La Habra Heights County Water District

2015 WATER MASTER PLAN UPDATE

PREPARED FOR THE

LA HABRA HEIGHTS COUNTY WATER DISTRICT
1271 NORTH HACIENDA ROAD
LA HABRA HEIGHTS, CA 90631

October 2015

PREPARED BY

CIVILTEC engineering inc.

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PREFACE - EXECUTIVE SUMMARY

BACKGROUND

The purpose of this Water Master Plan Update is to provide the Board of Directors and Management of the La Habra Heights County Water District (LHHCWD) with a thorough, straightforward, and practical planning document. This plan is designed to provide flexible guidance for future development and operations. At the same time, it is intended to identify potential regulatory constraints and recommend capital improvements that should be undertaken to satisfy immediate and build-out demands.

- Evaluate the performance and reliability of the District's water production, storage, and delivery systems.
- Identify system deficiencies and recommend improvements necessary to eliminate deficiencies to ensure reliable performance of the system.
- Update the computer model to reflect current conditions into InfoWater.
- Develop Capital Improvement Plans covering a 5-year and 10-year planning horizon.
- Identify additional and specific study needs for future well sitings, solutions for cross country pipelines, and SCADA system upgrades.

These objectives were accomplished by completing the following general scope of work:

Task I – Preliminary Research and System Review

Task II - Water Demand Analysis

Task III - Analysis

Task IV – Hydraulic Model

Task V - Capital Improvement Plan Development

Task VI – Master Plan Report

SUMMARY

Description

LHHCWD serves a population of approximately 5,560 residents per the 2010 US Census. A five-year study period from fiscal year (FY) 2010-11 to FY 2014-15 was determined to be generally representative of typical demand within the District. The average annual demand during the study period was found to be 2,825 acre-feet per year (AFY) which is equivalent to and an average day demand (ADD) of 1,751 gallons per minute (gpm). At build-out per the current General Plans, the population is anticipated to increase to 6,796 and the demand is expected to increase to 3,503 AFY (2,172 gpm).

Build-out population and demand are consistent with residential land use projections provided in the 2004 La Habra Heights General Plan and consider realistic constraints on development including topography, access, seismic and geologic concerns and adjacent uses. The City of La Habra Heights has, for many years, been essentially a fully developed community, with a relatively minor amount of accessible undeveloped land. A primary change from existing zoning would require a change to the General Plan or the implementation of a Specific Plan through official City action. It should be noted that the District has no role in this process other than to provide comments on any proposed change.

The District boundary encompasses approximately 3,904 acres which includes the vast majority of the City of La Habra Heights and small portions of the City of Whittier and unincorporated Los Angeles County.

Supply

Historically, LHHCWD has produced a blend of groundwater and imported water. Groundwater is extracted from the Judson Well Field and imported water is available via an MWD tie-in.

LHHCWD currently has 2,646 AFY of adjudicated water rights, or Annual Pumping Allocation (APA), in the Central Basin. LHHCWD operates four production wells at the Judson Well Field in unincorporated Los Angeles County. The Judson Well Field is located within unincorporated Los Angeles County adjacent to the San Gabriel River in the vicinity of West Whittier. A portion of the Judson Well Field production is distributed to OCWD via the La Mirada Reservoir by contractual agreement. The remaining production is utilized for the LHHCWD service area customers year round and is sold to the District's contractual customers on an as-needed basis. Average LHHCWD groundwater production for the 5-year study period from FY 2010-11 to 2014-15 is 2,825 AFY.

LHHCWD maintains an MWD connection to the Central Basin MWD Lower Feeder with a maximum capacity of 10-cubic feet per second (cfs) (4488 gpm). In addition, a new emergency inter-tie from the California Domestic Water Company (CDWC) to LHHCWD is in the final planning and design phases.

In the future, LHHCWD intends to meet its entire water demand with groundwater extracted from the Judson Well Field. From the standpoint of reliability, it is estimated that the pumping allocation from the Central Basin, combined with the availability of supplemental water from MWD, is adequate to meet annual demands of LHHCWD service area.

Water Quality

LHHCWD is compliant with all federal and state water quality requirements. LHHCWD chlorinates its well water as a precautionary measure. The chlorination system consists of one sodium hypochlorite chlorinator located at the La Mirada Pump Station. Residual chlorine in the water leaving the La Mirada Reservoir is maintained at 1 mg/L. This facility is adequate for the existing water production and demand of the District's service area.

Operations and Infrastructure

The groundwater conveyance system begins with water extracted and pumped from the Judson Well Field and conveyed approximately four and one half miles to the La Mirada Reservoir and Pumping Plant. A portion of the water stored in the La Mirada Reservoir flows by gravity to the Orchard Dale Water District (ODWD) per contractual agreement. The remaining water is pumped an additional three miles to the LHHCWD service area where it is distributed throughout the water system.

The system generally operates as follows:

1. Water level in the La Mirada Reservoir controls operations at the Judson Well Field. Well Nos. 8, 9, 10 and 11 turn on in a pre-programmed sequence to refill the Reservoir based upon the water level signal.
2. From the La Mirada Plant, water is pumped to the Pump Plant No. 1 47,000-gallon forebay, where it is boosted by Plant No. 1 pumps into the Lower Zone. Operation of pumps at Plant No. 1 is based upon the water level in the forebay at Plant No. 1.
3. Pumping Plant Nos. 5 and 6 boost water from the Lower Zone to the Upper Zone reservoirs.
4. Water level in the Lyons Reservoir controls Booster Pump Nos. 1, 2, and 3 at the La Mirada Plant.
5. Water level at Reservoir No. 10A controls Booster Pump Nos. 1 and 2 at Plant No. 5.
6. Water level at Reservoir No. 9 controls Booster Pump Nos. 1 and 2 at Plant No. 6.
7. As a precautionary measure, the high water level (HWL) in the forebay at Plant No. 1 turns off the boosters at La Mirada Plant.
8. Plant No. 2 pumps MWD water (when needed) directly into the Lower Zone and is controlled by the level at the Lyons Reservoir.
9. The District's water distribution system, beginning at the La Mirada Plant, consists of two water service pressure zones, seven reservoirs, one forebay, five

booster pump stations, six pressure regulating stations, and approximately 60 miles of pipeline ranging in diameter from 4 to 36-inches.

LHHCWD has four emergency interconnections, two contractual interconnections and one imported water supply interconnection.

Non-interruptible service is presently provided to the District by MWD.

Design criteria have been established for all components of the distribution system as a basis for determining the adequacy and redundancy of the District's infrastructure (see Table 13).

CONCLUSIONS

The analysis of the LHHCWD water system to determine required improvements was approached by identifying existing water supply sources and employing computer simulation technology to assess the ability of the storage and distribution systems to meet existing and projected demand scenarios. Although the computer model is a key element in the determination, other major considerations are included in the development of the recommended improvements. These considerations include:

- Water sources, including wells and imported water from MWD
- Storage in each zone
- Pumping capacity and efficiency
- Operational parameters determined by the LHHCWD Staff

Storage

There is surplus storage under all existing demand scenarios. There is a storage deficiency under the ultimate build-out scenario in the Lower Zone.

Booster Pumps

Booster pumps are adequate under existing conditions with the exception of 48-hour emergency refill capacity in the Upper Zone. There is an existing deficit of approximately 668 gpm increasing to approximately 1,200 gpm at build-out.

Supply

Well No. 9 has recently been activated after a rehabilitation process. Well No. 8 has also been rehabilitated. Well Nos. 8 and 9 are approaching the end of their service lives but should last another ten years with the recently rehabilitation. Due to LHHCWD's desire to meet its entire water demand with groundwater, additional capacity should be considered within the 10-year horizon.

Fire Protection

Nine fire hydrants were found to be deficient. Six are restricted by 4-inch or 6-inch pipelines; improvements to these hydrants should be considered as future capital improvement projects. Two are influenced by the pressure zone boundary in Avocado Crest Road and may benefit from reconfiguration into the Upper Zone. One is near the end of a dead-end pipeline in Oak Ranch Road and may benefit from additional connectivity via a new pipeline in Old Fullerton Road.

System Pressure

Fourteen areas were found to experience system pressure outside the recommended range of 40 psi to 125 psi. Five of these areas, which experience excessively high pressures, would benefit from the installation of pressure reducing stations similar to those already in use at Virazon, Greenview, Ganter and Escarpado.

Cross-country Pipelines

LHHCWD has expressed an interest in eliminating extraneous or unnecessary cross-country pipelines. There are twenty-three (23) cross-country pipelines in the LHHCWD distribution system. These pipelines are difficult to access which tends to make them less reliable. However, cross-country pipelines that form hydraulic loops tend to improve redundancy and capacity. Further study is necessary to determine the feasibility of abandoning the alignments of these pipelines in favor of more accessible alignments.

RECOMMENDATIONS

Twenty-four (24) improvements have been identified dealing with issues which address production reliability, fire flow, emergency recovery, reducing high system pressure, pump efficiency, maintenance and operations.

Costs for each proposed improvement were estimated, and each project was assigned a schedule for construction within one of the next two five-year periods, depending on the perceived urgency.

LHHCWD's financial planning and budgeting should allow for time-phased expenditures to implement the 5-year and 10-year Capital Improvement Plans. The total 10-year program is estimated at $5,921,000 in 2015 dollars.

CHAPTER ONE - INTRODUCTION

General

The La Habra Heights Mutual Water Company, established in 1919, formed as a private company to provide water to the 3,900 acres of land on the south slope of the Puente Hills. To accomplish this task the company built an impressive system of pipes and pumping stations to bring water from the San Gabriel River, several miles to the west.

By 1975, the population of La Habra Heights had grown. The land had transitioned from mainly agricultural to low-density residential, and the system was in need of upgrades. With the approval of the Local Agency Formation Commission (LAFCo) a measure was placed on the 1976 ballot to form a County Water District. The new La Habra Heights County Water District (LHHCWD) boundaries encompassed the same area as the original water company, with additional land to the northwest and west, for a total service area of approximately 3,900 acres.

As the new County Water District set about updating its infrastructure through the 1970s and 80s, the entire Southern California region was beset by a series of droughts. Furthermore, the partial paving of the lower San Gabriel River bed meant that, when rain did come, the available water was not as readily absorbed into the natural storage of the region’s underground aquifers.

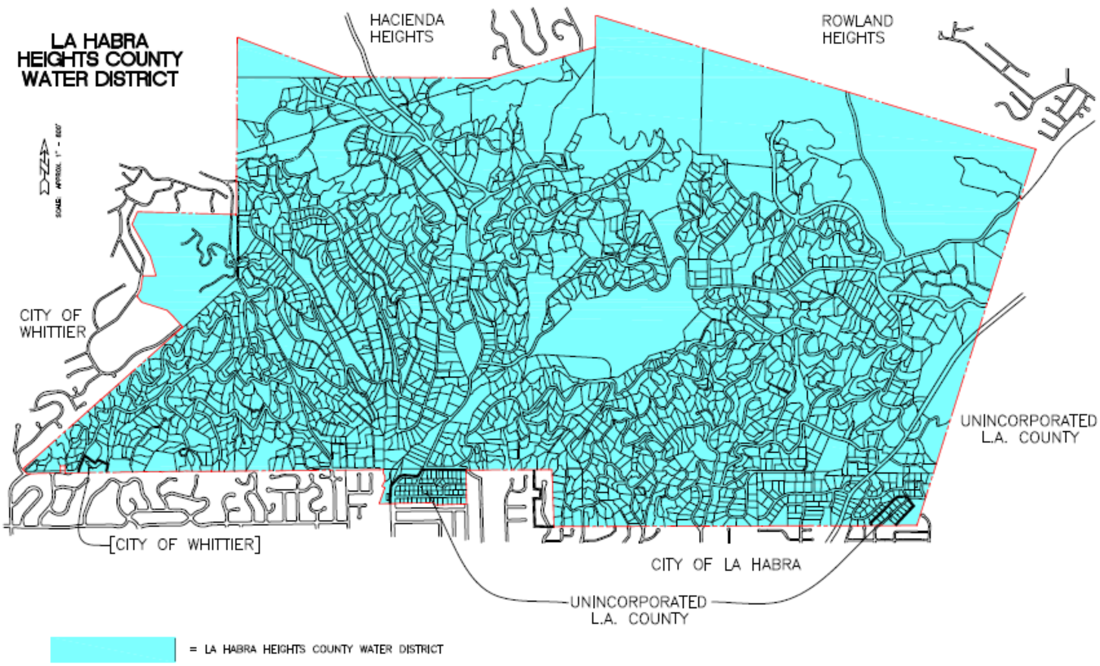
In the 1980s, LHHCWD began to occasionally buy water directly from the Metropolitan Water District of Southern California (MWD). In doing so, the system was connected to the whole of the state’s water supply, highlighting the need for continued diligence in water stewardship.

The Management, Staff, and Board of Directors of LHHCWD recognize how vital it is that the water system continues to develop to meet the new needs of the water users. Portions of the original water system had experienced low pressures from time to time, conditions that constitute potential health hazards. The existing water system has been constructed to minimize low pressures and is presently providing adequate flow and pressure to its customers. LHHCWD is continuing its efforts to maximize system effectiveness and efficiency with this 2015 Master Plan update.

Description of Study Area

The study area comprises all land within the boundary of LHHCWD as shown on Figure 1, District Boundary Map. This Water Master Plan Update study also includes areas to the west of the actual District service boundary that are utilized by the District for water production and transmission (shown in Figure 2).

Figure 1 – Study Area



Topography consists of rolling hills in the southerly portion of the District ranging to steep terrain in the north. Elevations within the District boundary vary from 340 feet above mean sea-level in the southwesterly corner of the District to 1,150 feet in the north-central part of the District. The present predominant land use within the District boundary is a blend of low-density residential zoning, with a current population of approximately 5,560 (District population) The City's 2014 population is listed as 5,420 in the Southern California Association of Governments (SCAG) 2015 Local Profiles report. The average 20-year annual rainfall is approximately 17 inches and the annual daily high mean temperature is approximately 76 degrees Fahrenheit. From a geotechnical standpoint, the area is intersected by numerous ground fault traces and is prone to landslides in parts of the northerly steep terrain.

Study Purpose, Scope and Authorization

Study Purpose

The purpose of this Water Master Plan Update is to provide the Board of Directors and Management of LHHCWD with a thorough, straightforward, and practical planning document. This plan is designed to provide flexible guidance for future development and operations. At the same time, it is intended to identify potential regulatory constraints and recommend capital improvements that should be undertaken to satisfy immediate and future demands through the year 2030.

This Water Master Plan Update is prepared in accordance our proposal dated June 17, 2015 with authorization obtained from the La Habra Heights County Water District on July 1, 2015.

Study Objective

As part of this investigation, LHHCWD requested ***Civiltec*** to perform specific tasks and address a number of ancillary issues that serve to further the overall study purpose. The four principle objectives of this Water Master Update Plan are to:

- Evaluate the performance and reliability of the District's water production, storage, and delivery systems.
- Identify system deficiencies and recommend improvements necessary to eliminate deficiencies to ensure reliable performance of the system.
- Update the computer model to reflect current conditions into InfoWater.
- Develop Capital Improvement Plans covering a 5-year and 10-year planning horizon.
- Identify additional and specific study needs for future well sitings, solutions for cross country pipelines, and SCADA system upgrades.

Study Scope

The scope of work for this Water Master Plan Update is as follows:

TASK I – PRELIMINARY RESEARCH AND SYSTEM REVIEW

A. Meet with District Management and Staff to discuss the initial goals and priorities of the study and discuss existing operational issues. We anticipate that this initial meeting will be a workshop involving the key members of our team and the District's operations and management personnel. It will be helpful to revisit water system design and operating criteria, thoroughly review the system's components and all operating procedures and conditions, identify all features that are unique, challenging to operate, worst case conditions experienced, and all areas that the District knows of where more capacity or better system performance is desired.

B. Obtain relevant maps, water use records, water supply records, water quality data, General Plans, previous studies, data from SCADA system, data on water rights and existing agreements with other water agencies.

C. Review the existing operations plan supporting documentation. Review all currently planned or designed capital improvement projects and ongoing and pending development projects.

TASK II - WATER DEMAND ANALYSIS

A. Analyze historical and existing system demands based upon data provided by the District. Analyze average day water demands on the system. Demands will be developed from District records of deliveries to customers and meter readings at pumping facilities.

B. Analyze water duty factors for each land use type as well as minimum day demand, maximum day demand and peak hour demand factors.

C. Develop demand projections for the year 2020 and 2025. The year 2025 is the generally accepted ultimate build out year as established by Regional Planning. We will utilize population projections contained in the City's General Plan to assist in development of future water demand projections. The growth projection of the General Plan and input from City Planners will be used to develop projections of demand as well as historical demand data.

D. Analyze existing and future system demands as they relate to District water rights, water lease options and MWD imported water connection capacity.

TASK III - ANALYSES

A. Perform analyses to determine adequacy of storage, pumping and distribution system to meet existing requirements. This will include an analysis of the LHHCWD well production capacity and the District's pump station capacities to meet existing and future demands as well as the ability to provide emergency water supply. We will review the condition of all pumps and wells and recommend improvements as necessary. We will analyze the storage by pressure zone and make recommendations for better utilization of all reservoirs.

B. Analyze the Near-Term and Ultimate system to determine storage, pumping, piping and supply requirements. We will analyze the District's transmission pipeline capacities for adequacy for existing and future demands as well as the need for interconnections between pressure zones.

TASK IV – HYDRAULIC MODEL

A. Update the computer model to represent present conditions. The District and ***Civiltec*** will work closely together to acquire all relevant features added to the system since the last modification to the water model. This will include as-built drawings of system components such as reservoirs, pipelines, pump stations, zone valves and pressure reducing valves. ***Civiltec*** will use this information to update pump control settings, pump curves, zone valve locations, pressure reducing valve settings, reservoir sizes and their settings. Of particular importance will be inclusion of groundwater production facilities which are not part of the existing model. These include the groundwater wells, the La Mirada Plant and associating piping.

B. Recalibrate the computer model for Extended Period Simulation analysis. ***Civiltec*** will compare model output data to SCADA data supplied by the District. Fine tuning will be made to facilities in the model such that model output best matches recorded field conditions.

C. Develop and evaluate Steady State model scenarios for Existing, Near-Term and Ultimate conditions
   - Maximum Day Demand + Fire Flow
   - Peak Hour Demand

D. Develop and evaluate Extended Period Simulation model scenarios for Existing, Near-Term and Ultimate conditions
   - 48-hour Emergency Refill
   - Equivalent 3-day ADD Storage Requirement

TASK V - CAPITAL IMPROVEMENT PLAN DEVELOPMENT

A. Determine required system improvements. Identify potential improvements with preliminary priorities. Analyze planned improvements and water resources. Identify any pipelines that require rehabilitation or replacement.

B. Evaluate existing water sources and analyze potential sources such as water reclamation, water purchases, transfers and conservation.

C. Meet with District staff to discuss improvements and finalize priorities.

D. Develop cost projections for each improvement and work with the District staff to establish 5-Year and 10-Year Water Capital Improvement Programs. Establish criteria for implementation of design and construction in terms of cost savings and emergency preparedness. Provide this information to District staff prior to finalization of the Report to assist in planning and design of budgeted projects.

E. Identify funding options for discussion in the final report.

TASK VI - MASTER PLAN REPORT

Compile and issue a comprehensive report that identifies and discusses the goals and aspects of the study. We will issue draft reports for review by District staff prior to finalization of the Report.

Abbreviations

As a matter of convenience, a number of abbreviations are used in this Report. Generally, the first time a term is used in the Report, abbreviations will follow in parenthesis. The following is a list of the most common abbreviations used in this Report.

Civiltec	***Civiltec engineering, inc.***
DDW	Drinking Water Division
DWR	California Department of Water Resources
CEPA	California Environmental Protection Agency
CBWMD	Central Basin Water Management District
CDWC	California Domestic Water Company
EPA	United States Environmental Protection Agency
LHHCWD	La Habra Heights County Water District
MWD	Metropolitan Water District of Southern California
RWD	Rowland Water District
USGS	United States Geological Survey
WMP	Water Master Plan
WRD	Water Replenishment District of Southern California
ac	acre
ADD	average day demand
AF	acre-feet
AF/Y	acre-feet per year
cfs	cubic feet per second
DU	dwelling unit
f/s	feet per second
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HGL	hydraulic grade line
I	Institutional
MDD	maximum day demand
MG	million gallons
mgd	million gallons per day
mg/l	milligrams per liter
MWSE	maximum water service elevation
O	Open Space
PF	Public Facilities
pH	acidity-alkalinity index
PHD	peak hour demand

ppm	parts per million
RA	Residential/Agricultural
PRV	pressure reducing valve
psi	pounds per square inch
SF	square feet
TDH	total dynamic head
VFD	variable frequency drive

Conversion Factors

Volumetric flow is presented with a variety of different units depending on context. Volumetric flow is expressed as a unit of volume per unit of time. The following volumetric flow units are used in this report:

Gallons per Minute (GPM)

GPM is commonly used to describe the capacity of a pump, valve, fire hydrant or other appurtenance. This unit was used to program the LHHCWD Water Model.

Cubic Foot per Second (CFS)

MWD rates the capacity it its interconnections in terms of CFS. This unit is often used for scientific calculations.

Acre-feet per Year (AFY)

When discussing volumetric flow over a long period of time, AFY is often used. Examples of the use of AFY include recharge of an aquifer, seasonal demand associated with agricultural irrigation and the conversion of a snowpack into melt.

The table below provides conversions for the above volumetric flows:

	GPM	**CFS**	**AFY**
1 GPM equals	1	0.00223	1.61
1 CFS equals	448.9	1	724.0
1 AFY equals	0.62	0.00138	1

The table below provides conversions for key volumes:

	gallons	**cubic feet**	**acre-feet**
1 gallons equals	1	0.1337	3.069×10^{-6}
1 cubic foot equals	7.481	1	43,560
1 acre-foot equals	325,872	2.296×10^{-5}	1

Acknowledgments

Civiltec engineering, inc., would like to express our appreciation for the cooperation and valuable assistance of the LHHCWD Management and Staff. In particular, the efforts of Michael Gualtieri – General Manager, Rick Vigil – Superintendent and Tammy Wagstaff – Office Manager proved to be invaluable.

CHAPTER TWO - LAND USE, POPULATION AND WATER REQUIREMENTS

General

This Chapter describes the study area and presents estimates of the service area's existing and future land use. Also included is an analysis of historical water production and water use records in terms of land use. The City of La Habra Heights 2004 General Plan (Land Use Element), Los Angeles County Municipal Code Title 22 (Planning and Zoning, updated June 2010), the 1993 Whittier General Plan, and the LHHCWD 2011 Water Master Plan Update were consulted pertaining to land use and zoning for their respective portions of the study area. The land use data identified in these planning documents were used to estimate future water demands.

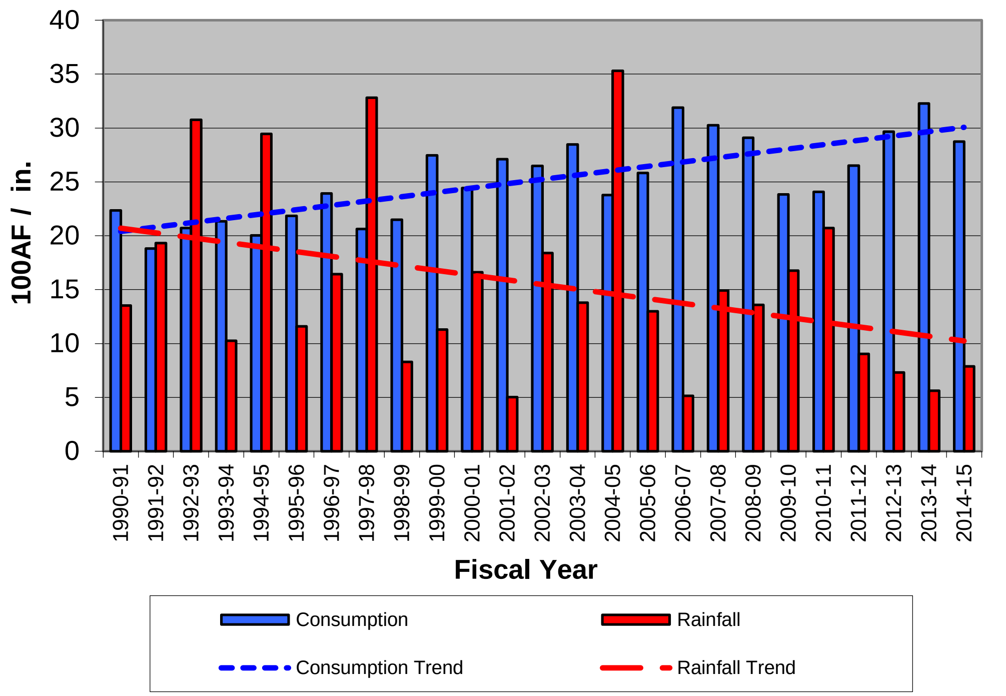
Historical Water Demand

Water usage data were collected from LHHCWD records from fiscal years 1990-91 to 2014-15. Annual precipitation data were also collected from LHHCWD which maintains Rain Gage 1088B at the District Office for the Los Angeles County Department of Public Works. Table 1 and Chart 1 show the annual consumption of water by the District's customers and the annual rainfall in the area for these fiscal years.

Table 1 - Consumption and Rainfall History

Fiscal Year	Consumption (AF)	Rainfall (in)
1990-91	2234	13.54
1991-92	1883	19.31
1992-93	2073	30.75
1993-94	2135	10.27
1994-95	2003	29.45
1995-96	2185	11.59
1996-97	2394	16.43
1997-98	2064	32.82
1998-99	2148	8.29
1999-00	2745	11.29
2000-01	2444	16.63
2001-02	2710	5.03
2002-03	2649	18.41
2003-04	2848	13.80
2004-05	2379	35.31
2005-06	2582	13.00
2006-07	3188	5.14
2007-08	3025	14.91
2008-09	2911	13.59
2009-10	2384	16.76
2010-11	2408	20.73
2011-12	2650	9.03
2012-13	2965	7.32
2013-14	3227	5.61
2014-15	2874	7.88
25-year Average	**2524**	**15.48**

CHART 1
Consumption vs Rainfall



The 25-year average of consumption indicated above is 2,524 AFY. Fiscal years 2010-11 to FY 2014-15 have been selected as the most recent and representative of typical annual water consumption. The average annual water consumption for the period was determined to be 2,825 AFY. The previous five year average is 2,814 AFY indicating consistent trending. Consumption and production data associated with this study period were used in the various analyses in this Water Master Plan Update.

Water Demand Coefficients and Requirements

Water demand coefficients (water duty and unit factors) are values developed to estimate the average water demand per acre of land or per unit for each type of land use. In this report, water duty factors are measured in acre-feet per year per acre (AFY/acre) and unit factors are measured in acre-feet per year per unit (AFY/unit). The water duty is the amount of water, excluding rainfall, applied annually to an acre of land in each land use category. The unit factor is the amount of water, excluding rainfall, applied annually to a typical parcel in each land use category. Each water duty and unit factor coefficient was determined by examining selected samples for the various land use categories and by correlating the metered records for those selected samples. Table 2 provides general reference data on the size and location of the sampled water users.

Table 2 - Development of Water Duty and Unit Factor Calculations

Jurisdiction	Land Use Designation	Sample Size (# of meters)	Sample Locations
City of La Habra Heights	RA**	363	West Rd., Las Cumbres, Monte Oro, Encanada Dr., Arbela Dr. Escarpado Dr., Cancho Dr., El Terraza Dr., Cloister Dr., La Riata Dr., Solejar Dr., Hacienda Rd., El Travesia Dr., East Rd. Ardsheal Dr., Chandos Ln., Avocado Crest, Churchill Rd., Deep Canyon Rd., Reposado Dr., Green View Rd., N. Nueva Vista Dr., E. Mira Verde Dr., Via Luna Dr., Sialic Place, Shawnan Ln., N. Walnut, Dorothea Rd., Pueblo Crest Ln., Lamat Rd., N. Cypress, N. Citrus St., Skycrest Rd., Ganter Rd., Via Miguel, Skyline Vista Dr., Kanola Dr., Picaacho Dr., Kashlan Rd., Tumin Rd., Sharpless Dr., Valle Dr., Ahuacate Rd., E. Leucadia Dr., Fullerton Rd., El Cajonita Dr., Flowerfield Ln., Mayapan Rd., Virazon Dr., Coban Rd.
	I	4	West Rd., Bella Vista Dr., Fullerton Rd.
	PF*	0	n/a
	O-1*	0	n/a
	O-2	2	Hacienda Golf Course, Hacienda Park
	O-3*	0	n/a
Los Angeles County	R-A-20000	17	Pine Edge Dr., Avocado Crest Rd., N. Citrus St., Vista Rd.
	R-1-10000	57	Villa Rita Dr., Eseverri Ln., Antoinette Dr., Villa Rita Dr.
	R-1-15000	3	Villa Rita Dr.
	R-1-20000	6	Avocado Crest Rd.

* No or negligible associated Water Duty

** The configuration and density of parcels under the jurisdiction of the City of Whittier are similar to RA. These parcels have been incorporated into the sampling of the RA designation.

The average total annual consumption for the study period (i.e. FY 2010-11 to 2014-15) is the basis for the calculation of water duty and unit factors. The calculated duties and factors used in the computer model are listed below in Table 3. These calculations include an adjustment to account for water loss. All water duty and unit factors were scaled up by 0.72% which represents the average water loss during the study period.

Table 3 – Water Duty and Unit Factors

Jurisdiction	Land Use Designation	Water Duty Factor (AFY/acre)	Unit Factor (AFY/unit)
City of La Habra Heights	RA - Residential Agricultural*	1.66	1.46
	I - Institutional	1.26	4.20
	PF - Public Facilities	0.00	n/a
	O-1 - Resource Production	0.00	n/a
	O-2 - Recreation	1.62	n/a
	O-3 - Conservation	0.00	n/a
Los Angeles County	R-A-20000	2.54	1.20
	R-1-10000	3.07	0.84
	R-1-15000	1.95	0.83
	R-1-20000	3.66	1.70

*The configuration and density of parcels under the jurisdiction of the City of Whittier is similar to RA and has been incorporated into the calculation of the RA Water Duty Factor.

LHHCWD's top twenty-five water users were identified by sorting consumption data for the study period and ranked by average annual water consumption. Table 4 delineates the results of this effort. The demands associated with these 25 users were programmed directly into the Water Model to better represent actual variation in demand distribution which produced more reliable simulation results. The remaining demands were distributed by a combination of application of water duty factors as presented in Table 3 and pressure zone demand breakdown percentages as calculated per LHHCWD's production reports since FY 2010-11. The locations of the impact of the top 25 water users on the distribution system are shown on Exhibit 3.

Table 4 - Top 25 Point Demand Water Users

Rank	Category	Pressure Zone	AFY	gpm	% of total demand
1	Open Space	Upper	149.4	92.6	5.29%
2	Open Space	Upper	77.8	48.3	2.76%
3	Open Space	Upper	29.0	18.0	1.03%
4	Residential	Upper	14.6	9.0	0.52%
5	Residential	Upper	12.9	8.0	0.46%
6	Residential	Upper	12.8	7.9	0.45%
7	Residential	Upper	12.3	7.6	0.43%
8	Residential	Upper	12.2	7.5	0.43%
9	Park	Lower	11.8	7.3	0.42%
10	Open Space	Upper	9.0	5.6	0.32%
11	Residential	Lower	8.4	5.2	0.30%
12	Residential	Upper	7.5	4.6	0.26%
13	Residential	Lower	7.3	4.5	0.26%
14	Residential	Lower	6.7	4.2	0.24%
15	Residential	Lower	6.7	4.1	0.24%
16	Residential	Upper	6.5	4.0	0.23%
17	Residential	Lower	6.3	3.9	0.22%
18	Residential	Upper	6.2	3.8	0.22%
19	Residential	Lower	6.1	3.8	0.21%
20	Residential	Upper	6.0	3.7	0.21%
21	Residential	Lower	5.9	3.7	0.21%
22	Residential	Upper	5.9	3.7	0.21%
23	Residential	Upper	5.6	3.5	0.20%
24	Residential	Lower	5.4	3.4	0.19%
25	Residential	Lower	5.4	3.3	0.19%

Demand Fluctuations

In order to determine the capacities of water supply facilities, daily and hourly fluctuations in demand must be considered in addition to average annual requirements. Residential demands fluctuate to greater extremes than do any other categories. This is due primarily to climatic conditions and varied user activities. A review of billing records, production records and SCADA data revealed the following current characteristics:

1. The five-year study period (FY 2010-11 to 2014-15) average day demand (ADD) is approximately 2,825 AFY or 1,751 gpm.

2. The maximum day demand (MDD) is approximately 4,142 gpm or 2.37 times the ADD.

3. MDD generally occurs during the months of July, August or September.

4. The highest maximum production day, within the five-year study period, occurred during the month of September 2013 and was estimated at 4,228,120 gallons.

5. The maximum demand during a one-hour period (peak hour demand or PHD) is estimated to be approximately 6,212 gpm (3.55 times the ADD).

6. PHD typically occurs during mid-morning or early evening hours.

Fire Flow Requirements

In addition to providing a reliable supply of water to meet the demands for residential, institutional and open space needs, the system must also be capable of supplying adequate quantities of water for firefighting purposes. The Safety and Environmental Quality section of the La Habra Heights Municipal Code currently determines fire flow requirements for development within the District. According to the Safety and Environmental Quality Code §4.4.20.K, no building permit may be issued prior to certification of available minimum fire flow and hydrant spacing requirements. These requirements include a minimum fire flow of 750 gpm at a fire hydrant safely accessible to the Fire Department located not over 600 paved roadway feet from the proposed residential structure. All fire flow information is provided by the District. Reference is made to Title 32 (Fire Code) of the Los Angeles County Code, which constitutes an amended version of the California Fire Code, 2013 Edition (Part 9 of Title 24 of the California Code of Regulations).

Residential properties under the jurisdiction of Los Angeles County are governed by Regulation #8 (Volume 7, Chapter 1, Section 8) of the Los Angeles County Fire Code which requires a minimum fire flow of 1,500 gpm at a residual pressure of 20 psi for a duration of two hours.

Future Water Demands

Future water demand represents the application of water duty and/or unit factors on the acreages and/or maximum number of units of the various land use categories within the LHHCWD service area. Table 5 provides a breakdown of future demand by land use category anticipated at ultimate build-out (2030).

Table 5 - Ultimate Water Requirements

Jurisdiction	Land Use Designation	Acres or Units		Factor		Demand (AFY)
City of La Habra Heights	RA*	2,142	units	1.46	AFY/unit	3,122
	I	21	acres	1.26	AFY/acre	26
	PF	15	acres	n/a		0
	O-1	208	acres	n/a		0
	O-2	166	acres	1.62	AFY/acre	269
	O-3	720	acres	n/a		0
Los Angeles County	R-A-20000	9	acres	2.54	AFY/acre	23
	R-1-10000	16	acres	3.07	AFY/acre	49
	R-1-15000	1	acres	1.95	AFY/acre	2
	R-1-20000	3	acres	3.66	AFY/acre	11
					Total	**3,503**

* RA includes all La Habra Heights and Whittier parcels within the LHHCWD service area.

The City of La Habra Heights has, for many years, been essentially a fully developed community, with a relatively minor amount of accessible undeveloped land. A primary change from existing zoning would require a change to the General Plan or the implementation of a Specific Plan through official City action. It should be noted that the District has no role in this process other than to provide comments on any proposed change.

In the event that the City approves a significant development, water supply and storage would be impacted. The potential of hillside communities and existing in-fill projects present two planning obstacles for the District in the future:

1. The possible creation of an additional pressure zone above the Upper Zone and the supporting infrastructure to serve the zone.

2. Potential increase in fire storage requirements due to possible densification of the existing service areas.

CHAPTER THREE - SOURCE OF SUPPLY

General

Historically, La Habra Heights County Water District (LHHCWD) has produced a blend of groundwater and imported water. Groundwater is extracted from the Judson Well Field and imported water is available via an MWD tie-in.

The Judson Well Field is located within unincorporated Los Angeles County adjacent to the San Gabriel River in the vicinity of West Whittier. The three wells the District currently operates extract from the Central Basin, a groundwater basin that has historically provided water to most of the southeasterly Los Angeles Coastal Plain. By way of contractual agreement, the Judson Well Field serves as the primary groundwater source for both LHHCWD and the Orchard Dale Water District (ODWD). Groundwater produced at the Judson Well Field is conveyed a distance of approximately four and one half (4-½) miles from the well field via the "low pressure" La Mirada Conduit to the La Mirada Reservoir. The La Mirada Reservoir serves as the distribution point for contractual deliveries to ODWD. Water conveyed beyond the La Mirada Reservoir via the La Mirada Booster Station is solely for the purposes of LHHCWD. Maintenance, improvements, and operational costs for the Judson Well Field, transmission facilities between the well field and La Mirada Reservoir, and the La Mirada Reservoir itself are shared between the District and ODWD. Maintenance and operations costs are prorated according to their individual annual water usage, and improvements are financed in proportion to their relative water rights.

LHHCWD maintains an MWD connection to the Central Basin MWD Lower Feeder with a maximum capacity of 10-cubic feet per second (cfs) (4488 gpm). In addition, an emergency inter-tie from the California Domestic Water Company (CWDC) to LHHCWD is under construction and is anticipated to be operational in late 2015.

In the future, LHHCWD intends to meet its entire water demand with groundwater extracted from the Judson Well Field.

Central Basin Overview

History of Water Resources Development

More than one hundred years ago, the Los Angeles Coastal Plain was on the threshold of a sharp increase in population. The key to its future was water. A shortage of sufficient year-round surface water in the Central Basin forced the development of groundwater sources. As early as 1870, water users had tapped the artesian wells and springs east of the Newport-Inglewood Uplift. When those wells stopped flowing, users were forced to drill shallow wells, which supplied enough water to continue development and economic growth.

Groundwater development increased dramatically in 1909 with the advent of the deep-well turbine pump. Its tremendous adaptability and superior operating characteristics placed efficient water wells within economic reach of everyone. In time, reliable water supplies attracted industry and agriculture. Eventually, however, the demand for groundwater exceeded the natural replenishment of the Central Basin. The overdraft affected the groundwater basin by lowering the water levels and by causing oceanfront areas to be subjected to seawater intrusion. The deteriorating groundwater situation in the Central Basin and the adjoining West Coast Basin led to the formation of the Central Basin Water Association in 1950, similar to the water association in the West Coast Basin. This led to a plan to:

1. Provide supplemental water to major producers;
2. Limit groundwater extractions from the Central Basin; and
3. Create an exchange water pool to provide groundwater-pumping rights for users lacking access to other supplemental water supplies.

Step 1 was realized in 1952 when the Central Basin Municipal Water District was formed to distribute water from the Colorado River. The district was annexed to The Metropolitan Water District of Southern California (MWD) in 1954, and Colorado River water soon flowed into the Central Basin. State Water Project water was first delivered in 1973.

The West Basin and the Central Basin Water Associations were largely responsible for the creation of the Central and West Basin Water Replenishment District (CWBWRD) in 1959. This special district covers 420 square miles of the Central and West Coast Basins (Coastal Plain) of Los Angeles County. Its objective is to replenish and maintain the groundwater basins by purchasing imported water, recharging the basins, and halting seawater intrusion.

On January 2, 1962, the CWBWRD filed Case No. 786,656 in the Superior Court, County of Los Angeles, naming more than 700 parties as defendants. It sought to obtain quiet title to the right to use groundwater and regulate withdrawals from the Central Basin to protect the water supply from deterioration.

Adverse groundwater conditions and the indefinite period before final adjudication prompted the Central Basin Water Association to draft an interim agreement curtailing extractions from the Basin. By September 1962, the proposed agreement had been approved by a sufficient number of water producers (producers owning over 75 percent of the Assumed Relative Rights within the Basin) to guarantee control over groundwater pumping in the Basin. On September 28, 1962, the Court signed the "Order Pursuant to Stipulation and Interim Agreement and Petition for Order" and appointed the Department of Water Resources (DWR) as Watermaster.

To avoid the protracted litigation experienced by other watermaster service areas in Los Angeles County, the attorneys representing principal parties held monthly meetings to work out a settlement. A stipulated judgment was drafted. Approval by public utility water companies and other producers represented well over 200,000 acre-feet, 75 percent, of the total rights within the Basin. This was a prerequisite to filing the stipulated judgment with the Court.

A pretrial hearing was held in March 1965, and on May 17, 1965, the case went to trial before Judge Edmund M. Moor. After a week's testimony on engineering, geology, hydrology, and safe yield of the Basin and arguments on water right entitlement, the case was continued to August 25, 1965. Shortly thereafter, Judge Moor appointed DWR as Watermaster. The final Judgment was signed on October 11, 1965 and became effective on October 1, 1966.

The Judgment was amended on March 21, 1980, to provide for a transition in the administrative year from a water year (October 1 to September 30) to a fiscal year (July I to June 30). Under the Judgment, this transition in turn contained a "short" administrative year of nine months - October 1, 1980, to June 30, 1981. The administrative year starting July 1, 1981, was on a fiscal year basis.

The Judgment was again amended on July 9, 1985, modifying the annual budget ($20 minimum assessment) and exchange pool provisions. The second amended Judgment of May 6, 1991, modified the carryover and overproduction provisions (to 20 percent or 20 acre-feet from 10 percent or 10 acre-feet), defined drought carryover, and provided for exemptions for extractors of contaminated groundwater.

Water Replenishment District of Southern California

The West Basin and the Central Basin Water Associations were largely responsible for the creation of the Central and West Basin Water Replenishment District (CWBWRD) in 1959. The CWBWRD eventually changed its name to Water Replenishment District of Southern California (WRD). WRD is an active water conservation organization in Los Angeles County. It is responsible for replenishing the underground water supply to both the Central and West Coast Basins.

The creation of water replenishment districts is a statutory procedure established by the Legislature. Division 18 of the California Water Code describes the duties and obligations of such a district, which has powers well suited to solving groundwater problems, whether they be quality- or quantity-oriented.

WRD is comprised of a Board of Directors and a large staff. It is actively engaged in several replenishment programs. These programs (i.e., water spreading, barrier operation and in-lieu replenishment) are described in a report published annually by WRD regarding its operations.

WRD Authority Management of Central Basin Storage

In 2012, enactment of SB 1386 amended Water Code §71610 via Chapter 215 resulted in the Water Replenishment District (WRD) becoming "the sole authority of groundwater management and storage in southeast Los Angeles County".

The Third Amendment to the Central Basin Judgment[1] (aka Third Amended Judgment) defines WRD's authority to manage groundwater storage in the Central Basin. The Third Amended Judgment defines Adjudicated Storage Capacity as 220,000 AF of available dewatered space (page 2: lines 12-23). Of this dewatered space, "WRD shall have a priority right to occupy up to 110,000 AF" as the Basin Operating Reserve (page 56, lines 7-9). This volume corresponds to the capture of storm runoff during wet years based on historical data. Furthermore, "The priority right is not intended to allow WRD to sell or lease stored water, storage, or water rights" (page 56, lines 11-12). [The remaining 110,000 AF of dewatered space is subject to individual storage allocation by parties to the judgment. Additionally, there are provisions for a community storage pool, procedures for transferring water in and out of storage and procedures for the implementation of storage and water augmentation projects.]

Central Basin Regulatory Environment

Enacted in January 2014, the Third Amended Judgment provides procedures for the implementation of storage/water augmentation projects for the first time since the 1960's. These procedures create an incentive for the development of new water supplies in the Central Basin by (1) granting ownership of the new supplies to their developer, (2) granting rights to store excess supplies in long-term accounts and (3) waiving all assessment fees on the production of stored water.

Definitions

A storage project is any activity that increases the volume of water stored in the Central Basin on an intermittent basis. For example, a project that captures, treats and places in storage rainwater would (1) increase stored water and (2) occur intermittently (i.e. only when it rains).

A water augmentation project is any activity that increases the volume of water stored in the Central Basin on a regular basis adding to the annual yield of the Central Basin. For example, a project that produces and places in storage desalinated seawater would (1) increase water storage and (2) operate continuously (i.e. seawater would be a long-term reliable source).

[1] Superior Court of the State of California for the County of Los Angeles: *Central and West Basin Water Replenishment District, etc. vs. Charles E. Adams, et al*. (Case No. 786,656); William F. Kreuse presiding.

The distinction between a storage project and a water augmentation project is administrative in nature and subject to the interpretation of an administrative body made up of parties to the Third Amended Judgment. We believe the administrative body will support the implementation of any project that increases the capacity of the Central Basin provided it does no physical harm (i.e. water contamination, erosion of geological structures, flooding, etc.).

Financial Incentive

Water generated by a storage/water augmentation project is owned by project's owner.

Stored water is a commodity which may be held, sold or leased by its owner.

Groundwater rights are subject to a replenishment assessment (i.e. for every acre-foot a purveyor pumps out of the basin, a fee is assessed to pay for putting it back in the ground at a later date). However, water generated by storage/water augmentation projects is exempt from the replenishment assessment. The current replenishment assessment is $283 per acre-foot and is increasing at a rate of 8.5% annually.

With certain limitations, a purveyor may implement a modest storage/water augmentation project independently for his sole benefit. However, a lead agency (i.e. the sponsor of a very large project) is obligated to offer an opportunity for other parties with interest in the Central Basin to participate in the project. This means that any party sharing the cost of implementation would share proportionally in the benefits of the project. The administrative body will determine the obligations of the lead agency.

Watermaster Service

Watermaster Service is administered by WRD in accordance with SB 1386 amended Water Code §71610 via Chapter 215.

Once a month, every groundwater pumper reports its extractions to the Watermaster. This makes it possible to update the water right account (Watermaster Water Production Summary) by computing the amount pumped during the previous month, the amount pumped during the current fiscal year, and the amount that can legally be pumped during the remainder of the year. A copy of the Watermaster Water Production Summary is mailed to the pumper each month.

If electric meter readings are reported along with water meter readings, electric power consumption can be correlated with water production. Erratic or rapidly increasing electric power consumption vs. water production, for instance, may suggest an inefficient pump, system losses, or an inaccurate or malfunctioning water meter.

The Watermaster's field staff schedules tests to determine water meter accuracy on every active well at least once every two years. Accurate measurement of groundwater extractions is absolutely necessary for the success of the Basin's management plan. All available means, including system efficiency tests, are used to confirm water meter test results. Results of each test are furnished to the well owner. If a meter is inaccurate beyond 5%, it must be repaired within 30 days. Follow-up tests on repaired meters and initial tests on new meters are scheduled whenever necessary. Parties may also request a meter test at any time.

Groundwater Recharge

Natural replenishment of the Basin's groundwater supply is largely from surface inflow (and some underflow) through Whittier Narrows from the San Gabriel Valley. Some of the water that percolates into the forebay areas of the Central Basin eventually crosses the barrier between the Central Basin and the West Coast Basin and flows into the West Coast Basin.

Generally, outflow and extractions have exceeded natural replenishment, thus upsetting the Basin's water balance. The availability and pricing of imported water also affect the amount of extractions from the Basin. Today, attempts are made to re-establish nature's balance by artificial and in-lieu replenishment.

One method of artificial replenishment is water spreading. Water is flooded on areas where it can percolate into the underground aquifers and supplement the natural recharge supply. Large quantities can be returned to the ground by spreading, but the process is limited by the space available for facilities for spreading and the ability of the recharge aquifers to percolate water back to the Basin. Imported water purchased from MWD and recycled water from the Whittier Narrows and San Jose Creek Water Reclamation Plants are used for artificial recharge.

In-Lieu Replenishment

During the 1965-66 water year, WRD began the "in-lieu replenishment" program. The program is authorized by Section 60230 (p) of the California Water Code, which states:

> *"For the purpose of replenishing the groundwater supplies within the district, a district shall have the power: (p) To fix the terms and conditions of any contract under which producers may agree voluntarily to use replenishment water from a non-tributary source in lieu of groundwater, and to that end a district may become party to the contract and pay from district funds that portion of the cost of the replenishment water as will encourage the purchase and use of that water in lieu of pumping so long as the persons or property within the district are directly or indirectly benefited by the resulting replenishment".*

The program enables the WRD to contract with any producer having access to supplemental water that can be used in-lieu of groundwater production. The in-lieu program is mainly used to alter pumping patterns within a groundwater basin. This type of program is also effective in areas of low transmissivity where conventional recharge techniques are ineffective. The in-lieu program also heightens the effect of injecting water to form a seawater barrier by reducing extraction in the vicinity. Overall, the in-lieu program has served to reduce the amount of replenishment water purchased by WRD and reduce the annual extraction from the groundwater basin.

The District has participated in the in-lieu program when the program has been offered and the District was eligible. When eligible to participate in this program, the District supplied its customers with MWD water and suspended groundwater production to accumulate in-lieu credits with the Central Basin Municipal Water District. A pre-determined amount of groundwater production rights were then retired to the WRD for that fiscal year. WRD used those rights to help offset their annual replenishment obligations.

Although the District has the facilities to participate in the in-lieu program, other factors determine participation. The WRD Board determines which producers can participate in the program. This is mainly dictated by local conditions. For the past seven years, conditions in the area of the Montebello Forebay (the area from which the District extracts) have not been conducive to in-lieu purchases. It should also be noted that District Staff must perform a financial analysis each time participation in the in-lieu program is considered. Factors such as power costs, seasonal water prices, and WRD reimbursements for retiring the original water right, all must be analyzed each time the District considers participation in the program.

Basin Wide Water Quality Monitoring

In compliance with Title 22 of the California Administrative Code, the Central Basin Water Association is involved in a basin-wide plan to monitor the quality of water being pumped for domestic use. Primary enforcement responsibility of the 1974 National Drinking Water Act, as embodied in the National Interim Primary Drinking Water Standards, was given to the states. California has assumed primary enforcement responsibility through passage of Senate Bill 1078, signed by the Governor in October 1976.

Groundwater Extractions

The Central Basin Judgment limits the amount of groundwater each party can extract annually from the Basin (July 1 of one year through June 30 of the following year). This limit is referred to as the "Allowed Pumping Allocation" (APA). Recipients of Exchange Pool water may pump the amount released to them in addition to their APA.

To provide flexibility in the control of groundwater extractions, the Judgment contains provisions allowing the parties to carry over into the succeeding water year a portion of their unused water right and in some cases to over-extract. This flexibility was necessary to meet unforeseen emergencies in water demand.

The previous provision allowed parties to carry over from one water year to another, any unused APA, not to exceed 20 percent of their APA or 20 acre-feet, whichever is greater. In addition, any unused Exchange Pool water can be carried over into the following fiscal year. The Third Amended Judgment modified the carryover provisions, incrementally increasing it from 20% to 60% over four years (30% in 2013-14, 40% in 2014-15, 50% in 2015-16, 60% in 2016-17).

Parties are also currently allowed to over-extract by 50 percent of their APA (increasing to 60% in 2016), or 20 acre-feet, whichever is greater. Under certain circumstances, parties may over-extract in greater amounts; however, prior approval by the Watermaster must be obtained. In any case, the over-extraction must be made up the following fiscal year unless Watermaster grants a relief due to an unreasonable hardship; such relief shall be prorated over a 5-year period.

Administration of the Judgment

The Central Basin Judgment contains provisions for the parties to obtain additional pumping rights, exceed entitled extractions, or make variations in annual pumping. The procedure thus established is described below.

Exchange Pool

The Court and parties foresaw that adjudicating the water rights in the Central Basin and limiting the total extractions would not suffice all parties. For this reason, Part 111, Subpart C of the Judgment authorizes an Exchange Pool to provide additional water rights for parties without a supplementary supply.

On or about July 1 of each year, the Watermaster mails an Exchange Pool form to each party, requesting that the form be completed and returned to the Watermaster by August 9. The form provides for making (1) mandatory offers of water rights to the pool, referred to as "Required Subscription" in the Judgment; (2) "Voluntary Subscription"; and (3) requests for water rights from the pool. In completing the form, the member must estimate his water needs and supply for the ensuing fiscal year.

Exchange Pool Requests

A request for Exchange Pool water rights may be made when a Party's estimated needs exceed its total supply, including leases. A Category (a) Request is defined as that quantity requested by a member not in excess of 150 percent of his APA or 100 acre-feet, whichever is greater. Category (b) Requests are those, which exceed the 150 percent or 100-acre-foot limitation. Whenever there are insufficient Voluntary Subscriptions to meet all Category

(a) Requests, Required Subscriptions may be used. All Category (a) Requests shall be filled first before any Category (b) Requests are filled. Category (b) Requests are filled first by any remaining Voluntary Subscriptions before the Required Subscriptions are used.

A Required Subscription can be made to the pool when a member has a connection to supplementary water and can obtain imported water from MWD or the Central and West Basin Municipal Water District. The Required Subscription is limited to 50 percent of the member's APA (increasing to 60% in 2016), except that the Required Subscription, plus the party's water needs for the year, cannot exceed the party's total supply.

Any member of the Exchange Pool can make a Voluntary Subscription. The only requirement is that the member's supply must exceed his estimated needs and only the difference may be offered. However, the Watermaster must first allocate all the Voluntary Subscriptions before using the Required Subscriptions in filling Category (a) Requests and Category (b) Requests.

Experience has shown that Voluntary Subscriptions have always been sufficient to meet the entire Category (a) Requests; as a result, no Required Subscriptions have been used to fill Category (a) Requests. It is doubtful whether Required Subscriptions will ever be used to meet Category (a) Requests.

Part III, Subpart C, and Paragraph 10 of the Judgment fix the price charged for Exchange Pool water rights. This provision was amended by Court order on July 9, 1985. The price is now based primarily on: (a) the weighted daily normal price as of the beginning of the administrative year charged by the Central Basin Municipal Water District for treated MWD water used by the exchangers during the preceding fiscal year (July 1 - June 30); (b) less the incremental cost of pumping water in the Basin at the beginning of the administrative year determined by Southern California Edison Company's schedule PA-1 rate multiplied by 560 kilowatt-hours per acre-foot rounded to the nearest dollar; and (c) less the current replenishment assessment. Because item (a) varies among exchangers and items (b) and (c) vary from year to year, the cost of Exchange Pool water will likewise vary among exchangers and from year to year.

Exchange Pool Carryover

The Central Basin Exchange Pool provides additional pumping rights to parties at a relatively high price. The authors of the Judgment believed that the parties should be allowed to pump their entire exchange-water-right purchases, regardless of the provisions limiting carryover of water rights. Hence, a specific exchange water carryover provision was drafted and included in the Judgment.

The provision specifically allows a party who purchased exchange water to carry over the unpumped portion of his allowable extraction into the next succeeding administrative year.

The charge is authorized by the Judgment and is based on the difference in the prices of Exchange Pool water between the year the water was purchased and the succeeding year.

Transfers of Allowed Pumping Allocations

The Central Basin Exchange Pool is not the only method of obtaining additional pumping rights. Each water year, there are many water-right leases and sales between parties.

When property on which water rights have been developed is sold, the Watermaster must be furnished a copy of the sale document. The sale document is required for the proper accounting of the water rights. The Watermaster assumes that the water rights pass to the new owner unless specifically reserved in the sale document.

In leasing, buying, or selling water rights, parties should be specific as to the type being exchanged, i.e., Total Water Right or Allowed Pumping Allocation. All leases should be entered into on the basis of Allowed Pumping Allocation, whereas sales should specify both amount of Total Water Right and amount of Allowed Pumping Allocation, each to the nearest whole acre-foot. All water-right leases should be made on a fiscal year basis (i.e., July 1 of one year through June 30 of the following year).

The Watermaster keeps a list of parties who have informed him of their interest in buying, selling, or leasing water rights. Any party wishing to be listed should call the Watermaster. This is not done as a Court-required function. It is an informal courtesy established to assist parties unable to resolve problems regarding an excess or deficiency of water rights. The Watermaster will make no recommendation regarding transactions conducted relative to the use of this service. The names of all parties using this service are available in the Watermaster's office and may be obtained by telephone or visit to the office.

Overextractions

Each year some parties extract more groundwater from the Central Basin than they are entitled to. The overextractions are usually small, within the tolerance set by the Judgment. Each party may overextract by 20 acre-feet or 20 percent of its Allowed Pumping Allocation, whichever is greater, on the premise that the overextraction will be eliminated during the following fiscal year. Any overextractions above this limit must have prior approval of the Watermaster. Most overextractions are caused by unexpected increases in water demand, so it would be unreasonable not to allow some deviation from the limits and guidelines of the Judgment.

Groundwater Rights

LHHCWD was granted 2,435 AFY of water rights, or Annual Pumping Allocation (APA), in the 1965 Central Basin Judgement that adjudicated all water rights in the Central and West Basins. Since then, the District has purchased 211 AFY of water rights as outlined in Table 6 below.

Table 6 – LHHCWD 2015 Water Rights

Year	Source	AFY
1965	Central Basin Judgement	2,435
1972	Union Oil Company	63
2007	John J. Hathaway	8
2009	Kal Kan Foods, Inc.	90
2014	Aqua Management	50
	Total AFY	2,646

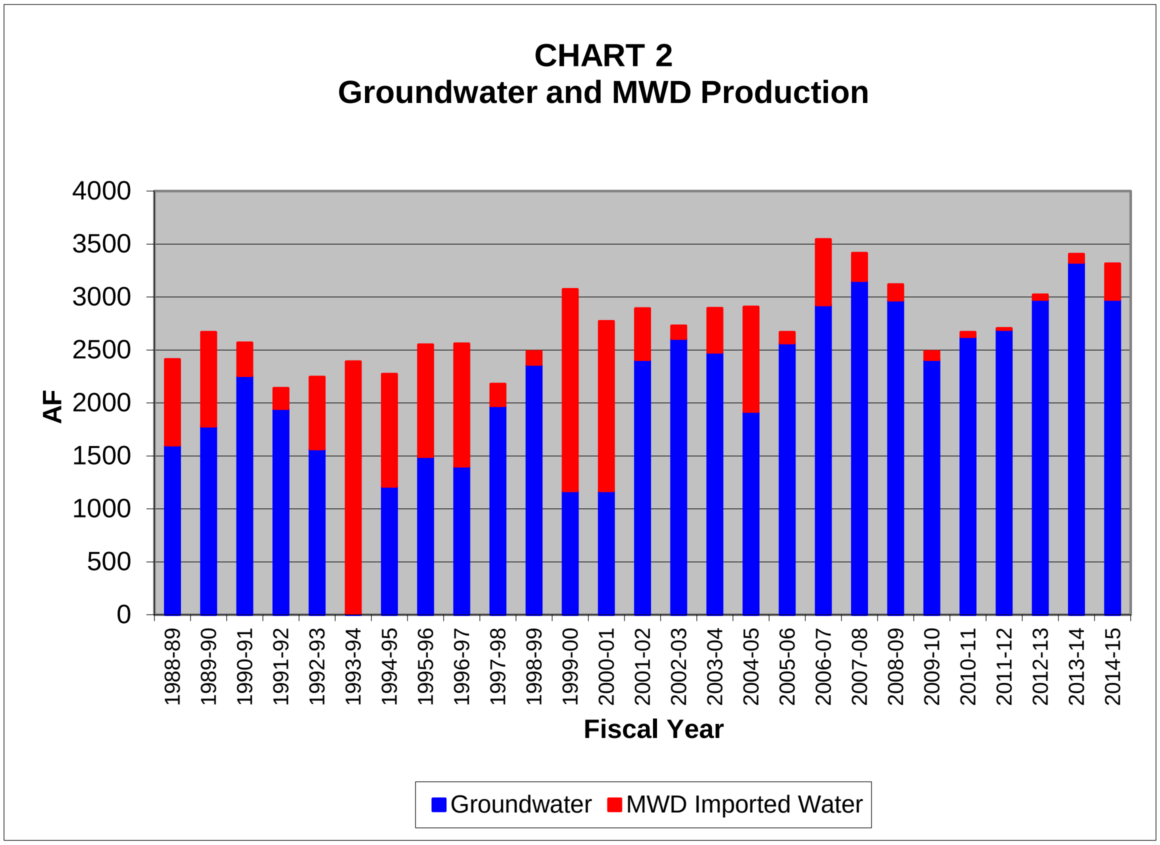
LHHCWD has set a goal of ultimately having water rights equal to 3,000 AFY.

As the need arises, LHHCWD participates in the lease market to obtain additional pumping rights for the year. Historically, LHHCWD has leased water rights to minimize the need to buy imported water.

LHHCWD operates four production wells at the Judson Well Field in unincorporated Los Angeles County. A portion of the Judson Well Field production is distributed to OCWD via the La Mirada Reservoir by contractual agreement. The remaining production is utilized for the LHHCWD service area customers year round and is sold to the District's contractual customers on an as-needed basis. Average LHHCWD groundwater production for the 5-year study period from FY 2010-11 to 2014-15 is 2,921 AFY. The divergence between the 15-year and 5-year averages can be attributed to recent purchases of groundwater rights and LHHCWD's commitment to decrease its dependence on imported water from MWD. Table 7 and Chart 2 show the historical breakdown of groundwater and imported water since FY 2001-02 and FY 1991-92 respectively.

Table 7 - Historical Groundwater and Imported Water Production

Fiscal Year	Well Production (AF)	MWD CENB-47 (AF)	Total (AF)
2001-02	2,408	484	2,892
2002-03	2,608	122	2,730
2003-04	2,477	418	2,895
2004-05	1,921	986	2,906
2005-06	2,567	101	2,668
2006-07	2,925	619	3,544
2007-08	3,155	259	3,414
2008-09	2,971	147	3,118
2009-10	2,410	77	2,487
2010-11	2,628	40	2,668
2011-12	2,692	14	2,706
2012-13	2,977	45	3,022
2013-14	3,328	79	3,407
2014-15	2,978	338	3,316
15-year Average	**2,381**	**489**	**2,870**
5-year Average	**2,921**	**103**	**3,024**



Imported water, purchased from MWD, presently augments the District's groundwater production by an average of 103 AFY (3.4%) during the 5-years study period (FY 2010-11 to 2014-15). LHHCWD receives imported water via the Central Basin MWD No. 47 turnout on the Lower Feeder, downstream of the Coyote Creek Pressure Control Station. The maximum capacity of the turnout is 10 cubic feet per second (cfs), or 4,488 gallons per minute (gpm). Water supplied through the Lower Feeder is treated at the Diemer Filtration Plant. There are two sources of supply to the Diemer Plant. The first source consists of blended water (i.e. State Water Project water and Colorado River water) supplied through the Yorba Linda Feeder. The second source arrives through the Lower Feeder from Lake Matthews.

Water Quality

Important regional water quality concerns include seawater intrusion, inflow of contaminated water from the San Gabriel Basin, and naturally occurring constituents with concentrations exceeding proposed State drinking water standards. Current activities for protecting the quality and quantity of the groundwater supplies include artificial recharge in percolation ponds, injection at three sets of seawater barrier wells, and in-lieu delivery of imported water to supplant groundwater production.

Judson Field Wells

The quality of water in the confined aquifers in the Central Basin is generally suitable for domestic use. Water quality testing in 2013-14 indicated that dissolved-solids concentrations in the water ranged from 580 to 660 milligrams per liter (mg/l), which are below the secondary standard of 1,000 mg/l recommended by the U.S. Environmental Protection Agency (EPA), and concentrations of chloride do not exceed 110 mg/l, which is well below the secondary standard of 500 mg/l. Water purchased for recharge from the State project and the Colorado River has a higher concentration of dissolved solids, chloride, and sulfate than local ground water, but the quality of the mixed native ground water and imported water is within State and Federal standards for drinking water.

The Central Basin Municipal Water District, and to some extent WRD, monitors the water quality of the water extracted from the Central Basin for domestic use. This includes the Judson Well Field. District personnel also perform monitoring for purposes consumer confidence reporting. All of these activities are done in accordance with Title 22 of the California Administrative Code. Primary enforcement responsibility of the 1974 Safe Drinking Water Act, as embodied in the National Interim Primary Drinking Water Standards, was given to the State Department of Health Services (CDHS). The State has assumed primary enforcement responsibility through the passage of Senate Bill 1078, signed by the Governor in October of 1976. Chemical and bacteriological qualities of the Judson Well Field comply with all standards established in the Safe Drinking Water Act.

The District contracts with an independent laboratory to perform analysis on three water samples each week, taken from widely separated sample stations within the service area. These samples reflect a representative sampling of water distributed in the system and are analyzed for the presence of bacteria. Once per month, samples are taken from each operating well and tested. Additionally, general physical analysis is done on a monthly basis. General mineral analysis is done to monitor secondary standards set by CDHS. As a part of this analysis, technicians record field temperature, color, odor, and turbidity of each sample. During the spring of each year, a complete chemical analysis of the water from the District’s wells is performed.

The California Domestic Water Quality and Monitoring Regulations (Title 22, California Code of Regulations), adopted in January 1989, include requirements on Public Information, Section 64463.1. This section requires that each community water system distribute to each customer an annual report on the quality of the water served. The annual report for the La Habra Heights County Water District is distributed in the spring of each year. The results of the 2014 Annual Consumer Confidence Report are illustrated in Appendix A: La Habra Heights County Water District 2014 Annual Consumer Confidence Report.

Safe Drinking Water Act

The federal government, with the passage of the Safe Drinking Water Act (U.S. Congress, 1974) through the U.S. Environmental Protection Agency (EPA), was given the authority to set drinking water quality standards for all drinking water delivered by community (public and/or private) water suppliers. The Safe Drinking Water Act (SDWA) requires two types of standards: primary and secondary. Primary standards protect public health, to the extent feasible, using technology, treatment techniques, and other means, which the EPA determines are generally available on the date of the enactment of the Act. Primary standards include performance requirements (Maximum Contaminant Levels, or MCL's) and/or treatment requirements. The Act also contains provisions for secondary drinking water regulations for MCLs on contaminants that may adversely affect odor or appearance of water.

Safe Drinking Water Act Amendments

The Safe Drinking Water Act Amendments of 1986 require the EPA to set federal standards for 83 contaminants listed in the Act, and an additional 25 contaminants every three years. Phase II regulation, effective July 1992, set maximum contaminant levels or treatment techniques for 33 contaminants. The Phase V Rule, effective January 1994, sets drinking water standards for 23 additional contaminants. These new regulations also established a revised "Standardized Monitoring Framework" (SMF) for inorganic and organic constituents, many of which have been regulated in the State for several years. The SMF establishes a three-year initial baseline monitoring period from January 1993 through the end of 1995. Testing for the Phase II/V contaminants was completed in fiscal year 1995-96.

The Safe Drinking Water Act Amendments of 1996 provided several improvements to the SDWA and the 1986 amendments. Preventative measures were implemented. The new bill maintains strict drinking water standards but eliminates the mandate for 25 new standards every three-years, allows the EPA to use cost-benefit analysis and risk analysis in setting standards, and provides authority and funding for new source water quality protection programs. It also calls for a new *Radon* standard that is protective of health, but avoids extreme cost; requires EPA to set a new standard for *Arsenic*, and after conducting health effects research and provides funding for the research and most important, authorizes approximately $7.2 million for a new State Revolving Fund. This fund is intended to promote low cost loans to communities and water utilities for water quality improvements.

Metropolitan Water District of Southern California

Metropolitan Water District (MWD) was formed in 1927 for the purpose of importing supplemental water to Southern California. MWD consists of 27 member cities and water agencies. MWD's imported supplies are obtained from its Colorado River Aqueduct and the State Water Project. Water delivered to LHHCWD is treated at the Diemer Plant in

Yorba Linda, California. The filtration plant is the operational headquarters for the Orange County Branch of MWD. The plant operates continuously to provide water to the following member agencies: City of Anaheim, City of Fullerton, City of Long Beach, City of Santa Ana, West Basin Municipal Water District, Coastal Municipal Water District, Municipal Water District of Orange County, and the Central Basin Municipal Water District. The Diemer Plant treats a blend of water from the Colorado River, Lake Matthews Reservoir, and the State Water Project. A current quality analysis of MWD water including water treated at the Diemer plant is shown in Appendix B – 2014 MWD Water Quality Report.

The Surface Water Treatment Rule (SWTR)

Water treatment operations at the Diemer Plant must comply with the Surface Water Treatment Rule, and supplemental amendments. The final SWTR was published on June 29, 1989 (54 FT27485). The effective date of the rule was December 31, 1990.

The SWTR established maximum contamination level goals (MCLG's) for Giardia lamblia, viruses, hetertrophic place count bacteria, Legionella, and turbidity. It promulgated regulations for public water systems (PWS) using surface water (and ground water under the direct influence of surface water), and requirements for disinfection and compliance, including filtration. PWSs that use surface water (or ground water under the direct influence of surface water) were required to meet the criteria for avoiding filtration specified in 40 CFR 141.71 by December 30, 1991, unless the State determined that filtration is required.

PWS's that use a surface water source and do not provide filtration treatment were required to begin disinfection treatment by December 30, 1991, unless the State had determined in writing that filtration was required. Additionally, PWS's that use a ground water source under the direct influence of surface water and do not provide filtration were required to provide disinfection treatment by December 30, 1991. A PWS that uses a surface water source and provides filtration treatment must provide the disinfection treatment specified in 40 CRF 141.72(b) by June 29, 1993. Finally, PWS's that use a surface water source or a ground water under the direct influence of surface water, and do not meet all of the criteria for avoiding filtration, must provide disinfection treatment and filtration by June 29, 1993.

Amendments to SDWA in 1996 require EPA to develop rules to balance the risks. It is important to strengthen protection against microbial contaminants, especially *Cryptosporidium*, and at the same time, reduce potential health risks from disinfection byproducts. Established in 2002, the Interim Enhanced Surface Water Treatment Rule and Stage 1 Disinfectants and Disinfection Byproducts Rule (EPA 815-F-98-010) are the first of a set of rules under the Amendments. Established in 2006, the Long Term 2 Surface Water Treatment Rule and the Stage 2 Disinfectants and Disinfection Byproducts Rule (EPA 815-F-05-002) build upon these earlier rules. These final rules strengthen public health protection for customers by targeting additional *Cryptosporidium* treatment requirements and by tightening compliance monitoring requirements for two groups of disinfection byproducts: trihalomethanes (TTHM) and haloacetic acids (HAA5).

Treatment Facilities Adequacy

La Habra Heights County Water District chlorinates its well water as a precautionary measure. The chlorination system consists of one sodium hypochlorite chlorinator located at the La Mirada Pump Station. Residual chlorine in the water leaving the La Mirada Reservoir is maintained at 1 mg/L. This facility is adequate for the existing water production and demand of the District's service area.

The District also has a backup sodium hypochlorite chlorination system located at the Well No. 10 site. This chlorination system can be activated in short notice should the District need to chlorinate well water from this location.

Water Supply Reliability

It is estimated that the pumping allocation from the Central Basin, combined with the availability of supplemental water from MWD, is adequate to meet annual demands of La Habra Heights County Water District service area. One question, which must be considered, is the likelihood of allowed extractions from the Central Basin being reduced in the future. If, for any reason, the trend toward rehabilitation of the Basin were to be reversed, then presumably the Court could reduce the present allowed pumping allocations of individual users. In view of the basin management program and the fact that there has been no such reduction since the original judgment, this possibility is considered remote. La Habra Heights should enjoy its present APA of 2,646 acre-feet for the foreseeable future.

MWD Entitlements

MWD has entitlements to State Water Project and Colorado River waters in excess of 2.5 million acre feet annually; the probability of extended water shortages forcing cutbacks to users is being mitigated by MWD's Integrated Resources Planning efforts.

MWD's entitlement to SWP water is based on a contract with the California Department of Water Resources (DWR) called the *1960 Contract between the State of California and the Metropolitan Water District of Southern California for a Water Supply*. This contract, initially executed in 1960 and amended numerous times since, is the basis for SWP deliveries to MWD. It requires DWR to make reasonable efforts to secure water supplies for MWD and its other contractors. The contract expires in 2035. At that time, MWD has the option to renew the contract under the same basic conditions. The contract entitles MWD to use up to 48% of the quantity of SWP water delivered annually.

According to DWR, the reliability of future SWP deliveries will be impacted by two factors. The first is climate change, which is altering hydrologic conditions in the State. Due to the uncertainty of the impacts by climate change on the availability of source water, SWP deliveries under future conditions are expected to decrease. The second is significant restrictions on SWP and Central Valley Project pumping in accordance with December 2007 federal court imposed interim rules to protect delta smelt.

Estimates of SWP deliveries are based upon operational simulations with DWR's CalSim II model using an extended record of runoff patterns. The CalSim II model predicts water reliability for a 20-year horizon. CalSim modeling data from 2007 show that annual SWP Table A deliveries from the Delta average from 66 to 69% of the maximum Table A amount through 2027. Potential deliveries under current conditions assume current methods of conveyance across the Delta and the interim operating rules defined by the recent court order to protect delta smelt.

MWD's entitlement to Colorado River water is based on a series of agreements and compacts which govern the distribution and management of Colorado River water. The following documents specifically determine MWD's dependable supplies:

> *1931 Seven Party Agreement*. The 1931 Seven Party Agreement recommended California's Colorado River use priorities and has no termination date. California's basic annual apportionment is 4.4 million acre-feet. The Palo Verde Irrigation District, the Yuma Project, the Imperial Irrigation District, the Coachella Valley Water District, and MWD are the entities that hold the priorities included in the contracts that the United States Department of the Interior executed with the California agencies in the 1930s for water from Lake Mead. MWD has the fourth priority to California's basic apportionment of Colorado River water and utilizes this water – 550,000 acre-feet per year – every year. In addition, MWD has access to additional Colorado River water – up to 662,000 acrefeet per year – through its fifth priority in the California apportionment.
>
> *MWD's Basic Contracts*. MWD's 1930, 1931, and 1946 basic contracts with the United States Secretary of the Interior permit the delivery of 1.212 million acre-feet per year when sufficient water is available. MWD's 1987 surplus flow contract with the United States Bureau of Reclamation permits the delivery of water to fill the remainder of the Colorado River Aqueduct when water is available.
>
> *1964 Court Decree*. The 1964 United States Supreme Court Decree confirmed the Arizona, California, and Nevada basic apportionments of 2.8 million acre-feet per year, 4.4 million acre-feet per year and 0.3 million acre-feet per year, respectively. The Decree also permits the United States Secretary of the Interior to make water available that is unused by one of the states for use in the other two states. In addition, it permits the Secretary of the Interior to make surplus water available.

2003 Quantification Settlement Agreement (QSA) and several other related agreements were executed in October 2003. The QSA quantifies the use of water under the third priority of the Seven Party Agreement. Although this agreement does not directly impact MWD's entitlements, it provides the numeric baseline needed to measure conservation and transfer programs, and it allows for implementation of agricultural conservation, land management, and other programs identified in the 1996 Integrated Resource Plan.

Water reliability at the state level is categorized with respect to historical annual precipitation rates as Wet Year, Normal Year, Dry Year and Multiple Dry Year. Annual allocation of Colorado River water is controlled by the U.S. Department of the Interior. Annual allocation of SWP water is controlled by the California Department of Water Resources (DWR). These waters are made available to MWD based on precipitation levels within the respective watersheds. MWD maintains multiple large reservoirs which serve to mitigate the impact of disruption or reduction of either SWP water or Colorado River water. According to the 2010 MWD Urban Water Management Plan, under a multi-dry year hydrology, MWD could face depleted supply capability. At the time of the report, MWD was emphasizing the development of robust short-term actions to increase supply reliability to their service area.

The 2015 MWD Regional Progress Report listed the following conservation highlights for the 2013-14 Fiscal Year:

- Metropolitan provided $18.6 million in rebates to help water customers improve water-use efficiency in their homes and businesses.
- Metropolitan doubled its annual conservation and outreach budget from $20 million to $40 million for fiscal year 2014/15.
- Metropolitan adopted a Water Supply Alert Resolution in February 2014 calling on its member agencies, retail water agencies, and cities in Southern California to implement extraordinary conservation measures, enforce water waste ordinances, and develop a unified message to reduce water demand.
- Metropolitan implemented the Public Agencies Landscape Program that provides financial incentives to Southern California public agencies to improve outdoor irrigation with water-efficient products.
- Metropolitan implemented the Recycled Water Hookup Pilot Program that provides financial incentives to help residential and business customers convert from potable water to recycled water systems to reduce outdoor potable demand.
- Metropolitan began an intensive outreach program informing residents of the drought and opportunities to use less water.
- Metropolitan increased the rebates on many water-efficient devices to encourage additional conservation. Rebates for replacing turf grass with a more sustainable landscape were doubled.

MWD maintains dedicated backup power generation at its treatment facilities and mobile generators that can be quickly moved to key locations as necessary to keep member agencies supplied with water. Furthermore, MWD's leadership in Integrated Resource Planning (IRP) has led to the development of a more reliable mix of sources at all levels within the regional water industry.

The goal of the IRP was to outline and implement a strategy for water reliability through the year 2030. A collaborative approach among water districts, local governments and interested stakeholder groups has served to lower local demand and increase local supplies. The following six objectives are the drivers behind the IRP as developed by MWD in concert with its member agencies: Reliability, Affordability, Water Quality, Diversity, Flexibility, Environmental and Institutional Constraints. The IRP established regional targets for the development of water resources including conservation, local supplies, SWP supplies, Colorado River supplies and water drawn from regional storage and purchased through water transfers.

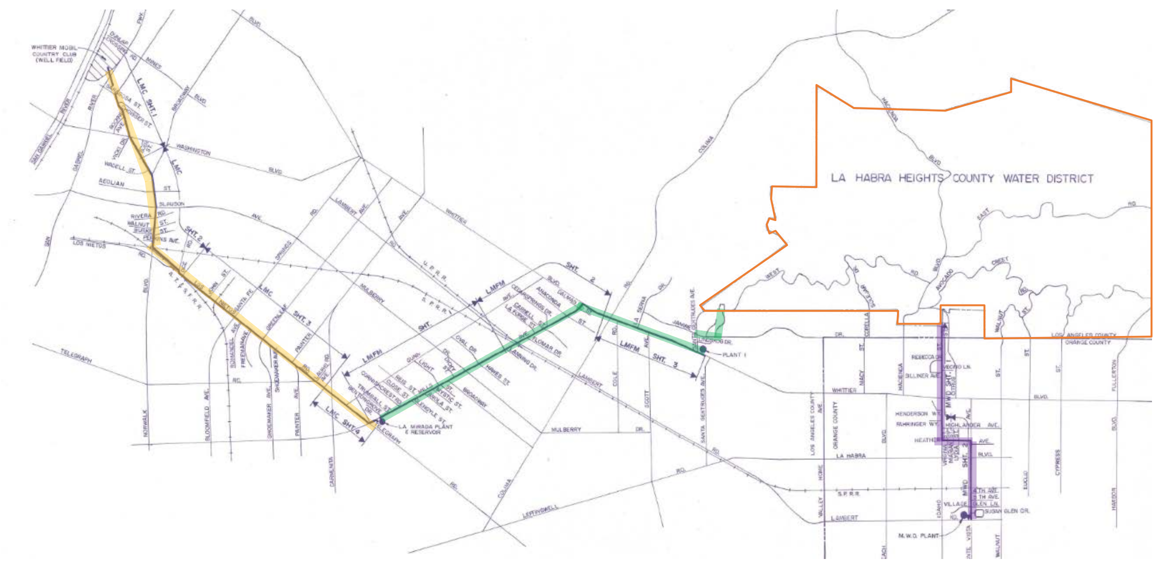
However, the possibility of shorter duration outages due to earthquakes or the like does exist. Under such conditions, MWD would continue deliveries up to its capability with the probable result that water would be apportioned on a priority basis. It appears that the highest priority would be those MWD users with limited local water resources or alternative sources of supply. In the case of LHHCWD, the priority would depend upon the extent to which local production and transmission facilities are operable. It is unlikely that MWD would distribute water in an emergency only in proportion to the total accumulation of amounts paid by the constituent member on tax assessments, even though this method is in accordance with MWD Act. This method would benefit the larger members who probably are capable of surviving short-term MWD cutbacks with minimum difficulty through use of seasonal storage and alternative sources of supply.

CHAPTER FOUR - EXISTING WATER SUPPLY SYSTEM

General

The groundwater conveyance system begins with water extracted and pumped from the Judson Well Field and conveyed approximately four and one half miles to the La Mirada Reservoir and Pumping Plant (as depicted by the yellow line in Figure 2 below).

Figure 2 – Groundwater Conveyance System



A portion of the water stored in the La Mirada Reservoir flows by gravity to the Orchard Dale Water District (ODWD) per contractual agreement. The remaining water is pumped an additional three miles to the LHHCWD service area where it is distributed throughout the water system (as depicted by the green line in Figure 2).

When needed, water can be pumped from the Metropolitan Water District turnout, located south of LHHCWD, to Plant No. 2 (as depicted by the purple line in Figure 2).

The system generally operates as follows:

1. Water level in the La Mirada Reservoir controls operations at the Judson Well Field. Well Nos. 8, 9, 10 and 11 turn on in a pre-programmed sequence to refill the Reservoir based upon the water level signal.
2. From the La Mirada Plant, water is pumped to the Pump Plant No. 1 47,000-gallon forebay, where it is boosted by Plant No. 1 pumps into the Lower Zone.

Operation of pumps at Plant No. 1 is based upon the water level in the forebay at Plant No. 1.

3. Pumping Plant Nos. 5 and 6 boost water from the Lower Zone to the Upper Zone reservoirs.
4. Water level in the Lyons Reservoir controls Booster Pump Nos. 1, 2, and 3 at the La Mirada Plant.
5. Water level at Reservoir No. 10A controls Booster Pump Nos. 1 and 2 at Plant No. 5.
6. Water level at Reservoir No. 9 controls Booster Pump Nos. 1 and 2 at Plant No. 6.
7. As a precautionary measure, the high water level (HWL) in the forebay at Plant No. 1 turns off the boosters at La Mirada Plant.
8. Plant No. 2 pumps MWD water (when needed) directly into the Lower Zone and is controlled by the level at the Lyons Reservoir.

Distribution System

The District's water distribution system, beginning at the La Mirada Plant, consists of two water service pressure zones, seven reservoirs, one forebay, five booster pump stations, six pressure regulating stations, and approximately 60 miles of pipeline ranging in diameter from 4 to 36-inches. For the hydraulic network analysis, the backbone system of 4-inch pipes and larger were modeled.

The majority of the pipeline system is comprised of asbestos cement pipe (ACP). However, the District also has ductile iron, cast iron, steel, and PVC pipe in service throughout the system. The layout of the existing system is illustrated on Exhibit 4, Existing Water System, Pressure Zones and Facilities. Operations of the LHHCWD system, including flows and interaction among wells, booster pump stations and reservoirs are illustrated in Exhibit 5, 2011 Water System Hydraulic Profile, which provides a hydraulic schematic of the primary production facilities. This hydraulic schematic indicates elevations of wells, pump stations, and reservoirs as well as pressure regulating stations and system interconnections. Typical operating conditions and pertinent characteristics of each facility are discussed herein.

Pressure Zones

LHHCWD system is divided into two main pressure zones. The hydraulic gradient for each zone is set by the zone reservoirs. Exhibit 4 (Existing Water System Pressure Zones & Facilities) shows the boundaries of the two Pressure Zones, the Lower Zone (833 HGL) and Upper Zone (1154 HGL). In addition, there are five sub-zones that are served by pressure regulating stations. Table 8, Reservoir Data, identifies the reservoirs, capacity, source of water and the Pressure Zone or subsequent Plant served. This information is also illustrated in Exhibit 5 (2015 Water System Hydraulic Profile).

In general, the description of each Zone is as follows:

Lower Zone:

- Southerly-most zone in system. Operates at a static HGL of 833.
- Bounded on the south, west and east by the LHHCWD boundary and on the north by an approximate service elevation of 730 feet.
- The Lower Zone consists of approximately 2,313 acres.

Upper Zone:

- Northerly-most zone in system. Operates at a static HGL of 1154.
- Bounded on the north, west and east by the LHHCWD boundary and on the south by an approximate service elevation of 730 feet.
- The Upper Zone consists of approximately 1,817 acres.

Table 8 – Reservoir Data

RESERVOIR	CAPACITY (MG)	MATERIAL	ZONE SERVED
La Mirada Plant	4.29	Steel	NA
No. 2	2.06	Steel	833
No. 5A	1.56	Steel	833
Lyons	1.94	Steel	833
Snooks	0.47	Steel	1154
No. 9	1.97	Steel	1154
No. 10A	1.56	Steel	1154
TOTAL STORAGE	**13.85**		

Booster Pumping Facilities

The District operates five booster pump stations. These stations are the La Mirada Pumping Plant (Mills Avenue at Telegraph Road), Plant No. 1 (Whittier Boulevard and Santa Gertrudes Avenue), Plant No. 2 (Hacienda Boulevard south of East Road), Plant No. 5 (Reservoir No. 2 site at Reposado Drive and Greenview Rd.), and Plant No. 6 (Lyons Reservoir site on Coban Road south of East Road). The characteristics of the booster pump stations are outlined in Table IV-2, Booster Pump Station Data.

Table 9 – Booster Pump Station Data

Pump Station or Plant	Location	Pump No.	Rated Horsepower (hp) (efficiency)	Capacity (gpm)*	Suction	Discharge
LM	La Mirada Plant Mills Ave. at Telegraph Rd.	LM-1 LM-2 LM-3	75 (62.9%) 75 (66.3%) 75 (66.1%)	1537 1560 1552	La Mirada Reservoir	Plant No. 1
1	Whittier Blvd. at Santa Gertrudes Ave.	B1-1 B1-2 B1-3	300 (64.7) 300 (67.8%) 350 (66.7%)	1395 1438 1750	Plant No. 1 Forebay	Reservoir Nos. 5A, 2, and Lyons 833 Zone
2	Hacienda Blvd. s/o East Rd.	B2-2 B2-3 B2-4 B2-5	75 (50.3%) 75 (57.5%) 75 (60.3%) 50 (58.6)	1670 1817 1817 831	MWD CENB - 47	Reservoir Nos. 5A, 2, and Lyons 833 Zone
5	Reservoir No. 2	B5-1 B5-2	125 (69.3%) 125 (70.9%)	758 778	Reservoir No.2	Snooks Reservoir Reservoir No. 10A 1154 Zone
6	Lyons Reservoir	B6-1 B6-2	75 (68.1%) 100 (69.4%)	630 878	Lyons Reservoir	Reservoir No. 9 1154 Zone

*Capacity and efficiency were based upon SCE pump tests conducted March 2006 for Plant 2, December 2010 for La Mirada and Plants 5 and 6, and August 2013 for Plant 1.

Wells

There are a total of four active wells in service. All of the wells discharge to the La Mirada Reservoir, where they are blended and treated by means of chlorine injection prior to entering the distribution system. Table **10**, Well Facilities, summarizes the active well facilities.

Table 10 – Well Facilities

Well	Year Drilled	Depth Below Grade (ft)	Motor Size (HP) (e)	Approx. Length of Column (ft)	Design Flow (gpm)	Existing Rate of Flow (gpm)*
Well No. 8	1950	650	100 (65.9%)	180	950	848
Well No. 9	1950	677	75 (62.1%)	350	750	760
Well No. 10	1998	800	150 (32.9%)	250	3000	1332
Well No. 11	2001	805	150 (36.8%)	250	3500	1470

*Capacity and efficiency were based upon SCE pump tests conducted in July 2015 for Wells 8, 10 and 11, Capacity and efficiency for Well 9 was based upon field tests performed in August 2015.

Well No. 8 was taken out of service in November 2011 due to water quality issues. The Well was rehabilitated in 2012 and returned to service in February 2013.

Well No. 9 was taken out of service in September 2010 due to loss of production issues. The Well was rehabilitated in the spring of 2015 and returned to service in July 2015.

Pressure Reducing Stations

There are six active pressure reducing stations or valves employed in the District's system. Four of the stations (Escarpado, Virazon, Ganter and Greenview) are set to maintain a constant downstream pressure, with associated hydraulic gradient, as summarized in Table 11, Pressure Reducing Station Data. Each of these four pressure reducing stations serves a sub-zone where pressures would be too great if served by the main Pressure Zones. The two remaining pressure reducing stations (Ardsheal and Dorothea) connect the Upper and Lower Pressure Zones at the pressure zone boundary and are intended to provide fire flow protection in the Lower Zone. In the event of a sudden drop in pressure in the Lower Zone due to a fire flow condition in the vicinity of the Ardsheal or Dorothea Pressure Reducing Stations, the respective valve would open and provide additional flow to the area as needed to meet the fire flow requirement and maintain minimum residual pressure.

Table 11 – Pressure Reducing Station Data

Name	Size	Location	Set Pressure (psi)	Ground Elevation	Set Downstream HGL (feet)
Escarpado	2.5" 4" 0.5"	Escarpado Drive, 50 feet north of West Road	83 75 90	375 375 375	567 548 Atmosphere
Virazon	2" 2" 4" 0.5"	6062 Virazon Drive, 1010 feet south of Encanada Drive.	52 24 20 30	765 765 765 765	885 820 811 Atmosphere
Ganter	1" 2" 6" 0.5”	3065 Ganter Road, 400 feet south of Cypress Drive.	45 43 40 50	780 780 780 780	884 879 872 Atmosphere
Greenview	2.5" to 2.5" 6" to 6" 2.5"	8077 Greenview Road, 580 feet east of Reposado Drive.	65 to 15 65 to 10 65	820 820 820	855 843 Atmosphere
Ardsheal PRV	6"	2323 Ardsheal Drive	13	800	830
Dorothea PRV	6"	Dorothea Rd. and Cypress St.	52	709	830

Water System Interconnections

The table below provides a summary of the interconnections in the LHHCWD system.

Table 12 – Interconnections

From	To	Type	Location
LHHCWD	SWS	Emergency	Plant 1
LHHCWD	SWS	Emergency	Solejar Drive
MWD	LHHCWD	Imported Water Supply	Plant 2
LHHCWD	CDWC	Emergency	Idaho Street
LHHCWD	ODWD	Contractual	La Mirada Plant
CDWC	LHHCWD	Emergency	CDWC HQ*
LHHCWD	RWD	Contractual	RWD HQ

*In the final planning and design phase

Suburban Water System

There are two emergency interconnections from LHHCWD to Suburban Water System (SWS). One is located at Plant 1 and the on Solejar Drive.

California Domestic Water Company

LHHCWD has an interconnection with the California Domestic Water Company (CDWC) located on Idaho Street near Rebecca Drive and connected to the LHHCWD 20-inch supply pipeline from the MWD CEN-B-47 connection. This CDWC interconnection was constructed to feed MWD water to CDWC on an emergency basis. The design flow HGL of the MWD Lower Feeder at this location is approximately 700 feet and may be higher during low flow periods in the Feeder. The CDWC HGL at this location is approximately 438. Although untested, it may be possible to take CDWC water at this location and feed the pumps at LHHCWD's Plant No. 2.

LHHCWD and CDWC have an interconnection located at the CDWC headquarters on Whittier Boulevard. The interconnection is approximately 95% complete and is missing about 30-feet on pipe between the metering structure and the connection to the LHHCWD 20-inch transmission pipeline in Whittier Boulevard. The two agencies are completing an agreement and easement documents which can lead to activation of the interconnection in the near future.

CDWC has upgraded their system to carry additional water to its customers and has additional capacity in the system to assist LHHCWD at times. In view of the current supply to the CDWC system, these interconnections should only be regarded as an additional emergency supply source in the event of failure along the LHHCWD transmission system or well field. Contact with CDWC should continue in the future to assess their capability to deliver water to LHHCWD on an as-needed basis.

Orchard Dale Water District

Over sixty years ago, La Habra Heights County Water District's (LHHCWD) and the Orchard Dale Water District (ODWD) served mainly agricultural customers and independently operated separate well fields along the San Gabriel River. At that time, ODWD's predecessor, owned by Edwin G. Hart Sr., lost all production from its wells. Through a mutually agreed upon court action and legal agreement established in 1957, ODWD became a limited partner in, what is called today, the Judson Well Field. Through this Joint Facilities Agreement, LHHCWD's business relationship with ODWD became essentially the first cooperative effort in the Central Basin intended to maximize regional water resources. The Agreement establishes the ownership of facilities and the conditions their use, operation, maintenance and repair.

The Judson Well Field continues to be ODWD's sole source for groundwater. Although LHHCWD owns and operates the Judson Well Field and La Mirada Reservoir, this resource is used to the mutual benefit of both agencies. ODWD pays a proportionate share of operation and maintenance costs for the Wells, Transmission Pipeline facilities and La Mirada Reservoir. In turn they are able to utilize their Central Basin Water Rights and avoid purchasing costly imported water from the Metropolitan Water District of Southern California (MWD).

During normal operations, all production from the Judson Well Field is pumped directly into the La Mirada Reservoir. ODWD is entitled to store water in the Reservoir for use in their system per the Agreement. The well water is then gravity fed to ODWD through a 16-inch metered connection. That 16-inch meter is read daily by LHHCWD and ODWD is billed monthly. The remaining storage in the Reservoir belongs to LHHCWD and is pumped by the La Mirada Pumping Plant toward the District for use by LHHCWD's customers.

Rowland Water District

LHHCWD and Rowland Water District (RWD) executed an agreement on May 16, 2012 for delivery of water from LHHCWD to RWD. A new 12-inch pipeline was constructed from the LHHCWD Upper Pressure Zone to the RWD Headquarters along Fullerton Road. A new interconnection was also built on the RWD Headquarters site to take the water deliveries. The Agreement spells out conditions by which capacity in the LHHCWD system may be available to RWD and operating conditions in the LHHCWD system that must be satisfied for RWD to take water. The new interconnection is operational. RWD has begun to use LHHCWD system capacity to move its water through the LHHCWD system.

Metropolitan Water District

MWD water supplied to the LHHCWD flows through the R. B. Diemer Filtration Plant. The Plant receives water from the State Water Project and the Colorado River Aqueduct. The R. B. Diemer Filtration Plant was originally designed to process approximately 400 million gallons per day (mgd) and at present has a capacity of approximately 520 mgd. The average daily flow is approximately 140 mgd in winter and 675 mgd in summer. The Plant has a clear well capacity of 24 million gallons (MG) and has a rejection hydraulic grade line at elevation 810. The 96-inch Lower Feeder leaving the Plant has a design capacity of 500 cfs. The Lower Feeder traverses the area in a westerly direction from the Plant, which is located on the easterly side of the City of Brea, to its termination point on the Orange County Feeder and Coyote Creek.

The LHHCWD presently has one connection to the Lower Feeder constructed in 1978. This connection is designated as CEN-B-47 (10 cfs or 4,488 gpm maximum). The CEN-B-47 connection is located on Monte Vista Street north of the intersection with Lambert Road. The pipeline stationing of the connection on the Lower Feeder is 1733+55.

MWD imposes certain restrictions on rates of flow through each connection to its system. These include the following:

1. Within any 24-hour period, changes in rate of flow shall not vary more than 10 percent above or below the average of the previous 24 hours.

2. Average flow during any one month shall not exceed 132 percent of annual average flow.

3. When flow through a connection is reduced below 10 percent of the requested flow or 10 percent of the design capacity of the meter, whichever is less, the District will be charged for flow at 10 percent of the capacity of the meter.

The water available to MWD from the Colorado River was curtailed upon activation of the Central Arizona Project in 1982. At that time, the District began to receive a substantially increased proportion of State Water Project water. In view of the controversy surrounding the Bay-Delta Conservation Plan, the impact of the Bureau of Reclamation's Biological Opinion related to the delta smelt, and other factors, the possibility of short-term deficiencies in MWD supplies has increased. For that reason, MWD has adapted its rate structure several times to account for variation in supply.

The rates July 1, 2015 to December 31, 2015 are a commodity fee Tier 1 Rate of $1,013 per acre-foot plus three fixed charges totaling $25,502. The rate per acre-foot will then increase to $1,032.00 and the three fixed charges will increase to $25,591 on January 1, 2016.

CHAPTER FIVE - DESIGN CRITERIA

Design Period

The future water requirements discussed in Chapter Two were based upon full development of the LHHCWD service area, per applicable General Plans, as shown in Exhibit 3 and listed in Table 5, and based upon future population estimates for the year 2020 which is considered build-out. Water facilities have been sized to deliver system demands plus fire flow based upon the land and water utilization shown. Should major changes be made in the type of land utilization, this Plan should be reviewed and revised to accommodate the changes. All design criteria is summarized in Table 13.

Ratios for MDD and PHD

The California Regulations Related to Drinking Water (§64554) outlines procedures for determining MDD and PHD. Applying those procedures to LHHCWD water production data provided for FY 2010-11 through 2014-15, Average Day Demand (ADD) is based upon delivery of 2,825 AFY.

Max Day Demand (MDD) was determined by analyzing the month (September 2013) with highest demand of 169,577 CCF and calculating average daily demand for that month. That average was then multiplied by the 1.5 peaking factor as outlined in Regulations to determine MDD. Thus, MDD = 2.37 times ADD.

Peak Hourly Demand (PHD) was calculated by taking the average hourly flow of MDD and multiplying the average by the 1.5 peaking factor as outlined in Regulations. PHD was determined to be 3.55 times average day demand (ADD).

The following ratios have been developed from LHHCWD water use data, taken from the five-year study period of FY 2010-11 to 2014-15, and have been used to predict maximum day demand (MDD) and peak hour demand (PHD) which the water system must be capable of supplying:

Maximum day demand (MDD) = 2.37 times average day demand (ADD)

Peak hour demand (PHD) = 3.55 times average day demand (ADD)

Water System Pressure Criteria

The level of service that is provided for domestic use is based on water pressure. The design criteria ultimate goal for system pressures for distribution mains under normal operating conditions should be 40 to 125 psi. Due to the terrain undulations within the community, this goal may not be achievable, but under no circumstances should the pressure in the system exceed the pressure class rating of the pipe. During minimum hour demands when booster pumps are operating to refill reservoirs, pressures should not exceed 200 psi as an ultimate goal, or the pressure rating of the pipe, whichever is lower. For fire conditions, residual pressures should not fall below 20 psi, per Fire Department requirements, except for fire hydrants that are located so close to reservoirs as to not achieve the requirement for pressure residual. These hydrants shall be designated as "draft hydrants" and piping shall be sized from the reservoir to the hydrant to provide the fire flow requirement as close to the static pressure as possible. Individual pressure regulators should be installed on any services that could have pressure greater than 80 psi at the meter as recommended in Section 1007 (b) of the Uniform Plumbing Code. The hydraulic profile of the water system is shown on Exhibit 5, Water System Hydraulic Profile.

Pipeline Design Criteria

Transmission mains should be sized in conjunction with the design of pumping plants to deliver maximum day demands. Reservoir inlet-outlet lines should be designed for maximum day demand plus fire flow or peak hour demand, whichever is greater. Transmission mains should also be sized such that the operating storage of reservoirs is replenished during minimum demand periods at night. Economical pump operation is an essential element of system design. To minimize pumping costs, velocities in transmission mains should be in the range of 4 to 6 feet per second and headloss should be in the range of 1.5 to 3 feet per 1,000 feet of pipe.

Distribution mains should be sized to provide peak hour demands or maximum day demand plus fire flow for the conditions anticipated. The maximum velocity shall not exceed 10 feet per second and headloss shall not exceed 10 feet per 1,000 feet except under fire flow conditions. To provide adequate fire flows, the minimum watermain pipeline diameter shall be 8-inches constructed anywhere in the system, except when system computer modeling proves a 6-inch pipeline is adequate.

Supply Criteria

The total water production capacity from the sources of supply must be capable of collectively meeting maximum day demands with the largest single source out of service. This standby capacity provides system reliability should wells or import water connections be out of service during maximum day demands. Sources of supply should also be sufficient to refill fire and emergency storage within 48-hours under maximum day demand conditions with all sources operating.

District Adopted Storage Criteria

The principal functions of storage in a water system are:

1. to equalize fluctuations in hourly demand so that extreme and rapid variations in demands are not imposed on the source of supply;
2. to provide water for firefighting; and
3. to meet demand during an emergency such a disruption of the major source of supply.

Operational Storage. Operational storage is determined by fluctuations in hourly demand during peak summer demand periods. Typically peak demands in excess of the maximum daily average are supplied from storage. Reservoirs are refilled during off-peak hours when demand is below the maximum day average. The volume of operational storage, as an industry standard, averages between 20 to 30 percent of maximum day demands. As a result, the recommended operational storage should equal to 30 percent of maximum day demands for all zones with storage.

Fire Storage. The water system must be capable of meeting maximum day demands and firefighting requirements simultaneously. The District's fire storage criterion is developed based on the recommendations of the Insurance Services Office (ISO), the County of Los Angeles Fire Department and the La Habra Heights Volunteer Fire Department. The present day criterion is 750 gpm for a duration of two hours in all parts of the City of La Habra Heights. The surrounding communities, governed by the County of Los Angeles Fire Department, are required to meet 1,500 gpm for a duration of two hours.

Emergency Storage. Emergency storage is required to meet demands during times of planned and unplanned equipment outages such as pump breakdown, power failure, pipeline rupture, etc. Emergency storage is estimated based on the water supply to a pressure zone being out of service for a period of 24 hours under maximum day demand conditions. This duration is based on a review of potential supply sources and their respective outages.

Equivalent ADD Storage. Operational storage is equivalent to 30% of MDD or 0.6 ADD. Emergency storage is equivalent to 100% of MDD or 1.9 ADD. Therefore, the equivalent ADD storage requirement for the system is two and one half (2.5) days of ADD, not including fire flow requirements.

MWD Suggested Storage Criteria

The MWD staff has recommended, since the late 1960's, member agencies that are 100% dependent upon MWD supplies, and their wholesale water customers, design their systems to withstand a shutdown of MWD’s facilities for an average seven day period. MWD staff strongly recommends this design criteria be adopted by its customers. This seven-day period is projected to be the maximum time required for a planned shutdown for repair and/or maintenance of the MWD system. The planned shutdowns should only occur during low to average water demand. In an emergency or water shortage, MWD will implement rationing to impacted agencies.

Should LHHCWD become 100% dependent on MWD year round due to the loss of the entire well field, it is recommended that the LHHCWD water system contain, as a minimum, storage equal to seven days of average water use, with the MWD connection shut down while maintaining other sources of supply.

Booster Pumping Units

The existing LHHCWD service demands are met directly by the booster pumping stations and reservoirs. Booster pumping plants should be sized to supply maximum day demands in pump and reservoir systems with the largest pump out of service. In addition, the booster pumps and storage should be capable of meeting peak hour demands. If there are sources of supply other than the booster plants to the pressure zones, then the capacity from the sum of the sources of supplies and the booster plant capacity should be able to provide maximum day demands with the largest booster out of service. In the future, any pressure zones without storage (closed systems) must have pumps that are capable of supplying maximum day demand plus fire flow or peak hour demand, whichever is greater.

Each pumping station should have a minimum of two pumping units of equal capacity, each sized to provide maximum day demands, so that service will remain uninterrupted in the event that one pump is not operational. Pumping stations, which consist of more than two units, should have adequate capacity to meet maximum day demands with the largest unit out of service. This criterion provides system reliability and flexibility.

It is also recommended that the District maintain an alternative power source for operating critical supply pump stations in case of power failure during emergencies.

Pressure Reducing Stations

Pressure reducing stations should be provided when needed to supplement deliveries to the Lower Pressure Zone, to supply closed pressure zones between Zones or below the Lower Zone. Pressure reducing stations should also be considered when distribution piping is operated at or above the maximum pressure rating of the pipe. Pressure reducing stations shall be sized to meet peak hour demand or maximum day demand plus fire flow, whichever is greater, within the continuous flow rating of the valves. It is recommended that three valves be installed within each pressure reducing station that is intended to feed a small closed pressure zone. Two smaller valves should be installed that, combined, can provide MDD. One larger valve should be installed that can provide all flow required in the zone.

There are two existing pressure reducing stations that support the Lower Zone from the Upper Zone should be analyzed for their specific tasks and sized appropriately. Three valves, staggered to deliver the required flow and pressure, should be installed in this type of station.

Table 13 – LHHCWD Water System Design Criteria

Element	Design Criteria
System Pressure	* Goal for normal system pressure range: 40 to 125 psi. * Goal for minimum pressure during fire: 20 psi. * Goal for maximum pressure during minimum hour: 200 psi or pipeline pressure class, whichever is less. * Daily pressure fluctuations: 20 psi maximum.
Supply	* Combined production capacity of MDD with largest single source out of service. * Combined production capacity sufficient to refill emergency and fire storage in two days with all sources operating.
Storage Capacity	* Operational: 30 percent of maximum day demand. * Fire flow: 1,500 gpm – Duration 2 hours. * Emergency: 24 hours at maximum day demand.
Booster Pumping Stations	* If gravity storage is available: capacity equals MDD with largest single pump out of service. * If gravity storage is not available: capacity equals MDD plus fire flow or PHD, whichever is greater, with largest pump out.
Pressure Reducing Stations	* Capacity equals MDD plus fire or PHD within the continuous rating of valves. Maximum intermittent flow rating of valves is acceptable for fire flows. Allowance made for low flows.
Pipeline Sizes	* Standard pipe sizes to be used are 8, 12 and 16 for distribution. 6" pipes may be considered for cul-de-sacs and in areas where hydraulic system analysis supports the smaller pipe size.
Transmission Mains	* Sized to meet MDD for pumping plant discharge lines. Sized for MDD plus fire or PHD, whichever is greater. For transmission main and reservoir inlet-outlet, velocity range: 4 to 6 fps, and headloss range: 1.5 to 3 feet per 1,000 feet of pipe.
Distribution Mains	* Sized to meet MDD plus fire or PHD, whichever is greater. * Maximum velocity of 10 fps and maximum headloss of 10 feet per 1,000 feet of pipe, except under fire flow conditions.
Fire Hydrant Spacing	* Residential: 600 feet * Commercial/Industrial: per Fire Department requirements.

CHAPTER SIX - EXISTING SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS

General

The analysis of the LHHCWD water system to determine required improvements was approached by identifying existing water supply sources and employing computer simulation technology to assess the ability of the storage and distribution systems to meet existing and projected demands. Although the computer model is a key element in the determination, other major considerations are included in the development of the recommended improvements. These considerations include:

- Water sources, including wells and imported water from MWD
- Storage in each zone
- Pumping capacity and efficiency
- Operational parameters determined by the LHHCWD Staff

The LHHCWD system is divided into two main pressure zones, Lower Zone, and the Upper Zone. Each zone includes of a series of reservoirs working collectively to provide fire, and emergency storage by gravity.

Storage Analysis

LHHCWD has seven existing reservoirs with a gross storage capacity of 13.85 MG. Of these, six reservoirs establish the hydraulic gradient of the two pressure zones, and one, the La Mirada Reservoir, acts as a groundwater blending facility and a forebay for pumping water to the gravity storage reservoirs in the Lower Zone. Gravity storage reservoirs are typically operated with a maximum water level one-foot below the reservoir overflow elevation. Table 14 shows reservoir data including capacity, construction material and the Zone or Plant served. Not shown in the Table is the 47,000-gallon forebay at Plant No. 1 as this does not serve as a storage facility but a functional component of the Plant No. 1 pumping facility.

The following storage analysis is based upon the District's adopted criteria and MWD's suggested criteria. The adopted criteria represent the sum of volumes required to provide functional storage with respect to fire storage, operational storage and emergency storage. The MWD criteria represent the required volume to maintain service during a planned shutdown of imported water deliveries for routine maintenance purposes, typically seven days of Average Day Demand (ADD).

Table 14 – Reservoir Data

RESERVOIR	CAPACITY (MG)	MATERIAL	ZONE SERVED
La Mirada Plant	4.29	Steel	NA
No. 2	2.06	Steel	Lower
No. 5A	1.56	Steel	Lower
Lyons	1.94	Steel	Lower
Snooks	0.47	Steel	Upper
No. 9	1.97	Steel	Upper
No. 10A	1.56	Steel	Upper
TOTAL STORAGE	**13.85**		

Storage criteria for water systems are based on the following District adopted storage requirements, per Chapter Five (Design Criteria):

- Operational Storage: The volume of water required to provide storage for fluctuations in demand during the day. This volume has been determined to be equivalent to 30% of one day of the Maximum Day Demand.

- Fire Storage: The volume of water required to meet the short-duration high demand of a fire flow. The La Habra Heights Municipal Code and Los Angeles County Fire Code determine fire flow requirements based on building characteristic and land use.

- Emergency Storage: The volume of water required to provide for planned and unplanned equipment outage such as pump breakdown, pipeline failure, electrical-power outage or natural disaster. This volume has been determined to be equivalent to 100% of one day of the Maximum Day Demand.

Table 15 provides an analysis of existing, near-term and ultimate conditions for the adopted and suggested storage criteria. The *Surplus or Deficit* column evaluates the existing storage capacity in each zone against the required storage per the adopted design criteria, and the *Equivalent Total Number of ADD Days* column indicates how the District's capacity compares to MWD suggested criteria for storage.

Table 15 - Reservoir Storage Analysis for Existing and Ultimate (2030) Conditions

Condition		Existing		Ultimate	
Zone		Lower	Upper	Lower	Upper
Useable Gravity Storage (MG)		5.56	4	5.56	4
ADD	(gpm)	1126	625	1397	775
	(mgd)	1.62	0.9	2.01	1.12
MDD	(mgd)	3.84	2.13	4.77	2.65
Fire Storage*	(gpm)	1500	750	1500	750
	(hrs.)	2	2	2	2
	(MG)	0.18	0.09	0.18	0.09
Operational Storage [0.3×MDD] (MG)		1.15	0.64	1.43	0.79
Emergency Storage [1.0×MDD] (MG)		3.84	2.13	4.77	2.65
Total Required Storage (MG)		5.18	2.86	6.38	3.53
Surplus or (Deficit) (MG)		**0.38**	**1.14**	**(0.82)**	**0.47**
Equiv. Total No. of ADD Days		3.43	4.45	2.76	3.59

* Fire storage considers fire flow requirements, which are based on housing density. The Upper Zone consists of low density residential with fire flow requirements of 750 gpm for two hours. Fire flow requirements in the Lower Zone are governed by several areas of medium density housing at 1500 gpm for two hours.

MWD recommends that member agencies provide storage equivalent to seven days of imported water average day demand so the agency may be sustained during routine shutdowns for maintenance. Currently, LHHCWD meets the vast majority of demand scenarios from groundwater and would therefore may be unaffected by an MWD shutdown. If, in the future, LHHCWD shifts production to include water imported from MWD, the issue of MWD's storage recommendation should be revisited.

The result of the storage analysis presented in Table 15 indicates the both pressure zones have sufficient storage for existing demand conditions to meet the adopted design criteria established in Chapter 5. However, the Lower Zone is projected to have a storage deficiency by 2030. The District would be able to share excess storage from the Upper Zone, but should begin planning for additional storage as demand increases. It is recommended that LHHCWD explore opportunities to take advantage of the adequate or surplus storage through operational scenarios aimed at peak shaving electric rates through more use of time of use (TOU) rates through Southern California Edison.

Booster and Well Pump Analysis

Efficiency

The most recent annual energy efficiency tests performed by Southern California Edison were examined for each of the well and booster pumps in the system. At such time that any pump falls below 65% efficiency, an analysis should be performed to determine capital improvements necessary to increase efficiency.

Per the latest pump efficiency tests, the pumps listed in Table 16 are candidates for retrofit or replacement strictly based on efficiency ratings with the lowest efficiency having the highest priority.

Table 16 - Booster Pump Efficiency Analysis

Pump No.	Efficiency	Test
Well No. 10	32.9%	July 2015
Well No. 11	36.8%	July 2015
All Plant 2 Boosters	50 - 60%	March 2006

To improve supply redundancy, it is recommended to perform work on Well Pumps No. 10 and No. 11.

Plant 2 is used as a secondary source of supply. Considering the District's desire to rely solely on groundwater, the benefits of upgrading or retrofitting these imported water connection pumps are minimal. Even though some of the pumps at Plant 2 fall below the 65% efficiency threshold, their role as a redundant supply source and the limited expected used of this facility precludes expenditures for high efficiency.

Booster Capacity

An analysis has been performed of the ability to meet the Chapter 5 design criteria for booster pumps. Table 17 provides an evaluation of existing demand against booster capacity per the Water Model with the largest pump in each station out of service. Since the Upper Zone is dependent for its supply on the Lower Zone, booster pumps in the Lower Zone must be capable of providing the MDD for the entire District. The booster pumps in the Upper Zone need only provide the Upper Zone's MDD. The Lower Zone booster pumps considered in this analysis include all Plant 2 boosters except Pump 3 and all Plant 1 boosters except Pump 3. The Upper Zone pumps considered were Pump 1 at Plant 5 and Pump 1 at Plant 6.

Table 17 - Booster Pump Analysis for Ultimate (2030) Conditions

Condition	Zone	ADD (gpm)	MDD (gpm)	Capacity w/ Largest Pump in Zone Off-line (gpm)	Surplus or (Deficit) (gpm)
Existing	Both	1,751	4,150	7,045	2,895
	Upper	625	1,481	1,578	97
Ultimate	Both	2,172	5,148	7,045	1,897
	Upper	775	1,838	1,578	**(260)**

There are no booster pump deficiencies under existing demand scenario. However, the capacity of the booster pumps in the Upper Zone is projected to have a deficiency under ultimate conditions. In conjunction with the Emergency Recovery requirements, it is recommended that a pump be added to an Upper Zone Plant to satisfy the deficiency.

Booster Capacity to Deliver Groundwater

The District desires to provide 100% of its supply from its groundwater sources in the Judson Well Field. Groundwater is boosted into the Lower Zone at Plant 1 only. An additional analysis was provided to demonstrate the capacity of Plant 1 and the La Mirada Plant to boost groundwater into the Lower Zone with Plant 2 (i.e. imported water) off-line. In this analysis per Table 18, Pump 3 at Plant 1 was considered to be out of service.

Table 18 - Additional Booster Pump Analysis

Condition	Zone	ADD (gpm)	MDD (gpm)	Plant	Capacity w/ Two Pumps Only (gpm)	Surplus or (Deficit) (gpm)
Existing	Both	1,751	4,150	Plant 1	2,890	**(1,260)**
				La Mirada	2,970	**(1,180)**
Ultimate	Both	2,172	5,148	Plant 1	2,890	**(2,258)**
				La Mirada	2,970	**(2,178)**

Neither Plant 1 nor the La Mirada Plant has sufficient capacity under any demand condition for redundant reliance on 100% groundwater for a Maximum Day Demand scenario. In the event of a booster failure at either plant, imported water would have to be supplied via Plant 2 to supplement the deficient groundwater flow.

Emergency Recovery

The water system's existing configuration maintains an excess source of emergency storage in the Lower Zone and at the La Mirada Reservoir. The ability to transfer the water to the Lower Zone and the Upper Zone after a major fire event is a critical element of the examination of the booster pump facilities. The criterion established is to recover emergency and fire storage within 48-hours in a maximum day demand environment.

The conditions for this analysis include:

1. Existing maximum day system demands of 4,150 gpm and 5,148 gpm in 2030 with 64.3% of the demand occurring in the Lower Zone and the remaining 35.7% in the Upper Zone.
2. Combined emergency and fire storage to be recovered is calculated in Table 15.
3. The largest well (Well No. 11) and the largest booster pump at each Plant are assumed to be out of service. The following were considered to be off-line for the existing system:

Table 19 – Off-Line Booster Pumps

Plants	Facility	Source
La Mirada	BP No. 1	La Mirada Reservoir
Plant No. 1	BP No. 3	Forebay
Plant No. 2	BP No. 3	MWD
Plant No. 5	BP No. 2	Reservoir No. 2
Plant No. 6	BP No. 2	Lyons Reservoir

Results for the emergency recovery analysis are summarized in Table 20.

Table 20 - 48-Hour Refill Capacity

Condition	Zone	MDD (gpm)	Required Refill (gpm)	Capacity (gpm)	Surplus or (Deficit) (gpm)
Existing	Both	4,150	2,169	6,856	538
	Upper	1,482	772	1,585	**(668)**
Ultimate	Both	5,148	2,668	6,856	**(959)**
	Upper	1,838	950	1,585	**(1,203)**

Under the conditions indicated, the Lower Zone will recover emergency and fire storage within 48-hours while meeting MDD in both Zones. Production is required from both groundwater and imported water sources. For groundwater production, the governing factor for groundwater capacity is the loss of Well 11. With Well 11 out of service, groundwater production is limited to 2,940 gpm from the remaining wells. The La Mirada Plant and Plant 1 have a redundant capacity of 2,969 gpm and 2,832 gpm, respectively. Therefore, the District must rely on imported water to supplement groundwater for emergency refill.

The Upper Zone booster capacity from Plants 5 and 6 cannot meet the 48-hour recovery criteria. The deficiency will reach approximately 1,203 gpm by 2030.

It is recommended the District provide increased pumping capability to the Upper Zone to meet the 48-hour refill requirements. Each Upper Zone Plant has a spare pump can. It is recommended that a 1,200 gpm capacity pump be added to at least one Plant to satisfy the deficiency.

Intimately linked to emergency pumping capacity is emergency power. To provide for emergency operations, all motor control centers and electrical panels should be upgraded and/or retrofitted to accept power supplied from a back-up generator. At this time, LHHCWD maintains four portable backup power generators and has retrofitted all plants with hookups to run off those generators. No additional backup power improvements are required.

Existing Wells and MWD Connection Analysis

LHHCWD has four active wells in service. The existing wells have a combined dynamic production capacity of 4,247 gpm based upon production tests conducted in late July 2015. The recent rehabilitation of Well No. 8 and No. 9 have increased their production. Typically, in older cable tool wells such as Well No. 8 and No. 9, production declines one half of one percentage per year and they have an operational life of approximately 60 to 80-years. LHHCWD Well No. 8 and No. 9 are approaching the end of their operational lives, as evidenced by accelerated production decline over the past ten years prior to rehabilitation. Rehabilitation of these wells has extended the operational life by an additional ten years; however, replacement of these wells is paramount to the District's ability to meet long-term future demands utilizing groundwater as a sole source.

At present, the water produced from the District's wells is delivered to contractual customers on an as-needed basis. At times of extremely high demand during the summer months or in the event of equipment failure, the District uses its wells in conjunction with MWD import water and storage to meet Maximum Day Demands of 4,142 gpm and Peak Hour Demands of 6,212 gpm.

The MWD connection is the most reliable, high quality, non-interruptible water source for the District. The inclusion of the connection provides sufficient water to meet the Maximum Day Demands of the system. In the future, the Judson Well Field may be subject to new, more stringent guidelines due to their proximity to Los Angeles County spreading operations. If the Department of Public Health concludes that the wells are under direct influence of the spreading operations and treatment is mandated, the District would be totally dependent on MWD for some time frame. To provide redundancy in the supply system, the District should develop another import source such as a contractual agreement for wholesale water supply with the California Domestic Water Company.

Computer Modeling Program

The computer modeling program used to model the District's water system is the InfoWater software by Innovyze. InfoWater is a sophisticated and powerful software package that uses GIS as a visual interface. It operates under a Windows environment to perform steady state analyses of water distribution systems including pipes, pumps, reservoirs, tanks and control valves.

Each element (pipe) is a fluid conductor of known properties connecting two nodes such that, for a given value of flow through the element, a unique value of head change will occur. There are five types of nodes utilized in the program:

- Reservoir – A reservoir represents a fixed head source with an infinite volume such as an aquifer or imported water connection.
- Tank – A tank represents a variable head source with a finite volume that may fill or empty.
- Pump – A pump adds head to the system in a predetermined direction according to a performance curve of head vs. flow.
- Valve – A valve subtracts head from the system in a predetermined direction. There multiple types of valves including pressure reducing, pressure sustaining and flow control. Furthermore, a valve may be programmed to represent a known point loss in the system such as a treatment facility or dynamic mixer.
- Demand Node – System demands are estimated for an area and allocated to the nearest demand node as a fixed flow.

InfoWater generates and maintains an interactive database containing static and variable data. The static data represent physical elements of the water system that remain constant over time, such as pipes, reservoirs, pumps, valves, hydrants and other appurtenances. The variable data represent the dynamic aspects of the water system that tend to change over time, such as demand, reservoir levels, and pump and valve operations. A scenario is a predetermined combination of static and variable elements that represents a set of boundary conditions of interest to the engineer. Through an iterative process, InfoWater applies a hydraulic gradient algorithm to the boundary conditions provided in the scenario to predict the hydraulic performance of the system.

InfoWater has the option of using one of three equations for head loss: the Hazen-Williams Equation, Manning's Equation and the Darcy-Weisbach Equation. The Hazen-Williams equation, which is an empirical formula applicable to turbulent flow, is the most frequently used and therefore, was used in the Water Model.

Redevelopment of the Model

As part of this Master Planning effort, the District's water system computer model has been updated to reflect all changes to the distribution system that impact hydraulics since the previous model update in 2010 The hydraulic implications of the following improvements and changes have been programmed into the Water Model to ensure accuracy and proper correlation between the Water Model and the actual distribution system:

- Pipeline improvements in Fullerton Road from Skyline Drive to the easterly District Boundary

- All pipelines and facilities related to groundwater production

A five-year study period from FY 2010-11 to 2014-15 was determined to be representative of typical water demand. Monthly records of water production and sales for the study period, identification of the twenty-five top water users, and continuous telemetry data from July 2015 were used for upgrading the model demands and system performance parameters.

Records of water use were analyzed to establish water consumption patterns. The water use was then reallocated among the demand nodes throughout the distribution system by the duty of water method described in Chapter Two. The top twenty-five large water consumers, specifically located by meter records, were superimposed as demands at the nearest node on the distribution system. Water use ascertained by the water duty method was distributed only to demand node not occupied by a large water customer.

Distribution System Analysis

The Water Model was run under two existing scenarios: Maximum Day Demand plus Fire Flow (MDD+FF) and Peak Hour Demand (PHD). MDD+FF is intended to determine the system's capacity to meet fire flow requirements under a worst case scenario while maintaining a minimum residual pressure of 20 psi throughout the system. PHD is intended to examine the impact of the worst case normal operating scenario on transmission and distribution pipe velocity and system pressure.

Per Table 21, the MDD+FF analysis revealed nine deficient hydrants under existing demand conditions.

Table 21 - Fire Flow Deficiencies

FH ID#	Model ID#	Location	Residual Pressure (psi)	Available Flow @ 20 psi (gpm)	Comments
5-1	840	Ganter Sub-zone Atlas Map Sheet 5	-182.24	342.37	4-inch pipe restricts flow
5-8	845	Ganter Sub-zone Atlas Map Sheet 5	-112.39	541.01	4-inch pipe restricts flow
No ID	FH-105	Skyline Dr. west of Casolero Dr. Atlas Map Sheet 30	-57.60	518.54	4-inch pipe restricts flow
No ID	605	Fullerton Rd. Atlas Map Sheet 28	-7.24	681.87	elevation and long dead-end pipe
No ID	FH-83	Skyline Dr. west of Casolero Dr. Atlas Map Sheet 30	-6.34	608.54	4-inch pipe restricts flow
11-47	J78	Avocado Crest Rd. east of Lamat Rd. Atlas Map Sheet 11	5.44	559.71	elevation and distance from reservoir
21-5	J372	2590 Skyline Dr. Atlas Map Sheet 21	8.71	680.04	elevation and long dead-end pipe
12-5	J76	Avocado Crest Rd. east of Lamat Rd. Atlas Map Sheet 12	10.19	609.32	elevation and distance from reservoir
31-19	1185	Leucadia Rd. east of Panchoy Pl. Atlas Map Sheet 31	15.70	666.04	elevation and long dead-end pipe

Hydrants 5-1, 5-8, and the hydrants on Skyline Dr are all restricted by 4-inch mains. It is recommended to replace the existing 4-inch mains with 8-inch pipelines.

Hydrants 11-47 and 12-5 are at high elevations in the Lower Zone and would benefit from reconfiguration into the Upper Zone. It is recommended to extend a pipeline from the zone boundary in Avocado Crest Rd. to the hydrant locations and reconnect them.

Hydrant 21-5 cannot provide adequate fire flow due to poor connectivity and distance from the reservoir. It is recommended to install an 8-inch pipeline between Skyline Dr at Hydrant 21-5 and Oak Ranch Rd.

Lastly, Hydrant 31-19 has poor fire flow capacity due to an undersized main. It is recommended to replace the existing 6-inch main in Leucadia Rd with a new 8-inch pipeline.

Table 22 summarizes improvements recommended to address the fire flow deficiencies identified in Table 21.

Table 22 - Recommended Pipeline Improvements for Fire Flow Deficiencies

FH ID#	Model Pipe ID#	Location	Length (ft)	Existing Diameter (inch)	Replacement Diameter (inch)
5-1, 5-8	P-910	Ganter Rd. between PRV and FH 5-8	700	4	8
FH-105	P175	Skyline Dr. between Casolero Dr. and Jct FH-115	1,000	4	8
FH-83	P173	Private Road between intersection of Skyline Rd./Casolero Dr. and Jct FH-83	500	4	8
11-47	Parallel to P163 P165	Avocado Crest Rd. between Hydrant 12-5 and Hydrant 11-47. Atlas Map Sheet 11 & 12	750	None; No Existing Pipe Present	8
12-5	Parallel to P-875	Avocado Crest Rd. between Zone Boundary and Hydrant 12-5. Atlas Map Sheet 12	570	None; No Existing Pipe Present	8
21-5		Cross-country pipe between Skyline Dr. and Oak Ranch Rd.	900	None; No Existing Pipe Present	8
31-19	P-1265	Leucadia Rd. between Skyline Dr. and Panchoy Pl.	820	6	8

High Pressure

There were multiple occurrences of high pressure that have been grouped into nine areas. Table 23 provides a summary of the affected areas. The location and extent of these areas is shown in Exhibit 6 (Existing Water System Pressure Deficiencies).

Table 23 - High System Pressure Deficiencies

Area No.	Area Name	Included Streets	Affected Model Junctions	Average Pressure (psi)	Max. Pressure (psi)
1	Picaacho	Picaacho Dr., Le Flore Dr., Las Palomas Dr., Subtropic Dr., El Empino Dr., Encanada Dr., Virazon Dr.	36	138	233
2	Dorothea	Dorothea Rd. between Cypress St. and Fullerton Rd., Nabal Rd., Cypress St.	23	128	189
3	East Rd.	East Rd. between Churchill Rd. and Fullerton Rd., Tumin Rd., Valle Dr., Churchill Rd.	15	159	190
4	West Rd.	West Rd, Cancho Dr., Calle Juca, Terraza Dr., Cloister Dr., La Riatta Dr., Bonnie Jean Rd., Angola Ave., Las Palomas Dr., El Travesia Dr.	40	125	188
5	Fullerton	3 residences near southern terminus of Fullerton Rd.	3	159	162
6	LA County	Villa Rita Dr., Eseverri Ln.	12	127	176
7	Canada Sombre	Canada Sombre Rd.	6	124	161
8	Avocado Crest	W Avocado Crest Rd., Hidden Canyon Rd.	4	142	170
9	Papaya Drive	At Papaya Dr.	1	149	149

Following are descriptions and recommendations for each of the high pressure areas cited in Table 23.

1. Picaacho

The Picaacho Area includes all points fed from the 12-inch main in Casolero Dr. south of the western terminus of Casolero Dr. Convert the Picaacho Area into a sub-pressure zone by installing a pressure reducing station in Casolero Dr. south of Lupin Hill Rd.

2. Dorothea

The Dorothea Area provides hydraulic looping in a large portion of the eastern Upper Zone. Leaving such loops intact offers superior system redundancy even at the cost of excess pressure. However, installation of a pressure reducing station in Dorothea Rd. just southwest of Tumin Rd. would segregate the highest pressure deficiencies into a sub-pressure zone without disrupting circulation or looping. Those residences in Dorothea Rd. east of Tumin Rd. should be fitted with individual pressure reducing devices as necessary.

3. East Road

East Rd. is an important transmission pipeline linking Plant 6 to the Upper Zone reservoirs. However, reconfiguration of a portion of the East Rd. Area is possible. Install a pressure reducing station in East Rd. just west of Valle Dr. and close an isolation valve in Ahuacate Rd. just north of Churchill Rd. Those residences in East Rd. east of Valle Rd. should be fitted with individual pressure reducing devices as necessary.

4. West Road

West Rd. is a primary transmission pipeline from Plant 1 into the Lower Zone. It is not recommended to make any hydraulic changes that may affect transmission in this corridor.

5. Fullerton

The number of affected residences in the Fullerton Area is small. Individual residential pressure reducing devices are recommended as necessary.

6. LA County

The LA County Area is currently fed by an 8-inch pipeline in Hacienda Blvd. and an 8-inch cross-country pipeline between Avocado Crest Rd. and Villa Rita Dr. This area has a higher fire flow requirement than most of the rest of the service area, due primarily to higher density. The following improvements are recommended to provide system pressures within the Design Criteria without compromising fire flow capacity:

- Replace the existing 4-inch pipelines in Hacienda Blvd. between Avocado Crest Rd. and Villa Rita Dr. with 8-inch pipe.
- Install a PRV on the new 8-inch pipeline in Hacienda Blvd. just south of Avocado Crest Rd.
- Abandon the 8-inch cross-country pipe between Avocado Crest Rd. and Villa Rita Dr.

7. Canada Sombre

Canada Sombre Rd. forms a critical loop in the Upper Zone. Individual residential pressure reducing devices are recommended as necessary.

8. Avocado Crest

The Avocado Crest Area is hydraulically isolated and would benefit from pressure reduction. Install a pressure reducing station in Solejar Dr. at Conchito Dr. and install and/or close a zone valve in the cross-country 6-inch pipeline connecting Amante Dr. to Hidden Canyon Rd. in the vicinity if the northern terminus of Hidden Canyon Rd.

9. Papaya Drive

The number of affected residences in the Papaya Drive Area is small. Individual residential pressure reducing devices are recommended as necessary.

Low Pressure

There was a small number of low pressure modeling results under PHD conditions as summarized in Table 24. The location and extent of these areas is shown in Exhibit 6 (Existing Water System Pressure Deficiencies).

Table 24 - Low System Pressure Deficiencies

Area No.	Area Name	Location	Model ID#	Pressure (psi)
10	Leucadia	East end of Leucadia Road	1185	36
11	Le Flore	Le Flore Drive north of Solejar Drive	1685	37
12	Chota	Fullerton Road and Chota Road	255	35
13	Skyline Vista	Skyline Vista Drive	720	28
14	Suncrest	Suncrest Court	J82	15

10. Leucadia

The Leucadia Rd. area is at a high elevation with no opportunity for looping. Recommended solutions for this deficiency are limited to installation of some kind of pump to provide additional pressure. If a higher pressure zone is established to accommodate further development at this elevation, Leucadia Rd. would be a good candidate for inclusion in that zone.

11. Le Flore

The 12-inch pipeline in Le Flore Dr. is a primary Lower Zone transmission pipeline between Plant 1 and Reservoir 5A. It is recommended to extend a small Upper Zone distribution pipeline south from Pichaacho Dr. to any affected residences.

12. Chota

If there are any residences experiencing low pressure in the vicinity of Fullerton Rd. and Chota Rd., it is recommended to extend a lateral from the Upper Zone to the affected residences.

13. Skyline Vista

The Skyline Vista Dr. area is at a high elevation and existing looping is insufficient to provide adequate pressure. Recommended solutions for this deficiency are limited to installation of some kind of pump to provide additional pressure. If a higher pressure zone is established to accommodate further development at this elevation, Skyline Vista Dr. would be a good candidate for inclusion in that zone.

14. Suncrest

Residences on Suncrest Ct. are at elevations too high to be effectively serviced by the Upper Zone. Residences in Suncrest Court are equipped with individual pressure pumps to overcome the low system pressure. If a higher pressure zone is established to accommodate further development at this elevation, Suncrest Ct. would be a good candidate for inclusion in that zone.

Cross-Country Pipelines

LHHCWD has expressed an interest in eliminating extraneous or unnecessary cross-country pipelines. In general, cross-country pipelines are difficult to access which tends to make them less reliable. However, cross-country pipelines that form hydraulic loops tend to improve redundancy and capacity. ***Civiltec*** has identified 23 cross-country pipelines as listed in Table 25 and shown in Exhibit 7 (Existing Cross-County Pipelines). It is recommended to perform additional hydraulic analysis on these pipelines to determine the feasibility of abandoning their alignments in favor of more accessible alignments.

Table 25 - Summary Of Cross-Country Pipelines

No.	Zone	From	To	Size (in.)	Purpose	Comments
1	Upper	El Cajonita	Le Flore	8	Distribution	Only supply to Le Flore and Picaacho
2	Upper	Las Palomas	El Cajonita	6	Distribution	Only supply to Le Flore and Picaacho
3	Upper	Lupin Hill	Las Palomas	12	Distribution	Only supply to western end of Upper Zone
4	Upper	Casolero	Lupin Hill	12	Distribution	Only supply to western end of Upper Zone
5	Upper	Hacienda	Ardsheal	6	Distribution	Forms minor loop
6	Upper	Reposado	Greenview	12	Transmission	Primary link between Plant 5 and Snooks Reservoir
7	Upper	Canada Sombre	Reposado	6	Distribution	Forms minor loop
8	Upper	Reposado	Papaya	10	Transmission	Provides equalization between Snooks Reservoir and Reservoir 9
9	Upper	Pinto	Valle	10	Transmission	Provides equalization between Snooks Reservoir and Reservoir 9
10	Lower	Dorothea	Coban	12	Transmission	Primary outlet for Lyons Reservoir

No.	Zone	From	To	Size (in.)	Purpose	Comments
11	Lower	East (Oil Company Rd)	Dorothea	18	Transmission	Primary link from Plants 1 & 2 to Lyons Reservoir
12	Lower	Dorothea	Caminita	18	Transmission	Primary link from Plants 1 & 2 to Lyons Reservoir
13	Lower	Choral	Pipe Edge Drive	8	Distribution	Forms minor loop
14	Lower	Popenoe	Bonita	6	Distribution	Forms minor loop
15	Lower	El Paseo	Dorothea	6	Distribution	Forms minor loop
16	Lower	Avocado Crest	Villa Rita	8	Distribution	Forms minor loop, recommended for abandonment per CIP #8
17	Lower	Villa Rita	Antoinette	8	Distribution	Forms minor loop
18	Lower	Encanada Drive	Nueva Vista Drive	10	Transmission	Primary link between Plant 2 and Reservoir 2
19	Lower	Nueva Vista Drive	Chandos	16	Transmission	Primary link between Plant 2 and Reservoir 2
20	Lower	Hidden Canyon	Amante	6	Distribution	Forms minor loop
21	Lower	Hacienda	Hacienda	4	Distribution	Minor dead-end
22	Lower	West	Hidden Canyon	8	Transmission	Forms minor loop
23	Lower	Nabal	1661,1675 & 1707	3	Service	Service line to homes

Time Phased Improvements and Expenditures

The improvements described herein include certain operational and maintenance items as well as new requirements identified in this investigation. Costs for each proposed improvement were estimated, and each project was assigned a schedule for construction within one of the next two five-year periods, depending on the perceived urgency. Total cost for pipeline replacements was estimated at $15.00 per inch diameter per linear foot to include conflict resolution with existing substructures, grade difficulties, traffic controls, and service reconnection costs. Cost escalation is assumed to be 5% per year.

The total cost has been estimated at 35 percent above construction cost as follows:

- 20% Engineering Design and Construction Management Cost
- 5% District Administration
- 10% Contingencies

The Capital Improvement Project Locations are shown on Exhibit 8 (Recommended Capital Improvements) and Schedules are provided in Tables 22 and 24 so the LHHCWD Staff and Management can prioritize expenditures, based on the availability of funding. Tables 23 and 25 provide descriptions of the projects. Market conditions, detailed design, and the extent to which designs are performed by consultants will determine actual cost. The number system in the CIP list does not reflect a priority.

LHHCWD's financial planning and budgeting should allow the time-phased expenditures to implement the 5-year and 10-year Capital Improvement Plans. The total 10-year program is estimated at $5,921,000 in 2015 dollars.

5-YEAR CAPITAL IMPROVEMENT PROGRAM

Table 26 - 5-Year Capital Improvement Program (Cost presented x $1,000)

No	DESCRIPTION	JUSTIFICATION	CONSTR. COST	ENGR & CONSTR MANAGEMENT (20%)	DISTRICT ADM. (5%)	CONTING. (10%)	2015 EST ($1,000)	2020 EST ($1,000)
1	Replace 700 feet of 8-inch pipe in Ganter Rd.	Improve fire flow	84	17	5	9	115	147
2	Existing Water Sources Study	Increase production reliability	25	5	2	3	35	45
3	Cross-country Pipeline Study	Operations and Maintenance	35	7	2	4	48	62
4	Upgrade or Retrofit Well Pump No. 10	Increase production reliability	50	10	3	5	68	87
5	Upgrade or Retrofit Well Pump No. 11	Increase production reliability	50	10	3	5	68	87
6	Well Siting Study	Increase supply reliability	65	13	4	7	89	114
7	SCADA System Upgrades	Improve emergency and operations response	100	20	5	10	135	173
8	Install 1330 feet of parallel 8-inch pipe in Avocado Crest Rd.	Improve fire flow	160	32	8	16	216	276
9	Replace 820 feet of new 8-inch pipe in Leucadia Rd.	Improve fire flow	99	20	5	10	134	172
10	Replace 1500 feet of 8-inch pipe in W Skyline Drive	Improve fire flow	180	36	9	18	243	311
11	Install 900 feet of 8-inch pipe between Skyline Drive and Oak Ranch Rd.	Improve fire flow	120	24	6	12	162	207
12	Install 800 feet of 8-inch pipe on Hacienda Road and Private Road north of Reposado Drive	Relocation of cross-country pipeline	155	31	8	16	210	268
13	Install 720 feet of 8-iuch pipe on Subtropic Drive and 680 feet of 6-inch pipe on Private Rd	Replacement of existing pipeline with leak history	240	48	12	24	324	413
14	Install 410 feet of 18-inch pipe on Tumin Road from Caminita Lane to abandoned Reservoir #4	Replacement of existing pipeline with leak history	111	23	6	12	152	194
15	Install 675 feet of 18-inch pipe on Tumin Road from Reservoir #4 to Coban Road	Replacement of existing pipeline with leak history	183	37	10	19	249	318
TOTAL			**1,657**	**333**	**88**	**170**	**2,248**	**2,876**

* The number system in this Table does not reflect priority.

5-YEAR CAPITAL IMPROVEMENT PROGRAM DESCRIPTIONS

Table 27 - 5-Year Capital Improvement Program (Cost presented x $1,000)

No	DESCRIPTION	PROJECT DESCRIPTIONS
1	Replace 700 feet of 8-inch pipe in Ganter Rd.	The Ganter Sub-zone has poor fire flow capacity due to undersized mains. Replace the existing 4-inch main in Ganter Rd. between the PRV and Hydrant 5-1 with 700 feet of 8-inch pipe.
2	Existing Water Sources Study	Conduct a study to determine available water resources in the vicinity of LHHCWD. Evaluate the feasibility of developing those sources.
3	Cross-country Pipeline Study	Perform a hydraulic analysis to determine the feasibility of eliminating cross-country pipelines from the distribution system. Recommend any upgrades or reconfigurations that would accomplish this goal.
4	Upgrade or Retrofit Well Pump No. 10	The efficiency of Well Pump No. 10 can be improved through upgrading or retrofitting the pump and/or motor. This will result in lower operating costs and longer service life. Inspect the pump to determine the best course of action. Perform recommended work to improve.
5	Upgrade or Retrofit Well Pump No. 11	The efficiency of Well Pump No. 11 can be improved through upgrading or retrofitting the pump and/or motor. This will result in lower operating costs and longer service life. Inspect the pump to determine the best course of action. Perform recommended work to improve efficiency.
6	Well Siting Study	Perform a well siting study to determine possible locations to site new well(s).
7	SCADA System Upgrades	Study and perform upgrades to the SCADA system to meet operational goals of the District.
8	Install 1330 feet of parallel 8-inch pipe in Avocado Crest Rd.	Hydrants 11-47 and 12-5 cannot maintain adequate residual pressure under the current configuration. Install 1330 feet of parallel 8-inch pipe in Avocado Crest Rd. from the Upper Zone between the zone boundary and Hydrant 11-47. Reconfigure Hydrants 12-5 and 11-47 into the Upper Zone.
9	Replace 820 feet of new 8-inch pipe in Leucadia Rd.	Hydrant 31-19 has poor fire flow capacity due to an undersized main. Replace existing 6-inch main in Leucadia Rd. between Skyline Dr. and Panchoy Pl with 820 feet of new 8-inch pipe.
10	Replace 1500 feet of 8-inch pipe in W Skyline Drive	Residences north of the intersection of W. Skyline Drive and Casolero Drive experience poor fire flow capacity due to undersized mains. Replace existing 4-inch mains in W. Skyline Drive and Private Road north of Casolero Drive with 1500 feet of 8-inch pipe.
11	Install 900 feet of 8-inch pipe between Skyline Drive and Oak Ranch Rd.	Hydrant 21-5 cannot provide adequate fire flow due to poor connectivity and distance from the reservoir. Install 900 feet of cross-country 8-inch pipe between Skyline Drive at Hydrant 21-5 and Oak Ranch Rd.
12	Install 800 feet of 8-inch pipe on Hacienda Road and Private Road north of Reposado Drive	The existing 4-inch cross-country pipeline is located behind existing properties and difficult to maintain. Install 800 feet of 8-inch pipe on Hacienda Road north of Reposado Drive and along a Private Road to a dead end reconnecting existing services.
13	Install 720 feet of 8-iuch pipe on Subtropic Drive and 680 feet of 6-inch pipe on Private Rd	Existing services are fed by very old 2-inch lines that cut through properties. Transfer existing services to 680 feet of 8-inch pipe on Subtropic Drive north of Virazon and 680 feet of 6-inch pipe on a Private Drive north of West Road east of Ladera Street.
14	Install 410 feet of 18-inch pipe on Tumin Road from Caminita Lane to abandoned Reservoir #4	Existing 18-inch pipe has a history of leaks and includes connections to the existing abandoned Reservoir #4. Install 410 feet of 18-inch pipe on Tumin Road from Caminita Lane to abandoned Reservoir #4.
15	Install 675 feet of 18-inch pipe on Tumin Road from Reservoir #4 to Coban Road	Existing 14-inch and 16-inch pipe has a history of leaks and includes connections to the existing abandoned Reservoir #4. Install 675 feet of 18-inch pipe on Tumin Road from the abandoned Reservoir #4 to Coban Road.

10-YEAR CAPITAL IMPROVEMENT PROGRAM (Cost presented x $1,000)

Table 28 - 10-Year Capital Improvement Program (Cost presented x $1,000)

No	DESCRIPTION	JUSTIFICATION	CONSTR. COST	ENGR & CONSTR MANAGEMENT (20%)	DISTRICT ADM. (5%)	CONTING. (10%)	2015 EST ($1,000)	2020 EST ($1,000)
16	Replace Well 9	Increase production reliability	1000	200	50	100	1,350	1,723
17	Install Additional 700-gpm Pump at Plant 5	Emergency Recovery	75	15	4	8	102	131
18	Install PRV in Casolero Dr.	Improve system pressure	50	10	3	5	68	87
19	Replace Well 8	Increase production reliability	1,000	200	50	100	1,350	1,723
20	Install PRV in Dorothea Rd.	Improve system pressure	50	10	3	5	68	87
21	Install PRV in East Rd.	Improve system pressure	50	10	3	5	68	87
22	Install PRV in Hacienda Blvd. south of Avocado Crest Rd.	Improve system pressure	162	33	9	17	221	283
23	Install PRV in Solejar Dr. at Conchita Dr.	Improve system pressure	50	10	3	5	68	87
24	Relocate District Shop	Operations	280	56	14	28	378	483
TOTAL			**2,717**	**544**	**139**	**273**	**3,673**	**4,691**

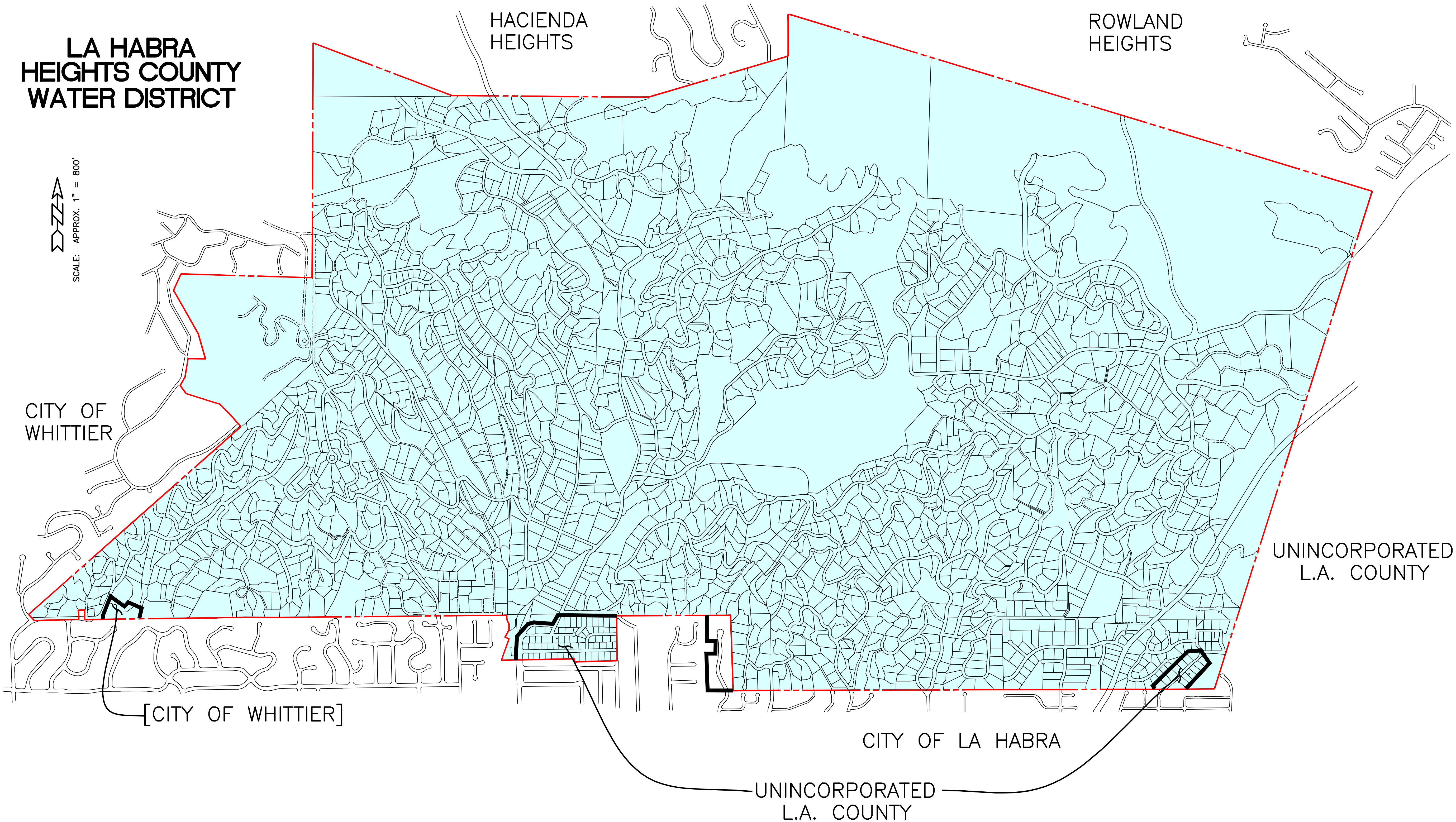
* The number system in this Table does not reflect priority.

10-YEAR CAPITAL IMPROVEMENT PROGRAM DESCRIPTIONS

Table 29 - 10-Year Capital Improvement Program (Cost presented x $1,000)

No	DESCRIPTION	PROJECT DESCRIPTIONS
16	Replace Well No. 9	Well No. 9 was constructed in 1950. The Well is near the end of its service life. A well siting study will need to be conducted prior to selection of a site for the new well. The cost for this CIP does not include siting and property acquisition.
17	Install Additional 700-gpm Pump at Plant 5	The combined redundant capacities of Plants 5 and 6 cannot satisfy the 48-hour emergency refill Design Criteria. Install an additional pump at Plant 5 with a capacity of at least 700 gpm.
18	Install PRV in Casolero Dr.	A large isolated portion of the western Upper Zone experiences system pressures as high as 230 psi. Install a pressure reducing station in Casolero Dr. south of Hill Rd.
19	Replace Well 8	Well No. 8 was constructed in 1950. The Well is near the end of its service life. A well siting study will need to be conducted prior to selection of a site for the new well. The cost for this CIP does not include siting and property acquisition.
20	Install PRV in Dorothea Rd.	A large isolated portion of the southern Upper Zone experiences system pressures as high as 188 psi. Install a pressure reducing station in Dorothea Rd. southwest of Tumin Rd.
21	Install PRV in East Rd.	A small isolated portion of the central Upper Zone experiences system pressures as high as 190 psi. Install a pressure reducing station in East Rd. west of Valle Dr. Close an isolation valve in Ahuacate Rd. north of Churchill Rd. to create a sub-zone boundary.
22	Install PRV in Hacienda Blvd. south of Avocado Crest Rd.	A densely population area in the southern Lower Zone experiences system pressures as high as 169 psi. Replace the existing 4-inch main in Hacienda between Avocado Crest Rd. and Villa Rita Dr. with 930 feet of new 8-inch pipe. Install a pressure reducing station in Hacienda Blvd. south of Avocado Crest Rd. on the new pipe. Abandon the 8-inch cross-country main between Avocado Crest Rd. and Villa Rita Dr.
23	Install PRV in Solejar Dr. at Conchita Dr.	A small isolated portion of the central Lower Zone in the vicinity of Avocado Crest Rd. and Hidden Canyon Rd. experiences system pressure as high as 165 psi. Install a pressure reducing station in Solejar Dr. at Conchita Dr. Close an isolation valve in the cross-country pipeline connecting Amante Dr. to Hidden Canyon Rd. to create a sub-zone boundary.
24	Relocate District Shop	The existing District carport and shop is located is an area experiencing slope creep and subsidence. The project proposes to relocate and expand the shop as well as incorporate the capabilities of the existing office trailer. The total square footage of the proposed shop, carport and offices is 2890 SF. The existing shop and carport area will be demolished and remediated and will become the site of covered vehicle parking. The new shop and office space will be located in the north parking lot.

LA HABRA HEIGHTS COUNTY WATER DISTRICT



= LA HABRA HEIGHTS COUNTY WATER DISTRICT

= LA HABRA HEIGHTS COUNTY WATER DISTRICT SERVICE BOUNDARY

= LA HABRA HEIGHTS CITY BOUNDARY (SHOWN WHERE BOUNDARIES DIFFER)

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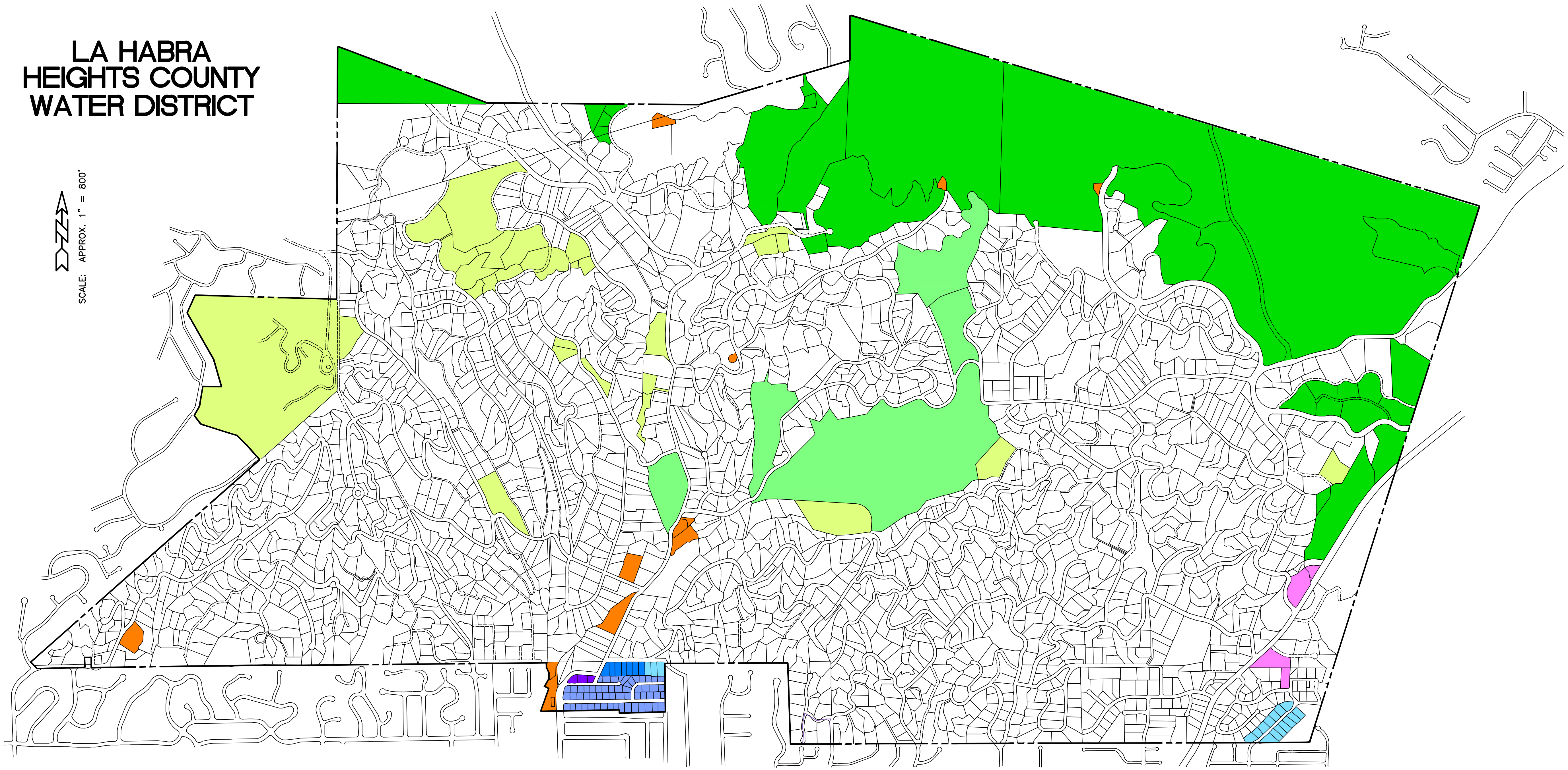
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

DISTRICT BOUNDARY MAP

EXHIBIT 1

LA HABRA HEIGHTS COUNTY WATER DISTRICT



LAND USE DESIGNATION

CITY OF LA HABRA HEIGHTS

- RA – RESIDENTIAL AGRICULTURAL
- I – INSTITUTIONAL
- PF – PUBLIC FACILITIES
- O-1 – RESOURCE PRODUCTION
- O-2 – RECREATION
- O-3 – CONSERVATION

UNINCORPORATED LOS ANGELES COUNTY

- R-A – 20000 – 1DU/20000 SF
- R-I – 10000 – 1DU/10000 SF
- R-I – 15000 – 1DU/15000 SF
- R-I – 20000 – 1DU/20000 SF

(SEE TABLE 5 FOR LAND USE ACREAGE, DESIGNATION AND UNIT FACTORS)

— - - — WATER DISTRICT BOUNDARY

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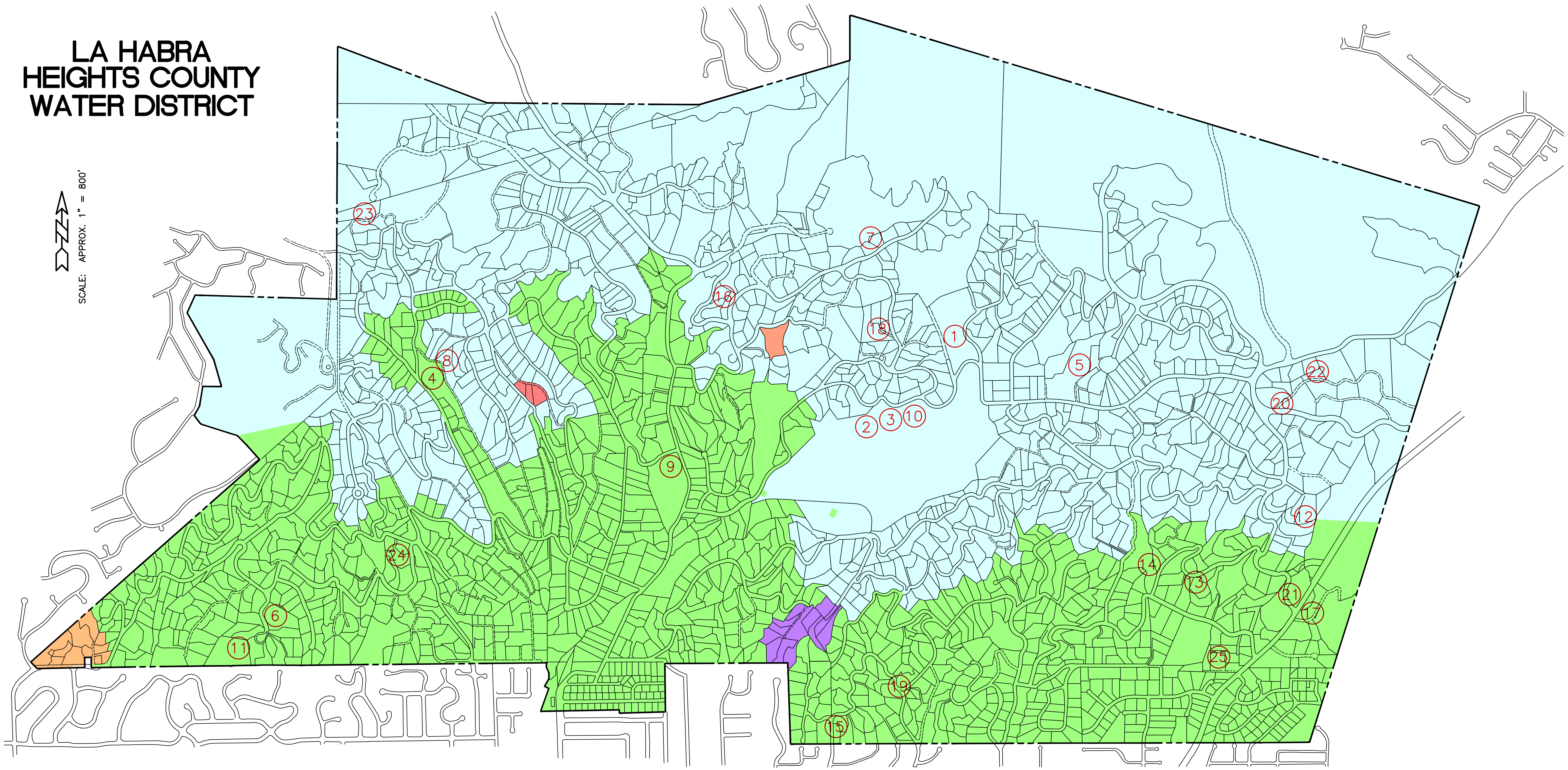
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

EXISTING LAND USE AND ZONING MAP

EXHIBIT 2

LA HABRA HEIGHTS COUNTY WATER DISTRICT



LEGEND

(#) = NUMBER RANKING OF TOP TWENTY WATER USERS. (SEE TABLE 4 FOR A LIST OF THE CUSTOMERS AND USE DATA)

= UPPER ZONE (1154)

= LOWER ZONE (833)

= ESCARPADO SUB-ZONE

= GANTER-LAMAT SUB-ZONE

= GREENVIEW SUB-ZONE

= VIRAZON-SUBTROPIC SUB-ZONE

— - - — WATER DISTRICT BOUNDARY

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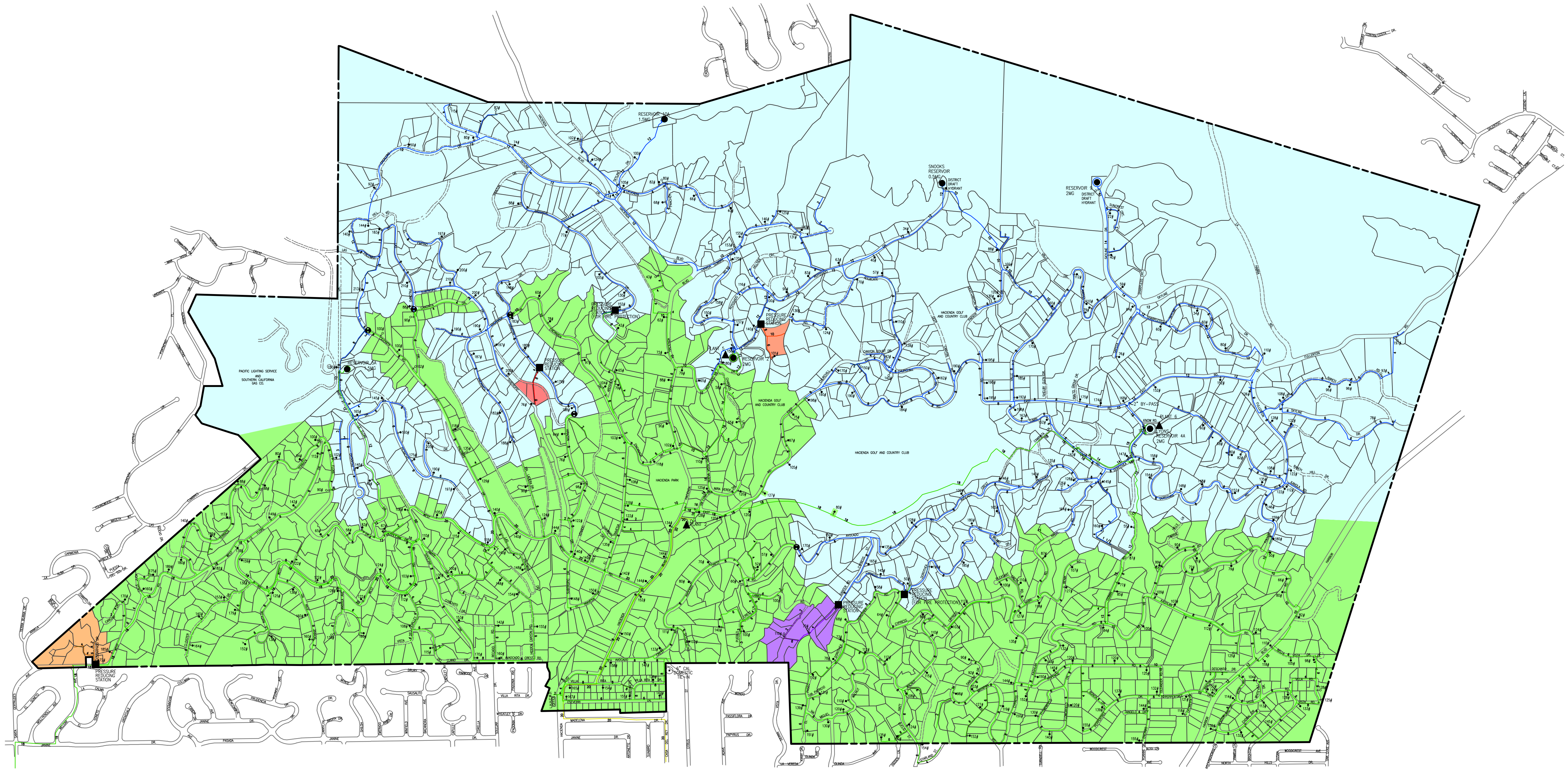
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

TOP 25 POINT DEMAND USERS

EXHIBIT 3



LEGEND

140#	PRESSURE AT HYDRANT (PSI)
	6" FIRE HYDRANT
	4" FIRE HYDRANT
	4" FIRE HYDRANT WITH 6" BARREL
	LESS THAN 4" FIRE HYDRANT
	REDUCER
	MAINS DO NOT CONNECT
	WATER DISTRICT BOUNDARY
	UPPER ZONE (1154)
	UPPER ZONE PIPELINE
	LOWER ZONE (833)
	LOWER ZONE PIPELINE
	ESCARPADO SUB-ZONE
	GREENVIEW SUB-ZONE
	GANTER/LAMAT SUB-ZONE
	VIRAZON/SUBTROPIC SUB-ZONE
	MWD TRANSMISSION PIPELINE
●	RESERVOIR
▲	BOOSTER PUMP STATION
■	PRESSURE REGULATING STATION
	WATER SYSTEM INTERCONNECT
	CLOSED ZONE VALVE (ZB = ZONE BREAK)

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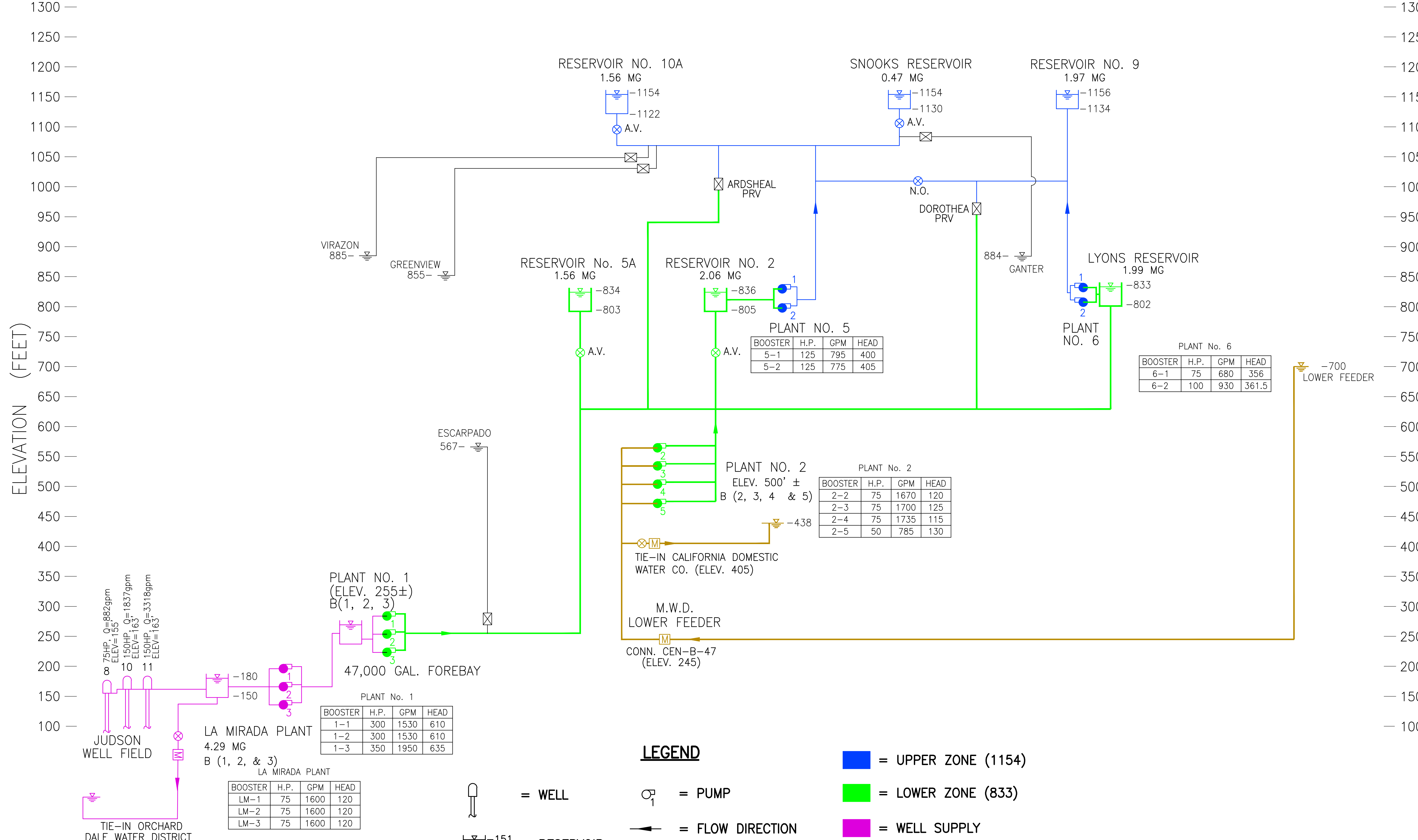
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

EXISTING WATER SYSTEM PRESSURE ZONES & FACILITIES

EXHIBIT 4



PLANT NO. 5

BOOSTER	H.P.	GPM	HEAD
5-1	125	795	400
5-2	125	775	405

PLANT No. 6

BOOSTER	H.P.	GPM	HEAD
6-1	75	680	356
6-2	100	930	361.5

PLANT No. 2

BOOSTER	H.P.	GPM	HEAD
2-2	75	1670	120
2-3	75	1700	125
2-4	75	1735	115
2-5	50	785	130

PLANT No. 1

BOOSTER	H.P.	GPM	HEAD
1-1	300	1530	610
1-2	300	1530	610
1-3	350	1950	635

LA MIRADA PLANT

BOOSTER	H.P.	GPM	HEAD
LM-1	75	1600	120
LM-2	75	1600	120
LM-3	75	1600	120

LEGEND

= WELL

151 / 119 = RESERVOIR

= VALVE

= PRV

= PUMP

= FLOW DIRECTION

= HIGH WATER LEVEL

N.O. = NORMALLY OPEN

A.V. = ALTITUDE VALVE

= UPPER ZONE (1154)

= LOWER ZONE (833)

= WELL SUPPLY

= MWD SUPPLY

= SUB-ZONES

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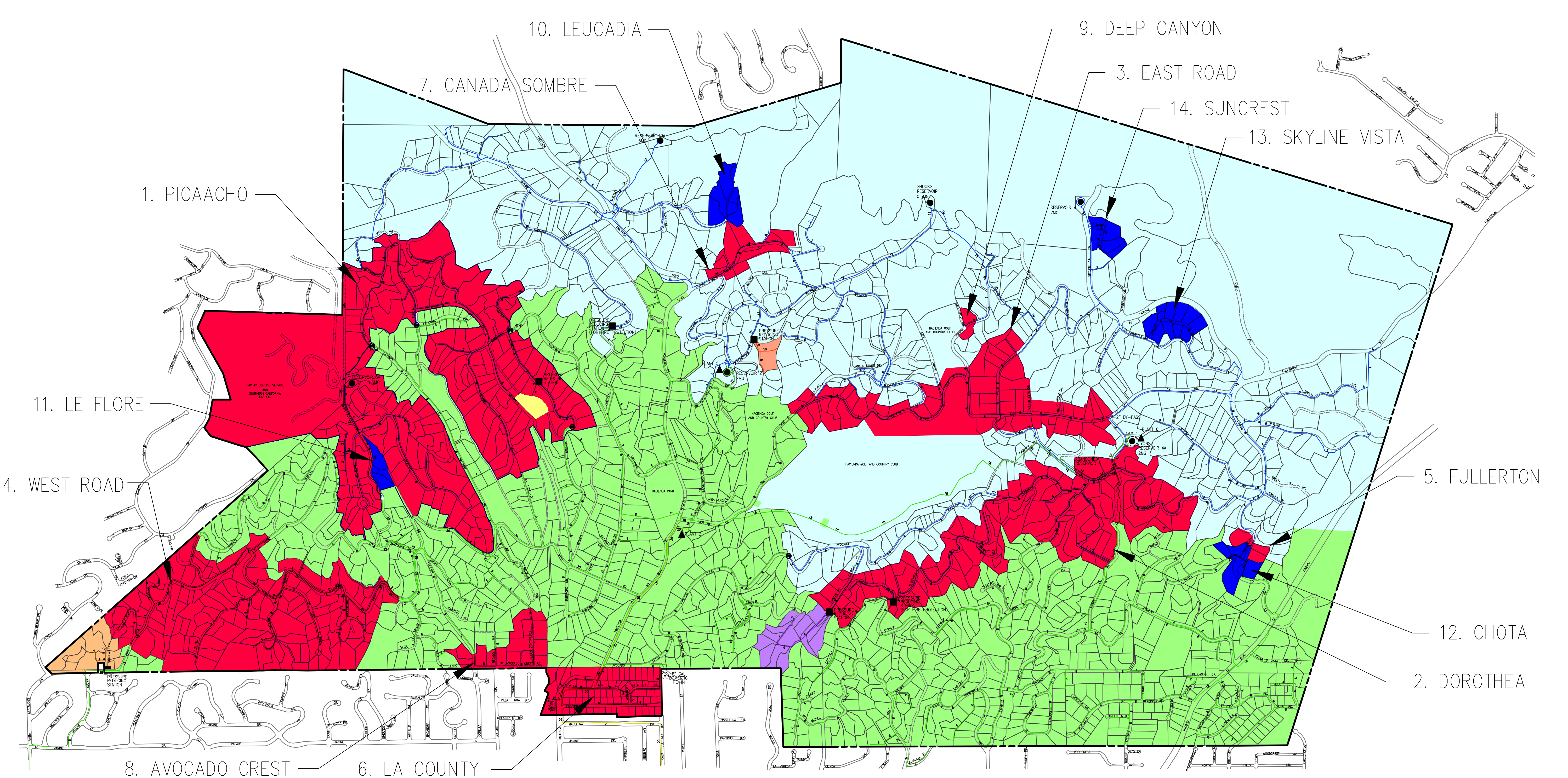
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

2015 WATER SYSTEM HYDRAULIC PROFILE

EXHIBIT 5



LEGEND

140#	PRESSURE AT HYDRANT (PSI)
	6" FIRE HYDRANT
	4" FIRE HYDRANT
	4" FIRE HYDRANT WITH 6" BARREL
	LESS THAN 4" FIRE HYDRANT
	REDUCER
	MAINS DO NOT CONNECT
	WATER DISTRICT BOUNDARY
	UPPER ZONE PIPELINE
	UPPER ZONE (1154)
	LOWER ZONE PIPELINE
	LOWER ZONE (833)
	ESCARPADO SUB-ZONE
	GREENVIEW SUB-ZONE
	GANTER/LAMAT SUB-ZONE
	VIRAZON/SUBTROPIC SUB-ZONE
	MWD TRANSMISSION PIPELINE
	RESERVOIR
	BOOSTER PUMP STATION
	PRESSURE REGULATING STATION
	WATER SYSTEM INTERCONNECT
	CLOSED ZONE VALVE (ZB = ZONE BREAK)
	AREA IMPACTED BY HIGH PRESSURE (P > 125 PSI)
	AREA IMPACTED BY LOW PRESSURE (P < 40 PSI)

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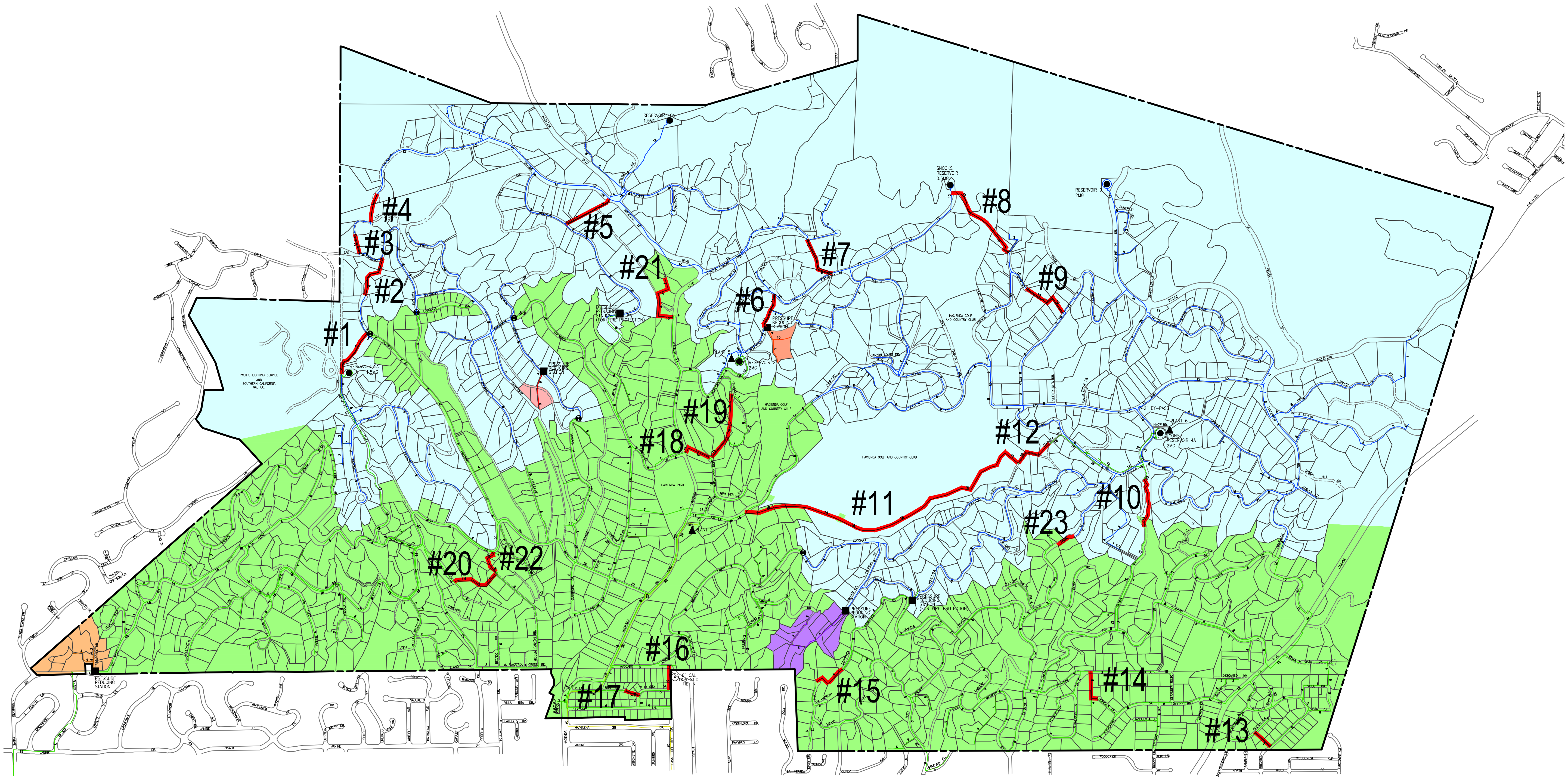
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

EXISTING WATER SYSTEM PRESSURE DEFICIENCIES

EXHIBIT 6



LEGEND

- WATER DISTRICT BOUNDARY
- UPPER ZONE (1154)
- UPPER ZONE PIPELINE
- LOWER ZONE (833)
- LOWER ZONE PIPELINE
- ESCARPADO SUB-ZONE
- GREENVIEW SUB-ZONE
- GANTER/LAMAT SUB-ZONE
- VIRAZON/SUBTROPIC SUB-ZONE
- MWD TRANSMISSION PIPELINE
- CROSS-COUNTRY PIPELINE
- RESERVOIR
- BOOSTER PUMP STATION
- PRESSURE REGULATING STATION
- WATER SYSTEM INTERCONNECT
- CLOSED ZONE VALVE (ZB = ZONE BREAK)

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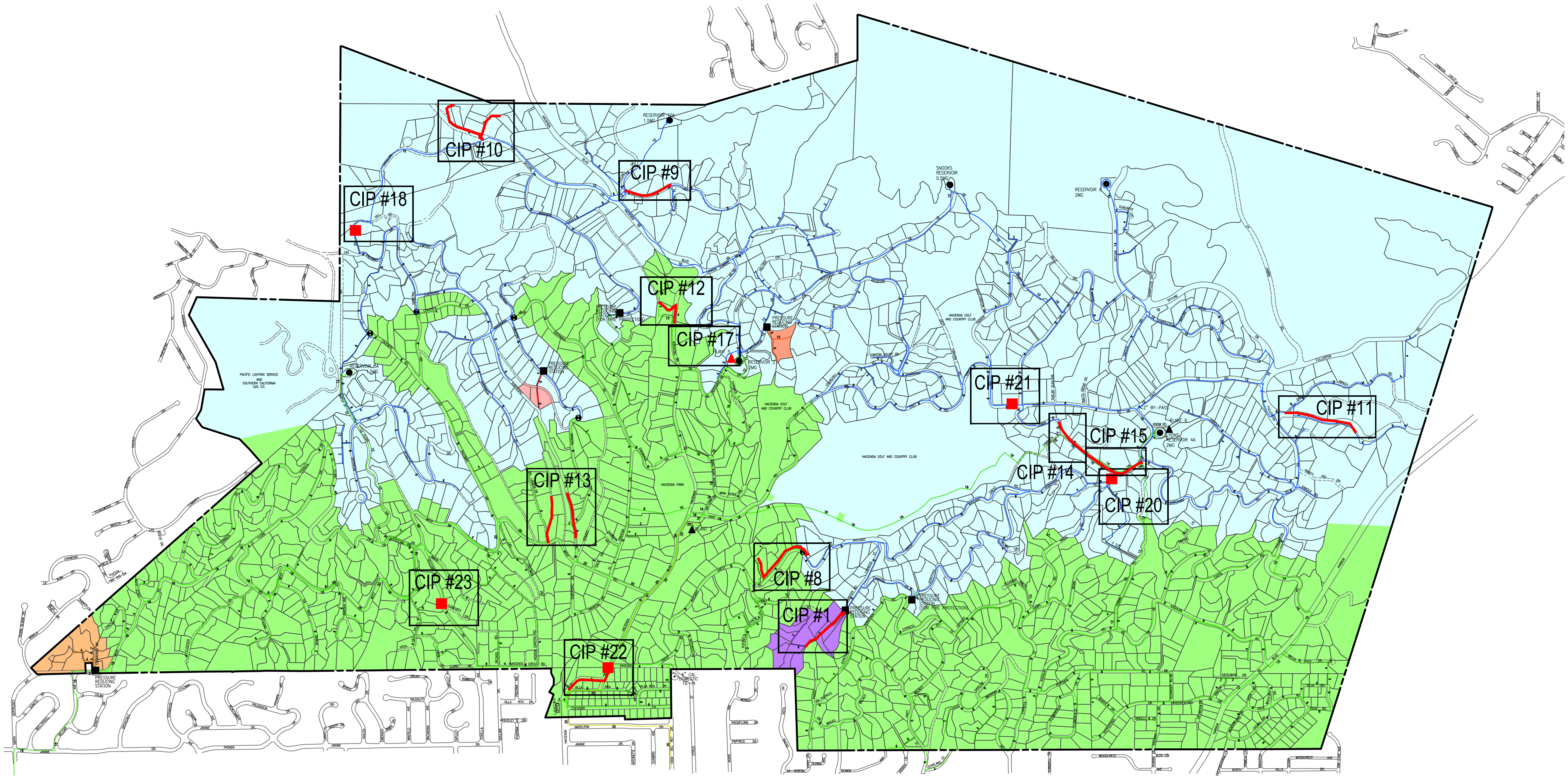
LA HABRA HEIGHTS COUNTY WATER DISTRICT
2015 WATER MASTER PLAN UPDATE

EXISTING CROSS-COUNTRY PIPELINES

EXHIBIT 7



LEGEND

- WATER DISTRICT BOUNDARY
- UPPER ZONE (1154)
- UPPER ZONE PIPELINE
- LOWER ZONE (833)
- LOWER ZONE PIPELINE
- ESCARPADO SUB–ZONE
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- VIRAZON/SUBTROPIC SUB–ZONE
- MWD TRANSMISSION PIPELINE

- ● RESERVOIR
- ▲ BOOSTER PUMP STATION
- ■ PRESSURE REGULATING STATION
- ⊙ WATER SYSTEM INTERCONNECT
- CLOSED ZONE VALVE (ZB = ZONE BREAK)

OFF–SITE CIPS

CIP #2 – EXISTING WATER RESOURCES STUDY
CIP #3 – CROSS–COUNTRY PIPELINE STUDY
CIP #4 – UPGRADE OR RETROFIT WELL 10
CIP #5 – UPGRADE OR RETROFIT WELL 11
CIP #6 – WELL SITING STUDY
CIP #7 – SCADA SYSTEM UPGRADES
CIP #16 – REPLACE WELL 9
CIP #19 – REPLACE WELL 8
CIP #24 – RELOCATE DISTRICT SHOP

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LA HABRA HEIGHTS
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RECOMMENDED CAPITAL IMPROVEMENTS

EXHIBIT 8