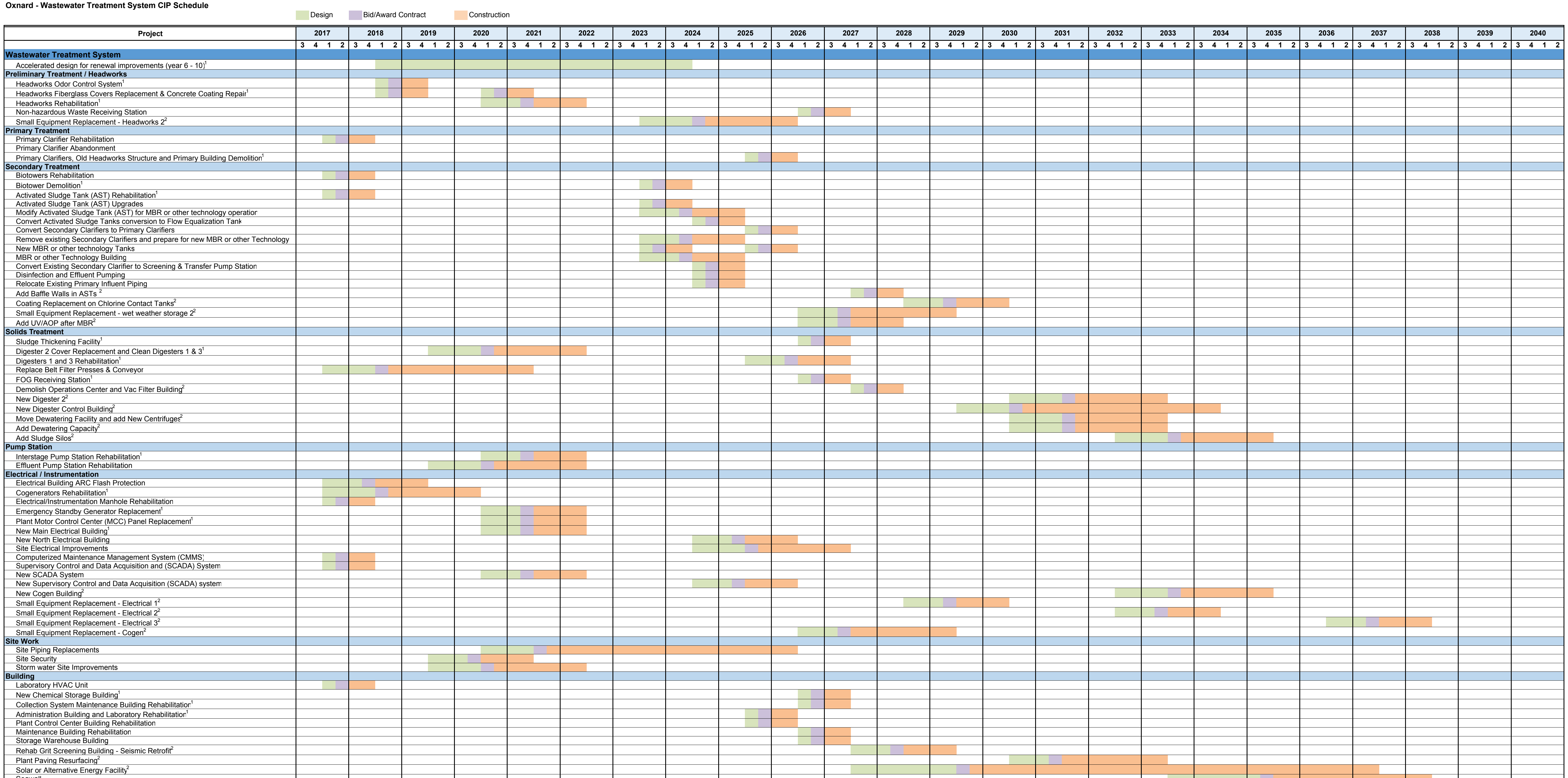
Oxnard - Wastewater Treatment System CIP Schedule



Notes:
(1) Projects correspond to refinements and updates provided by City after Dec. 2015 publication date.
(2) Projects start year correspond to refinements and updates provided by City after Dec. 2015 publication date

RECOMMENDED WASTEWATER SYSTEM PROJECTS SCHEDULE

FIGURE 5.11B

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA
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Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Driver	Start Year	Years to Implement
--		Accelerated design for renewal improvements (year 6 - 10)[2]		2018	6
Preliminary Treatment/Headworks					
T-1	WW-P-83	Headworks Odor Control System[3]	Small Equipment Replacement	2018	1
T-2	WW-P-67	Headworks Fiberglass Covers Replacement & Concrete Coating Repair[3]	R&R	2018	2
T-3	WW-P-66	Headworks Rehabilitation[3]	R&R	2020	2
	WW-P-84	Small Equipment Replacement - Headworks[2]	Small Equipment Replacement	2023[4]	3
T-4	WW-P-41	Non-hazardous Waste Receiving Station	Performance	2026	1
Primary Treatment					
T-5		Primary Clarifier Rehabilitation	R&R	2017	1
T-6		Primary Clarifier Abandonment	R&R	N/A	0
T-7	WW-P-23	Primary Clarifiers, Old Headworks Structure and Primary Building Demolition[3]	R&R	2025	1
Secondary Treatment					
T-8		Biotowers Rehabilitation	R&R	2017	1
T-10	WW-P-69	Activated Sludge Tank (AST) Rehabilitation[3]	R&R	2017	1
T-9	WW-P-20	Biotower Demolition[3]	R&R	2023	1

Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Driver	Start Year	Years to Implement
T-11	WW-P-72 WW-P-74 WW-P-76	Activated Sludge Tank (AST) Upgrades	R&R, Performance	2023	1
T-12	WW-P-72	Modify Activated Sludge Tank (AST) for MBR or other technology operation	Performance	2023	2
T-15		Remove existing Secondary Clarifiers and prepare for new Membrane Bioreactor (MBR) or other Technology	R&R	2023	2
T-16	WW-P-75 WW-P-97	New MBR or other technology Tanks	R&R, Resource Sustainability	2023	2
T-17	WW-P-97	MBR or other Technology Building	Resource Sustainability	2023	2
T-13	WW-P-68 WW-P-72	Convert Activated Sludge Tanks conversion to Flow Equalization Tank	R&R, Performance	2024	1
T-18		Convert Existing Secondary Clarifier to Screening & Transfer Pump Station	R&R	2024	1
T-19	WW-P-96 WW-P-80 WW-P-81	Disinfection and Effluent Pumping	Small Equipment Replacement, R&R	2024	1
T-20		Relocate Existing Primary Influent Piping	R&R	2024	1
T-14	WW-P-70 WW-P-73	Convert Secondary Clarifiers to Primary Clarifiers	R&R	2025	1
	WW-P-79	Small Equipment Replacement - wet weather storage[2]	Small Equipment Replacement	2026[4]	3

Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Driver	Start Year	Years to Implement
	WW-P-98	Add UV/AOP after MBR	Resource Sustainability	2026[4]	2
	WW-P-21	Add Baffle Walls in ASTs	R&R	2027[4]	1
	WW-P-95	Coating Replacement on Chlorine Contact Tanks	R&R	2028[4]	2
Solids Treatment					
T-24	WW-P-40	Replace Belt Filter Presses & Conveyor	R&R	2017	4
T-22	WW-P-43	Digester 2 Cover Replacement and Clean Digesters 1 & 3[3]	R&R	2019	3
T-23	WW-P-87 WW-P-89	Digesters 1 and 3 Rehabilitation[3]	R&R	2025	2
T-21	WW-P-44 WW-P-45 WW-P-51	Sludge Thickening Facility[3]	R&R, Performance	2026	1
T-25	WW-P-94	FOG Receiving Station[3]	Resource Sustainability	2026	1
	WW-P-46	Demolish Operations Center and Vac Filter Bld	R&R	2027[4]	1
	WW-P-90	New Digester Control Building	R&R	2029[4]	5
	WW-P-88	New Digester 2	R&R	2030[4]	3
	WW-P-47	Move Dewatering Facility and add New Centrifuges	Performance	2030[4]	3
	WW-P-48	Add Dewatering Capacity	Performance	2030[4]	3
	WW-P-50	Add Sludge Silos	Performance	2032[4]	3

Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Driver	Start Year	Years to Implement
Pump Station					
T-27		Effluent Pump Station Rehabilitation	R&R	2019	3
T-26	WW-P-22	Interstage Pump Station Rehabilitation[3]	R&R	2020	2
Electrical / Instrumentation					
T-28		Electrical Building ARC Flash Protection	Performance	2017	2
T-29	WW-P-93	Cogenerators Rehabilitation[3]	R&R	2017	3
T-30	WW-P-32	Electrical/Instrumentation Manhole Rehabilitation	R&R	2017	1
T-36	WW-P-39	Computerized Maintenance Management System (CMMS)	R&R	2017	1
T-37	WW-P-35	Supervisory Control and Data Acquisition and (SCADA) System	R&R	2017	1
T-31	WW-P-33	Emergency Standby Generator Replacement[3]	R&R	2020	2
T-32	WW-P-34	Plant Motor Control Center (MCC) Panel Replacement[3]	R&R	2020	2
T-33	WW-P-30 WW-P-31	New Main Electrical Building[3]	R&R	2020	2
T-38	WW-P-35	New SCADA System	R&R	2020	2
T-34	WW-P-59	New North Electrical Building	R&R	2024	2
T-35		Site Electrical Improvements	R&R	2024	3
T-39	WW-P-35	New Supervisory Control and Data Acquisition (SCADA) system	R&R	2024	2
	WW-P-92	Small Equipment Replacement - Cogen	Small Equipment Replacement	2026[4]	3

Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[1]	2015 Project ID	Project	Driver	Start Year	Years to Implement
	WW-P-36	Small Equipment Replacement - Electrical 1	Small Equipment Replacement	2028[4]	2
	WW-P-91	New Cogen Building	R&R	2032[4]	3
	WW-P-37	Small Equipment Replacement - Electrical 2	Small Equipment Replacement	2032[4]	2
	WW-P-38	Small Equipment Replacement - Electrical 3	Small Equipment Replacement	2036[4]	2
Site Work					
T-41		Site Security	R&R	2019	2
T-42		Storm water Site Improvements	R&R	2019	3
T-40	WW-P-42	Site Piping Replacements	R&R	2020	5
Building					
T-43		Laboratory HVAC Unit		2017	1
T-46	WW-P-49	Administration Building and Laboratory Rehabilitation[3]	R&R	2025	1
T-47		Plant Control Center Building Rehabilitation	R&R	2025	1
T-44	WW-P-57	New Chemical Storage Building[3]	R&R	2026	1
T-45	WW-P-56	Collection System Maintenance Building Rehabilitation[3]	R&R	2026	1
T-48	WW-P-58	Maintenance Building Rehabilitation	R&R	2026	1
T-49	WW-P-27 WW-P-28	Storage Warehouse Building	R&R	2026	1
	WW-P-60	Rehab Grit Screening Building - Seismic Retrofit	R&R	2027[4]	2
	WW-P-99	Solar or Alternative Energy Facility	Resource Sustainability	2027[4]	10

Table 5.14 Recommended Projects for Within Fence-Line Wastewater System
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[(1)]	2015 Project ID	Project	Driver	Start Year	Years to Implement
	WW-P-65	Plant Paving Resurfacing	R&R	2030[(4)]	3
	WW-P-100	Seawall	Resource Sustainability	2033	5

Notes:
(1) 2017 Project ID's were arbitrarily assigned for Project ease. T = Treatment System Project. These are the projects from the approved Cost of Service Studies (Carollo, 2017).
(2) Cost added by City consultant after December 2015 publication during facilities pre-design/planning.
(3) Projects correspond to refinements and updates provided by City after December 2015 publication date.
(4) Project start year corresponds to refinements and updates provided by City after December 2015 publication date.

Table 5.15 Immediate CIP Projects Approved in Years 1 – 2[(1)]
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[(2)]	2015 Project ID	Unit Operation	Project	Driver	Start Year	Years to Implement
C-1	WW-P-6	Collection System	Central Trunk Manhole Rehabilitation Phase 1	R&R	2018	1
C-17	WW-P-5	Collection System	Meter Vault/Vortex Structure Coating Rehabilitation[(3)]	R&R	2018	1
T-1	WW-P-83	Preliminary Treatment/Headworks	Headworks Odor Control System[(3)]	Small Equipment Replacement	2018	1
T-2	WW-P-67	Preliminary Treatment/Headworks	Headworks Fiberglass Covers Replacement & Concrete Coating Repair[(3)]	R&R	2018	2

Table 5.15 Immediate CIP Projects Approved in Years 1 – 2[1]
Public Works Integrated Master Plan
City of Oxnard

2017 Project ID[2]	2015 Project ID	Unit Operation	Project	Driver	Start Year	Years to Implement
T-5		Primary Treatment	Primary Clarifier Rehabilitation	R&R	2017	1
T-6		Primary Treatment	Primary Clarifier Abandonment	R&R	N/A	0
T-8		Secondary Treatment	Biotowers Rehabilitation	R&R	2017	1
T-10	WW-P-69	Secondary Treatment	Activated Sludge Tank (AST) Rehabilitation[3]	R&R	2017	1
T-24	WW-P-40	Solids Treatment	Replace Belt Filter Presses & Conveyor	R&R	2017	4
T-28		Electrical/Instrumentation	Electrical Building ARC Flash Protection	Performance	2017	2
T-29	WW-P-93	Electrical/Instrumentation	Cogenerators Rehabilitation[3]	R&R	2017	3
T-30	WW-P-32	Electrical/Instrumentation	Electrical/Instrumentation Manhole Rehabilitation	R&R	2017	1
T-36	WW-P-39	Electrical/Instrumentation	Computerized Maintenance Management System (CMMS)	R&R	2017	1
T-37	WW-P-35	Electrical/Instrumentation	Supervisory Control and Data Acquisition and (SCADA) System	R&R	2017	1
T-43		Building	Laboratory HVAC Unit		2017	1

Notes:
(1) Approved by City Council based on Wastewater Cost of Service Study (Carollo.2017).
(2) 2017 Project ID's were arbitrarily assigned for Project ease. C = Collection System Project: T = Treatment System Project. These are the projects from the approved Cost of Service Studies (Carollo, 2017).
(3) Project corresponds to refinements and updates provided by City after December 2015 publication date.

At this time, the new plant location is assumed to be less space-limited than the existing site. Thus, to reduce costs, conventional activated sludge treatment and chlorine disinfection could be installed for secondary treatment instead of MBR and ultraviolet light (UV) facilities. All other new facilities recommended for the existing plant option, such as a FOG receiving station and Chemically Enhanced Primary Treatment (CEPT), are still recommended with this option.

Table 5.16 lists the details of these projects.

**Table 5.16 List of Projects Needed with Relocated Wastewater Treatment Plant Option
Public Works Integrated Master Plan
City of Oxnard**

Project Name	Driver	Start Year	Years to Implement
Phase 1 Projects			
New Primary Clarifiers	R&R	2023	5
CEPT	Performance	2023	2
New Digesters	R&R	2023	5
New DAFTs	Performance	2023	3
New Chemical Handling Facilities	R&R	2023	2
New Primary Sedimentation Building	R&R	2023	5
New Chemical Handling Building	R&R	2023	3
New Non Hazardous Liquid Receiving Station	Performance	2023	2
New FOG Receiving Station	Resource Sustainability	2023	2
New Digester Control Building	R&R	2023	5
New Polymer Building	R&R	2023	3
New Solids Processing Facility	Performance	2023	3
New Sludge Silos	Performance	2023	3
New Cogeneration Facility	R&R	2023	3
New Operations Center and Lab Building	R&R	2023	4
New Collection System Maintenance Building	R&R	2023	2
New Storage/Warehouse	R&R	2023	2
New Effluent Electrical Building	R&R	2023	3
New North Area Electrical Building	R&R	2023	3
New Main Electrical Building	R&R	2023	3
Solar Facilities	Resource Sustainability	2023	10

Table 5.16 List of Projects Needed with Relocated Wastewater Treatment Plant Option
Public Works Integrated Master Plan
City of Oxnard

Project Name	Driver	Start Year	Years to Implement
SCADA System Upgrade	R&R	2023	5
AST Blower and Diffuser Replacement	R&R	2017	3
Secondary Small Equipment Replacement	Small Equipment Replacement	2017	3
Secondary Sedimentation Tanks Replace Skimmers, Collectors, Drives and RAS Pumps	R&R	2017	3
EQ Basin Small Equipment Replacement	Small Equipment Replacement	2019	3
AST Concrete Rehabilitation	R&R	2017	11
SST Concrete Rehabilitation	R&R	2017	11
EQ Concrete Rehabilitation	R&R	2017	3
Chlorine Contact Tanks Rehabilitation	Small Equipment Replacement	2023	3
Chlorine Contact Tanks Coating	R&R	2025	2
Effluent Pump Station Rehabilitation	R&R	2017	3
CMMS	R&R	2017	3
Phase 2 Projects			
New Activated Sludge Tanks	R&R	2035	5
New Secondary Sedimentation Tanks	R&R	2035	5
New EQ Basin	R&R	2035	5
New Chlorine Contact Tanks	R&R	2035	5
New Effluent Pump Station	R&R	2035	5
Headworks Rehabilitation	R&R	2035	5

RECYCLED WATER SYSTEM MASTER PLAN

6.1 INTRODUCTION

The City is committed to providing recycled water with its Groundwater Recovery Enhancement and Treatment (GREAT) Program, which gives the City access to a reliable and sustainable supply of high quality water, thus decreasing the City's reliance on imported water. Key components of the GREAT program include the following:

<u>Recycled Water (RW) System</u>
Treating and distributing wastewater to the most stringent levels [via the Advanced Water Purification Facility (AWPF)].

<u>Water Supply</u>
Treating groundwater for total dissolved solids (TDS) and nitrate reduction through a desalter.

<u>Indirect Potable Reuse (IPR) / Direct Potable Reuse (DPR) Through Groundwater Injection</u>
Adding wells that allow recycled water to be injected into and extracted from the local groundwater aquifer.

<u>Elements Related to the AWPF and Desalter:</u>
Collecting and treating concentrate (brine) from both AWPF and desalters.

A major part of the GREAT program is the use of recycled water, which the City has studied and made plans for over many years. This chapter outlines the portion of the system already used to provide tertiary-treated recycled water for irrigation. The remainder of the planned systems is summarized as well.

The analysis and evaluations contained in this Summary Report are based on data and information available at the time of the original date of publication of the Project Memos (PMs), December 2015. After development of the December 2015 Final Draft PMs, the City continued to move forward on two concurrent aspects: 1) advancing the facilities planning for the water, wastewater, recycled water, and stormwater facilities; and 2) developing Updated Cost of Service (COS) Studies (Carollo, 2017) for the wastewater/collection system and the water/distribution system. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The complete updated CIP based on the near-term and long-term projects is contained in Appendix B.

6.1.1 GREAT Program Foundation & Evolution

When the GREAT program was formally established in 2002, its objectives were to:

- Increase the reliability of the water supply during drought.

- Reduce water supply costs.
- Secure the water supply's ability to meet a growing water demand.
- Enhance stewardship of the local water supply through recycling and reusing a substantial portion of the region’s wastewater.
- Increase environmental benefits associated with developing and rehabilitating local saltwater wetlands.

Although the program has evolved over the years, it has generally maintained its support of water recycling and reuse, groundwater injection, storage and recovery, and groundwater desalination. Thus, the goal of this Integrated Master Plan is to build on the foundation already in place.

To build on this foundation, it's helpful to analyze past reports to understand the program's evolution. Two reports are of particular importance: *The 2002 Advanced Planning Study* and *The 2012 GREAT Program Update*. These reports are summarized below.

- <u>2002 – Advanced Planning Study (K/J, 2002)</u> – This study recommended a series of projects aimed at providing a sustainable water supply for the City, including construction of tertiary and advanced recycled water treatment facilities, aquifer storage and recovery (both for IPR/DPR and seawater intrusion barrier), regional and local desalting to treat additional groundwater, and concentrate collection.
- <u>2012 – GREAT Program Update (City, 2012)</u> – This report provided additional details for many of the projects established in 2002, updated the progress to date, and estimated costs for the program elements.

Over the years, utilities have shifted from using groundwater recharge for seawater intrusion barriers to using it for ASR. This is largely due to the high cost of the wells. In addition, because of recent pumping cutbacks from the Fox Canyon Groundwater Management Agency (FCGMA), access to more local groundwater through pump-back credits is not guaranteed and is therefore of little direct benefit to the City.

At the same time, the City began to look at IPR/DPR with renewed interest because of its benefit to the City and the impending regulatory acceptance for it. As a result, the Integrated Master Plan focuses on recycled water for irrigation use as well as for IPR/DPR.

6.2 DESCRIPTION OF EXISTING FACILITIES

Wastewater from the Oxnard Wastewater Treatment Plant (OWTP) provides secondary treated wastewater to the AWPF for recycled water treatment. In general, the collected flow is residential. About 75 percent of all wastewater is domestic, with the remaining 25 percent from industrial users. Average secondary effluent flows (2009- 2013) from the wastewater facility are 20.5 mgd at average dry weather flow (ADWF) conditions and 22.9 mgd for an average day maximum month day flow (ADMMF). The OWTP is permitted at a capacity of 31.7 mgd ADWF.

6.2.1 AWPF

The recycled water system currently consists of an AWPF and distribution pumping and conveyance. The AWPF consists of microfiltration (MF), reverse osmosis (RO), and advanced oxidation processes (AOP), including ultraviolet light and hydrogen peroxide and the necessary ancillary equipment for a fully functional facility. Figure 6.1 illustrates a schematic of the AWPF process in its current configuration.

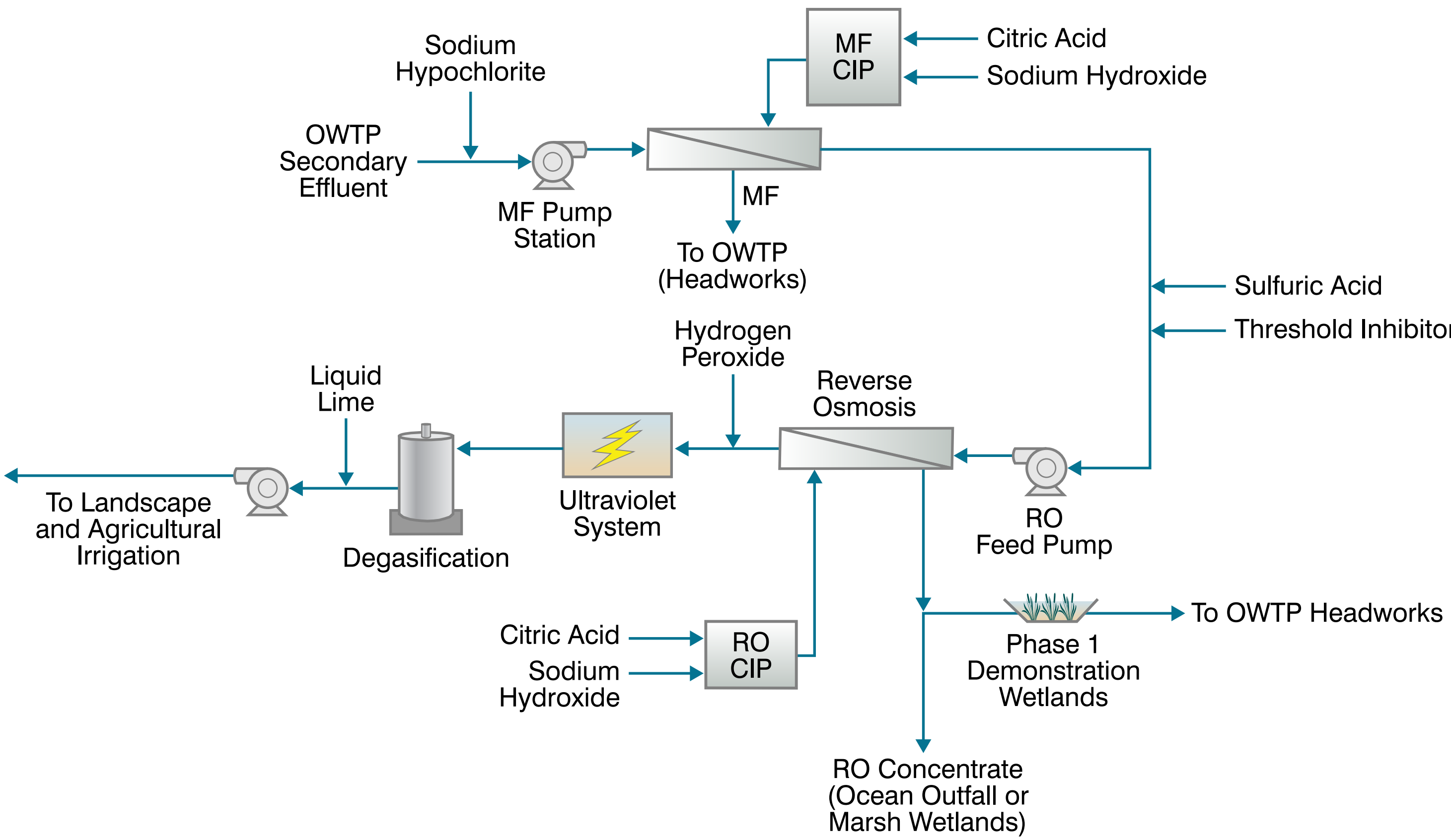
6.2.2 Recycled Water Distribution System

The main components of the existing recycled water distribution system include the following:

- Recycled Water Backbone System (RWBS)
  The constructed Phase 1 recycled water conveyance system is a combination of PVC and high-density polyethylene (HDPE) pipelines, with diameters ranging from 16 inches to 36 inches in the main transmission line and 6 to 8 inches in the distribution pipe to the River Park Development.
- Finished Recycled Water Pump Station
  The AWPF recycled water pump station contains two variable frequency drive (VFD) pumps, each with a design capacity of 4,000 gallons per minute (gpm) with an output pressure of about 150 psi.
- Hueneme Road – Phase 1

  A 42-inch diameter pipeline was recently installed from the existing 36-inch diameter connection to the AWPF at the intersection of Hueneme Road and Perkins Road. The 42-inch diameter section of this pipeline continues to the intersection of Hueneme Road and Edison Drive. From there, a 36-inch diameter recycled water pipeline continues down Hueneme Road until the intersection at Olds Road where it terminates. A Phase 2 Hueneme Road pipeline, beginning where Phase 1 left off, is in the planning stages.
- Temporary Salinity Management Pipeline (SMP) Line

  Because the Hueneme Road - Phase 2 pipeline will not be constructed and operational for several years, the City will temporarily deliver recycled water to the agricultural customers in the Oxnard Plain through the SMP. This is for two reasons: 1) the SMP's route runs parallel to the City's planned Hueneme Road pipeline, and 2) the SMP is underutilized at this time. For this to occur, the Los Angeles Regional Water Quality Control Board (LARWQCB) amended the City's Waste Discharge Requirements (WDRs), Order No. R4-2011-0079-A01 and Monitoring and Reporting Program, R4-2008-A01, in July of 2015 to allow the SMP to temporarily deliver AWPF effluent to farmers. Construction and planning for the temporary SMP connection are complete, with water delivery currently taking place.



AWPF SCHEMATIC

FIGURE 6.1

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- Ocean View Pump Station
  This Pump Station contains two VFD pumps, each with a design capacity of 2,210 gpm with an output pressure of about 50-psi. These pumps will be used to supply the SMP Line.

Currently, no storage tanks are in the distribution system, meaning peak demands must be met directly from the AWPF. A map of the existing recycled water distribution system is shown in Figure 6.2 along with major users.

6.2.3 ASR Demonstration Well (Under Construction)

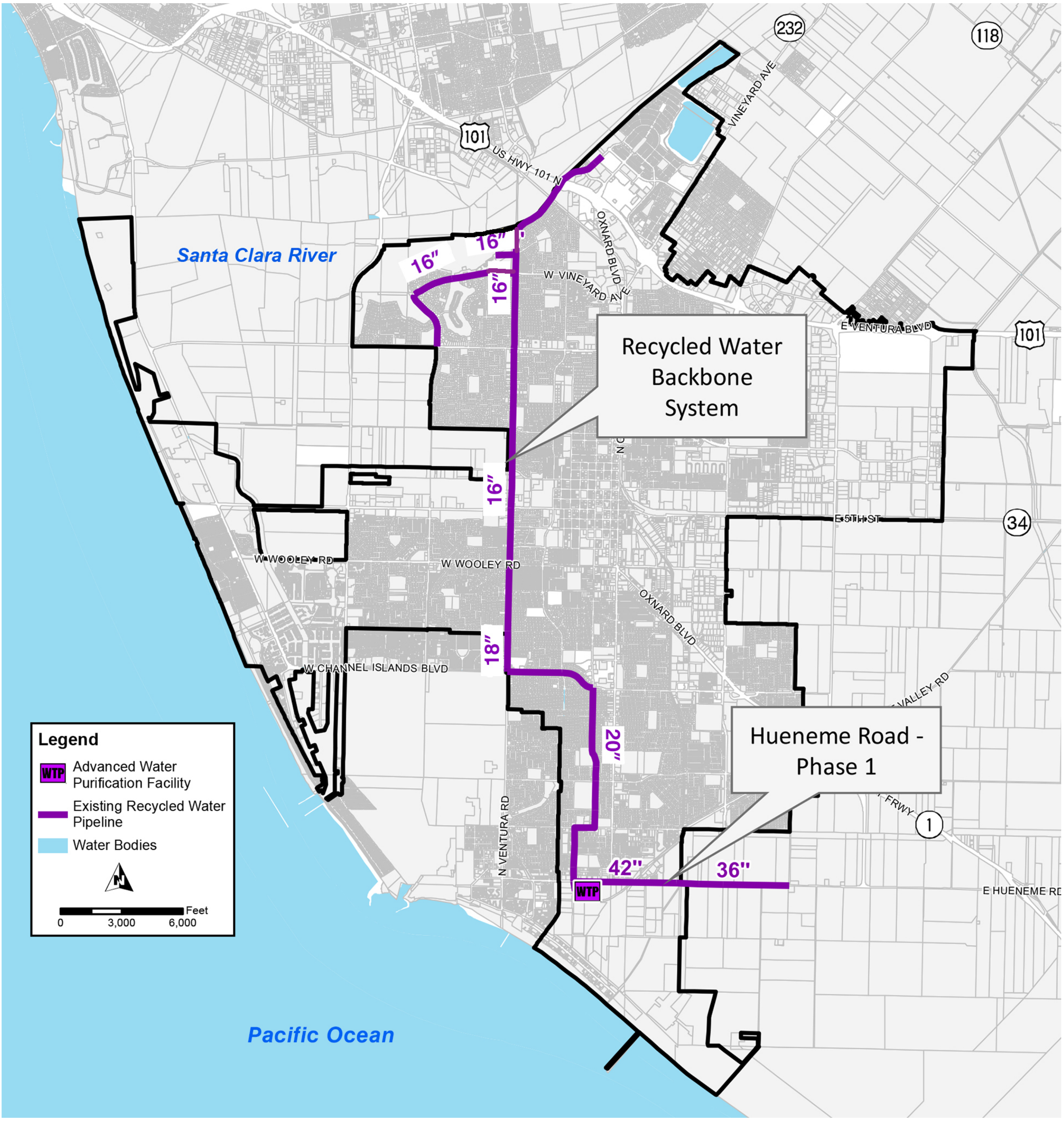
The City is currently constructing an ASR Demonstration well, which is expected to be completed in 2018. The construction of this well is grant funded and will serve as a test well for the City to understand how ASR/IPR will work moving forward.

Initially, the ASR Demonstration well will be used as an ASR well for the recycled water system. Recycled water from the AWPF will be injected into the ground and then extracted and put back into the City's RW system for irrigation use. Ultimately, once all of the required start-up testing and monitoring are complete, the well will switch to IPR operation, and the extracted water will be conveyed to the BS No. 1/6 nearby for disinfection and injection into the potable system.

Elements of this ASR Demonstration Well installation include the following:

- Constructing one IPR/ASR well at the Campus Park site.
- Constructing three monitoring wells (two shallow and one deep aquifer) for the one IPR/ASR well.
- Adding 2,000 linear feet (lf) of RW piping connecting the IPR/ASR well to the Recycled Water Backbone piping located in Ventura Road.
- Adding 4,000 lf of piping to convey IPR water from Campus Park to BS No. 1/6 for blending into the potable system, which will eventually be converted to a potable line when the IPR/ASR operation is fully approved.

A hydrogeological study was conducted (Hopkins, 2016) to assess the proposed location and capacity for this well at Campus Park. This study recommended an injection and extraction capacity of approximately 2,000 gpm and recommended operating the well on a 3-month rotation of recharge, retention, and recovery. Figure 6.3 illustrates the location of the proposed ASR well at Campus Park.



EXISTING RECYCLED WATER FACILITIES

FIGURE 6.2

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DEMONSTRATION ASR WELL PROPOSED LOCATION

FIGURE 6-3

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6.3 CURRENT RECYCLED WATER DEMANDS

The City projects that in the initial phases of the GREAT Program, approximately 7,000 AFY (acre-feet per year), or 6.25 mgd, of AWPF water will be produced. The City has an approved Full Advanced Treatment Recycled Water Management and Use Agreement, A-7651. Signatories to the Agreement include: United Water Conservation District (UWCD), Pleasant Valley County Water District (PVCWD), Houweling Nurseries Oxnard, Inc., Southland Sod, and Reiter Brothers, Inc. According to this agreement, the following significant demands are accounted for:

- The City has the right to the first 1,500 to 1,800 AFY, which will be delivered to existing customers in lieu of potable water and to the River Ridge Golf Club. In addition, the City will deliver RW water to River Park Development and New Indy Container Board for a total of approximately 2,800 AFY, or 2.5 mgd in Phase 1A. This RW will be used to offset potable water demand along the completed RWBS that would otherwise be served through the City's potable water system.
- For Phase 1B, an additional 2,000 AFY, or 1.8 mgd, of AWPF water is dedicated to agricultural users along the (future) Hueneme Road Pipeline.
- According to Agreement A-7651, using the remaining 7,000 AFY of RW available from the AWPF is to be determined by the City, UWCD, and PVCWD.

Table 6.1 summarizes the existing and future recycled water demands as they are currently known. The City is also planning to implement 40 to 50 small urban recycled water irrigation projects along the RWBS to offset further potable use. This implementation would be phased over several years. Figure 6.4 illustrates the locations of the existing and planned customers, as they are known that this time.

6.4 PROJECTED RECYCLED WATER DEMANDS

Under the GREAT Program, construction of the AWPF is planned in four phases that result in AWPF capacities of 7,000, 14,000, 21,000 and 28,000 AFY. As previously noted, the first phase of 7,000 AFY, which has been completed, is largely accounted for through urban and agricultural irrigation uses.

As subsequent phases of the AWPF come online, AWPF effluent will go first to recycled water users currently under contract, then to IPR/DPR, and then to additional agricultural users, which would benefit the City in the form of groundwater pump-back credits. Therefore, Phase 2 and 3 RW demands shown in Table 6.1 are shown as additional ASR capacity.

Table 6.1 Existing and Future Recycled Water Demands
Public Works Integrated Master Plan
City of Oxnard

Phase	Location	Recycled Water Use	Average Day Demand (gpm)	Delivery Pressure (psi)	Daily Demand Timing
1A	New Indy Paper Company	Irrigation	456	60	Constant
1A	River Park Development	Irrigation	651	60	10:00 a.m. - 6:00 p.m.
1A	River Ridge Golf Course	Irrigation	1,057	20(2)	Constant
1B	Houweling Nursery	Irrigation	1,000	60	6:00 p.m. - 6:00 a.m.
1B	Southland Sod	Irrigation	1,000	60	6:00 a.m. - 6:00 p.m.
1B	Reiter	Irrigation	1,400	60	6:00 a.m. - 6:00 p.m.
2	Blending Station (BS) 1/6	IPR	8,000(1)	20(3)	Constant
2	Campus Park	IPR	6,000(1)	20(3)	Constant
3	BS 3	IPR	8,000(1)	20(3)	Constant

Notes:
(1) There is no required amount for IPR; the required flow listed is equal to the maximum proposed capacity based on the recommended projects needed for water supply, per PM 2.5; IPR is to be maximized using excess flow after customer contracted flows are delivered.
(2) The customer pumps RW a lake onsite after delivery; therefore, lower delivery pressures are acceptable.
(3) RW is delivered for ASR; lower delivery pressures are acceptable.

6.5 RECYCLED WATER SUPPLY (SECONDARY EFFLUENT)

The AWPF's water supply source is secondary effluent from the OWTP. Therefore, it is necessary to assess whether enough OWTP effluent exists to feed into the AWPF as capacity increases. In general, the AWPF's capacity cannot be expanded beyond what the OWTP can supply.

Table 6.2 summarizes the amount of OWTP effluent needed for the planned capacity expansions at the AWPF. Based on the future wastewater flow projections outlined in Chapter 5, by 2040, ADWF to the OWTP is expected to reach only 27.4 mgd. Given this, it is unlikely that there would be sufficient supply to the AWPF for the Phase 4 expansion (see Table 6.2).

It is equally important to consider the diurnal variation of the average daily flow. While the AWPF is optimally operated at a constant (or relatively constant) flow, secondary effluent flow from the OWTP varies throughout the day. Therefore, storing secondary effluent may be required to allow the AWPF to draw a consistent supply. Table 6.2 summarizes the results of that analysis.

The OWTP currently has 5 MG of secondary effluent storage, which it uses for peak shaving of its effluent pumping. Based on the required storage noted in Table 6.2, it is believed that the existing secondary effluent storage will be sufficient to serve as both AWPF storage and peak shaving for effluent pumping.

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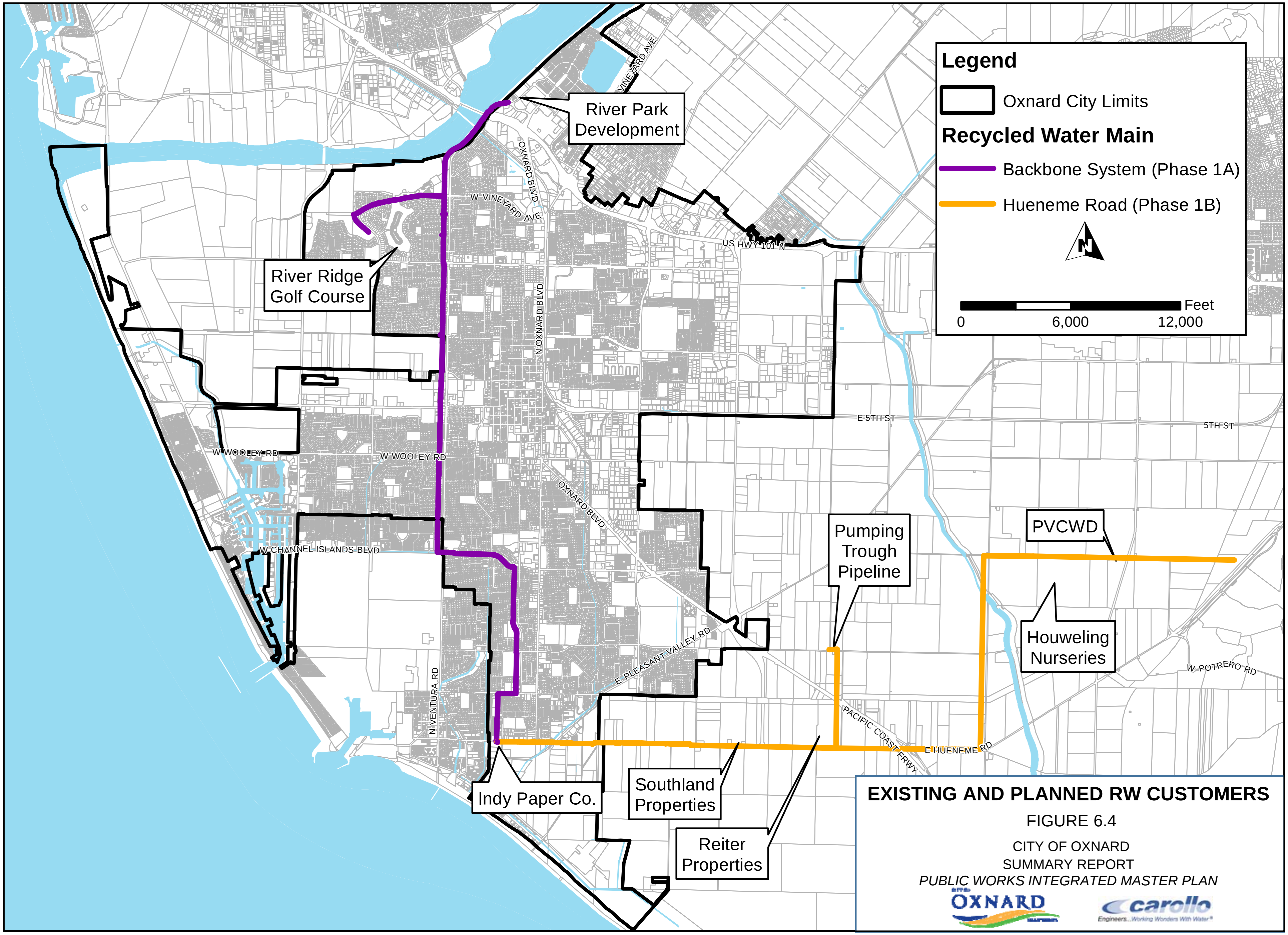

EXISTING AND PLANNED RW CUSTOMERS

FIGURE 6.4

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Table 6.2	Secondary Effluent Storage Needs Public Works Integrated Master Plan City of Oxnard		
AWPF Phase	**AWPF Capacity, mgd**	**Secondary Effluent Needed (Avg Day), mgd(1)**	**Secondary Effluent Storage Required, MG**
1	6.25	8.2	--
2	12.5	16.3	0.7
3	18.75	24.5	2.3
4	25	32.7	(2)

Notes:
(1) Estimated based on a MF recovery of 90% and RO recovery of 85%.
(2) Based upon wastewater flow projections for the PWIMP (by 2040, the average day flow is expected at 27.4 mgd), it is unlikely there will be enough secondary effluent flow to support an expansion of the AWPF up to 25 mgd.

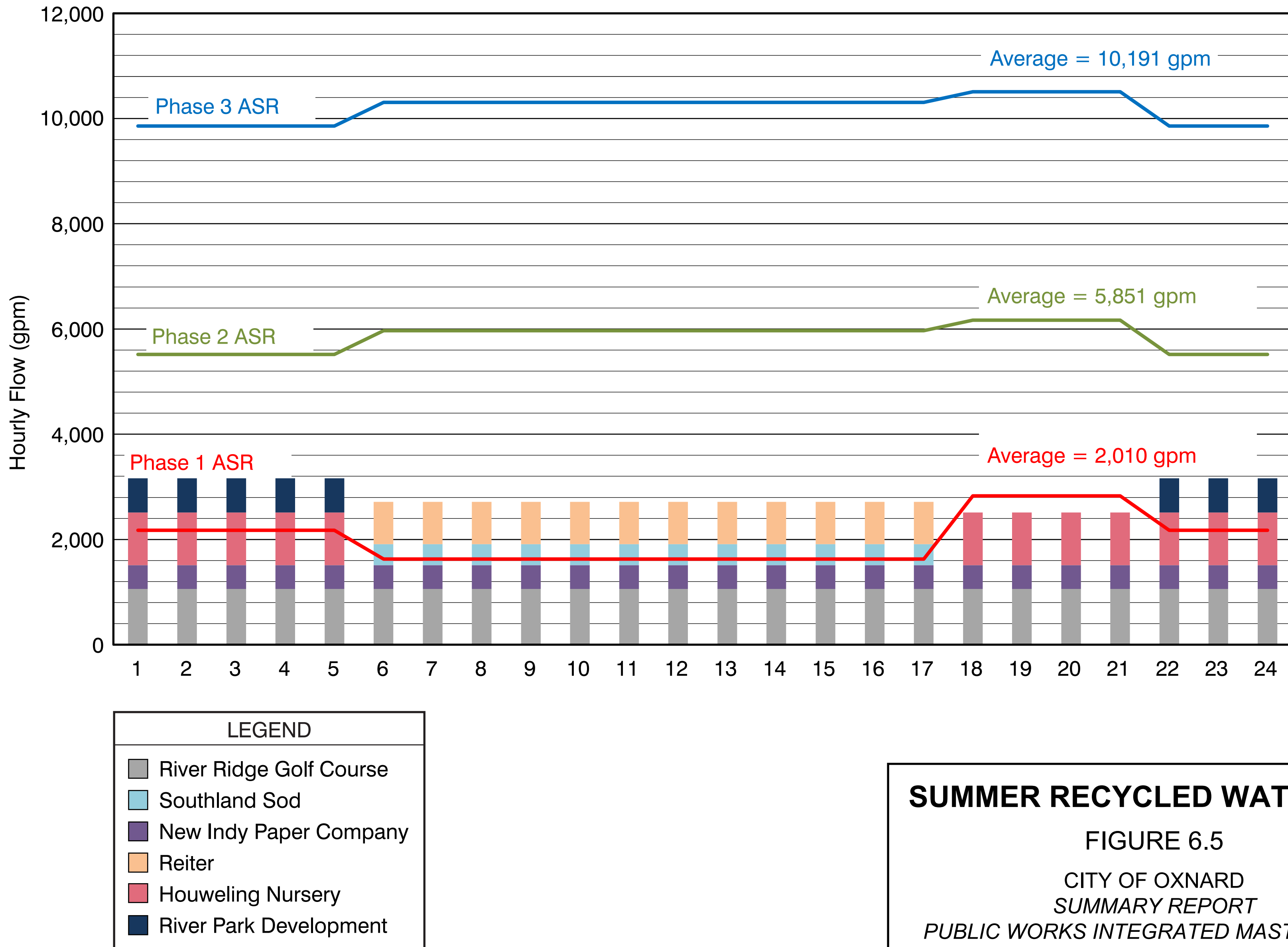
6.6 MASTER PLAN/DESIGN CRITERIA

Peaking conditions of particular importance to a hydraulic analysis of the distribution system include the following:

- Average Day Demand (ADD): the total annual production divided by number of days in the year.
- Maximum Day Demand (MDD): the greatest water demand during a 24-hour period of the year.
- Peak Hour Demand (PHD): the highest water demand during any 1-hour period of the year.

Recycled water demands are similar to water system demands in that water use above the ADD varies daily and seasonally. Irrigation demands vary from drinking water demands in that the peak use often occurs overnight so less irrigated water is lost from evapotranspiration.

For most of the customers shown in Table 6.1, water demand will be seasonal, peaking in the summer months. The only exceptions are the New Indy Paper Company, which has a year-round demand of 456 gpm, and the IPR operation, which is also expected to operate year-round. The RW customer demands are greater in the summer months but less in the winter, leaving more available water for IPR/ASR in the winter than in the summer. For Phases 1, 2 and 3, Figure 6.5 and Figure 6.6 display the projected diurnal demand curves for both the summer and winter demand conditions, respectively.



SUMMER RECYCLED WATER USE

FIGURE 6.5

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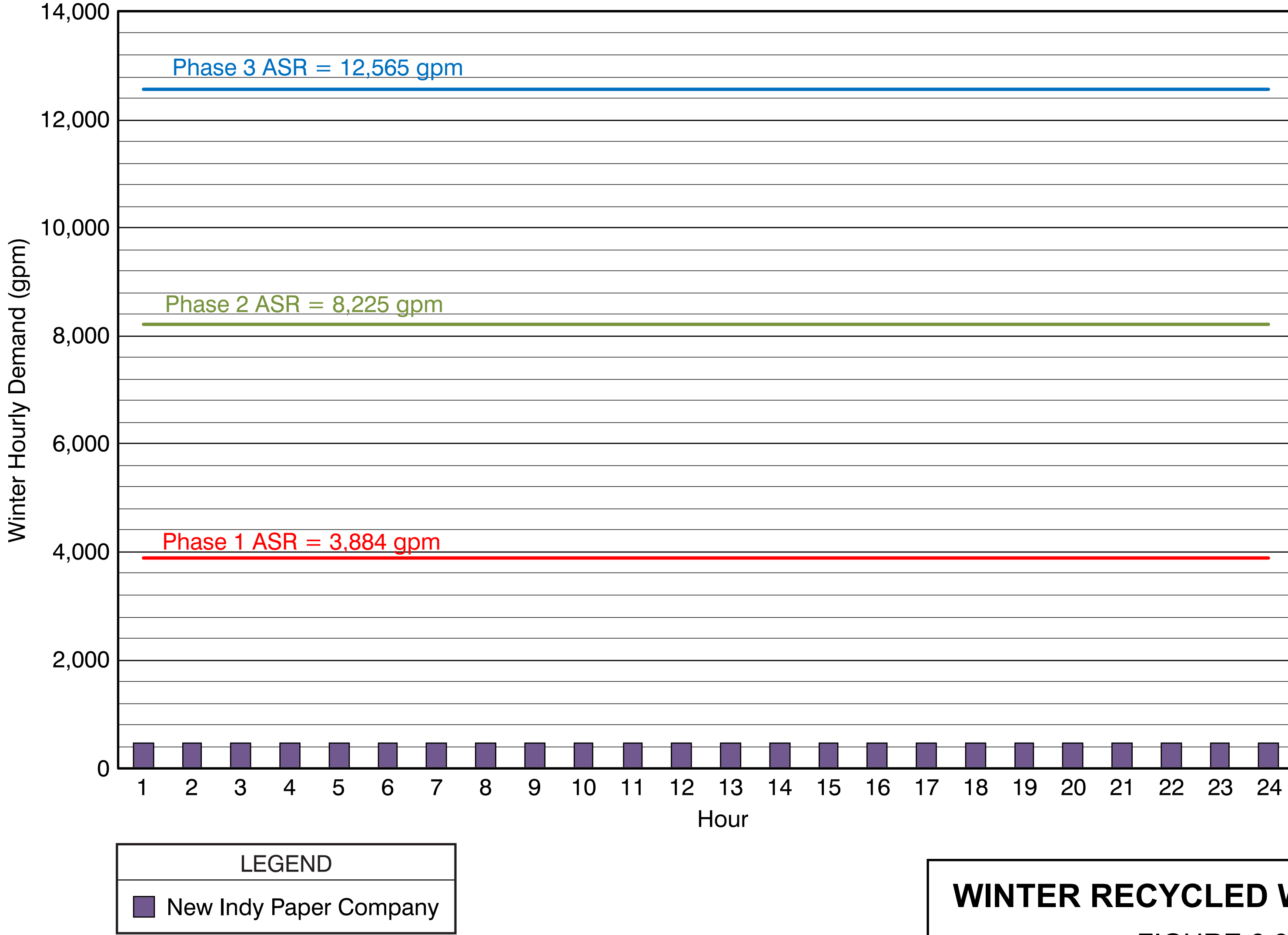

WINTER RECYCLED WATER USE

FIGURE 6.6

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6.6.1 Storage and Pumping

Currently, there are no operational storage tanks in the recycled water distribution system, although some small recycled water users maintain their own onsite storage, which reduces peak demand on the AWPF and the distribution system. Because of the lack of operational storage within the system, finished water storage was considered for the following RW operations:

- To provide operational storage for the IPR so the ASR well pumps can operate at a consistent rate while meeting peak demands out of storage.
- To provide a decoupling and monitoring step for future DPR, with each tank operating in one of three modes: filling, holding (for testing), or emptying.

If storage is installed, booster pumping capacity would be needed to pump from the distribution system's storage to meet PHD. For reliability, maintaining a firm pump station capacity equal to the PHD is desirable. Firm capacity is equal to the total capacity of the pump station minus the largest pump's capacity (in case one pump is out of service for maintenance).

In addition to the MDDs and PHDs discussed above, planning and design criteria were established for sizing the distribution system piping, storage, and pumping, and ASR operations. Table 6.3 summarizes all of the key planning criteria outlined for the RW system.

Table 6.3 RW System Master Planning/Design Criteria Public Works Integrated Master Plan City of Oxnard

Description	Value	Units
Design Capacity Criteria		
Treatment Facilities/Well Pumping	Max Day	--
Distribution System Piping/Pumping	Peak Hour	--
Aquifer Storage and Recovery Site		
Number of Wells per Site	6	--
Number of Monitoring Wells	3 per ASR Well	--
Well Capacity, each	2,000	gpm
Operational Storage(1)	1.0	MG
Booster Pumping(2)	500	HP
DPR Storage		
Number of Tanks	3	
Detention Time	12	hours
Tank Volume (per Tank)	3.1	MG

Table 6.3 RW System Master Planning/Design Criteria Public Works Integrated Master Plan City of Oxnard		
Description	**Value**	**Units**
Distribution System - Minimum Pressure		
Recycled Water Customers	60	psi
ASR Sites (Campus Park, BS No. 1/6, and BS No. 3)	20	psi
Customer Storage Tanks/Ponds	20	psi
Distribution System - Maximum Pressure		
Recycled Water Customers without Pressure Regulators	90	psi
Recycled Water Customers with Pressure Regulators	150	psi
Distribution Pipeline	150	psi
Distribution System - Pipeline Criteria		
Maximum Velocity at PHD	7	fps
Design Velocity for New Pipelines	5	fps
Hazen-Williams C-factor	130	n/a
Minimum Size for New Pipelines	8	inches
Head Loss for 1,000 feet of Pipeline	10	ft

Notes:

(1) Because the ASR wells are sized to supply a relatively constant supply (equal to the maximum day demand), operational storage provides additional capacity meet the peak demands (i.e., the difference between peak hour and maximum day demands) for the potable supply.
(2) Booster pumping designed to supply peak hour demands into the system for the potable supply.

6.7 FUTURE FACILITY NEEDS

The recycled water system's capacity and performance were compared with the above criteria to locate system shortfalls for both current and future conditions. In general, the existing system, which was newly constructed, will meet the demands of the current recycled water demands, as noted in Table 6.1, Phase 1A, and Phase 1B.

Since the AWPF was just completed and put online in 2015, the City is planning only minor adjustments for the facility, such as using sodium hypochlorite instead of hydrogen peroxide and modifying the A/V and security equipment. From a performance standpoint, the AWPF is operating as intended.

The WaterGems model was used to evaluate the existing water distribution system's performance for meeting current demands. The model was updated to reflect existing conditions of Oxnard’s recycled water system, including updated information on the AWPF, pump station, and pipelines. In general, under the established design criteria, the existing system was found to be adequately sized to meet the existing recycled water customer needs.

The treatment and distribution systems are currently sized to provide recycled water for the first phase of the GREAT program (up to 7,000 AFY) but not through the full 4 phases of the GREAT Program (up to 28,000 AFY). The WaterGems analysis was performed to reconfirm and refine the timing of those phases and the specific facilities needed to move recycled water throughout the City to provide a sustainable water supply for its customers. Since these two systems will work closely together moving forward, the analysis was done in close coordination with the potable water supply (summarized in Chapter 4).

6.8 APPROACH TO EXPANDING THE RECYCLED WATER SYSTEM AS A SUPPLEMENTAL WATER SUPPLY

Based on the alternatives analysis presented in Chapter 4, recycled water will be considered as a supplemental water supply to the City's current groundwater and imported water. Recycled water treated through the AWPF will be available for non-potable irrigation use (offsetting potable needs) for both agricultural and urban uses and for IPR and/or DPR. This approach adds flexibility and resiliency while maintaining significant local control of the water supply.

To implement this approach, the AWPF will need to be expanded (in the phases currently planned for with in the GREAT program) and facilities will need to be added to distribute recycled water to IPR/ASR wellfields. These facilities are in addition to already planned pipelines that will convey recycled water to agricultural uses for irrigation.

A review of the ultimate AWPF expansion capacity was presented in Chapter 4. Based solely on projected wastewater flows entering the OWTP, Phase 4 (up to 28,000 AFY) of the AWPF can be realized is uncertain. In addition, as discussed in Chapter 3, there are regulatory implications for the amount of secondary effluent that can be routed to the AWPF and not discharged to the outfall. At this time, based upon the data available (as noted in Chapter 3), it appears that Phase 3 (up to 21,000 AFY) may be the limit for AWPF expansion but further investigation of this implication will take place during subsequent phases of work.

To convey recycled water to various identified uses throughout the City, a closed recycled water loop will be built on the already constructed RWBS pipeline, which is intended to convey flows for the first phase (up to 6.25 mgd) along one north-south artery in the City (Ventura Road). The recycled water loop will provide access to a variety of geospatial points slated for IPR, including BS No. 1/6 and No. 3. Adding the loop will also eliminate any capacity issue the RWBS might have due to its size and construction.

In terms of the recycled water's end use/destination, irrigation uses make up the biggest component of Phase 1 capacity. For Phases 2 and 3, the largest use of the recycled water will be IPR/DPR. ASR wells will be used to inject recycled water into the underlying groundwater basin and to withdrawal the water for IPR use. Suitable sites for IPR operation are the Campus Park site, along with BS Nos. 1/6 and 3 because of the existing infrastructure already present.

Table 6.4 provides a high-level summary of the approach to expanding the recycled water system within the City.

**Table 6.4 Recycled Water System Expansion Approach
Public Works Integrated Master Plan
City of Oxnard**

Phase	AWPF Flow (mgd)	Recycled Water Distribution System[1]	ASR Well Capacity
Phase 1A	6.25	• Recycled Water Backbone System Pipeline (completed)	1 Demonstration Well
Phase 1B	6.25	• Hueneme Road Phase 2 Pipeline • Pipeline from RWBS to Campus Park • Pipeline from Campus Park to BS No. 1/6	1 Demonstration Well
Phase 2	12.50	• Complete Pipeline for RW Loop	4 duty + 4 standby
Phase 3	18.75	• N/A	6 duty + 3 standby

Note:
(1) Additions are to the existing recycled water described in Section 6.8; each additional phase includes the addition of previous phases.

6.9 RECOMMENDED PROJECTS

This section summarizes the recommended projects for the recycled water system based on the existing system capacity and performance needs for meeting projected future demands and water quality objectives. These projects cover needs through the Integrated Master Plan's planning period (2015-2040). The recommended projects are summarized in Table 6.5 and organized by project type. Figure 4.7 in Chapter 4 illustrates all of the water and recycled water projects recommended for water supply purposes. For further details, refer to that figure.

The projects were split into phases that loosely follow the projects' timing: Phase 1 – Immediate Needs (First 2 years), Phase 2 – Near-Term Needs (Years 2 to 10), and Phase 3 – Long-Term Needs (Beyond 10 years).

The phases presented here are what are recommended based upon the technical needs identified within this assessment. However, the actual timing of implementation may defer when compared and balanced against the financial considerations of total implementation of the Integrated Master Plan. Costs and timing for these projects is summarized under Chapter 9 as well as in the Cost of Service (COS) Rate Study (Carollo, 2015a).

Table 6.5 Recommended RW Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
Recycled Water Treatment					
AWPF	Phase 1 Improvements (Disinfection conversion, security, A/V upgrade)(1)	1	--		
AWPF	UV/AOP Brine Treatment	1	1	Unit	--
AWPF	Phase 2 Expansion to 12.5 mgd (including backup power)	2	1	ea	6.25 mgd
AWPF	Phase 3 Expansion to 18.75 mgd	3	1	ea	6.25 mgd
Recycled Water Distribution					
Various	Recycled Water Distribution System Retrofits(2)	1	--	--	--
Campus Park to RWBS	Connect Initial ASR Well to RWBS Line in Ventura Road - 20: pipe(1)	1	2,000	Lf	--
Campus Park to BS No. 1/6	Construct Dedicated IPR Pipeline along 2nd Street - 24" pipe(1)	1	4,000	lf	--
AWPF	Ag RW Storage	2	1	--	--
Hueneme Road - Phase 2 (to Ag Users)	24" pipe – Along Wood Road from Hueneme Road to Laguna Road and east on Laguna terminating before Lewis Road	2	20,700	Lf	--
Hueneme - Phase 2 (to Ag Users)	36" pipe – Along Hueneme Road from Olds Road to Wood Road	2	16,000	Lf	--
Recycled Water Loop (to ASR Sites)	24" pipe – Along 2nd St to N Rose Ave	2	9,000	Lf	--
Recycled Water Loop (to ASR Sites)	30" pipe – Along N Rose Ave from 2nd St to Hueneme Road	2	19,700	Lf	--
AWPF	DPR Storage Tanks	3	3	MG	3.1
Recycled Water Loop (to ASR Sites)	24" pipe – North along N Rose Avenue from 2nd St. to Camino Del Sol; then east on Camino Del Sol to N Rice Ave; North along N Rice Ave to Wankel Way	3	10,600	LF	--

Table 6.5 Recommended RW Projects to Meet Water Supply Needs through 2040
Public Works Integrated Master Plan
City of Oxnard

Facility/Location	Description	Phase	Quantity	Unit	Capacity
IPR/DPR					
Campus Park	Demonstration ASR Well[3]	1	1	Ea	2,000 gpm
BS No. 1/6 & BS No. 3	Land Acquisition and Improvements	1	10	Ac.	--
Campus Park	RW Pond for Off-Spec Water	1	1	MG	1.9
Campus Park	2 duty + 2 standby ASR wells[3]	2	4	Ea	2,000 gpm
BS No. 1/6	2 duty + 2 standby ASR Wells[3]	2	4	Ea.	2,000 gpm
BS No. 1/6	Chemical Feed Expansion	2	1	Ea.	--
BS No. 1/6	Operational Storage	2	1	MG	1
BS No. 1/6	Booster Pumping	2	1	HP	500
Well 18 @ Golf Course	Rehab to Groundwater Recharge Well	2	1	Ea.	3,000 gpm
BS No. 1/6	2 duty + 1 standby ASR Wells[3]	3	3	Ea.	2,000 gpm
BS No. 3	4 duty + 2 standby ASR Wells[3]	3	6	Ea.	2,000 gpm
BS No. 3	Chemical Feed Expansion	3	1	Ea.	--
BS No. 3	Operational Storage	3	1	MG	1
BS No. 3	Booster Pumping	3	1	HP	500

Notes:
*General Notes: Project costs, schedules, and phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) – December 2015.
(1) As documented in the City's GREAT program CIP, February 18, 2015.
(2) Assumed 10 retrofits per year for 4 years.
(3) Each ASR well installed will have 3 associated monitoring wells installed.

6.9.1 Treatment

Phase 1 of the AWPF is already completed, with only minor improvements slated as immediate needs. A UV/AOP treatment system for the RO concentrate from the AWPF is recommended to address water quality-related issues.

Phase 2 will involve expanding the existing Phase 1 AWPF facility by an additional 6.25 mgd. The existing 6.25 mgd facility was constructed to allow for modular expansion of the MF, RO, and UV/AOP treatment trains without adding ancillary equipment (i.e., cleaning and support systems). Phase 3 will require adding more treatment and ancillary equipment to reach the 18.75 mgd capacity.

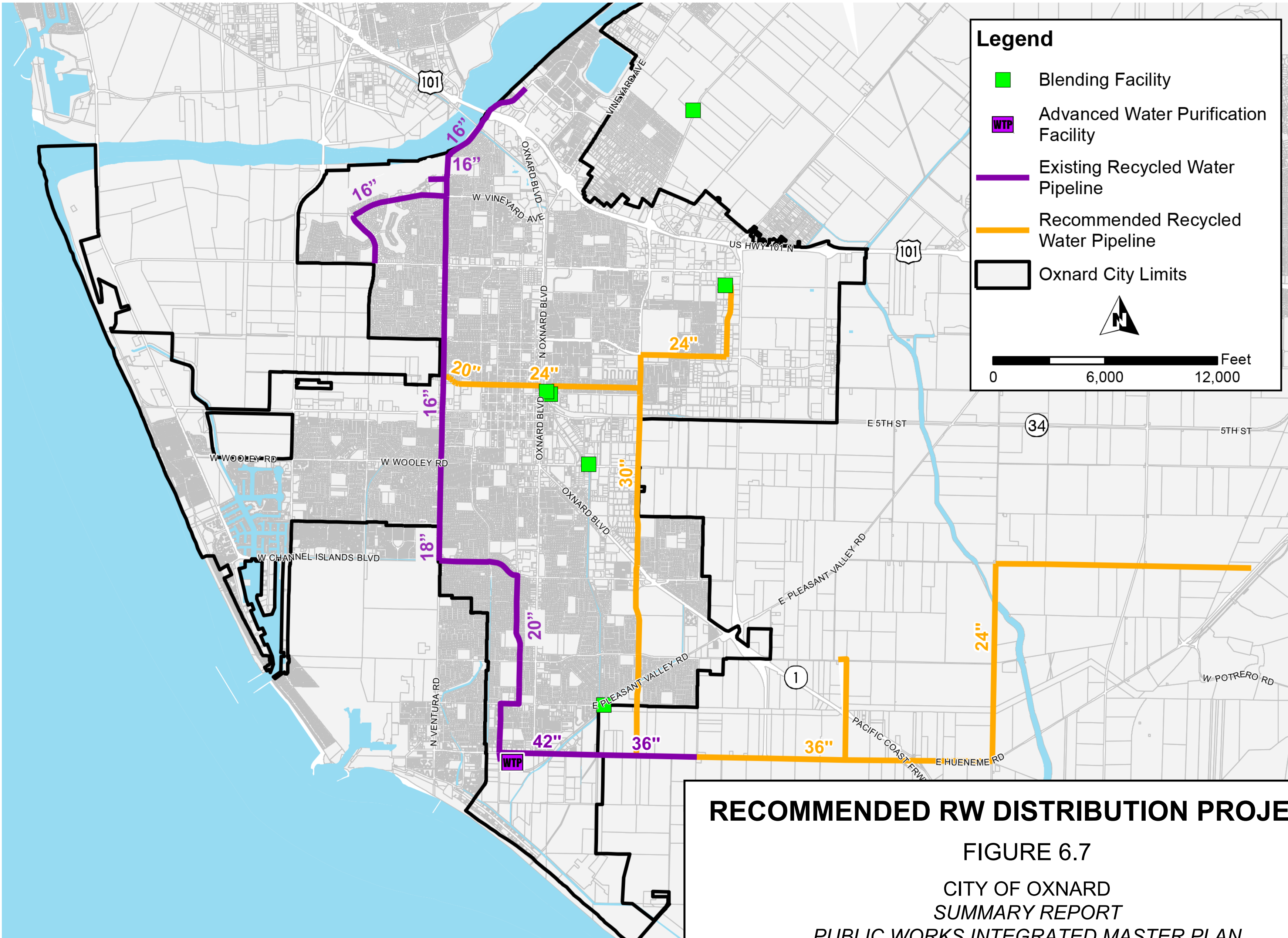
6.9.2 Distribution

Phase 1B of the recycled water distribution system expansion focuses on delivering recycled water to the agricultural users east of the City, which will be accomplished with Phase 2 of the Hueneme Road Pipeline. The pipeline's alignment will start at the end of the Hueneme Road Phase 1 Pipeline, at the intersection of Hueneme Road and Olds Road. The 36-inch diameter pipeline continues east down Hueneme Road to Wood Road and then transitions to a 24-inch pipeline, heading north on Wood Road until the intersection of Wood Road and Laguna Road. From there, it runs east on Laguna Road where it terminates just before Lewis Road. The Hueneme Road Phase 2 pipeline will supply an agricultural demand to the farmers of up to 5,200 AFY or 3,225 gpm depending on the RW supply available.

Phase 2 involves constructing the RW loop that will feed the proposed ASR locations at Campus Park and BS Nos. 1/6. The RW Loop tees off the existing 16-inch RWBS pipeline at the intersection of South Ventura Road and West Second Street. From this location, a 20-inch diameter pipeline continues east down West Second Street to the Campus Park ASR Facility where it increases to a 24-inch pipeline and continues past Campus Park and into BS No. 1/6. Once past BS No. 1/6, the 24-inch diameter pipeline continues east along East Second Street, intersecting at N Rose Avenue. There, it turns south on North Rose Ave, increasing to a 30-inch pipeline until it connects to the existing 36-inch Hueneme Road Pipeline.

Phase 3 involves constructing a 24-inch pipeline connecting BS No. 3 to the RW Loop. The pipeline starts from the RW Loop at the intersection of East Second Street and North Rose Avenue. This 24-inch pipeline continues north on N Rose Avenue, then east on Camino Del Sol, and then north on N Rice Avenue to Wankel Way where it terminates at BS No. 3.

Figure 6.7 shows the routings of these pipelines.



RECOMMENDED RW DISTRIBUTION PROJECTS

FIGURE 6.7

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6.9.3 IPR/DPR

Implementing IPR as a supplemental water supply will occur in steps. In Phase 1, the City will construct one demonstration ASR well (as noted in Section 6.2.3). With this demonstration well, the City can assess the feasibility of the IPR process in real time and refine the assumptions surrounding aquifer capacity and extracted water quality. In addition, the well will establish the process for regulatory approval for the IPR process. A Title 22 Engineer's Report (Carollo, 2016) and a Report of Waste Discharge (ROWD) (Carollo, 2016) were developed for this demonstration ASR well.

Phase 2 contains the majority of the ASR installations for supplemental water supply use, which will also happen in steps. First, the Campus Park site will be built-out. Four additional ASR wells will be added, each with their own set of monitoring wells (i.e., 3 per ASR well). Currently, a built-out ASR site will also consist of operational storage, sized to offset PHDs, booster pumping, and additional conditioning facilities (i.e., disinfection and fluoride addition). However, because the Campus Park site is near BS No. 1/6, it makes more sense to house the ancillary equipment at BS No. 1/6. Thus, extracted IPR water will be conveyed from Campus Park to BS No. 1/6 for storage and conditioning.

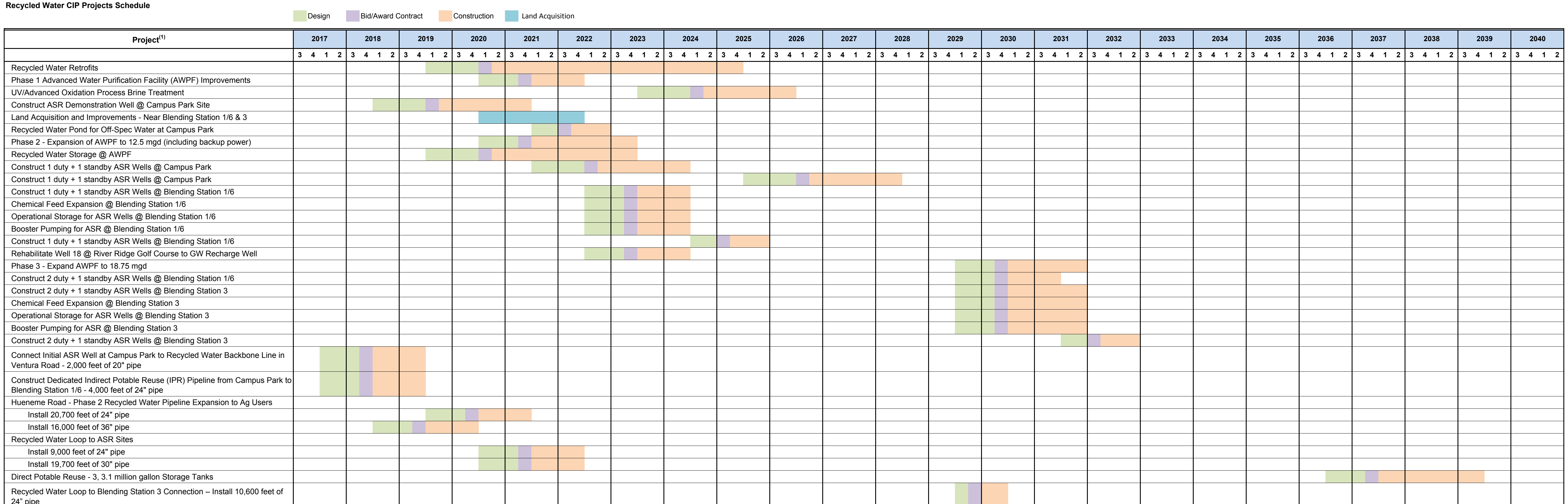
After build-out of the Campus Park ASR wells, four ASR wells will be added near the BS No. 1/6 site. Additional property near BS No. 1/6 will need to be acquired, which the City has already discussed with property owners. Adding these wells will correspond to the Phase 2 expansion of the AWPF and should help to meet potable water demands through approximately 2030.

Phase 3 will then continue to expand the City's ASR capacity and will correspond to expanding the AWPF to 18.75 mgd. Build-out of the BS No. 1/6 site with the addition of three ASR wells will occur next, followed by the construction of six ASR wells at BS No. 3. As with BS No. 1/6, additional property will need to be acquired near BS No. 3 to make this feasible. Operational storage, booster pumping, and conditioning facilities will need to be added to BS No. 3 as well.

6.9.4 Implementation Schedule

Implementing these recycled water projects will occur in conjunction with the water system master plan projects in Chapter 4. The proposed schedule for these improvements is included in **Error! Not a valid bookmark self-reference.**, and costs for the recommended recycled water projects are summarized in Chapter 9.

Recycled Water CIP Projects Schedule



Notes:
(1) Project start years adjusted with City input and do not correspond to Dec. 2015 publication start years.

RECOMMENDED RECYCLED WATER SYSTEM PROJECTS SCHEDULE

FIGURE 6.8

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STORMWATER SYSTEM MASTER PLAN

7.1 INTRODUCTION

The City's stormwater system serves the City and surrounding areas that drain into Oxnard, approximately 35 square miles in drainage area. Within this system, the City maintains a network of storm drains comprised of gravity pipes, force mains, lift stations, and additional infrastructure associated with a stormwater drainage system.

The Ventura County Watershed Protection District (VCWPD) has either partial or complete jurisdiction over each of the City's drainage channels. As such, the City's drainage facilities discharge either directly into the ocean or into the VCWPD facilities first and then into the ocean.

When evaluating improvements to the stormwater collection system, a number of goals were established to help develop scenarios. Consistent with the overall goals established in Chapter 1, the five main goals for improvements are as follows:

- Goal 1: Provide a compliant, reliable, resilient, and flexible system.
- Goal 2: Manage assets in a way that maximizes economic sustainability.
- Goal 3: Mitigate and adapt to the potential impacts of climate change.
- Goal 4: Protect and enhance environmental and resource sustainability.
- Goal 5: Investigate green and gray infrastructure with an emphasis on energy efficiency.

As shown, these goals aim for more than simply maintaining the existing system. Instead, they seek to produce stormwater projects that can enhance the quality of stormwater entering the environment and potentially harvest some of it as an additional water supply. In doing this, the City aims for a more robust, adaptable, and cost-efficient system overall.

This chapter provides an overview of the existing stormwater system, including its strengths and vulnerabilities, as well as the regulatory requirements and climate change issues the system might face. This chapter also defines the recommendations for meeting the defined goals.

The analysis and evaluations contained in this Summary Report are based on data and information available at the time of the original date of publication of the Project Memos (PMs), December 2015. After development of the December 2015 Final Draft PMs, the City continued to move forward on two concurrent aspects: 1) advancing the facilities planning for the water, wastewater, recycled water, and stormwater facilities; and 2) developing Updated Cost of Service (COS) Studies (Carollo, 2017) for the wastewater/collection system and the water/distribution system. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The complete updated CIP based on the near-term and long-term projects is contained in Appendix B.

7.2 DESCRIPTION OF EXISTING FACILITIES

7.2.1 Stormwater Collection System

The City's existing storm drainage system collects and conveys stormwater runoff from developed and undeveloped areas throughout the City. The system includes circular pipelines from 4 to 96 inches in diameter, rectangular pipes up to 264-by-96 inches wide, open channels, 5 stormwater pump stations and associated force mains, and various valves and diversion structures throughout the system. The majority (approximately 63 percent) of the pipes were built using reinforced concrete pipes (RCP).

Figure 7.1 shows the existing storm drainage system, including storm drain diameters, detention/retention ponds, pump stations, canals, and outfall locations. In total, the City owns approximately 162 miles of storm drains and open channels, and VCWPD has jurisdiction over 28 miles of open channels.

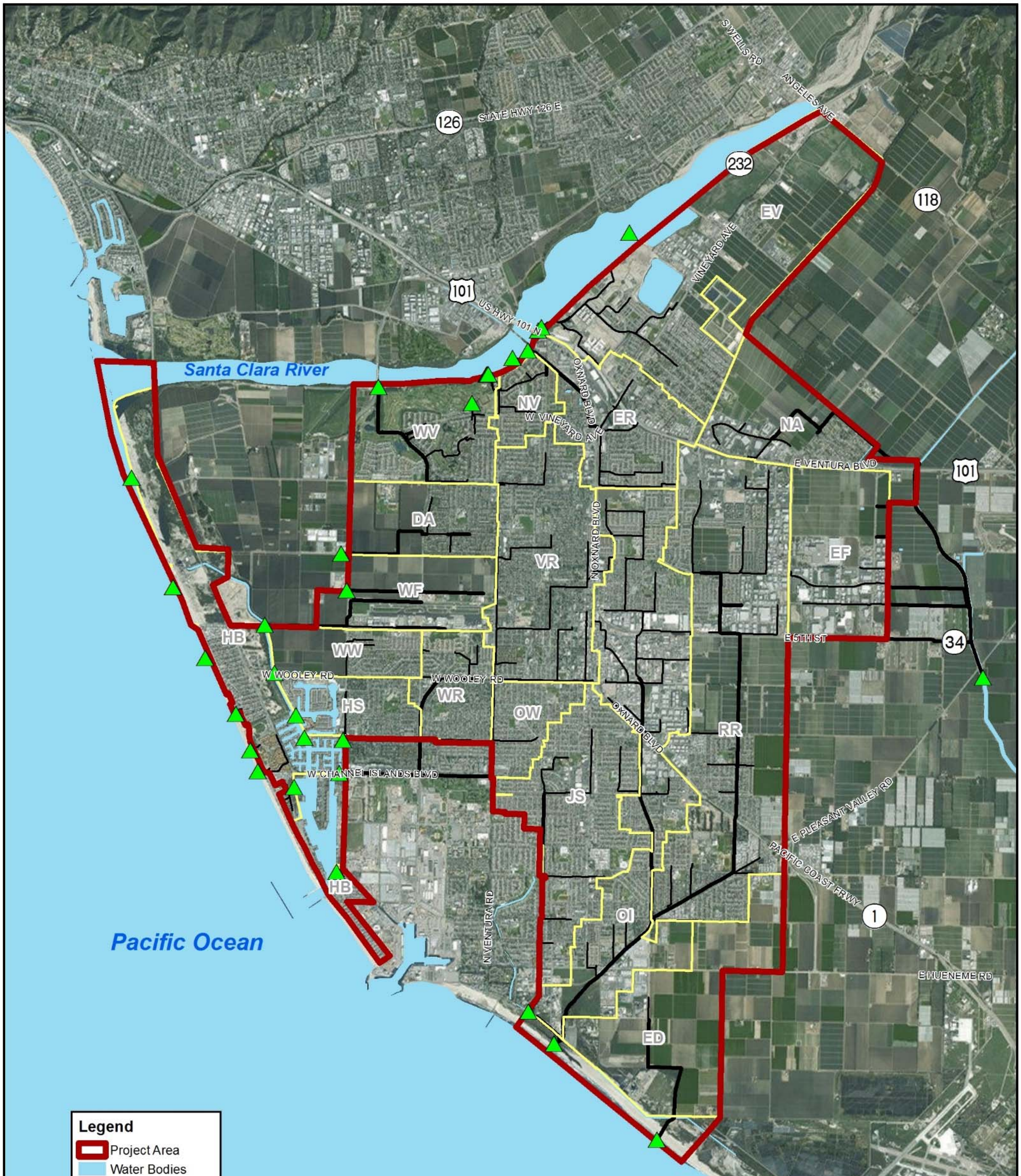
The VCWPD, previously called the Ventura County Flood Control District (VCFCD), was formed in 1944 to perform drainage services not readily performed by local agencies. The City resides in the VCWPD Flood Zone 2 and City drainage facilities discharge into the VCWPD channels whenever possible. Major drainage channels within Oxnard include Doris Avenue Drain, Fifth Street Drain, Wooley Road Drain, Oxnard West Drain, Ormond Lagoon Waterway, Rice Road Drain, Tsumas Creek, El Rio Drain, Camarillo Drain, and Nyeland Drain.

7.2.2 Condition Assessment

Between September 12, 2014, and September 18, 2014, a condition assessment was conducted of select storm drain facilities throughout the City. Assets for inspection were chosen based on age, slope, and proximity to areas prone to flooding. Groupings of old assets with small slopes located near flood-prone areas were assessed first.

This evaluation involved visually inspecting the topsides of 304 manholes, catch basins, pipes, channels, flood zones, and outfalls, as well as select areas that have flooded in the past. In total, 29 sites were assessed, representing 2 percent of the entire stormwater collection system.

Although the majority of the assets were in excellent condition, the assessment found that approximately 12 percent need immediate attention or attention within the next five years. Furthermore, although the majority of assets showed negligible amounts of sediment, sediment build-up is a concern in approximately 12 percent of the stormwater collection system assets. These assets had moderate to significant sediment buildup and should be cleaned within five years.



EXISTING STORMWATER SYSTEM

FIGURE 7.1

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Figure 7.2 illustrates the locations of assets in poor condition. Priority 4 assets in orange are in poor condition, and priority 5 assets in red require immediate attention.

7.3 MASTER PLAN/DESIGN CRITERIA

Key LOS criteria were used to evaluate the existing stormwater system's ability to meet the future needs summarized in Table 7.1. The criteria were used to evaluate the stormwater collection system and to plan for future system improvements.

Table 7.1 Level of Service Criteria
Public Works Integrated Master Plan
City of Oxnard

Design Storm	Facilities to be Evaluated	Maximum HGL Depth/Flooding Depth Criteria
10-year, 24-hour	Storm Conveyance Facilities and Basins	Surcharging allowed, but no flooding above surface elevation
100-year, 24-hour	Combined Capacity of Streets, Basins, and Pipes	Flooding allowed not higher than the building finish floor levels

7.4 FUTURE FACILITY NEEDS AND OPPORTUNITIES

The capacity and performance of the existing stormwater system were compared with the above LOS criteria to locate system shortfalls. In general, the system has adequate capacity to meet current and future demand conditions. However, some capacity deficits and R&R needs exist.

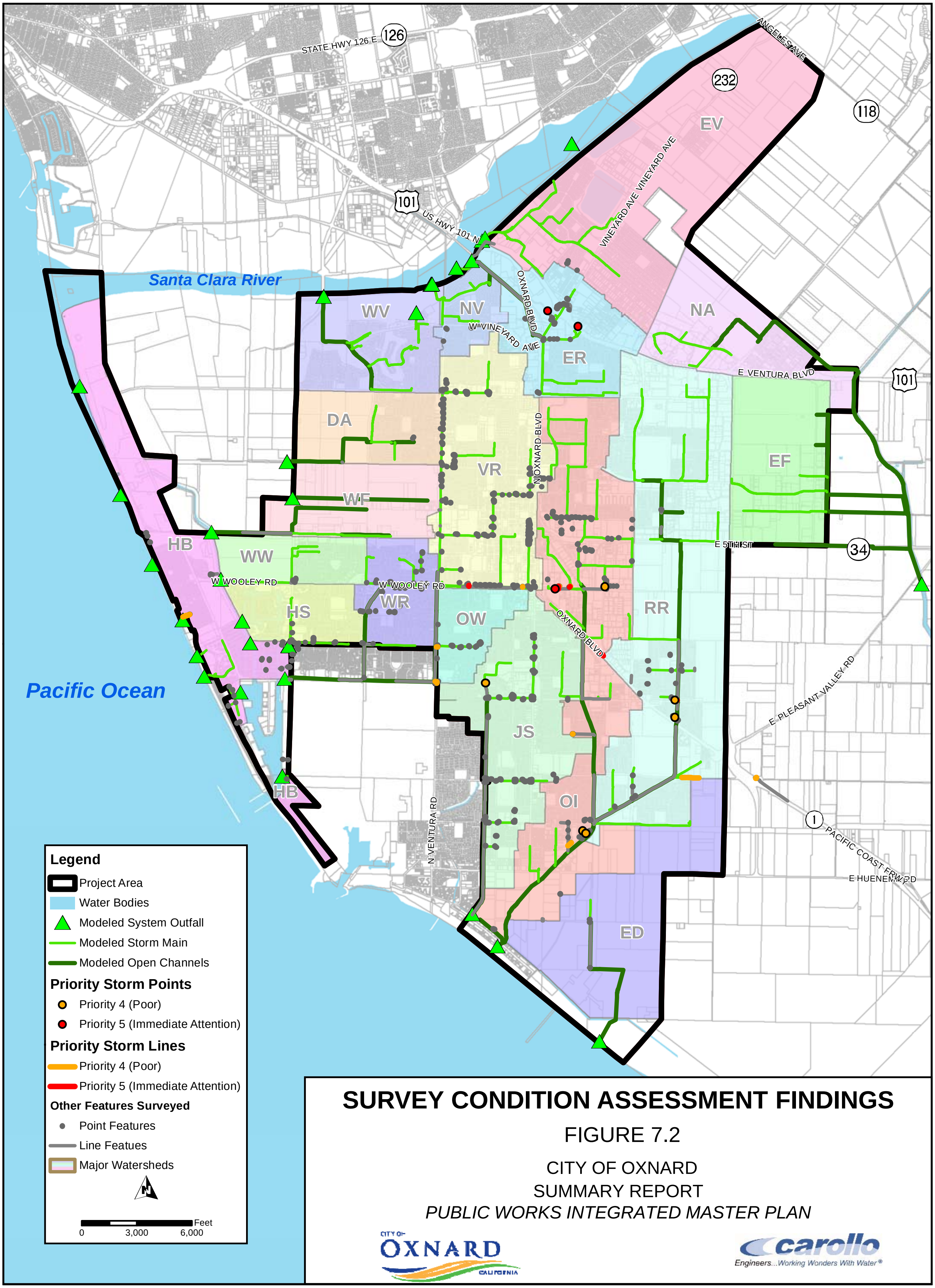
7.4.1 Stormwater Collection System

7.4.1.1 <u>Capacity</u>

As part of the planning effort, Carollo developed a storm drainage hydrologic and hydraulic model for the City in SewerGEMS. The model was used to identify existing system deficiencies, characterize infrastructure needs for future growth, and develop capital improvements to mitigate deficiencies and meet the City's planning criteria.

To develop the model, a capacity analysis was performed on pipelines 24 inches in diameter and larger as well as other critical facilities of all sizes. The first step in the capacity analysis was to divide the 22,709 acres within the service area into 418 individual subcatchments. In addition, appropriate outlet points (i.e., drainage inlets and catch basins in City Streets or nearby manholes) were defined. The resulting subcatchments range from 1.7 acres to 374.9 acres and average approximately 54.3 acres.

Rainfall data were used to generate the basis for stormwater evaluations. As shown in Figure 7.1, a 10-year 24-hour storm (total rainfall of 4 inches) and a 100-year 24-hour storm (total rainfall of 6.4 inches) were used for the capacity assessment.



SURVEY CONDITION ASSESSMENT FINDINGS

FIGURE 7.2

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Results from the modeling effort indicate that during the 10-year, 24-hour design storm, the hydraulic grade line (HGL) in the Ventura channels is elevated, which causes significant surcharging in the City's storm pipes that drain to the channels. However, because the Ventura channels have insufficient conveyance capacity and the City's pipes are not capacity deficient, no improvements to the City's drainage pipes are proposed. Instead, the recommendation is to improve the Ventura channel conveyance to lower the HGL and allow more stormwater to drain to the canals without being held upstream in the City's system.

The modeling effort also indicated that the majority of the surcharging and flooding problems under the 10-year design storm are located in Ventura Road, Tsumas Creek, Ormond Lagoon Waterway, and north of Rice Road Avenue watersheds, which correspond to the City's downtown core. The existing storm drain system also lacks sufficient capacity to convey the 100-year design runoff while meeting the flooding criteria. Figure 7.3 shows the location of this surcharging infrastructure.

The project team evaluated the reasonableness of the model results by comparing them with the City's observations. Based on staff observations during storm events, the model results confirmed areas around the City that typically experience flooding.

In addition to the sewerGEMS model, the City recently completed a Green Alleys Plan. This plan had two goals: to identify the City's alleys that are good candidates for green alley projects and to provide a framework for the future design and implementation of these projects.

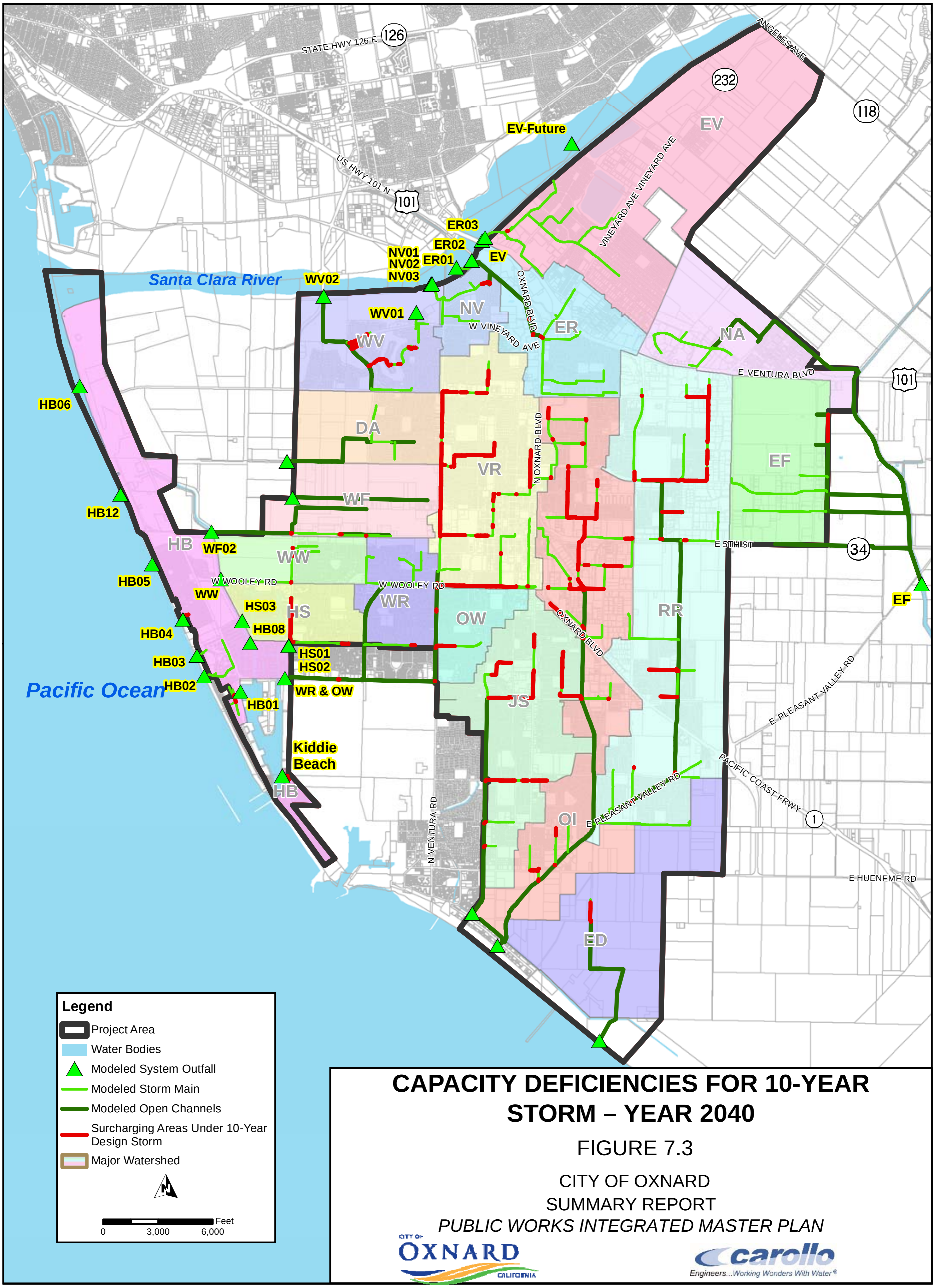
After comparing the environmental prioritization results performed in the Green Alley program, some of the high priority public alleys were noted to overlap with the observed areas of flooding. As a result, it is recommended, where appropriate, that the City incorporate bioswales, permeable paving, or rain barrels (for community gardens) to help decrease flooding in these locations. Figure 7.4 shows the areas of high priority for Green Alleys projects and the existing flooding areas.

7.4.1.2 R&R

As previously mentioned, approximately 12 percent of the assets need immediate attention or attention within the next five years. These assets are in poor or very poor condition. In addition, sediment build-up was a problem in approximately 12 percent of the assets.

7.4.2 New Stormwater Projects

A number of new stormwater projects were considered to achieve the goals outlined in the Integrated Master Plan. The goal of these projects is to improve stormwater quality so it can be harvested as an additional water source and meet regulatory requirements.



CAPACITY DEFICIENCIES FOR 10-YEAR STORM – YEAR 2040

FIGURE 7.3

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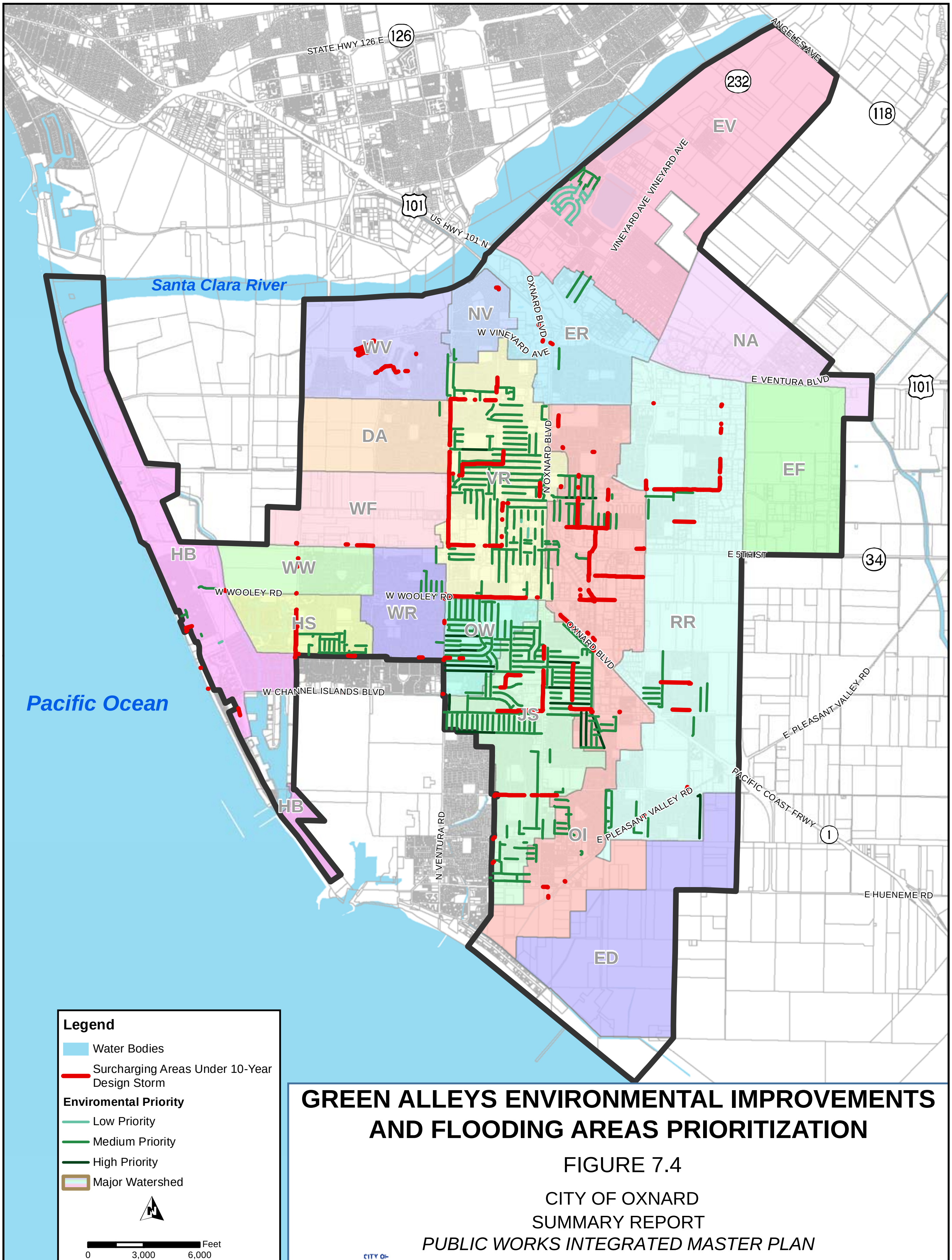

GREEN ALLEYS ENVIRONMENTAL IMPROVEMENTS AND FLOODING AREAS PRIORITIZATION

FIGURE 7.4

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Once an initial list of stormwater project options was identified, all options went through a fatal flaw screening to determine which were the most viable. From this screening, three new stormwater projects were selected: dry weather diversion, a citywide incentive program, and total maximum daily load (TMDL) compliance. Each project is described in the following sections.

7.4.2.1 Dry Weather Diversion

The first project would divert dry weather stormwater channel flows to the Oxnard Wastewater Treatment Plant (OWTP) to be treated and potentially reused at the Advanced Water Purification Facility (AWPF). Dry weather flows include flow from irrigation runoff, pool draining, washdown water, construction work, and other related activities. In Oxnard, shallow groundwater infiltration is likely another component of dry weather 'stormwater' flow.

Water could be diverted from the stormwater collection system in a number of ways. Typically, stormwater diversion structures in California are constructed by first screening water for trash and then pumping water from a stormwater pump station to a sanitary collection system. However, water can also be diverted in an open channel by installing an inflatable dam or mechanical gate. Water that builds up behind the dam or gate can then be pumped into the sanitary collection system. The diverted stormwater would be treated downstream at the OWTP and potentially the AWPF.

A dry weather diversion could be used only when the OWTP has excess capacity. In Oxnard's case, storage would not be required because dry weather flows in stormwater channels occur year-round. To prevent significant water quality degradation of OWTP influent, however, dry weather diversions should be kept small in proportion to OWTP influent.

Before this project could be implemented, the City should consider the effects removing this dry weather storm channel flow could have on downstream habitat. Additionally, water quality implications should be studied further.

7.4.2.2 Citywide Incentive Program

The second project is a citywide incentive program that would involve capturing stormwater to offset potable water use. A program like this would encourage new developers to invest in rainwater harvesting and onsite reuse. It would also give interested residents the opportunity to retrofit their homes with rain barrels or rain cisterns. These measures would lower the risk of flooding and would encourage residents and developers to take a proactive stance on stormwater.

The City could encourage such rainwater collection in several ways. It could provide discounted rain barrels and cisterns for purchase or offer a discount on water utilities bills. Such incentives could be provided for both existing land owners and developers. The cost for such an incentive program would depend entirely on its size and the amount the City is willing to offset.

Since the City is located on a shallow perched aquifer, the Integrated Master Plan recommends focusing any incentive program on onsite capture and use instead of infiltration. This focus will decrease customers' potable water use for landscape irrigation the most.

7.4.2.3 TMDL Compliance

The final project involves reaching a TMDL for indicator bacteria. The Los Angeles Regional Water Quality Control Board (LARWQCB) adopted a TMDL for indicator bacteria in the Santa Clara River Estuary. This TMDL requires participating agencies like the City to prepare an implementation plan outlining proposed activities to achieve a reduction in bacteria load.

In March 2015, a draft implementation plan was developed that located potential infiltration basins and subsurface infiltration basins for both dry and wet weather stormwater throughout the watershed. South Bank Park in Oxnard was one of the locations identified. This location, shown in Figure 7.5, is the proposed site for a subsurface infiltration basin.

This infiltration basin would be sized to treat the 85th percentile volume from the local drainage area and would require approximately 85,000 square feet. It would be approximately 2 feet deep and infiltrate at a rate of 0.5 inches per hour.

7.5 RECOMMENDED PROJECTS

7.5.1 Stormwater Collection System

Stormwater collection system improvements were focused on capacity and R&R needs and based on the capacity assessment and condition assessment, respectively. Through these assessments, 13 main capacity projects were identified. These projects are summarized in Table 7.2.

In addition, a total of 21 assets with a Level 4 rating were identified, as was an asset with a Level 5 rating that requires R&R. Costs for these R&R needs are also shown in Table 7.2, and an overall schedule can be found in Figure 7.6.

7.5.2 New Stormwater Projects

As outlined above, three new stormwater projects have been proposed for the Integrated Master Plan. The infiltration basin, recommended for TMDL compliance, should be implemented, since it is required to meet the Santa Clara River's indicator bacteria TMDL. The remaining two projects, a dry weather diversion and an incentive program, should be considered for future implementation. For more information about these projects, refer to Table 7.3. For an overall schedule, refer to Figure 7.6.

**Table 7.2 Recommended Collection System Projects
Public Works Integrated Master Plan
City of Oxnard**

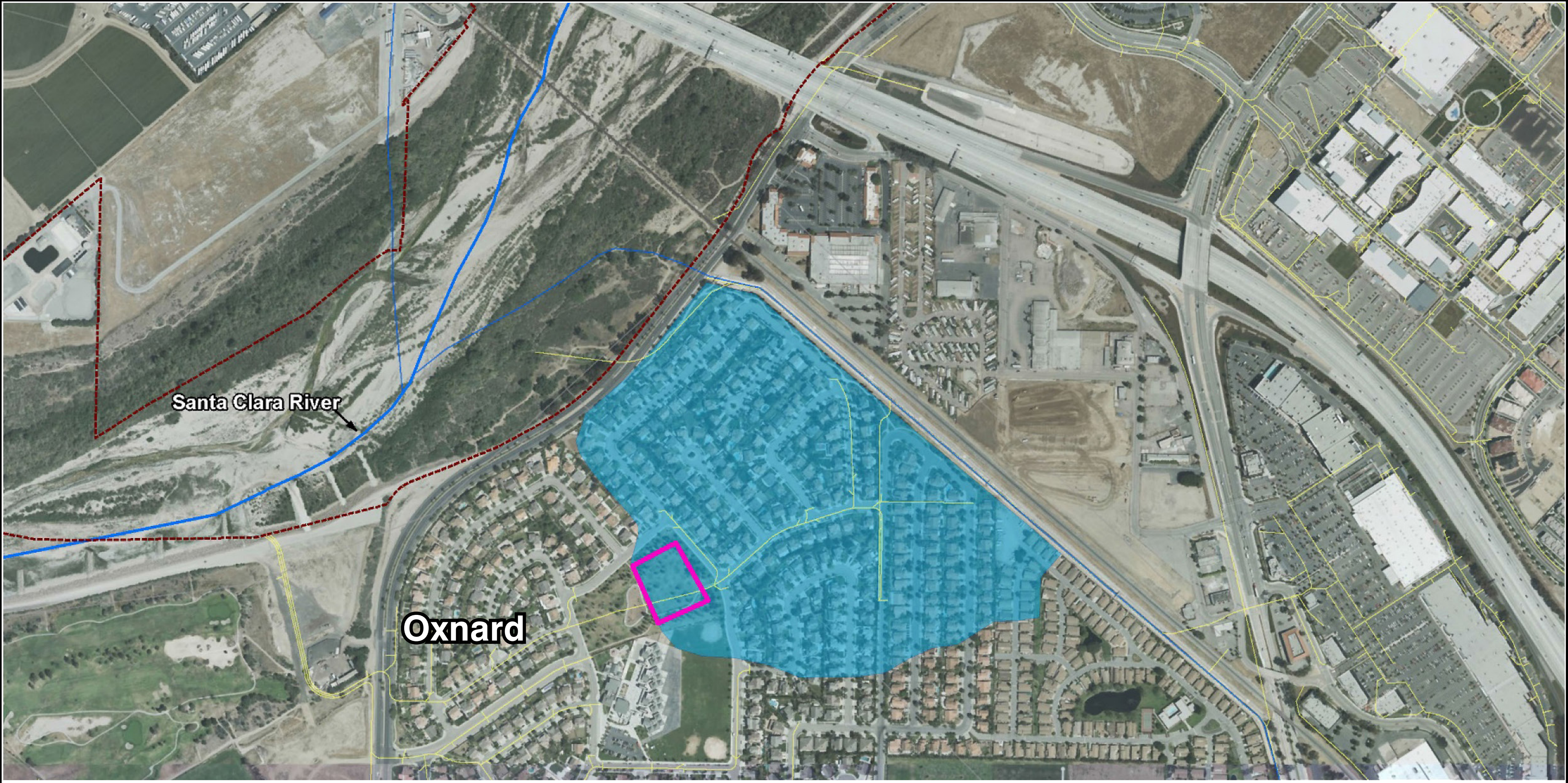
Project Name	Driver	Phase Ranking
Drainage Basin WV (444 ft)	Capacity	2
Drainage Basin WV (748 ft)	Capacity	4
Drainage Basin OI (607 ft)	Capacity	2
Drainage Basin RR (2,436 ft)	Capacity	3
Drainage Basin OI (2,388 ft)	Capacity	4
Drainage Basin VR (5,872 ft)	Capacity	1
Drainage Basin JS (1,421 ft)	Capacity	1
Drainage Basin JS (1,292 ft)	Capacity	2
Drainage Basin JS (426 ft)	Capacity	2
Drainage Basin JS (457 ft)	Capacity	2
Drainage Basin JS (655 ft)	Capacity	2
Drainage Basin JS (701 ft)	Capacity	2
Drainage Basin HS (1,552 ft)	Capacity	2
22 assets	R&R	1

General Note: For the pipeline replacement projects, see the hydraulic models developed as part of this integrated master plan to identify the exact pipeline locations. Project costs, schedule, and phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) – December 2015.

**Table 7.3 Recommended New Stormwater Projects
Public Works Integrated Master Plan
City of Oxnard**

Project Name	Driver	Start Year	Phase Ranking
Dry Weather Diversion Structure	Resource Sustainability	2021	2
City-Wide Incentive Program	Resource Sustainability	2021	2
TMDL Infiltration Basin	Resource Sustainability	2023	2

General Note: Project costs, schedule, and phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) – December 2015.



N

0.1 0.05 0 0.1 Miles

LEGEND

- Regional BMP Parcel
- BMP Drainage Area
- IP Area
- Santa Clara River
- Santa Clara River Watershed
- Tributaries to SCR
- Storm Drains

Source: "Draft Lower Santa Clara River TMDL Implementation Plan," Geosyntec, March 2015.

PROPOSED INFILTRATION BASIN FOR TMDL COMPLIANCE

FIGURE 7.5

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

CITY OF OXNARD CALIFORNIA

carollo
Engineers...Working Wonders With Water®

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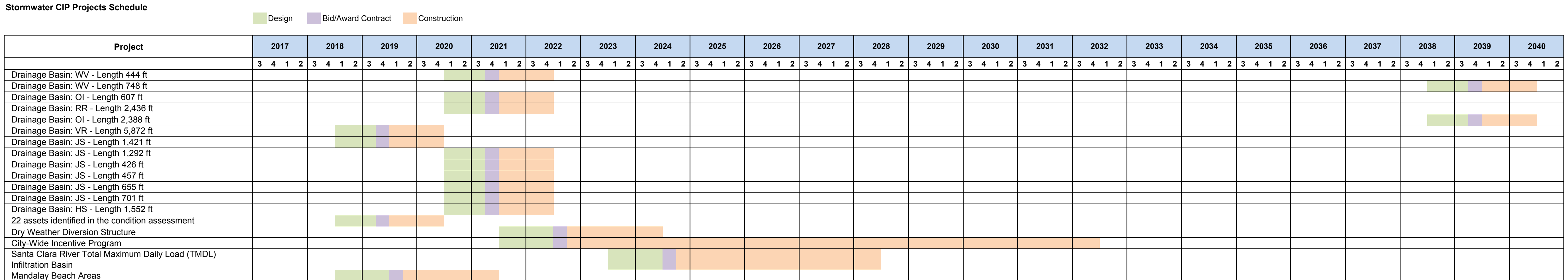

Notes:
(1) Project start year moved two years later compared to 2015 CIP.
(2) Project start year adjusted with City input and do not correspond to Dec. 2015 publication start year.
(3) Project added by City after December 2015 publication.

RECOMMENDED STORMWATER PROJECTS SCHEDULE

FIGURE 7.6

CITY OF OXNARD
SUMMARY REPORT
PUBLIC WORKS INTEGRATED MASTER PLAN

ox0817f4-9587(SumRepFIG7-6).ai

INTEGRATED AND COMMON SUPPORT ELEMENTS

8.1 INTRODUCTION

This chapter summarizes the studies conducted on common support elements (i.e., operation and data management systems, security, etc.) connecting the multiple utilities (water, wastewater, recycled water, and stormwater). An integrated approach was taken to analyze these support elements for greater efficiency and cost savings and to take a more a holistic approach to the overall system recommendations.

The analysis and evaluations contained in this Summary Report are based on data and information available at the time of the original date of publication of the Project Memos (PMs), December 2015. After development of the December 2015 Final Draft PMs, the City continued to move forward on two concurrent aspects: 1) advancing the facilities planning for the water, wastewater, recycled water, and stormwater facilities; and 2) developing Updated Cost of Service (COS) Studies (Carollo, 2017) for the wastewater/collection system and the water/distribution system. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The complete updated CIP based on the near-term and long-term projects is contained in Appendix B.

8.2 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS)

The Computerized Maintenance Management System (CMMS) assessment evaluated the City's water treatment and distribution, wastewater collection and treatment, recycled water treatment and distribution, and stormwater assets, taking into account the Public Works' Enterprise Asset Management needs, existing capabilities and tools, and possible improvements. In the near-term, the focus will be on evaluating its CMMS needs, selecting a CMMS suitable to the City's daily needs, and implementing a CMMS to support maintenance and capital planning specifically for the Public Works Department.

In the next phase of work, Carollo recommends that the City start requesting proposals from the shortlisted CMMS vendors described in the Integrated Master Plan. Based on a review of the proposals received and preliminary reference checks, Carollo recommends narrowing down the shortlist to two or three preferred CMMS vendors that it can invite for software demonstrations.

The proposals, reference checks, and software demonstrations will serve as a basis for selecting a CMMS vendor. Table 8.1 includes summary costs for Year 1 and Year 2 activities. These cost estimates include software and implementation costs for both vendor and consultant services. These costs are included in the overall CIP.

Table 8.1 Compiled Summary of Vendor CMMS Software Cost Estimates
Public Works Integrated Master Plan
City of Oxnard

Cost Component	Cost Estimate[1]	Description	Basis/Assumptions
Year 1 Projects			
Software Licensing (Vendor)	$40,000 - $200,000	• Provides core functionality for assets, service requests, work orders, and Project Memorandums (PMs) • Provides basic inventory management functionality • Provides mobile functionality	• 55 named users or 20 concurrent users • 120 total users for service requests • Low estimate for enterprise license agreement • High estimate for user and module-based licensing • No add-on integration
Software Implementation Services (Vendor)	$50,000 - $300,000	• Implements core functionality for assets, service requests, work orders, and PMs • Implements GIS fleet management, inventory management, and mobile functionality	• Software installation • Software configuration for core modules • Limited data conversion and population for core functionality • Software testing • Basic training
Estimated Total Cost for Year 1	**$90,000 - $500,000**		
Year 2 Projects			
Annual Software Maintenance/Support (Vendor)	$15,000 - $150,000	• Provides vendor support and software upgrades and patches • Starts in Year 2 • Recurs each year of use	• Low estimate of 20 percent of licensing fee • High estimate for enterprise license agreement • Annual cost incurred indefinitely
Software Integration Services (Vendor)	$75,000 - $300,000	• Provides integration software and implementation services for SCADA and Enterprise Resource Planning • Provides additional business process implementation and training • Starts in Year 2	• Varies widely based on specific integration points, data flows, and selected software capabilities • May require multiple phases and years of implementation
Estimated Total Cost for Year 2	**$90,000 - $450,000**		

Note:

(1) Cost estimates are preliminary and subject to change based on detailed evaluation of requirements and negotiation of specific software licensing and services with selected vendor applicable to this specific Owner. Cost estimates are based on an approximate accuracy range of -15% to -30% on the low side to +20% to +50% on the high side.

8.3 GIS

The City is significantly invested in ArcGIS (ESRI). In 2015, the IT department started significantly updating the Public Works Geodatabase to ESRI's new "Local Government Schema" (LGS) configuration. By adopting the LGS, the ESRI could provide a significant number of free or low cost extensions to manage the Public Work Department's projects.

ESRI offers a *CIP Planning Tool* that allows users to define projects within the GIS by selecting assets. The tool then groups these assets into a project, allowing the user to enter unit costs and calculate the total cost by project. The user can also enter a schedule for starting and completing each project and for assigning a project manager.

Although the *CIP Planning Tool* is fairly simplistic, it allows users to easily manage individual CIP projects and compare multiple projects. The information can also be easily exported to MS Excel to complete additional calculations. Ultimately, the schedule can be imported to MS Project or a similar program to comprehensively manage project schedules.

This *CIP Planning Tool* has been briefly demonstrated to select individuals in the Public Works Department with a positive response. However, in discussing and understanding the Public Works Geodatabase setup further, there is the potential that the LGS may be changed in the future. If the LGS is changed, or "customized," then the extension tools in the *CIP Planning Tool* may not work with the new database structure, therefore rendering it less effective.

Therefore, Carollo recommends that the City maintain the LGS structure so these tools can be applied in the future. Carollo and the City should meet to further discuss the Public Works Geodatabase structure.

The *CIP Planning Tool* will also help in coordinating projects from multiple departments. For example, water and sewer projects can be overlaid with street improvement projects. With this, the City can adjust project schedules so streets are impacted only once and all infrastructure can be completed as a single project. This will significantly streamline project construction and minimize costs and disruptions to City stakeholders.

Using the *CIP Planning Tool* will also allow Carollo to deliver the CIP in GIS format, permitting continual update of the projects as time progresses and factors change. Since the City now uses tablets with GIS, this planning tool could ultimately become a "dynamic living CIP," so that Public Works Department employees can access the most current CIP projects and track which are completed and which are being deferred because of changing conditions.

8.4 SECURITY

Summers Associates, LLC, was contracted to develop a basis of design for physical and electronic security for the City's water resources facilities and to identify existing deficiencies in the facilities' security. A set of guidelines for enhancing security during their design and construction was also developed. Threats to the facilities include common crime, terrorist attacks, other manmade hazards, and some natural hazards.

Cost-effective recommendations are within the CIP to enhance safety throughout a facility's lifetime. These recommendations apply to new facilities as well as additions and modifications to the existing facilities.

8.5 SCADA

For this Integrated Master Plan, the existing supervisory control and data acquisition (SCADA) systems for the City's water and wastewater system were assessed and capital improvement projects were recommended. Planning efforts focused on these two systems in particular based on need and age of the existing SCADA systems. These projects, shown in Table 8.2 for water and Table 8.3 for wastewater, are included in the overall CIP recommendations.

Table 8.2 Recommended SCADA Projects for Water
Public Works Integrated Master Plan
City of Oxnard

Project Name	Driver	Start Year	End Year	Un-escalated Project Cost ($)
Programmable Logic Controllers (PLC) Cabinet Replacements (6)	R&R	2015	2018	$2,050,000
SCADA Programming	Performance	2016	2021	$2,100,000
Asset Management Software Package Installation	Performance	2021	2022	$100,000
Network Upgrades (8)	Performance	2015	2022	$400,000
Control Room Upgrades	Performance	2016	2021	$300,000
			TOTAL:	**$5,000,000**

General Note: Project Costs, Schedules, and Phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) - December 2015.

Table 8.3 Recommended SCADA Projects for Wastewater
Public Works Integrated Master Plan
City of Oxnard

Project Name	Driver	End Year	Start Year	Un-escalated Project Cost ($)
PLC Cabinet Replacements (12)	R&R	2018	2015	$4,601,000
SCADA Programming (12)	Performance	2021	2016	$4,989,000
Asset Management Software Package Installation	Performance	2022	2021	$104,000
Network Upgrades (12)	Performance	2022	2015	$776,000
Control Room Upgrades	Performance	2021	2016	$346,000
			TOTAL:	**$10,816,000**

General Note: Project Costs, Schedules, and Phasing are based on data and information available at the time of the original publication of the Project Memos (PMs) - December 2015.

RECOMMENDED CAPITAL IMPROVEMENT PLAN AND KEY OUTSTANDING PLANNING CONSIDERATIONS

9.1 INTRODUCTION

This chapter summarizes the key points of the four system master plans and presents a list of recommended projects for all water utilities. The Integrated Master Plan also integrated several other planning efforts such as data managements systems (e.g., SCADA, CMMS, GIS) and street planning efforts related to buried infrastructure and street upgrades such as repaving.

As with any planning effort, the Integrated Master Plan represents present and known conditions. Because of this, several key decisions and outcomes could dramatically affect the ultimate direction and phasing of implementation as the Plan progresses. Those key outstanding planning considerations and their potential impacts are summarized in this chapter.

Also summarized are the recommended costs for each project and an overall schedule for implementation. These recommended costs and schedules are based on a detailed evaluation of the existing water, wastewater, recycled water, and stormwater facilities, an assessment of likely future system needs, an analysis of master plan scenarios, and numerous meetings and workshops with City staff and management.

Until the environmental review and assessment for the Integrated Master Plan are complete, this Summary Report is considered a final draft. After those assessments are completed and approved by the City Council, the list of recommended projects may be revised based on a number of factors, such as the outcome of the environmental review process and the utility billing rates approved by the City Council.

9.2 APPROACH TO CIP DEVELOPMENT

As noted in Chapters 4 through 7, recommended projects were developed individually for each utility in 2014/2015. Also, as noted in the Brief History and Overview Section at the beginning of this report, the City continued to move forward with planning efforts and adoption of the Cost of Service (COS) studies (Carollo, 2017) from 2015 through 2017. Therefore, certain projects in these planning documents have been refined and updated since the original publication date in 2015/2016. It should be noted that the refinements were generally not capacity related, but instead related to improved financial strategies, technology updates, and climate change strategies. The updated 2017 COS studies contain the most recent near-term Capital Improvement Projects (CIP). The updated CIP list was combined with the December 2015 list to make a complete Integrated Master Plan CIP through 2040.

The costs and timing presented in this Integrated Master Plan represent Carollo's best professional judgment of the City's capital expenditure needs and timing to maintain a reliable and compliant system that can meet current and future water demands and wastewater generation needs.

Project timing was set to align with the seven master plan drivers, as noted earlier in Chapter 1: 1) repair & replacement (R&R), 2) regulatory requirements, 3) economic benefit, 4) performance benefit, 5) growth, 6) resource sustainability, and 7) policy decisions. Project timing is also based on input from City staff / management and the condition assessments performed as part of this planning project.

The projects were divided into three project timing phases: Immediate Needs (First 2 years); Near-Term Needs (years 3 to 5); and Long-Term Needs (Beyond 5 years).

9.3 SUMMARY OF THE PLANS

For each individual system, projects were developed based upon the system's most significant drivers and needs. For example, for water and wastewater systems, the facilities' ages and condition necessitate immediate R&R, whereas projects for the relatively new recycled water system involve maintaining and incorporating a reliable supply into the City's boundary. Given the complexity of each system and the systems' unique integration as a whole, a high-level summary of each of the four system plans is helpful. This summary is shown in Table 9.1.

9.4 OUTSTANDING PLANNING CONSIDERATIONS AFFECTING OVERALL CIP AND INDIVIDUAL PLANS

The projects/programs recommended within this Integrated Master Plan support the City's most current thinking, direction, and needs. However, the outcome, timing and phasing of the projects and programs could change depending on the outcome of several key outstanding planning considerations. Four key considerations include:

- The OWTP's eventual location – Two major options are being considered: continue treatment in the same location by repairing and replacing facilities, or relocate all or part of treatment to a completely new site.

  Continuing in the same location will require R&R of most of the major processes. Furthermore, future seawater intrusion due to rising sea levels is a concern and may require constructing a sea wall to mitigate and safeguard facilities.

  Conversely, relocating all of, or parts of, the OWTP to a new site reduces site issues, but implementation of the treatment plant can be challenging. Additionally, many of the existing OWTP facilities need to be upgraded immediately due to their age and condition. However, constructing them at a new site would require a longer lead time to acquire the land and to plan, design, and implement the facilities.

Table 9.1 Key Recommendations of Each Water System Plan
Public Works Integrated Master Plan
City of Oxnard

Timing	Water	Wastewater	Recycled Water	Stormwater
Years 1 - 2	R&R of pipelines and blending stations(1) Improve fire flow capability Separate system into 4 pressure zones for improved LOS Operations Optimization	Focus on R&R from minor to major projects on nearly every process within the OWTP R&R and Capacity improvements on several central trunk sewers	Minor R&R related to AWPF and conversion of recycled water customers	R&R of existing stormwater assets Limited capacity upgrades
Years 3 - 5	Add well and pipeline capacity to meet added demand Add desalter capacity to improve overall water quality of blended ground and surface water Add reliable water supply through ASR/IPR	Continued R&R on headworks and disinfection processes Energy efficiency improvements on digester / co-gen facilities	Add reliable water supply through AWPF Expansion and ASR/IPR	Capacity upgrades of existing assets Infiltration basin for TMDL compliance Dry weather diversion to capture dry weather flow in storm system Incentive program
Beyond 5 years	Continue to meet future demand through upgraded pipeline capacity Continue to bolster water supply through ASR/IPR integration	Focus on improved resource sustainability through process upgrades and alternative power	Continue to add reliable water supply, as needed, through AWPF Expansion and ASR/IPR facilities	Continues capacity upgrades (Phase 3 & 4)

Notes:
(1) Includes electrical and SCADA system upgrades and cathodic protection. Based on data and information available at the time of the original publication of the Project Memos (PMs) – December 2015.

- Regulatory considerations for the existing OWTP/AWPF outfall based on overall water infrastructure operation – Reusing water instead of discharging it to the ocean could have unintended consequences on the ocean outfall. Water reuse could limit the AWPF's ultimate capacity, require nitrification, and denitrification in the secondary effluent before discharge, and change local limits to industrial users. Preliminary mitigation measures have been explored through the Integrated Master Plan. However, conversations with regulators must continue until a cost-effective and reliable approach is determined.
- The FCGMA and future ground water allocations – Developing a sustainable water supply for the City's future depends on the long-term yield of the existing groundwater basin and the allocation apportioned to the City, which is closely tied to the drought conditions and the availability of natural supply. This Master Plan made certain assumptions about future allocations, trying to consider best- and worst-case conditions that provide flexibility for working within these parameters. However, at best, the future of FCGMA and groundwater are highly uncertain and must be monitored frequently to ensure that the City can plan for changes as they occur. Although changes are eminent, they are not fully defined at this time due to the recent passage of the 2015 Groundwater Management Act.
- Future of imported water from CMWD and Metropolitan Water District of Southern California – As the drought continues, regional authorities are exploring the best alternative water supplies to mitigate the drought's effects, including IPR and seawater desalination. In response, the City is staying abreast on the possibility of regional desalting and/or desalination facilities. These facilities could relieve some of the AWPF capacity for more potable offset or groundwater replenishment.

9.5 RECOMMENDED CIP/COST SUMMARY

An overall summary of the recommended CIP projects and their associated costs is presented in Table 9.2. The CIP costs are summarized for each system according to implementation phase. More detailed project costs and project drivers can be found in Appendix B.

The estimated near-term project costs shown in Table 9.2 and the associated operations and maintenance costs developed for the Integrated Master Plan are consistent with those developed for the Cost of Service (COS) Studies (Carollo, 2017). However, the timing of the costs presented may differ. This is partially because timing and implementing certain projects are based on assumptions with a range of uncertainty.

Uncertainties that can affect timing include the rate of population growth, the timing and performance standards of future regulatory requirements, the outstanding planning considerations mentioned above, and the development of new technologies and associated reliabilities. Therefore, while the overall investment and total CIP budget over the 25-year planning horizon are consistent between the Integrated Master Plan and the COS, timing the implementation of some projects may differ with the range of variability in the underlying assumptions of the Integrated Master Plan drivers.

Table 9.2 CIP Costs by Phase
Public Works Integrated Master Plan
City of Oxnard

Projects		Cost[(1)]
Water		
Years 1-2		$3,175,000
Years 3-5		$61,839,333
Years 6-10		$62,527,333
Years 11-16		$19,238,333
Years 17-23		$80,600,000
	Subtotal:	**$227,380,000**
Wastewater[(1)]		
Years 1-2		$8,405,000
Years 3-5		$68,425,064
Years 6-10		$244,311,000
Years 11-16		$58,908,334
Years 17-23		$112,983,933
	Subtotal:	**$493,033,330**
Recycled Water		
Years 1-2		$11,166,667
Years 3-5		$81,033,333
Years 6-10		$57,500,000
Years 11-16		$80,500,000
Years 17-23		$22,200,000
	Subtotal:	**$252,400,000**
Stormwater		
Years 1-2		$8,363,333
Years 3-5		$18,118,000
Years 6-10		$2,936,667
Years 11-16		$1,338,000
Years 17-23		$1,930,000
	Subtotal:	**$32,686,000**
	Total:	**$1,005,499,330**

Notes:
(1) Project costs correspond to refinements and updates provided by City after December 2015 publication date.

9.6 IMPLEMENTATION TIMING

Appendix B presents the timing for the recommended CIP projects.

APPENDIX A – LISTING OF THE PWIMP PROJECT MEMORANDUMS

CITY OF OXNARD

PUBLIC WORKS INTEGRATED MASTER PLAN

INDEX

Section No.	PM No.		PM Description
			Brief History and Overview
1			**General Overview**
	1.1		Master Planning Process Overview
	1.2		Public Works Maintenance and Optimization Plan
		1.2.1	Staffing
		1.2.2	Computerized Maintenance Management System (CMMS)
		1.2.3	Agreements/Contract Database Development Summary
	1.3		Population and Land Use Estimates
	1.4		Basis of Costs
	1.5		Security of Utilities Facilities
2			**Water System**
	2.1		Background Summary
	2.2		Flow Projections
	2.3		Infrastructure Modeling and Alternatives
	2.4		Condition Assessment
	2.5		Supply and Treatment Alternatives
	2.6		Arc Flash Assessment
	2.7		Cathodic Protection Assessment - Phases 1 and 2
	2.8		SCADA Assessment
3			**Wastewater System**
	3.1		Background Summary
	3.2		Flow and Load Projections
	3.3		Infrastructure Modeling and Alternatives
	3.4		Treatment Plant Performance and Capacity
	3.5		Condition Assessment
	3.6		Seismic Assessment
	3.7		Treatment Alternatives
		3.7.1	Traditional OWTP Assessment - Upgrade in Place
		3.7.2	Alternative OWTP Assessment - Relocate OWTP
	3.8		Arc Flash Assessment
	3.9		Cathodic Protection Assessment - Phase 1
	3.1		SCADA Assessment
	3.11		Flow Monitoring
	3.12		Biosolids Management

Section No.	PM No.	PM Description
4		**Recycled Water System**
	4.1	Background Summary
	4.2	Infrastructure Modeling and Alternatives
	4.3	AWPF/OWTP Outfall Regulatory Considerations
	4.4	Arc Flash Assessment
	4.5	Envision Documentation & Certification Summary Assessment
	4.6	Pathogen Analysis for Direct Potable Reuse (DPR) Summary
	4.7	Salt and Nutrient Management Plan (SNMP) Summary
5		**Stormwater System**
	5.1	Background Summary
	5.2	Infrastructure Modeling and Alternatives
	5.3	Condition Assessment
	5.4	Treatment Alternatives
6		**Streets**
		Integration of Streets with Planned Public Works Infrastructure and Summary of Current Street Planning Efforts

APPENDIX B – MASTER CIP TABLE

Table B1 Potable Water System Capital Improvements Program (CIP) Projects

Project ID 2017	Project ID 2015	Project Name	Project Description	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
		Production Total					**$47,590,000**	**$1,955,000**	**$13,705,000**	**$30,350,000**	**$1,580,000**	**$0**
W-1	W-P-35	Existing desalter upgrades	Membrane replacement, CIP automation, electric valve actuator replacements, discharge piping reconfiguration	R&R	2017	5	$5,000,000	$930,000	$4,070,000	$0	$0	$0
W-2	W-P-28 W-P-40	Desalter, piping and permeate tank cathodic protection	Investigate requirements for electrical isolation and CP of buried piping and RO finished water, and design and install capital project as warranted; Replacement of CP system at WTP and steel permeate tank	R&R	2020	2	$110,000	$0	$110,000	$0	$0	$0
W-3	W-P-62 W-P-65	Expand water treatment facility and storage (incl. booster pump station)	Expand disinfection system at Blending Station 1/6. Install new 1.5 MG storage reservoir for finished water. Install new booster pump station for new storage tank	Water Supply	2021	8	$6,600,000	$0	$500,000	$5,100,000	$1,000,000	$0
W-4	W-P-19	Blending Station #2 upgrade	R&R of mechanical, electrical, and AUX equipment	R&R	2028	1	$430,000	$0	$0	$0	$430,000	$0
W-5	W-P-20	Blending Stations #1 and #6 upgrade	R&R of wells, mechanical, electrical, and AUX equipment	R&R	2018	4	$3,400,000	$850,000	$2,550,000	$0	$0	$0
W-6	W-P-21	Water System CMMS	Water CMMS System (City Works)	R&R	2017	3	$300,000	$175,000	$125,000	$0	$0	$0
W-7	W-P-22	Water System SCADA Improvements	Perform water SCADA system improvements (design and implementation plan year 1)	R&R	2020	5	$5,000,000	$0	$2,000,000	$3,000,000	$0	$0
W-8		Security Improvements at Water Yard and Blending stations	Access Control, Cameras		2020	5	$500,000	$0	$250,000	$250,000	$0	$0
W-9		Chemical Tank Replacements	Replacement of chemical tanks (required every 10 years)	R&R	2025	3	$450,000	$0	$0	$300,000	$150,000	$0
W-10	W-P-32	Blending Station #3 Rehabilitation	R&R of wells, mechanical, electrical, and AUX equipment, VFD replacement	R&R	2019	2	$2,500,000	$0	$2,500,000	$0	$0	$0
W-11	W-P-33	Blending Station #4 Rehabilitation	Pumps, mechanical, electrical, and AUX equipment, VFD	R&R	2019	2	$400,000	$0	$400,000	$0	$0	$0
W-12	W-P-34	Blending Station #5 Rehabilitation	Mechanical, electrical, and AUX equipment	R&R	2019	2	$200,000	$0	$200,000	$0	$0	$0
W-13	W-P-61	Construct 3 new potable wells at BS 1/6	Add potable water wells, land management	Water Supply	2020	7	$11,000,000	$0	$1,000,000	$10,000,000	$0	$0
W-14	W-P-66	Construct 2 new potable wells (BS 1/6) and 1 new stainless steel well at BS 3	Add potable water wells	Water Supply	2023	4	$11,700,000	$0	$0	$11,700,000	$0	$0
		Transmission Total					**$2,405,000**	**$405,000**	**$1,620,000**	**$380,000**	**$0**	**$0**
W-15	W-P-23 W-P-36 W-P-37	Del Norte Transmission Main Cathodic Protection (CP)	Install 20 missing test stations; Replace rectifiers and anodes and resurvey; Locate and repair discontinuity near the east end of the Del Norte PI	R&R	2019	2	$450,000	$0	$450,000	$0	$0	$0

Project ID 2017	Project ID 2015	Project Name	Project Description	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
W-16	W-P-26	Gonzalez 36-inch Pipeline CP	Replace the seized test traffic box lids; test the CP system	R&R	2018	1	$5,000	$5,000	$0	$0	$0	$0
W-17	W-P-27 W-P-10 W-P-5 W-P-6	Oxnard Conduit CP	Excavate & install new test stations at BFV near Del Norte connection, 9+10, 39+10, 57+45, 69+50, 111+50, 165+20; Install new test stations in ex manhole at 284+80; Corrosion engineer to conduct Close Interval Survey (CIS); Replace deep anode beds at Rectifiers #1 , #2, & #3; Locate, excavate, and bond across approximately three (3) points of electrical isolation	R&R	2017	4	$890,000	$400,000	$490,000	$0	$0	$0
W-18	W-P-38 W-P-39	Wooley Road / United CP	Replace 5 test stations and add 2 new stations; Replace rectifier and anode; resurvey	R&R	2020	1	$160,000	$0	$160,000	$0	$0	$0
W-19	W-P-7 W-P-24	3rd Street Lateral CP	Replace rectifer and anode bed; resurvey; Replace all test stations at an interval of 1,000-ft minimum and 2,000-ft maximum; Locate & repair discontinuity between 27+88 and South Hayes WTP; Provide electrical isolation at the main treatment plant	R&R	2020	3	$360,000	$0	$310,000	$50,000	$0	$0
W-20	W-P-25 W-P-8	Industrial Lateral CP	Replace all test stations; resurvey	R&R	2020	3	$130,000	$0	$100,000	$30,000	$0	$0
W-21	W-P-11	3rd St 27" UWCD CP	Bond UWCD pipeline to Oxnard Extension at rectifier	R&R	2020	2	$110,000	$0	$110,000	$0	$0	$0
W-22		Condition assessment program	Physical condition assessment of mains program	R&R	2022	5	$300,000	$0	$0	$300,000	$0	$0
			Distribution Total				**$58,965,000**	**$815,000**	**$24,551,000**	**$23,574,000**	**$10,025,000**	**$0**
W-23	W-P-9	Replacement of AMR Devices	Design and construct a new Advance Metering Infrastructure (AMI) system (Cost is possibly reduced by 1/2 if shared with wastewater division)	R&R	2017	7	$22,000,000	$200,000	$13,000,000	$8,800,000	$0	$0

Project ID 2017	Project ID 2015	Project Name	Project Description	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
W-24		Pipe Capacity Improvements	Pipe capacity improvements for 8-inch to 24-inch pipe	Water Supply	2019	9	$13,040,000	$0	$5,620,000	$6,870,000	$550,000	$0
	W-P-51 W-P-52 W-P-53 W-P-54 W-P-56 W-P-57 W-P-58 W-P-59 W-P-67 W-P-68 W-P-69 W-P-70 W-P-71 W-P-72		Upgrade 322 feet to 8" pipe Upgrade 238 feet to 12" pipe Upgrade 164 feet to 14" pipe Upgrade 3,804 feet to 30" pipe Upgrade 69 feet to 6" pipe Upgrade 391 feet to 8" pipe Upgrade 1,011 feet to 10" pipe Upgrade 2,447 feet to 12" pipe Upgrade 32 feet to 6" pipe Upgrade 233 feet to 8" pipe Upgrade 1,243 feet to 10" pipe Upgrade 997 feet to 12" pipe Upgrade 2,453 feet to 14" pipe Upgrade 937 feet to 24" pipe									
W-25	W-P-12 W-P-13 W-P-14 W-P-15	Neighborhood CIP Pipe Replacement*	Replace existing distribution pipes in La Colonia Neighborhood, Redwood Neighborhood, Fremont North Neighborhood, and Bryce Canyon South Neighborhood	R&R	2018	6	$10,500,000	$615,000	$5,931,000	$3,954,000	$0	$0
W-29		Large Valve Replacement Program	Replace valve 10-inch and larger	R&R	2022	10	$1,926,000	$0	$0	$926,000	$1,000,000	$0
W-30		Small Valve Replacement Program	Replace valves 8-inch and smaller	R&R	2022	10	$3,780,000	$0	$0	$1,780,000	$2,000,000	$0
W-31		Air / Vac Valve Replacement Program	Replace air and vacuum valves and covers	R&R	2022	10	$1,422,000	$0	$0	$672,000	$750,000	$0
W-32		Hydrant Replacement Program	Replace dry barrel hydrants to wet barrel	R&R	2022	10	$1,197,000	$0	$0	$572,000	$625,000	$0
W-33	W-P-74 W-P-75 W-P-76 W-P-77	North Zone Modifications	Install 1000 feet of 24-inch pipeline from BS#3 to the North Pressure Zone, Rehab 3 Pressure Reducing Stations (PRS), modify minor piping	Pressure Zone Separation	2027	4	$1,100,000	$0	$0	$0	$1,100,000	$0
W-34	W-P-78 W-P-79 W-P-80 W-P-81	Coast Zone Modifications	Install 3000 feet of 8-inch pipeline, construct 3 new Pressure Reducing Stations (PRS), modify minor piping	Pressure Zone Separation	2027	4	$1,600,000	$0	$0	$0	$1,600,000	$0
W-35	W-P-82 W-P-83 W-P-84 W-P-85	South Zone Modifications	Install 6000 feet of 8-inch pipeline, construct 3 new Pressure Reducing Stations (PRS), modify minor piping	Pressure Zone Separation	2027	3	$2,400,000	$0	$0	$0	$2,400,000	$0
				2017 Potable Water System CIP Subtotal			**$108,960,000**	**$3,175,000**	**$3,9876,000**	**$5,4304,000**	**$11,605,000**	**$0**

Project ID 2017	Project ID 2015	Project Name	Project Description	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
Additional 2015 Projects												
	W-P-1	Electrical Rehabilitation - Well Nos. 30, 32, 33 & 34		Operations Optimization	2026	1.5	$1,000,000	$0	$0	$666,667	$333,333	$0
	W-P-2	Sodium Hypochlorite Piping Replacement		Operations Optimization	2022	1.5	$30,000	$0	$0	$30,000	$0	$0
	W-P-4	Generator and ATS Service		Operations Optimization	2019	1.5	$20,000	$0	$20,000	$0	$0	$0
	W-P-16	Fire Flow Improvements - Install/Replace 18,500 feet of 8" pipe		R&R	2020	2	$4,600,000	$0	$4,600,000	$0	$0	$0
	W-P-17	Fire Flow Improvements - Install/Replace 13,500 feet of 12" pipe		R&R	2020	2	$4,400,000	$0	$4,400,000	$0	$0	$0
	W-P-18	Fire Flow Improvements - Install 250 feet of 14" pipe		R&R	2020	1	$100,000	$0	$100,000	$0	$0	$0
	W-P-64	Blend Station Tie-In (@ Blending Station 1/6)		Water Supply	2022	1	$250,000	$0	$0	$250,000	$0	$0
	W-P-60	Construct new concentrate line from Oxnard Wastewater Treatment Plant (OWTP) to Blending Station 1/6		Water Supply	2020	3	$18,800,000	$0	$12,533,333	$6,266,667	$0	$0
	W-P-28	Blending Station 1/6 - Install electrical isolation at all steel and cast iron water risers		R&R	2022	2	$30,000	$0	$0	$30,000	$0	$0
	W-P-30	Well 23 & 31 Rehabilitation		R&R	2022	1.5	$210,000	$0	$0	$210,000	$0	$0
	W-P-31	Wells Electrical & Variable Frequency Drive (VFD) Replacement		R&R	2022	1.5	$770,000	$0	$0	$770,000	$0	$0
	W-P-41	Age Replacement- 109,100 feet of 6" pipe		R&R	2033	2	$25,500,000	$0	$0	$0	$0	$25,500,000
	W-P-42	Age Replacement - 47,000 feet of 8" pipe		R&R	2034	2	$11,700,000	$0	$0	$0	$0	$11,700,000
	W-P-43	Age Replacement - 55,000 feet of 10" pipe		R&R	2035	2	$17,100,000	$0	$0	$0	$0	$17,100,000
	W-P-44	Age Replacement - 24,000 feet of 12" pipe		R&R	2036	2	$7,900,000	$0	$0	$0	$0	$7,900,000
	W-P-45	Age Replacement - 2,300 feet of 14" pipe		R&R	2037	1	$900,000	$0	$0	$0	$0	$900,000
	W-P-46	Age Replacement - 4,000 feet of 16" pipe		R&R	2037	1	$1,700,000	$0	$0	$0	$0	$1,700,000
	W-P-47	Age Replacement - 3,700 feet of 24" pipe		R&R	2037	2	$2,300,000	$0	$0	$0	$0	$2,300,000

Project ID 2017	Project ID 2015	Project Name	Project Description	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
	W-P-48	Age Replacement - 5,000 feet of 36" pipe		R&R	2038	2	$3,900,000	$0	$0	$0	$0	$3,900,000
	W-P-49**	Age Replacement - 5,300 feet of 42" pipe		R&R	2038	2	$5,500,000	$0	$0	$0	$0	$5,500,000
	W-P-50**	Age Replacement - 3,800 feet of 48" pipe		R&R	2038	2	$4,100,000	$0	$0	$0	$0	$4,100,000
	W-P-55	Connection to OH / United pipeline		Water Supply	2020	1.5	$310,000	$0	$310,000	$0	$0	$0
	W-P-73	Expand desalter at Blending Station 1/6 to 15 mgd (3.75 mgd expansion)		Water Supply	2028	3	$7,300,000	$0	$0	$0	$7,300,000	$0
				Unmatched 2015 Water Projects Subtotal			**$118,420,000**	**$0**	**$21,963,333**	**$8,223,333**	**$7,633,333**	**$80,600,000**
						Overall Total	**$227,380,000**	**$3,175,000**	**$61,839,333**	**$62,527,333**	**$19,238,333**	**$80,600,000**

Notes:

1. Projects W-25 through @-28 combined into single project ID'ed as W-25.
2. Project start years correspond to refinements and updates provided by City after December 2015 publication date.

Table B2 Wastewater Collection System and Treatment System Capital Improvements Program (CIP) Projects

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
Wastewater Collection System Projects													
C-1	WW-P-6		Central Trunk Manhole Rehabilitation Phase 1	Rehabilitate 47 existing manholes	R&R	2018	1	**$1,410,000**	$1,410,000	$0	$0	$0	$0
C-2	WW-P-13		Central Trunk Manhole Rehabilitation Phase 2[2]	Rehabilitate 27 existing manholes	R&R	2020	1	**$810,000**	$0	$810,000	$0	$0	$0
C-3	WW-P-8		Harbor Blvd Manhole Rehabilitation	Rehabilitate 12 existing manholes	R&R	2019	1	**$100,000**	$0	$100,000	$0	$0	$0
C-4			Pleasant Valley Manhole Rehabilitation	Rehabilitate 14 existing manholes	R&R	2019	1	**$200,000**	$0	$200,000	$0	$0	$0
C-5	WW-P-9		Redwood Tributary Manhole Rehabilitation	Rehabilitate 38 existing manholes	R&R	2019	1	**$300,000**	$0	$300,000	$0	$0	$0
C-6			Annual Existing Manhole Rehabilitation	Various locations throughout the City based on sewer inspection	R&R	2022	5	**$1,000,000**	$0	$0	$1,000,000	$0	$0
C-7	WW-P-16		Rice Avenue Sewer Improvement	Install new 24-inch sewer from Latigo to Camino Del Sol to replace existing 18-inch sewer line.	R&R	2020	2	**$1,300,000**	$0	$1,300,000	$0	$0	$0
C-8	WW-P-1		Existing Sewer Deficient Capacity Replacement	Ventura Road from Doris Avenue to Oxnard Airport	Capacity	2020	2	**$1,755,197**	$0	$1,755,197	$0	$0	$0
C-9	WW-P-2		Existing Sewer Deficient Capacity Replacement	Third Street & Navarro Street	Capacity	2021	1	**$364,869**	$0	$364,869	$0	$0	$0
C-10	WW-P-7		Existing asbestos concrete pipe (ACP) Replacement	Various locations throughout the City	R&R	2019	8	**$4,000,000**	$0	$1,500,000	$2,500,000	$0	$0
C-11			Annual Existing Pipe Repair	Various locations throughout the City based on sewer inspection	R&R	2019	8	**$1,600,000**	$0	$600,000	$1,000,000	$0	$0
C-12			Collection System Chemical Addition	Construct 3 new magnesium hydroxide addition facilities to reduce nuisance odors and protect sewer infrastructure	Performance	2019	2	**$4,400,000**	$0	$4,400,000	$0	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
C-13	WW-P-10 WW-P-18		Devco Development Lift Station	Construct new lift station at Devco development & abandon existing lift station #23. The new lift station will accommodate sewer flows from existing lift station #23, Devco, Village (Wagon Wheel) developments. The lift station cost is $1,500,000 & the City cost is $500,000.	R&R, Performance	2019	1	**$500,000**	$0	$500,000	$0	$0	$0
C-14	WW-P-12		Existing Lift Station #4 (Mandalay & Wooley) Rehabilitation	Install new supervisory control and data acquisition (SCADA) & motor control center (MCC) panels. Install new valve vault door. Rehabilitate wet well coating.	R&R	2019	1	**$500,000**	$0	$500,000	$0	$0	$0
C-15	WW-P-11		Existing Lift Station #6 (Canal) Rehabilitation	Install new pumps. Replace MCC panel. Install new emergency standby generator.	R&R	2019	1	**$500,000**	$0	$500,000	$0	$0	$0
C-16			Existing Lift Station #20 (Beardsley) Rehabilitation	Install new MCC panel and concrete pad.	R&R	2019	1	**$300,000**	$0	$300,000	$0	$0	$0
C-17	WW-P-5		Meter Vault/Vortex Structure Coating Rehabilitation[2]	Rehabilitate coating in meter vault/vortex structure	R&R	2018	1	**$280,000**	$280,000	$0	$0	$0	$0
Additional Wastewater Collection System Projects from 2015 Capital Improvements Program													
	WW-P-3		Project 3: S Victoria Ave and W Hemlock St - Sewers in the Channel Islands Neighborhood		Capacity	2027*	2	**$1,112,267**	$0	$0	$0	$1,112,267	$0
	WW-P-14		Phase 1 Central Trunk replacement		R&R	2033**	2	**$36,500,000**	$0	$0	$0	$0	$36,500,000
	WW-P-15		Phase 2 Central Trunk Replacement		R&R	2036**	2	**$30,000,000**	$0	$0	$0	$0	$30,000,000
							Wastewater Collection System Total	**$86,932,333**	**$1,690,000**	**$13,130,066**	**$4,500,000**	**$1,112,267**	**$66,500,000**

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
Wastewater Treatment System Projects													
--			Accelerated design for renewal improvements (year 6-10)			2018	6	**$15,130,000**	$1,500,000	$86,360,000	$5,000,000		
			Preliminary Treatment/Headworks										
T-1	WW-P-83		Headworks Odor Control System[2]	Install new odor control dampers and fan. Repair existing foul air ductwork.	Small Equipment Replacement	2018	1	**$220,000**	$220,000	$0	$0	$0	$0
T-2	WW-P-67		Headworks Fiberglass Covers Replacement & Concrete Coating Repair[2]	Install new grit chamber & wet well fiberglass covers. Rehabilitate grit chamber & wet well concrete coating. Year 1 to 2: high foot traffic areas. Year 3 to 5: remaining areas.	R&R	2018	2	**$499,100**	$90,000	$409,100	$0	$0	$0
T-3	WW-P-66		Headworks Rehabilitation[2]	Install new odor control system. Enclose bar screen & conveyor areas to minimize odor complaints. Install screen wall along north and west property areas. In 2011, City settled $4.6M lawsuit related to Headworks construction and nuisance odor complaints.	R&R	2020	2	**$7,250,000**	$0	$7,250,000	$0	$0	$0
T-4	WW-P-41		Non-hazardous Waste Receiving Station	New non-hazardous waste receiving station with metering and screening systems	Performance	2026	1	**$2,100,000**	$0	$0	$ 2,100,000	$0	$0
			Primary Treatment										
T-5			Primary Clarifier Rehabilitation	Install new effluent launders. New primary clarifier #4 walkway. Install polymer addition system to improvement primary treatment efficiency.	R&R	2017	1	**$655,000**	$655,000	$0	$0	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
T-6			Primary Clarifier Abandonment	Abandon existing primary clarifiers. Repurpose a portion existing secondary sedimentation tanks as primary clarifiers. Convert remaining secondary sedimentation tanks to membrane bioreactors (MBR).	R&R	N/A	0	**$0**	$0	$0	$0	$0	$0
T-7	WW-P-23		Primary Clarifiers, Old Headworks Structure and Primary Building Demolition[2]	Remove equipment, concrete, piping and electrical systems in old headworks and primary tanks area. Reroute piping and electrical systems	R&R	2025	1	**$7,300,000**	$0	$0	$7,300,000	$0	$0
			Secondary Treatment										
T-8			Biotowers Rehabilitation	Install wire wrap or mesh around biotowers to prevent block wall from falling.	R&R	2017	1	**$630,000**	$630,000	$0	$0	$0	$0
T-9	WW-P-20		Biotower Demolition[2]	Remove superstructure, remove concrete below ground, reroute piping and electrical; restore grade	R&R	2023	1	**$2,850,000**	$0	$0	$2,850,000	$0	$0
T-10	WW-P-69		Activated Sludge Tank (AST) Rehabilitation[2]	Install new air flow meters, air control valves, and dissolved oxygen meters.	R&R	2017	1	**$150,000**	$150,000	$0	$0	$0	$0
T-11	WW-P-72 WW-P-74 WW-P-76		Activated Sludge Tank (AST) Upgrades	Replace diffusers and add return sludge piping, aeration piping, gates and controls	R&R, Performance	2023	1	**$4,600,000**	$0	$0	$4,600,000	$0	$0
T-12	WW-P-72		Modify Activated Sludge Tank (AST) for MBR or other technology operation	Partition Tanks, add internal recycle system	Performance	2023	2	**$7,200,000**	$0	$0	$7,200,000	$0	$0
T-13	WW-P-68 WW-P-72		Convert Activated Sludge Tanks conversion to Flow Equalization Tank	Convert existing AST 4 to 8. Remove diffusers and add flow equalization pumps. Concrete repair and	R&R, Performance	2024	1	**$5,525,000**	$0	$0	$5,525,000	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
				seismic retrofit - EQ Tank									
T-14	WW-P-70 WW-P-73		Convert Secondary Clarifiers to Primary Clarifiers	Convert existing secondary clarifiers 6 to 12. Install clarifier mechanisms, replace primary sludge pumps, isolation gates and scum systems. Replace collectors, skimmers, and drives. Concrete repair and re-painting - SSTs.	R&R	2025	1	**$8,300,000**	$0	$0	$8,300,000	$0	$0
T-15			Remove existing Secondary Clarifiers and prepare for new Membrane Bioreactor (MBR) or other Technology	Demolish existing secondary clarifiers 13 to 18. Remove equipment, re-route piping and electrical, reinforce walls of aeration basin, modify inlet and outlet channels	R&R	2023	2	**$7,150,000**	$0	$0	$7,150,000	$0	$0
T-16	WW-P-75 WW-P-97		New MBR or other technology Tanks	Construct new tanks, channels, membranes and piping, pump gallery, pumps, cranes, roof and ventilation systems, aeration blowers	R&R, Resource Sustainability	2023	2	**$57,200,000**	$0	$0	$57,200,000	$0	$0
T-17	WW-P-97		MBR or other Technology Building	New Chemical systems, electrical room, SCADA system, effluent pumps	Resource Sustainability	2023	2	**$12,350,000**	$0	$0	$12,350,000	$0	$0
T-18			Convert Existing Secondary Clarifier to Screening & Transfer Pump Station	Install screen channels for primary effluent, convert to flow equalization basin, add transfer pumping and pipes	R&R	2024	1	**$7,150,000**	$0	$0	$7,150,000	$0	$0
T-19	WW-P-96 WW-P-80 WW-P-81		Disinfection and Effluent Pumping	New Disinfection system, effluent wet well and pumps	Small Equipment Replacement, R&R	2024	1	**$7,215,000**	$0	$0	$7,215,000	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
T-20			Relocate Existing Primary Influent Piping	Connect to main header and re-route to influent channel of clarifiers. Provide controls and valves	R&R	2024	1	**$3,510,000**	$0	$0	$3,510,000	$0	$0
			Solids Treatment										
T-21	WW-P-44 WW-P-45 WW-P-51		Sludge Thickening Facility[2]	Demolish Dissolved Air Flotation Tank (DAFT) structures, gravity thickener tanks and chemical storage. New building with Rotating Drum Screens for primary sludge and Gravity Belt thickeners for waste secondary sludge	R&R, Performance	2026	1	**$24,700,000**	$0	$0	$24,700,000	$0	$0
T-22	WW-P-43		Digester 2 Cover Replacement and Clean Digesters 1 & 3[2]	Install digester 2 cover and clean digester 1 and 3.	R&R	2019	3	**$3,700,000**	$0	$3,700,000	$0	$0	$0
T-23	WW-P-87 WW-P-89		Digesters 1 and 3 Rehabilitation[2]	Replacement of mixing systems, roof and concrete walls repair; heat exchanger upgrades	R&R	2025	2	**$8,500,000**	$0	$0	$8,500,000	$0	$0
T-24	WW-P-40		Replace Belt Filter Presses & Conveyor	Year 1 to 2: Replace two existing belt filter presses. Year 3 to 5: Replace two existing belt filter presses and conveyor.	R&R	2017	4	**$2,610,000**	$1,180,000	$1,430,000	$0	$0	$0
T-25	WW-P-94		FOG Receiving Station[2]	Fats Oils Grease receiving station with tank heaters and pumps, for transfer to digesters	Resource Sustainability	2026	1	**$845,000**	$0	$0	$845,000	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
			Pump Station										
T-26	WW-P-22		Interstage Pump Station Rehabilitation[2]	Install new pumps, motors, variable frequency drives. Rehabilitate wet well concrete coating. Upgrade control facility to meet building seismic code.	R&R	2020	2	**$2,087,199**	$0	$2,087,199	$0	$0	$0
T-27			Effluent Pump Station Rehabilitation	Install new isolation valve, pumps, motors, variable frequency drives. Rehabilitate wet well concrete coating. Install bypass piping. Upgrade control facility to meet building seismic code.	R&R	2019	3	**$8,900,000**	$0	$8,900,000	$0	$0	$0
			Electrical/Instrumentation										
T-28			Electrical Building ARC Flash Protection	Install temporary 25kV circuit breakers on each side of 16kV and 480 volt transformers.	Performance	2017	2	**$575,000**	$575,000	$0	$0	$0	$0
T-29	WW-P-93		Cogenerators Rehabilitation[2]	Year 1 to 2: Rebuild two existing cogenerators. Year 3 to 5: Rebuild one existing cogenerator.	R&R	2017	3	**$1,215,000**	$810,000	$405,000	$0	$0	$0
T-30	WW-P-32		Electrical/Instrumentation Manhole Rehabilitation	Rehabilitate seven existing electrical and instrumentation manholes.	R&R	2017	1	**$175,000**	$175,000	$0	$0	$0	$0
T-31	WW-P-33		Emergency Standby Generator Replacement[2]	Install new emergency standby generator	R&R	2020	2	**$5,000,000**	$0	$5,000,000	$0	$0	$0
T-32	WW-P-34		Plant Motor Control Center (MCC) Panel Replacement[2]	Install new MCC panels	R&R	2020	2	**$2,087,199**	$0	$2,087,199	$0	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
T-33	WW-P-30 WW-P-31		New Main Electrical Building[2]	New Building; new transformers; reroute electrical duct banks and run new cabling; new Automatic transfer switches; demolish old electrical building and equipment, and restore grade.	R&R	2020	2	**$6,000,000**	$0	$6,000,000	$0	$0	$0
T-34	WW-P-59		New North Electrical Building	New Building; new Motor Control Centers	R&R	2024	2	**$4,400,000**	$0	$0	$4,400,000	$0	$0
T-35			Site Electrical Improvements	Install cables, duct banks, and wiring	R&R	2024	3	**$10,920,000**	$0	$0	$10,920,000	$0	$0
T-36	WW-P-39		Computerized Maintenance Management System (CMMS)	Install new CMMS system for plant maintenance record keeping, including work scheduling, equipment records keeping, labor hours, and costs.	R&R	2017	1	**$300,000**	$300,000	$0	$0	$0	$0
T-37	WW-P-35		Supervisory Control and Data Acquisition and (SCADA) System	Temporary convert existing fiber network to Ethernet to prevent SCADA drop-out.	R&R	2017	1	**$225,000**	$225,000	$0	$0	$0	$0
T-38	WW-P-35		New SCADA System	Install new SCADA system	R&R	2020	2	**$4,946,500**	$0	$4,946,500	$0	$0	$0
T-39	WW-P-35		New Supervisory Control and Data Acquisition (SCADA) system	Replace plant-wide SCADA systems and PLCs with current technology. Reprogram all processes for new Plant Control System	R&R	2024	2	**$9,620,000**	$0	$0	$9,620,000	$0	$0
				Site Work									
T-40	WW-P-42		Site Piping Replacements	Install new process water piping, buried valves, fire line.	R&R	2020	5	**$23,970,000**	$0	$1,350,000	$22,620,000	$0	$0
T-41			Site Security	Install site cameras, security fencing, building locks	R&R	2019	2	**$1,000,000**	$0	$1,000,000	$0	$0	$0
T-42			Storm water Site Improvements		R&R	2019	3	**$2,100,000**	$0	$2,100,000	$0	$0	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
			Building										
T-43			Laboratory HVAC Unit	Install new 20-ton HVAC unit.		2017	1	**$205,000**	$205,000	$0	$0	$0	$0
T-44	WW-P-57		New Chemical Storage Building[2]	Demolish old structures, Centralized chemical storage, new storage tanks, pumps and piping to various processes	R&R	2026	1	**$2,730,000**	$0	$0	$2,730,000	$0	$0
T-45	WW-P-56		Collection System Maintenance Building Rehabilitation[2]	Rehabilitate existing building to meet building code requirements.	R&R	2026	1	**$500,000**	$0	$0	$500,000	$0	$0
T-46	WW-P-49		Administration Building and Laboratory Rehabilitation[2]	Rehabilitate existing building to meet building code requirements.	R&R	2025	1	**$850,000**	$0	$0	$850,000	$0	$0
T-47			Plant Control Center Building Rehabilitation	Rehabilitate existing building to meet building code requirements.	R&R	2025	1	**$850,000**	$0	$0	$850,000	$0	$0
T-48	WW-P-58		Maintenance Building Rehabilitation	Rehabilitate existing building to meet building code requirements.	R&R	2026	1	**$500,000**	$0	$0	$500,000	$0	$0
T-49	WW-P-27 WW-P-28		Storage Warehouse Building	New storage warehouse building	R&R	2026	1	**$1,500,000**	$0	$0	$1,500,000	$0	$0
Additional Wastewater Projects from 2015 Capital Improvements Program													
	WW-P-84	Preliminary Treatment	Small Equipment Replacement - Headworks 2		Small Equipment Replacement	2023*	3	**$6,306,000**	$0	$0	$6,306,000	$0	$0
	WW-P-21	Secondary Treatment	Add Baffle Walls in ASTs		R&R	2027*	1	**$380,000**	$0	$0	$0	$380,000	$0
	WW-P-95	Secondary Treatment	Coating Replacement on Chlorine Contact Tanks		R&R	2028*	2	**$1,359,000**	$0	$0	$0	$1,359,000	$0
	WW-P-79	Secondary Treatment	Small Equipment Replacement - wet weather storage 2		Small Equipment Replacement	2026*	3	**$527,000**	$0	$0	$175,667	$351,333	$0
	WW-P-98	Secondary Treatment	Add UV/AOP after MBR		Resource Sustainability	2026*	2	**$13,200,000**	$0	$0	$6,600,000	$6,600,000	$0
	WW-P-46	Solids Treatment	Demolish Operations Center and Vac Filter Building		R&R	2027*	1	**$448,000**	$0	$0	$0	$448,000	$0

Project ID 2017	Project ID 2015	Unit Operation	Project Name	Project Description	Driver	Start Year	Years to Implement	Total Un-escalated Project Cost	Years 1 to 2 (FY2017/18-2018/19)	Years 3 to 5 (FY2019/20-2021/22)-	Years 6 to 10 (FY2022/23-2026/27)	Years 11 to 16 (FY2027/28-2032/33	Years 17 to 23 (FY20363/34-2039/40)
	WW-P-88	Solids Treatment	New Digester 2		R&R	2030*	3	**$12,950,000**	$0	$0	$0	$12,950,000	$0
	WW-P-90	Solids Treatment	New Digester Control Building		R&R	2029*	5	**$1,543,000**	$0	$0	$0	$1,234,400	$308,600
	WW-P-47	Solids Treatment	Move Dewatering Facility and add New Centrifuges		Performance	2030*	3	**$23,370,000**	$0	$0	$0	$23,370,000	$0
	WW-P-48	Solids Treatment	Add Dewatering Capacity		Performance	2030*	3	**$2,160,000**	$0	$0	$0	$2,160,000	$0
	WW-P-50	Solids Treatment	Add Sludge Silos		Performance	2032*	3	**$6,370,000**	$0	$0	$0	$2,123,333	$4,246,667
	WW-P-91	Electrical / Instrumentation	New Cogen Building		R&R	2032*	3	**$4,630,000**	$0	$0	$0	$1,543,333	$3,086,667
	WW-P-36	Electrical / Instrumentation	Small Equipment Replacement - Electrical 1		Small Equipment Replacement	2028*	2	**$275,000**	$0	$0	$0	$275,000	$0
	WW-P-37	Electrical / Instrumentation	Small Equipment Replacement - Electrical 2		Small Equipment Replacement	2032*	2	**$626,000**	$0	$0	$0	$313,000	$313,000
	WW-P-38	Electrical / Instrumentation	Small Equipment Replacement - Electrical 3		Small Equipment Replacement	2036*	2	**$653,000**	$0	$0	$0	$0	$653,000
	WW-P-92	Electrical / Instrumentation	Small Equipment Replacement - Cogen		Small Equipment Replacement	2026*	3	**$2,233,000**	$0	$0	$744,333	$1,488,667	$0
	WW-P-60	Building	Rehab Grit Screening Building - Seismic Retrofit		R&R	2027*	2	**$1,866,000**	$0	$0	$0	$1,866,000	$0
	WW-P-65	Building	Plant Paving Resurfacing		R&R	2030*	3	**$410,000**	$0	$0	$0	$410,000	$0
	WW-P-99	Building	Solar or Alternative Energy Facility		Resource Sustainability	2027*	10	**$1,540,000**	$0	$0	$0	$924,000	$616,000
	WW-P-100		Seawall		Resource Sustainability	2033	5	**$37,260,000**		$0	$0	$0	$37,260,000
							Wastewater Treatment Total	**$406,100,998**	**$6,715,000**	**$55,294,998**	**$239,811,000**	**$57,796,067**	**$46,483,933**
							Wastewater Treatment System and Collection System Total	**$493,033,331**	**$8,405,000**	**$68,425,064**	**$244,311,000**	**$58,908,334**	**$112,983,933**

Notes:
1. 2017 Project ID's were arbitrarily assigned for Project ease. C = Collection System Project; T = Treatment System Project.
2. Projects and costs correspond to refinements and updates provided by City after December 2015 publication date. Costs may not correspond to project costs in PM 1.4 Basis of Cost.
3. Projects approved by Council in 2017 Cost of Service Rate studies.
4. Costs were equally split between years to implement.

*Projects start year correspond to refinements and updates provided by City after December 2015 publication date.
**Projects start year was adjusted by City at August 7, 2017 meeting, based on recent CCT inspection.

Table B3 Recycled Water Capital Improvements Program (CIP) Projects

Project ID	Project Name	Driver	Start Year[1]	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)[2]	Years 3 to 5 (FY2019/20-2021/22)[2]	Years 6 to 10 (FY2022/23-2026/27)[2]	Years 11 to 16 (FY2027/28-2032/33[2]	Years 17 to 23 (FY20363/34-2039/40)[2]
RW-P-1	Recycled Water Retrofits	R&R	2019	6	$4,000,000	$0	$2,000,000	$2,000,000	$0	$0
RW-P-2	Phase 1 Advanced Water Purification Facility (AWPF) Improvements (Disinfection conversion, security, A/V upgrade)	R&R	2020	2	$1.000,000	$0	$1,000,000	$0	$0	$0
RW-P-3	UV/Advanced Oxidation Process Brine Treatment	Water Supply	2023	3	$5,700,000	$0	$0	$5,700,000	$0	$0
RW-P-4	Construct Aquifer Storage and Recovery (ASR) Demonstration Well @ Campus Park Site (and associated monitoring wells)	Water Supply	2018	3	$4,400,000	$1,466,667	$2,933,333	$0	$0	$0
RW-P-5	Land Acquisition and Improvements - Near Blending Station 1/6 & 3	Water Supply	2020	2	$10,000,000	$0	$10,000,000	$0	$0	$0
RW-P-6	Recycled Water Pond for Off-Spec Water at Campus Park	Water Supply	2021	1.5	$1,600,000	$0	$1,066,667	$533,333	$0	$0
RW-P-7	Phase 2 - Expansion of AWPF to 12.5 mgd (including backup power)	Water Supply	2020	3	$27,500,000	$0	$18,333,333	$9,166,667	$0	$0
RW-P-8	Recycled Water Storage @ AWPF	Water Supply	2019	4	$8,000,000	$0	$6,000,000	$2,000,000	$0	$0
RW-P-9	Construct 1 duty + 1 standby ASR Wells @ Campus Park	Water Supply	2021	3	$7,800,000	$0	$2,600,000	$5,200,000	$0	$0
RW-P-10	Construct 1 duty + 1 standby ASR Wells @ Campus Park	Water Supply	2025	3	$7,800,000	$0	$0	$5,200,000	$2,600,000	$0
RW-P-11	Construct 1 duty + 1 standby ASR Wells @ Blending Station 1/6	Water Supply	2022	2	$7,800,000	$0	$0	$7,800,000	$0	$0
RW-P-12	Chemical Feed Expansion @ Blending Station 1/6	Water Supply	2022	2	$ 300,000	$0	$0	$300,000	$0	$0
RW-P-13	Operational Storage for ASR Wells @ Blending Station 1/6	Water Supply	2022	2	$2,100,000	$0	$0	$2,100,000	$0	$0
RW-P-14	Booster Pumping for ASR @ Blending Station 1/6	Water Supply	2022	2	$7,200,000	$0	$0	$7,200,000	$0	$0
RW-P-15	Construct 1 duty + 1 standby ASR Wells @ Blending Station 1/6	Water Supply	2024	1.5	$7,800,000	$0	$0	$7,800,000	$0	$0
RW-P-16	Rehabilitate Well 18 @ River Ridge Golf Course to Groundwater Recharge Well	Water Supply	2022	2	$2,500,000	$0	$0	$2,500,000	$0	$0
RW-P-17	Phase 3 - Expand AWPF to 18.75 mgd	Water Supply	2029	2.5	$28,100,000	$0	$0	$0	$28,100,000	$0
RW-P-18	Construct 2 duty + 1 standby ASR Wells @ Blending Station 1/6	Water Supply	2029	2	$11,500,000	$0	$0	$0	$11,500,000	$0
RW-P-19	Construct 2 duty + 1 standby ASR Wells @ Blending Station 3	Water Supply	2029	2.5	$11,500,000	$0	$0	$0	$11,500,000	$0
RW-P-20	Chemical Feed Expansion @ Blending Station 3	Water Supply	2029	2.5	$ 500,000	$0	$0	$0	$500,000	$0
RW-P-21	Operational Storage for ASR Wells @ Blending Station 3	Water Supply	2029	2.5	$2,100,000	$0	$0	$0	$2,100,000	$0
RW-P-22	Booster Pumping for ASR @ Blending Station 3	Water Supply	2029	2.5	$7,200,000	$0	$0	$0	$7,200,000	$0
RW-P-23	Construct 2 duty + 1 standby ASR Wells @ Blending Station 3	Water Supply	2031	1.5	$11,500,000	$0	$0	$0	$11,500,000	$0
RW-P-24	Connect Initial ASR Well at Campus Park to Recycled Water Backbone Line in Ventura Road - 2,000 feet of 20" pipe	Water Supply	2017	2	$700,000	$700,000	$0	$0	$0	$0
RW-P-25	Construct Dedicated Indirect Potable Reuse (IPR) Pipeline from Campus Park to Blending Station 1/6 - 4,000 feet of 24" pipe	Water Supply	2017	2	$2,500,000	$2,500,000	$0	$0	$0	$0
	Hueneme Road - Phase 2 Recycled Water Pipeline Expansion to Ag Users					$0	$0	$0	$0	$0
RW-P-26	Install 20,700 feet of 24" pipe	Water Supply	2019	2	$12,900,000	$0	$12,900,000	$0	$0	$0
RW-P-27	Install 16,000 feet of 36" pipe	Water Supply	2018	2	$13,000,000	$6,500,000	$6,500,000	$0	$0	$0
	Recycled Water Loop to ASR Sites					$0	$0	$0	$0	$0
RW-P-28	Install 9,000 feet of 24" pipe	Water Supply	2020	2	$7,500,000	$0	$7,500,000	$0	$0	$0
RW-P-29	Install 19,700 feet of 30" pipe	Water Supply	2020	2	$10,200,000	$0	$10,200,000	$0	$0	$0
RW-P-30	Direct Potable Reuse - 3, 3.1 million gallon Storage Tanks	Water Supply	2036	3	$22,200,000	$0	$0	$0	$0	$22,200,000

Project ID	Project Name	Driver	Start Year[1]	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)[2]	Years 3 to 5 (FY2019/20-2021/22)[2]	Years 6 to 10 (FY2022/23-2026/27)[2]	Years 11 to 16 (FY2027/28-2032/33[2]	Years 17 to 23 (FY20363/34-2039/40)[2]
RW-P-31	Recycled Water Loop to Blending Station 3 Connection – Install 10,600 feet of 24" pipe	Water Supply	2029	1	$5,500,000	$0	$0	$0	$5,500,000	$0
	Recycled Water Capital Improvements Program Projects Total				$252,400,000	$11,166,667	$81,033,333	$57,500,000	80500000	$22,200,000

Notes:
1. Project start years adjusted with City input and do not correspond to December 2015 publication start years.
2. Costs were equally split between years to implement.

Table B4 Stormwater Capital Improvements Program (CIP) Projects

Project ID	Project Name	Driver	Start Year	Years to Implement	Total	Years 1 to 2 (FY2017/18-2018/19)(1)	Years 3 to 5 (FY2019/20-2021/22)(1)	Years 6 to 10 (FY2022/23-2026/27)(1)	Years 11 to 16 (FY2027/28-2032/33)(1)	Years 17 to 23 (FY20363/34-2039/40)(1)
SW-P-1	Drainage Basin: WV - Length 444 ft	Capacity	2020(2)	2	$173,000	$0	$173,000	$0	$0	$0
SW-P-2	Drainage Basin: WV - Length 748 ft	Capacity	2038	2	$439,000	$0	$0	$0	$0	$439,000
SW-P-3	Drainage Basin: OI - Length 607 ft	Capacity	2020(2)	2	$237,000	$0	$237,000	$0	$0	$0
SW-P-4	Drainage Basin: RR - Length 2,436 ft	Capacity	2020(3)	2	$2,621,000	$0	$2,621,000	$0	$0	$0
SW-P-5	Drainage Basin: OI - Length 2,388 ft	Capacity	2038	2	$1,491,000	$0	$0	$0	$0	$1,491,000
SW-P-6	Drainage Basin: VR - Length 5,872 ft	Capacity	2018(2)	2	$5,768,000	$2,884,000	$2,884,000	$0	$0	$0
SW-P-7	Drainage Basin: JS - Length 1,421 ft	Capacity	2018(2)	2	$968,000	$484,000	$484,000	$0	$0	$0
SW-P-8	Drainage Basin: JS - Length 1,292 ft	Capacity	2020(2)	2	$885,000	$0	$885,000	$0	$0	$0
SW-P-9	Drainage Basin: JS - Length 426 ft	Capacity	2020(2)	2	$292,000	$0	$292,000	$0	$0	$0
SW-P-10	Drainage Basin: JS - Length 457 ft	Capacity	2020(2)	2	$313,000	$0	$313,000	$0	$0	$0
SW-P-11	Drainage Basin: JS - Length 655 ft	Capacity	2020(2)	2	$449,000	$0	$449,000	$0	$0	$0
SW-P-12	Drainage Basin: JS - Length 701 ft	Capacity	2020(2)	2	$480,000	$0	$480,000	$0	$0	$0
SW-P-13	Drainage Basin: HS - Length 1,552 ft	Capacity	2020(2)	2	$606,000	$0	$606,000	$0	$0	$0
SW-P-14	22 assets identified in the condition assessment	R&R	2018(2)	2	$3,324,000	$1,662,000	$1,662,000	$0	$0	$0
SW-P-15	Dry Weather Diversion Structure	Resource Sustainability	2021	3	$370,000	$0	$123,333	$246,667	$0	$0
SW-P-16	City-Wide Incentive Program	Resource Sustainability	2021	10	$2,420,000	$0	$242,000	$1,210,000	$968,000	$0
SW-P-17	Santa Clara River Total Maximum Daily Load (TMDL) Infiltration Basin	Resource Sustainability	2023	5	$1,850,000	$0	$0	$1,480,000	$370,000	$0
SW-P-18(4)	Mandalay Beach Areas	Capacity	2018	3	$10,000,000	$3,333,333	$6,666,667	$0	$0	$0
	Stormwater Capital Improvements Program Projects Total				**$32,686,000**	**$8,363,333**	**$18,118,000**	**$2,936,667**	**$1,338,000**	**$1,930,000**

Notes:
1. Costs were equally split between years to implement.
2. Project start year moved two years later compared to 2015 Capital Improvements Program.
3. Project start year adjusted with City input and do not correspond to December 2015.
4. Project added by City after December 2015 version.