2020 Water Master Plan

April 30, 2021

Prepared For:

City of La Verne
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Phone: 909.596.8741

Prepared By:

CIVILTEC engineering inc.

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EXECUTIVE SUMMARY

Background

The City of La Verne (City) is in the easterly portion of Los Angeles County and approximately 32 miles east of metropolitan Los Angeles. The City is bordered by the cities of San Dimas, Pomona and Claremont, as well as portions of unincorporated Los Angeles County. The City was incorporated in 1906.

The water system serving the community is owned and operated by the City. The 2019 population of the City is approximately 31,947 per the City's profiles published by the Southern California Association of Governments (SCAG) Regional Council. The water system serves a population of 29,916. The City's 1998 General Plan projects the population at ultimate development to be 37,430. Per the 2014-2021 Housing Element, adopted December 2, 2013, SCAG predicts that the City's 2035 population will increase to 38,742 and the number of households will increase from 11,875 to 12,819.

The study area for this Water Master Plan (WMP) is approximately 5,341 acres within the incorporated boundary of the City. There are 34 different Land Use Zoning designations for customers served by the City. For the purposes of this WMP and to establish a unified consistent planning approach, analysis of Land Use Zoning designations was performed using the City's General Plan, latest zoning map issued in 2016, City's specific plans, City's Housing Elements of 2008-2014 and 2014-2021, and City's geographic information system (GIS) database.

The City has more than 8,600 service connections on the water system of which 92% of the services are for residential use. Approximately 77% of all water used by the City since 1987 is imported water treated and delivered by the Three Valleys Municipal Water District (TVMWD). The remaining 23% is produced from local groundwater basins. Groundwater produced by the City exceeds a few water quality contaminant levels established by the U.S. Environmental Protection Agency (EPA), therefore, blending with imported water is required or treatment is required for designated contaminates.

Study Purpose

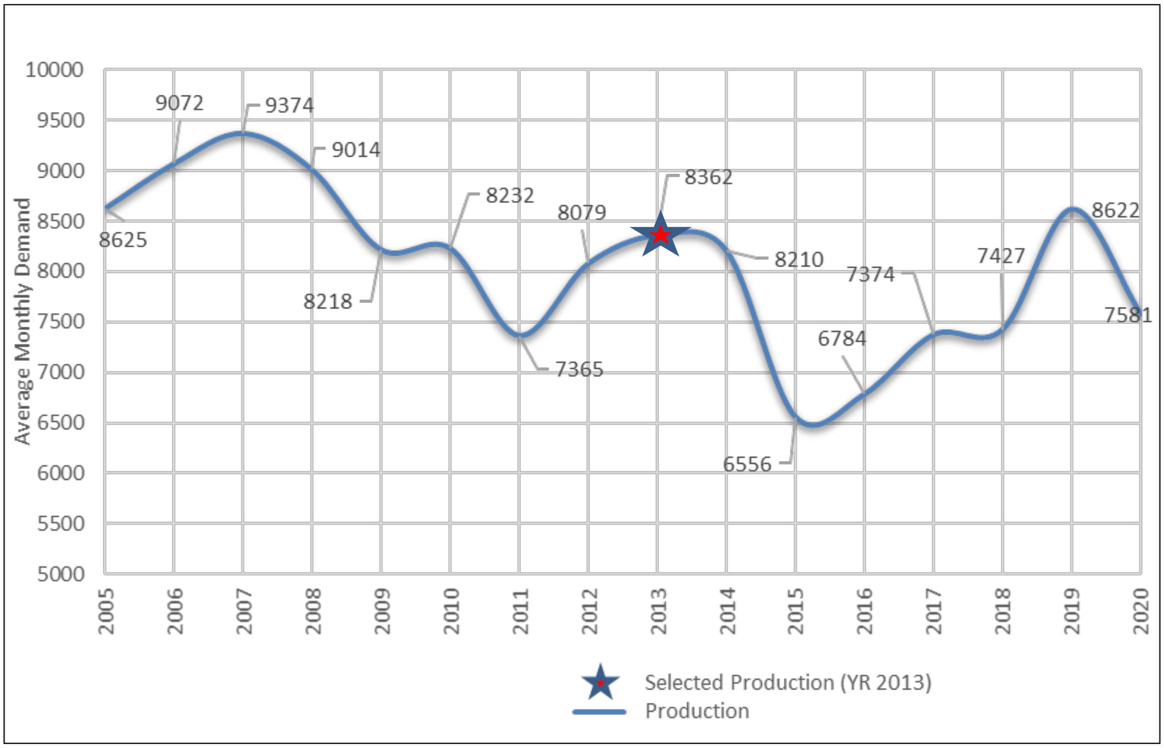
The City's current updated WMP was completed in 2010. The purpose of this study is to provide the City with an assessment of its current and future ability to provide domestic water service and fire flows and to identify those improvements necessary to provide reliable service throughout the study period. This study will also provide the City with an evaluation of its water system, operating procedures and a plan to ensure the most reliable and cost-effective delivery of water to the City's water users.

Summary

The City extracts groundwater from three local basins known as the Live Oak Basin, Pomona Basin and Ganesha Basin. The Pomona Basin has an established operating safe yield (OSY) controlled by the Six Basins Water Master and the City has rights to 7.601% of the annually established safe yield. The Live Oak and Ganesha Basins are for the sole benefit and use by the City. An OSY for these two basins has not been established and the City may use these basins to their fullest capacity until the use negatively impacts a neighboring basin or producer.

The City has approximately 132 miles of transmission and distribution mains in the system ranging in size from 2 inch to 24 inch. There are 11 reservoirs in the system with a total of 27 million gallons (MG) of capacity. There are 10 active booster pumping stations in the system with a total pumping capacity of approximately 23,720 gallons per minute (gpm) and one active hydropneumatic pumping station with a total pumping capacity of approximately 3,280 gpm. There are 8 active groundwater wells in the system with a total pumping capacity of 4,100 gpm.

The annual water sales for the system has averaged 6,903 acre-feet (AF) from 2012 to 2019 with a peak annual usage year of 8,101 AF in 2013. In 2013, the production was 8,362 AF as shown in the figure below. Based upon the water demand analysis in Chapter 2, the year 2013 was selected to be the most representative year for the analyses conducted in Chapter 8. The water use at ultimate development (year 2035) of the study area is estimated to be 10,542 AF.



There are five pressure zones in the system, which have reservoirs providing gravity flow into each zone. There is one additional pressure zone served by a hydropneumatic pumping station and two subzones served by a pressure regulating system. The City is operating an air stripping system at the White Avenue Plant. The strippers remove volatile organic compounds (VOCs) from the groundwater. The present blending rate at the station is 80% imported water and 20% well water, primarily due to nitrate concentration. The City is also operating a nitrate/perchlorate reduction treatment plant at the Amherst Reservoir site.

Civiltec Engineering, Inc. (Civiltec) has created several previous water models for the City and prepared the GIS based version of the model in 2009. ***Civiltec*** has been utilizing this model since that time in preparation of the 2010 WMP update and numerous other specific hydraulic studies. By using the shapefiles, geodatabase files provided by Nobel Systems and information provided by the City's staff, ***Civiltec*** updated the water model to reflect updates to the system since 2009. After reviewing the existing model, the following items were updated:

- Pipeline Mains – Updated per new developments and capital improvement program (CIP) projects after year 2009 and GIS data. Pipe material and year of construction was also added to the GIS database and is utilized in the model to create accurate friction values.
- Pump Curves – Used the most up to date Southern California Edison (SCE) pump efficiency curves.
- Demands – Used the 2013 sales data (8,101 acre-feet per year (AFY) or 5,023 gpm – average day demand (ADD)). See Chapter 2 regarding the water demand analyses.

The City's water system Design Criteria were updated to current water industry standards and adapted to conform to current demand patterns and access to more detailed provisions of the Los Angeles County Fire Code. The criteria are presented in Chapter 7.

Findings

The analyses within the 2010 WMP were compared to the results of this study and the 2010 projections in general were high. The 2019 population and water demands are lower than anticipated in the 2010 projections. The ultimate build-out population is also lower than anticipated in 2010. The water demand averaged 7,464 AFY over the period from 2012 to 2019 and is projected to increase to 10,542 AFY at ultimate build-out per the City's General Plan.

Utilizing the Design Criteria established in Chapter 7, the existing water storage in the system was analyzed. There is no present storage deficiency in any pressure zone for maximum day demands (MDD). Pressure Zone I will ultimately be deficient 0.79 MG and Pressure Zone II will ultimately be deficient 0.90 MG by 2035. Surplus storage capacity in pressure zones above Pressure Zones I and II can accommodate projected future storage deficiencies.

The ability to achieve storage requirements for a 7-day planned shutdown of the Metropolitan Water District of Southern California (MWD) system was analyzed. Emergency supplies were examined and equated to storage capacity. This analysis indicates the City presently has 12.67 MG surplus in total emergency supply and storage to achieve the MWD recommendation but is storage deficient in Pressure Zones II, III and IV. There is a total existing MWD storage deficiency of 11.81 MG within the City which is comprised of 8.55 MG in Pressure Zone II, 0.76 MG in Pressure Zone III and 2.50 MG in Pressure Zone IV. Operationally, surplus supply can be moved from Pressure Zone I to the higher zones through the existing booster pump capacity.

Utilizing the Design Criteria established in Chapter 7, the existing booster pump capacities are adequate to achieve MDDs, except in Pressure Zone I. Pressure Zone I is presently deficient in supply by 134 gpm[1] and will be deficient 1,304 gpm by 2035. Pressure Zone I is supplied by gravity from TVMWD which is adequate to supply this pumping deficit.

The City owns eight groundwater production wells. Below is a table indicating information about each well and the most significant information is the year drilled.

Well	From Basin	Capacity (gpm)	Year Drilled
Lincoln	Pomona	1,000	1929
Mills Tract	Pomona	950	1965
Walnut	Ganesha	450	2000
Amherst	Live Oak	450	1999
Beech	Live Oak	500	2010
La Verne Heights No. 1	Live Oak	200	1964
La Verne Heights No. 2	Live Oak	200	1964
La Verne Heights No. 3	Live Oak	350	1964
Total		**4,100**	

The City is maintaining these wells through aggressive maintenance. At some time in the future, well capacity will need to be replaced in the Pomona Basin and Live Oak Basin.

The TVMWD import water connections are adequate to supply the City with import water projected to ultimate development per the City's General Plan. No TVMWD system capacities require upgrading.

The City's transmission and distribution systems were analyzed utilizing the updated hydraulic computer model (Water Model) of the water system. Through these analyses, transmission system capacities and distribution system capacities were identified for upgrading and upsizing as identified in Chapter 8.

System improvements were developed for a 5-year CIP as well as a 10-year CIP.

- The estimated costs of the 5-year CIP is $9,469,000. These improvements consist of a new pressure reducing valve (PRV) station, new transmission mains, new distribution mains, fire flow improvements, emergency response improvements, and pumping capacity in Pressure Zone I.
- The estimated costs of the 10-year CIP is $17,531,000. These improvements consist of a new Pressure Zone I reservoir, new distribution mains, a new Pressure Zone 1 treatment plant, and two Pressure Zone I replacement groundwater wells.

[1] Pressure Zone I is supplied by gravity from TVMWD at the White Avenue Pump Station which offsets any potential deficit. See Table 8-11.

Recommendations

It is recommended the City:

- Proceed with planning and construction of the 5-year CIP projects listed in Table 8-18. The higher priority projects improve firefighting capability, transmission pipeline capacity, distribution pipeline capacity and water quality.
- Proceed with the procurement of two portable generators and installation of four transfer switches at the White, Wheeler, Plateau and Pressure Zone V plants. Additionally, proceed with the study of a generator staging protocol to place and move generators when required in an emergency.
- Begin well siting studies for replacement of Pressure Zone I wells and study of the replacement of the Amherst Reservoir that was constructed in the 1930's.

Chapter 1 - INTRODUCTION

1.1 General

The City of La Verne (City) is in the easterly portion of Los Angeles County, approximately 32 miles east of metropolitan Los Angeles. The City is bordered by the cities of San Dimas, Pomona and Claremont, as well as portions of unincorporated Los Angeles County.

The City was incorporated in 1906. The City presently has 5,478 acres (8.56 square miles) of land area, based on the latest zoning map issued in 2016. Population has been estimated by several agencies or methods as follows:

- 32,389 per the United Stated Census Bureau (July 2017)
- 33,200 per the City's 2017 profile published by the SCAG
- 31,043 (based on the actual service area) per the 2015 Urban Water Management Plan (UWMP)

According to the SCAG 2016-2040 Regional Transportation Plan/Sustainable Communities Strategies (RTP/SCS) Demographics and Growth Forecast, the SCAG region population is estimated to have a 0.7% annual average growth rate from 2015-2040 and an estimated population in 2040 of approximately 32,900.

Per the 1998 General Plan, the service capacity will be maximized at a build-out population of 37,430. Approximately 54% of the total land area is zoned residential, 7% is zoned commercial/ business park, 2% is zoned industrial, and the remaining 37% is zoned for community facility or open space use.

During the past 50 years, the City has experienced a surge of residential development that has almost tripled the population since 1970. The development of land for residential use has been concentrated in the foothills north of Baseline Road.

1.2 Description of Study Area

The study area comprises approximately 5,478 acres (8.56 square miles) within the incorporated boundary and approximately 861 acres considered to be within the sphere of influence (SOI) of the City. The study area is bounded on the west by San Dimas, on the south by the Puddingstone Recreation area, on the east by Fulton Road and the prolongation of Williams Avenue, and on the north by the Los Angeles National Forest. Exhibit 1 indicates the study area limits and the present City limits.

1.3 Purpose, Objectives, Scope and Authorization

1.3.1 Study Purpose

The City's current updated WMP was completed in 2010. The purpose of this study is to provide the City with an assessment of its current and future ability to provide domestic water service and fire flows and to identify those improvements necessary to provide reliable service throughout the study period. The study will also provide the City with an evaluation of its water system and operating procedures and a plan to ensure the most reliable and cost-effective delivery of water to the City's water users.

1.3.2 Study Objective

As part of this investigation, the City requested ***Civiltec*** perform specific tasks and undertake several ancillary issues that serve to further the overall study purpose. The nine principle objectives of this WMP are:

- Evaluate the performance and reliability of the City's water production, storage, and delivery systems. Identify system deficiencies and recommend improvements necessary to eliminate deficiencies to ensure reliable performance of the system.
- Evaluate groundwater supply reliability and identify opportunities to expand groundwater extraction operations and export potentials.
- Evaluate existing water rights, agreements, spreading operations and alternate supply sources.
- Evaluate the reliability of import water supplies from the Three Valley Municipal Water District (TVMWD) and the Metropolitan Water District of Southern California (MWD).
- Evaluate emergency water supplies.
- Evaluate groundwater quality and management plans.
- Update the Water Model based upon the most recent updates to the GIS platform.
- Develop CIP project plans covering a 5-year and 10-year planning horizon and project potential ultimate development improvements.
- Confirm Design Criteria for the future water system improvements and development generated water system upgrades.

1.3.3 Scope of Water Master Plan (WMP) Update

The scope of work for this WMP is as follows:

Phase 1 - Preliminary Research and System Review

1. Perform a review of the existing water supply and distribution system within the City's water system and supply and transmission system outside the City's water system. ***Civiltec*** issued a comprehensive request for information (RFI) detailing the information and data necessary to perform the update of demand analysis, water quality, supervisory control and data acquisition (SCADA) data, and all other pertinent data.
2. Update relevant maps, water use records, water supply records, water quality data, SCADA data, and operational plans were acquired as needed to support the update.
3. Review and analyze the operations plan and supporting documentations for each pressure zone to ensure that the Water Model is updated to reflect all operational scenarios.

Phase 2 - Review Land Use, Zoning and Population

1. Review and analyze the City and Los Angeles County General Plans for the City's service area to assist in projecting future demands on the system, update the land use categories and locations, and acreage of each, analyze land uses that may be potentially high water demand as well as population growth trends within the City's boundary.
2. Conduct an extensive review and analysis of the current 2016 zoning map, all available specific plans, housing elements, and GIS to update the general plan build-out land use category that was originally specified in the 1998 General Plan.
3. Incorporate the extensive population analysis conducted for the City's 2015 UWMP into this WMP update. Review other sources such as the Census and SCAG.

Phase 3 - Water Demand Analysis

1. Analyze historical and existing system demands based upon data provided by the City to include 2017 data as well. Redevelop and update water duty factors for each land use type as well as ADD, MDD, and peak hour demand (PHD) factors.
2. Redevelop demand projections through ultimate development per the City's General Plan and other updates.
3. Tabulate all demand conditions in coordination with the existing demand analysis as follows:
    a. Existing Conditions – ADD, MDD, and PHD
    b. Near Term Conditions – ADD, MDD, and PHD

Phase 4 - Water Quality

1. Review the documentations of imported water availability, reliability, and quality of water accessible for purchase from the TVMWD Miramar Water Treatment Plant and MWD Weymouth Filtration Water Treatment Plant via Pomona-Walnut-Rowland Joint Water Line.
2. Review information of emergency supply connections with the Golden State Water Company (GSWC) Claremont and San Dimas water systems.
3. Incorporate ***Civiltec***'s Study that was prepared in March 2017 regarding pH adjustment, corrosion control, and nitrification issues. The study included the corrosion potential of each source water to establish the conditions wherein the water quality of the source waters can be maintained to minimize corrosive conditions prior to introduction of that water into the distribution system.
4. Review all current available water quality reports, identify issues, and provide recommendations.
5. Review groundwater quality trends including a discussion of the status and capacity of the City's disposal and access to additional and diverse sources. Evaluate water quality trends and the City's capacity to maintain compliance while providing adequate supply. Evaluation is based on our understanding of current and pending legislation related to water quality.
6. Update the Water Quality Chapter herein to incorporate all new issues and our recommendations.

7. Evaluate and discuss planned water transfers to the Puente Basin Water Authority (PBWA) via the Old Baldy and/or Walnut wells and impacts to groundwater basins.

Phase 5 – Water Model Update and Analyses

The Water Model is an important tool for assessing the distribution system with respect to capacity, State Water Resources Control Board, Division of Drinking Water (DDW), efficiency, and surge. It is ideally suited for evaluating alternative mitigations to a deficiency and for performing time-based analyses such as emergency storage recovery and disinfectant residual decay. Specific adaptations and uses of the Water Model in support of the WMP effort include the following:

1. Perform steady state hydraulic simulations. Each steady state simulation represents the performance of the distribution system under a unique and fixed set of boundary conditions at a single moment in time. Compile a comprehensive Water Model including all new piping in the system and the recent system improvements. Analyze and distribute ADD water demands on the system. Apply the updated factors for MDD and PHD developed from the City's data to the Water Model. Demands for the Water Model are updated based on City's records of deliveries to customers and meter readings at pumping facilities.
2. Perform numerous steady state simulations to determine adequacy of storage, pumping, and distribution systems to comply with updated requirements and ultimate conditions. Each simulation generated results used in the analysis of the various system components. Evaluate the capacity under the existing conditions through performing the three steady state simulations of minimum day demand, PHD, and MDD plus fire flow (MDD + FF).
3. Analyze the ultimate system to determine ultimate storage, pumping, distribution piping, and supply requirements.

Phase 6 - System Analysis

1. Develop a redundant and reliable supply portfolio as the foundation of a robust water distribution system. Analyze the existing supply capacity and reliability from the City's wells and wholesalers (imported water connections) to achieve existing and near-term demands. The supply analysis focuses on two key aspects: capacity to deliver adequate supply per design and planning criteria, and access to adequate sources of supply based on regional water management agreements.
2. Perform a storage analysis that focuses on the adequacy of existing storage capacity to provide for emergency, firefighting, and operational purposes as defined by the Design Criteria. Analyze the near-term storage to provide insight into the nature of larger developer driven projects.
3. Perform a transmission system analysis that focuses on the adequacy of existing transmission mains, pressure reducing stations, and booster pumping stations to move water throughout the system in an efficient manner under normal operating conditions. Use Water Model to examine the transmission system performance under normal operating conditions.
4. Perform a distribution system analysis that focuses on two key aspects: system pressure and fire flow capacity. Use Water Model to examine system pressure in

every pipeline throughout the system under normal operating conditions. Additionally, use Water Model to assess the fire flow capacity at every fire hydrant location in the system. As a rule, fire flow capacity is the governing factor for sizing distribution system pipelines; therefore, confidence in Water Model output is paramount to making accurate recommendations.

Phase 7 - Design Criteria

Update the Design Criteria to incorporate the new fire code requirements, planning criteria, and additional specific information.

Phase 8 - CIP Development

1. Utilize the Water Model to determine required system improvements based on the results of analysis and evaluation. Identify potential improvements with preliminary priorities. For each recommended project, the following is provided:
    - Priority
    - Justification
    - Description
    - Other alternatives considered, if any
    - Cost estimate
2. Review pending CIPs. Examine the status of the 5-Year and 10-Year CIP specified in 2010 WMP.
3. Develop an implementation projection for the recommended improvements over a 10-year planning horizon.

Phase 9 - WMP Update Report

1. Compile and issue a comprehensive report that identifies and discusses the goals, aspects, and conclusions of the updated report.
2. Issue each chapter in the draft format for review by the City prior to finalization.
3. Perform additional enhancements as part of this WMP update effort as outlined below. These enhancements provide flexibility and viability to current and future planning efforts performed by the City and enable a broader approach to identifying system needs and deficiencies moving forward.
    a. Conduct a water source review. Review potential sources such as transfers, conservation, and expansion of groundwater production to improve water reliability and sustainability.
    b. Perform a pipe break analysis. Use the Water Model to simulate pipe breaks throughout the distribution system to determine system redundancy and to delineate vulnerable areas.
4. The final report includes the summary, conclusions, and recommendations.

1.4 Abbreviations

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

Abbreviation	Description
1,2,3-TCP	1,2,3 Trichloropropane
ADD	Average Day Demand
AF	Acre-Feet
AFY	Acre-Feet Per Year
AWWA	American Water Works Association
BATs	Best Available Technologies
cfs	Cubic Feet Per Second
CII	Commercial, Institutional and Industrial
CIP	Capital Improvement Program
City	City Of La Verne
Civiltec	Civiltec Engineering, Inc.
DCE	Dichloroethylene
DDW	State Water Resources Control Board, Division of Drinking Water
DEM	Digital Elevation Model
DIPAW	Deep Infiltration of Precipitation and Applied Water
DLR	Detection Level for Purposes of Reporting
DU	Dwelling Units
DWR	California Department of Water Resources
EDC	Endocrine-Disrupting Compounds
EPA	United States Environmental Protection Agency
fps	Feet Per Second
GIS	Geographic Information System
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
GSWC	Golden State Water Company
HGL	Hydraulic Grade Line
ISO	Insurance Services Office
LACFCD	Los Angeles County Flood Control District
LCR	Lead and Copper Rule
MCL	Maximum Contaminate Level
MDD	Maximum Day Demand
MDD+FF	Maximum Day Demand Plus Fire Flow
MG	Million Gallons
mg/l	Milligrams Per Liter
MGD	Million Gallons Per Day
MSL	Mean Sea Level
MTBE	Methyl Tertiary-Butyl Ether
MWD	Metropolitan Water District of Southern California
MWSE	Maximum Water Surface Elevation
NFPA	National Fire Protection Association
OAL	Office of Administrative Law
OEHHA	California's EPA Office of Environmental Health Hazard Assessment
OSY	Operating Safe Yield
OU	Operable Unit
PBWA	Puente Basin Water Authority
PCE	Tetrachloroethylene
PCL	Programmable Logic Controller
PF	Peaking Factors

Abbreviation	Description
pH	Acidity-Alkalinity Index
PHD	Peak Hour Demand
PHG	Public Health Goal
Ppb	Parts Per Billion
ppm	Parts Per Million
PRV	Pressure Reducing Valve
psi	Pounds Per Square Inch
PVMWD	Pomona Valley Municipal Water District
PVPA	Pomona Valley Protective Association
PWRJF	Pomona Walnut Rowland Joint Feeder
RFI	Request for Information
RWD	Rowland Water District
SASG	San Antonio Spreading Grounds
SCADA	Supervisory Control and Data Acquisition
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SDWA	Safe Drinking Water Act
SOI	Sphere of Influence
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TTHM	Trihalomethanes
TVMWD	Three Valleys Municipal Water District
UCMR	Unregulated Contaminant Monitoring Rule
μg/l	Micrograms Per Liter
USACE	U.S. Army Corps of Engineers
UWMP	Urban Water Management Plan
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound
Water Model	Hydraulic Computer Model
WMP	Water Master Plan
WVWD	Walnut Valley Water District

1.5 Acknowledgments

We, at ***Civiltec.***, would like to express our appreciation for the cooperation and valuable assistance of the City (Public Works Department, Fire Department, Planning Department and Finance Department). In particular, the efforts of the following individuals proved to be invaluable:

- Daniel Keesey, Assistant City Manager/Director of Public Works
- Richard Martinez, Utilities Manager
- Anthony Ciotti, Deputy Director of Public Works

Chapter 2 - LAND USE, POPULATION AND WATER REQUIREMENTS

2.1 General

This chapter reviews the City's historical water usage, current population and projections, and determines potential future water requirements for the City based on that data and information published in the City and Los Angeles County General Plans. The City is in the process of updating its General Plan.

Water consumption varies with the population, occupancy, and other social, economic, political, and environmental factors. In order to make a reasonable estimate for the future water supply requirements for the City, all existing and planned land uses in the study area will be considered along with population projections and historical water usages.

2.2 Land Use – Existing and Proposed

An adequate and reliable water supply plays a very important role in the City's sustained development. Land use directly influences water demands. Thus, it will be used as the basis for water requirement estimates in this WMP. Since the early 1960s, the City has been developed generally in accordance with adopted General Plans. The current General Plan was adopted on December 7, 1998. The northern portions of the City are made up of rolling hillsides and the southern portion of the City is considered to be a valley floor. The existing ground elevations in the developed portion of the City are generally between 1,000 feet in the south and 1,700 feet in the north.

The majority of the land use is multiple categories of residential. Other land uses are commercial, business parks, industrial, community facilities and open space areas.

2.2.1 Land Use Categories

The City is a well-balanced residential community. Approximately 54% of the City's land area is designated for residential. Single-family residential neighborhoods are by far the most common residential use in the City, accounting for 47% of all the City acreage, and 86% of residential acreage in the City. Residential land use acreage includes land used for apartment complexes and condominiums.

According to the City's 2014-2021 Housing Element, adopted March 2013, there is a land area of 98.21 acres that is currently zoned for residential uses and is considered vacant or underutilized residentially zoned. This land area can accommodate 65 residentially zoned parcels.

Residential Land Use categories were broken down into four sub-categories as follows:

- ***Hillside (0-2 DU/Acre)***: Per the City's General Plan, the Hillside potential maximum built-out area is 625 acres and the existing developed area is 321 acres. According to the 2008-2014 Housing Element, this area can be updated to 360 acres to consider the approved development plans and to 671 acres to include an additional 11 acre of potential site development with no constraints as identified in the same housing element. Single-family units may be built up to a density of two dwelling units (DU) per acre. However, the Hillside development is faced with difficult circumstances such as steep slopes, faults, landslides, fire danger, etc. Some areas in this category may not be developable. The Hillside residential category is subject to four zoning plans of PR1/5 (1 DU/5 acre), PR1D (1 DU/acre), PR2D (2 DU/acre), and HDOZ (Hillside Development Overlay Zone). The population density for this category could range from zero to six per acre, assuming an average household size of 2.85.

- ***Low-Density (0-5 DU/Acre)****:* Per the City's General Plan, the Low-Density potential maximum built-out area is 2,098 acres and the existing developed area is 2,070 acres. According to the 2008-2014 Housing Element, this area can be updated to 2,077 acres to consider the approved development plans. This category will permit single-family units at a density of 0-5 units per acre. The Low-Density residential category is subject to four zoning plans of PR2D (2 DU/acre), PR3D (3 DU/acre), PR4.5D (4.5 DU/acre), and PR5D (5 DU/acre). Population density for this category could range from zero to 14 persons per acre, assuming an average household size of 2.85.
- ***Medium-Density (0-10 DU/Acre)***: Per the City's General Plan, the Medium-Density potential maximum built-out area is 384 acres and the existing developed area is 367 acres. According to the 2008-2014 Housing Elements, this area can be updated to 375 acres to consider the approved development plan and 380 acres to include development of potential sites with no constraints. The updated potential maximum built-out area is 392 acres to consider zoning changes. This category allows for the development of duplexes and other attached dwellings. The Medium-Density residential category is subject to six zoning plans of PR6A (6 DU/acre), PR7A (7 DU/acre), PR7.5A (7.5 DU/acre), PR8A (8 DU/acre), PR10A (10 DU/acre), and MHP (Mobile Home Park Zone). Population density for this category could range from zero to 27 persons per acre, assuming an average household size of 2.85.
- ***High-Density (0-15 DU/Acre)***: Per the City's General Plan, the High-Density potential maximum built-out area is 50 acres and the existing developed area is 50 acres. According to the 2008-2014 Housing Elements, there is an area of 19 acres that may be rezoned from PRA15 to PRA25 to accommodate additional residential dwellings of 25 attached units per acre. This category is for multiple-family residential units and also provides for the development of duplexes and other attached DUs. The High-Density residential category is subject to one zoning plan of PR15A (15 DU/acre). Population density for this category could range from zero to 42 persons per acre, assuming an average household size of 2.85.

Additional Land Use categories are as follows:

- ***Commercial/Business Park:*** Per the City's General Plan, the Commercial/Business Park potential maximum built-out area is 509 acres and the existing developed area is 324 acres. According to the Housing Elements of 2008-2014 and 2014-2021, the existing developed area can be updated to 356 acres to consider the Oldtown Specific Plan changes and 380 acres to include an additional 24 acres for development of potential sites with no constraints. Also, the potential maximum built-out can be increased to 562 acres to consider the rezoning changes of the housing elements. This category permits retail commercial, office, light manufacturing, industrial, and mixed uses. The Commercial/Business Park category is subject to four zoning plans of CPD

(Commercial-Professional Development), C-M (Commercial Manufacturing), NC (Neighborhood Commercial), and A-P (Administrative-Professional). Maximum lot coverage of 50% in permitted.

- ***Industrial***: Per the City's General Plan, the Industrial potential maximum built-out area is 131 acres and the existing developed area is 126 acres. According to the Housing Elements of 2008-2014 and 2014-2021, the built-out area can be updated to 92 acres to consider rezoning changes. This category allows for more intense manufacturing and industrial uses than allowed in the commercial/business park areas of the City. The Industrial category is subject to two zoning plans of PID (planned Industrial Development), and Industrial (SP84-12). Maximum lot coverage of 50% in permitted.
- ***Community Facility/Freeway:*** Per the City's General Plan, the Community Facility/Freeway potential maximum built-out area is 1,251 acres and the existing developed area is 1,242 acres. According to the 2008-2014 Housing Element, this area can be updated to 1,254 acres to include the development of potential sites of no constraints. This category includes Schools, Senior Housing Units, the University of La Verne, Brackett Field, MWD's properties, water/sewer facilities, storm drains, libraries, churches, and any special facilities unique to the City. The right-of-way of the Foothill (210) Freeway including access points is designated in this category.
- ***Open Space:*** Per the City's General Plan, the Open Space potential maximum built-out area is 767 acres and the existing developed area is 762 acres. To incorporate the changes of the 2014-2021 Housing Element, the potential maximum built-out area will be reduced to 742 acres and the existing developed area will be 737 acres. This category includes City parks, utilities, easements, flood control channels, and some hillside areas that will remain undeveloped due to environmental and fire safety constraints. The Open Space category is subject to two zoning plans of O (Official) and A-1 (Limited Agriculture).

According to the Land Use chapter in the 1998 General Plan, residential land uses will continue to be the largest water consumer in the City. Residential and business park land uses show the most growth potential.

Table 2-1 shows both the existing and potential land use distribution for the City. This table has been updated to incorporate zoning changes, approved new developed areas, and potential developed areas based on the City's most updated Housing Elements of 2008-2014 and 2014-2021.

For purposes of projecting water demand at build-out, the existing built-out area of 5,341 acres that includes potential sites for development has been considered. This table does consider recent or pending Land Use changes, planned development, type of industry, or occupancy as anticipated by 2035. Proposed Land Use assumes 100% occupancy and complete build-out.

2.2.2 Zoning Designations

Planning for growth poses significant opportunities and challenges for the City. The City's Land Use Plan is an important means to ensure that the City is adequately prepared to respond to these opportunities and challenges. The Land Use Plan plays a key role in managing growth within the City.

There are as many as 34 different Land Use Zoning designations for customers served by the City. For the purposes of this WMP and to establish a unified consistent planning approach, analysis of Land Use Zoning designations was performed using the General Plan, latest zoning map issued in 2016, the City's specific plans, the City's Housing Elements of 2008-2014 and 2014-2021, and the City's GIS database.

Exhibit 2 presents the zoning designations of the City. Additionally, Table 2-2 below lists the acreages of all zoning designations.

Planning Districts/Neighborhoods

The 1998 General Plan divides the City into eight planning districts/neighborhoods as follows:

- **Neighborhood One - North La Verne Hillsides**: This district/foothill neighborhood contains 1,043 acres of residential uses and open space. Most development is single-family detached housing, on lots ranging from 10,000 to 15,000 square feet. The existing City General Plan has identified significant single-family development for portions of this area. Development is faced with difficult circumstances such as steep slopes, faults, landslides, fire danger, etc. Individual site constraints combined to severely constrain density and, in some cases, prohibit development. The most recent development was completed under the Marshall Canyon Specific Plan.
- **Neighborhood Two - North La Verne**: This district/neighborhood contains 1,334 acres. The developed portion is almost exclusively single-family residential. This district includes undeveloped natural oak woodland as well as the Live Oak Reservoir. Significant natural open space remains in this district.
- **Neighborhood Three - Northwest La Verne**: This district/neighborhood contains 277 acres. Development in this district may be limited by fire danger and geologic hazard as well as by the desire to protect natural terrain and views. Development in Northwest La Verne consists primarily of single-family homes constructed in the 1960s and 1970s.
- **Neighborhood Four - Foxglen**: This district/neighborhood is in the western portion of the City. It is the smallest district with just 127 acres. Foxglen is comprised of one small park and single-family homes.
- **Neighborhood Five - Foothill Corridor**: This district/neighborhood contains 810 acres with a diversity of land uses, including residential development (single/multi-family and mobile homes), open space, recreation, and agriculture. Additionally, there is commercial development along Foothill Boulevard which establishes the character of this district. It remains some vacant commercial land that may be developed in the future.
- **Neighborhood Six - West La Verne**: This district/neighborhood contains 618 acres. Adjacent to West La Verne is a pocket of unincorporated Los Angeles County land that is within the City's SOI. The most prominent feature of this district is the MWD Weymouth Filtration Water Treatment Plant. Mobile home communities and a

variety of single and multiple-family housing characterize the remainder of West La Verne.

- **Neighborhood Seven - Lordsburg**: This neighborhood includes most of the Lordsburg Historic District. The northern portion of this 788 acre neighborhood is dominated by community facilities. Lordsburg homes include both single and multiple-family units. Single-family homes characterize residential development in this district. Most of the development is managed under the Old Town and Lordsburg specific plans.
- **Neighborhood Eight - South La Verne**: This District/Neighborhood contains 891 acres and includes the greatest amount of vacant land in the City. The most prominent land use is the general aviation airport of Brackett Field. The La Verne Business Park occupies 100 acres north of the airport. This district includes other industrial uses. Residential development is limited. There is a community of mobile home parks in the east and scattered single-family residential development just south of Arrow Highway.

2.2.3 Accessory Dwelling Units (ADUs) onto Single Family Residential Parcels

California has signed new bills regarding Accessory Dwelling Units (ADUs) to make them more accessible. Two bills with the potential largest impact to the water purveyors are AB-881 and AB-68.

ADUs are separate dwelling areas that are built on parcels designated as single family residential under land usage. As stated in Assembly Bill 881,"ADU shall not be considered by the local agency, …or water corporation to be a new residential use for purposes of calculating connection fees or capacity charge for utilities including water and sewer service,…". It is recommended the City conduct a study to determine if with the addition of the ADUs onto single family residential parcel would have potential impacts on the City's water and sewer system and potential impact to the size of water meters. CIP No.11 in Chapter 8 is intended to initiate this study for the City.

2.3 Sphere of Influence (SOI)

The land area within the SOI is presently outside the City boundary and covers three major areas as follows: (1) parts of Marshal Canyon County Park and San Gabriel Mountains National Monument; (2) the area located between San Dimas and the City that is located south of Gladstone Street and (3) the area that is located between the City and Claremont. All of this land is north of Baseline Road except the area that is located between the City and San Dimas, which is found south of the Baseline Road. This study includes an additional 303 acres of land not considered to be within the SOI of the City's water system. The area is located north of Summit Road, along Live Oak Canyon Road.

It has been determined through previous master planning efforts that the City is the only feasible source of water for future development in this area. The 303 acres of land was assumed to be in the residential hillside land use category for the determination of future water usage. Per the 2015 UWMP, approximately 861 acres are considered to be within the SOI of the City. The SOI used for this WMP is shown on Exhibit 2.

Table 2-1 – Land Use

Land Use Category	Existing General plan (Acres)	Existing 2016/W Approved Sites (Acres)	Existing 2016/W Potential Sites (Acres)	Potential Built-Out per General Plan (Acres)	Potential Updated Built-Out (Acres)	% (Increase) with Potential Sites ±
Hillside - Residential (0-2 DU/Acre)	321	360	371	625	625	+68.46
Low Density - Residential (0-5 DU/Acre)	2,070	2,077	2,077	2,098	2,098	+1.01
Medium Density – Residential (0-10 DU/Acre)	367	375	380	384	392	+3.16
High Density - Residential (0-15 DU/Acre)	50	50	50	50	50	0
Subtotal Residential	2,808	2,862	2,878	3,157	3,165	+9.97
Commercial Business Park	324	356	380	509	562	+47.90
Industrial	126	116	92	131	92	+0
Community Facility/Freeway	1,242	1,242	1,254	1,251	1,254	+0
Open Space	762	737	737	767	742	+0.68
Totals	**5,262**	**5,313**	**5,341**	**5,815**	**5,815**	**+8.87**

Table 2-2 – Zoning Designation Acreage

Number	Zoning Designation Abbreviation	Zoning Designations	Acreage (acres)
1	A1	Limited Agriculture	110.75
2	PR1/5D	1 DU /5 Acres Detached	327.03
3	PR1D	1 DU /Acre Detached	4.46
4	PR2D	2 DU /Acre Detached	205.75
5	PR3D	3 DU /5 Acres Detached	754.21
6	PR4.5D	4.5 DU /Acre Detached	657.14
7	PR5D	5 DU /Acre Detached	12.29
8	PR6A	6 DU /Acre Attached	35.91
9	PR7A	7 DU /Acre Attached	17.87
10	PR7.5A	7.5 DU /Acre Attached	0
11	PR8A	8 DU /Acre Attached	44.86
12	PR10A	10 DU /Acre Attached	26.17
13	PR15A	15 DU /Acre Attached	62.5
14	CPD	Commercial/Professional District	4.99
15	MHP	Mobile Home Park	210.14
16	O	Official	608.54
17	I	Institutional	115.03
18	OVERLAY ZONE	Hillside Development	24
19	WSP	Walnut	20.79
20	PSP	Puddingstone	40.35

Number	Zoning Designation Abbreviation	Zoning Designations	Acreage (acres)
21	LOSP	Live Oak	148.7
22	ERSP	Emerald Ridge	41.24
23	SLVSP	Sierra La Verne	37.85
24	ACSP	Arrow Corridor	649.53
25	RESP	Rancho Esperanza	11.11
26	LVHSP	La Verne Heights	230.77
27	FBSP	Foothill Boulevard	221.66
28	MCSP	Marshall Canyon	296.23
29	LSP	Lordsburg	224.31
30	900BSP	900 Bonita Avenue	0.85
31	RLVSP	Rancho La Verne	168.18
32	PLVSP	Puddingstone La Venture	38.5
33	OTLVSP	Old Town LA Verne	121.9
34	ECSP	Emerald Collection	4.48
Total Area			**5,478**

2.4 Population

The 2015 UWMP indicates that the City had a population of 31,043 based on the actual service area in 2015, compared to 29,639 in 2000, which is a 4.7% increase over the past 15 years.

According to the City's profiles published by SCAG Regional Council for the years 2017 and 2019 as shown in Table 2-3, the overall population decreased but the population of young adults and children increased. Research shows that in a city with a high population of young adults and children, water use is higher than in cities with an older median age.

Table 2-3 – City Population[2]

Population		2017	2019
		32,389 ppl	31,947 ppl
Age Range	Under 18 years old	18.8%	21.0%
	19 and 64 years old	61.4%	60.5%
	Over 65 years old	19.8%	18.5%

The City's 1998 General Plan projects the population at ultimate development to be 37,430. Per the 2014-2021 Housing Element, adopted December 2, 2013, SCAG predicts that the City's 2035 population will increase to 38,742 and the number of households will increase from 11,875 to 12,819.

[2] Population data was obtained using the City's profile published by SCAG Regional Council, dated 2017 and 2019.

2.4.1 Service Area Population

The service area population takes into consideration the number of customers serviced by the GSWC and the four sub-groups that are within the City's SOI but outside of the City's boundary.

There are 819 customers serviced by GSWC and there are four private water groups within the City's SOI but outside of the City's boundary:

- Webb Oak Group (55 customers)
- Oakglen Heights Group (4 customers)
- Flaten-Heuer Group (6 customers)
- Briney Water Group (19 customers)

It is assumed the number of customers associated with these five sub-groups has remained constant throughout the study period. SCAG estimated the average household size in the City to be 2.8 persons per household. This equates to a net difference between the City's population and the distribution system boundary population of 2,058 persons.

ΔP = (Σ *private water group customers – GSWC customers*) *(*occupancy rate*)
= (55+4+6+19-819 *customers*) * (2.8 *persons per household*) ≈ **-2,058 *persons***
where: ΔP is the difference in population between the City and the service area.

The actual population within the service area in 2019 = 31,974-2,058 = 29,916.

2.5 Water Demand

Water production capacity must be capable of satisfying all water demands and water losses. Water demands are considered to be the sum of all water delivered to customers and billed for at a commodity rate. Water losses include water uses whose revenue cannot be recovered through activities such as flushing, unauthorized uses, water quality sampling, maintenance, hydrant testing, fire suppression, street cleaning water, undocumented water uses, unmetered construction water, etc. Water to waste includes other forms of unaccounted water such as leaks, reconciliation of inaccurate meters, pumping to waste, and pipe breaks.

For the purpose of this WMP, the term water demand refers to the level of water production necessary to satisfy customer demands and typical losses. Water losses are not referred to as a separate category or water use; rather, they are considered a functional reality of managing a distribution system that must be considered when projecting requirements and recommending improvements. The concept of "demand" will refer to all water needed to satisfy water use and water loss.

2.5.1 Historic Water Production and Consumption

The City uses a combined water supply of groundwater and imported water. Below is a summary table of average water production and water sales ranging from 2012 through 2020. The average shown is based on data from 2012 – 2019 and the fourth quarter data for 2020 was calculated based on historical averages from 2014-2019 between the months of October to December.

Table 2-4 – Average Water Production and Sales (2012-2020)

Year	Gallons per capita per day (gpcd)	Net Water Production (AFY)	Service Area Population	Water Sales (AFY)
2012	250.7	8,102	29,382	7,580
2013	255.8	8,421	29,925	8,101
2014	246	8,248	30,479	7,691
2015	188.6*	6,561	31,043*	5,971
2016	194.5*	6,781	31,142*	6,319
2017	209.7	7,470	32,389*	6,218
2018	206.3	7,216	31,801	6,936
2019	192.7	6,778	31,974*	6,407
2020	197.6	7,221	33,216	6,711
Average	**215.8**	**7,422**	**31,262**	**6,881**

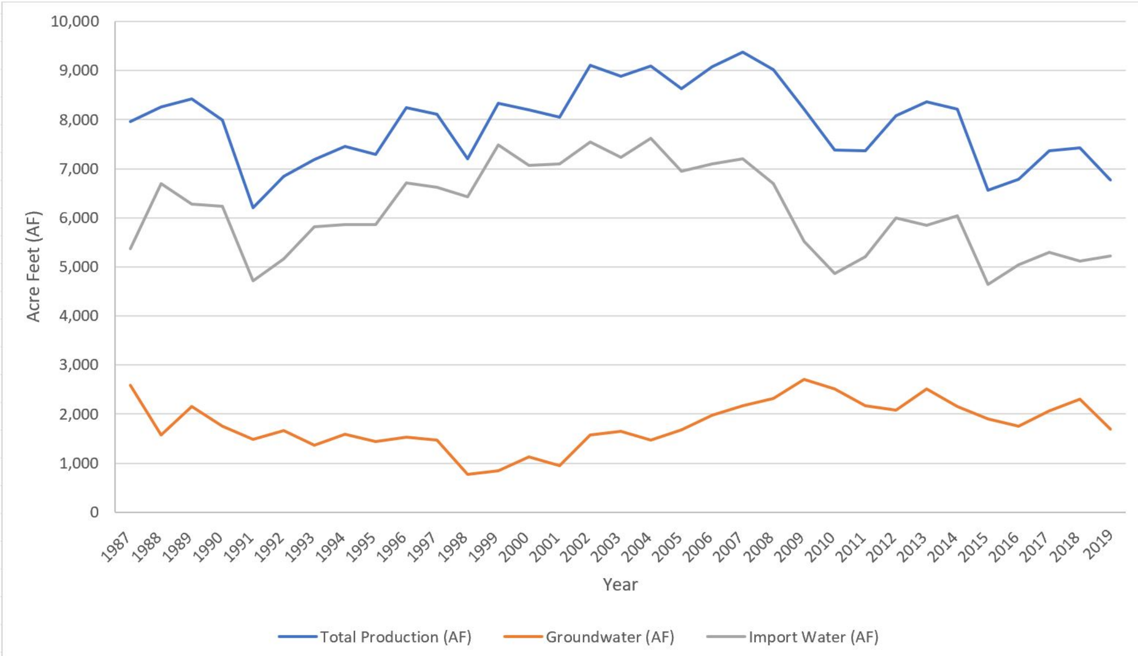
Notes:

- * = Given values from 2015 UWMP.
- Average values were calculated based on data from 2012-2020, where 2020's October, November and December months were a projection of data ranging from 2014-2019.

Table 2-4 above demonstrates the average water production and sales between calendar years 2012 through 2020. As seen, year 2013 displays the highest value in net water production, 8,101 AFY, for the City. Service area population varies and were calculated for years not given based on given data from the 2015 UWMP.

Figure 2-1 below lists the historical water production during the most recent 32 calendar years of 1987 to 2019. As seen, water production increased to the highest in recorded history between calendar years 2006 and 2008, peaking in 2007, and then decreases as it reaches 2011. Thus far, the 2007 total production peak has not been reached or surpassed between again.

Figure 2-1 – Historical Water Production (1987-2019)



For the period 2012 to 2019, the water production average and the water sales average are 7,447 AF and 6,903 AF (Appendix A), respectively with a difference of 544 AF for the unaccounted water usages; the proportion of groundwater utilization compared to imported water use was at 30% in 2013 (highest) and at 26% in 2012, 2014, and 2016. For the same period, the highest total annual water production was 8,421 AF in 2013 and the lowest water production was 6,561 AF in 2015. The difference between the billing and production data revealed that 3.12% to 8.91% of production for this period was not billed. For the peak month production, seen in Table 2-5, the ratio of groundwater to imported water for the period of 2012 to 2019 was at the highest groundwater production of 27.2% to 72.8% in August 2018 and the lowest groundwater production was 19.2% to 80.8% in August 2019. The historical peak monthly use (sales) was 1,273 AF in August 2014. Factors affecting water usages include the City's water supply strategies, operational procedures, development and construction, climate, characteristics of population, environmental concerns, industry and commerce adjustment, water rates, metering, and water conservation.

Table 2-5 – Peak Month Water Production (1987-2019)

Year	Peak Month	Total Production (AF)	Groundwater (AF)	% of Total	Import Water (AF)	% of Total
1987	August	1,028	373	36.3	655	63.7
1988	July	1,013	203	20.0	810	80.0
1989	July	1,033	246	23.8	787	76.2
1990	July	1,021	264	25.9	757	74.1
1991	August	734	183	24.9	551	75.1
1992	August	931	203	21.8	728	78.2
1993	August	904	207	22.9	697	77.1

Year	Peak Month	Total Production (AF)	Groundwater (AF)	% of Total	Import Water (AF)	% of Total
1994	August	1,005	181	18.0	824	82.0
1995	August	1,009	161	16.0	848	84.0
1996	July	1,025	161	15.7	864	84.3
1997	August	987	162	16.4	825	83.6
1998	August	1,044	27	2.6	1,017	97.4
1999	August	1,066	67	6.3	999	93.7
2000	July	1,032	151	14.6	881	85.4
2001	August	1,054	115	10.9	939	89.1
2002	July	1,141	171	15.0	970	85.0
2003	August	1,158	212	18.3	946	81.7
2004	October	1,217	196	16.1	1,021	83.9
2005	August	1,847	358	19.4	1,488	80.6
2006	August	1,388	302	21.8	1,085	78.2
2007	October	1,332	309	23.2	1,023	76.8
2008	August	1,230	314	25.5	916	74.5
2009	July	1,225	402	32.8	823	67.2
2010	October	1,003	345	34.1	658	65.6
2011	August	976	273	28.0	703	72.0
2012	August	1,072	208	19.4	864	80.6
2013	August	1,009	259	25.7	750	74.3
2014	July	966	203	21.0	763	79.0
2015	August	719	182	25.3	537	74.7
2016	August	844	184	21.8	660	78.2
2017	July	879	207	23.5	673	76.6
2018	August	925	252	27.2	673	72.8
2019	August	830	160	19.3	671	80.8
Average (1987-2019)	**August**	1,050	219	21.0	830	79.0

The service area boundary, as shown in Exhibit 1, is identical to the City incorporated boundary with the following exceptions:

- 819 customers in the southwest corner of the City are serviced by the GSWC. This configuration was put in place due to a division in the development of water supply created following the construction of Puddingstone Channel for flood control purposes.
- Four private water groups located in unincorporated Los Angeles County and within the City's SOI are serviced by the City. These include (1) the Webb Oak Group, (2) the Oakglen Heights Water Group, (3) the Flaten-Heuer Group, and (4) the Briney Water Group.
- Water is supplied to Marshall Canyon via a dedicated Los Angeles County master meter. Los Angeles County maintains and manages all water distribution downstream of the master meter including service connections at the Marshall Canyon Golf Course, Fred M. Palmer Marshall Canyon Equestrian Center, Marshall Canyon Tree Farm, and

Los Angeles County Probation Department Camp Joseph M. Paige Juvenile Detention Facility. Service connections to these facilities are in the unincorporated Los Angeles County and within the City's SOI.

Table 2-16 contains the average water sales by pressure zone from 2013 to 2020. The data from October through December for 2020 were not available at the time of the study, so projections for that time frame were calculated by utilizing data from 2013 through 2019. The minimum year for water sales was in 2015 at 5,971 AF total for all zones and the maximum year was in 2013 with water sales for all zones totaling to 8,101 AF.

Table 2-6 – Water Sales by Pressure Zone (2013-2020)

Water Sales (AF)	Pressure Zone							Totals
	I	II	III	IV	V	L	P	
2013	3,481	2,089	522	1,228	249	6	526	8,101
2014	3,054	2,056	501	1,253	234	6	588	7,692
2015	2,436	1,561	371	920	175	4	504	5,971
2016	2,557	1,607	412	1,010	186	5	542	6,319
2017	2,711	1,548	437	1,023	167	5	328	6,218
2018	2,705	1,796	469	1,198	218	6	545	6,936
2019	2,684	1,676	408	911	187	4	537	6,407
2020	2,768	1,760	442	996	221	6	518	6,711
Average	2,799	1,762	445	1,067	205	5	511	6,794
%	41%	26%	7%	16%	3%	0%	8%	100%

Notes:

1) Pressure Zone IIa sales is included in the Pressure Zone II data.
2) Pressure Zone IVa sales is included in the Pressure Zone IV data.
3) "L" is the La Verne Water Association area – served by Pressure Zone IV.
4) "P" is the Plateau Mutual area – served by Pressure Zone IV.
5) No water losses or to waste are included

2.5.2 Top Water Users

The basis of identifying the top users was the highest 12-month billing cycle for the study period of 2012-2019.

Typical customer water demands (sales) are considered as a relatively uniform water demand throughout the water system service area, except that some of the users in the City use relatively larger amounts of water compared with the others. Table 2-7 lists the top 20 water consumers within the calendar year 2013 in the City, which will be considered as point flow in the Water Model. The total water demands (sales) of the year 2013 is the highest water consumption for the 20-top water users comparing to the other years within the period 2012-2019. The total demand from these top 20-point users is 1,297.47 AFY, which equates to approximately 15.5% of the total water use of the year 2013. The top 20 users are shown on Exhibit 3.

Direct allocation of high water users to the Water Model provides correlation between the best available hydraulic data and the simulation of typical stresses seen in the field.

Table 2-7 – Top Twenty Point Demand Water Users 2013

Ranking	Customer Name	Address	Land Use	Consumption 2013 (AFY)	Percent %
1	County of Los Angeles	Marshall Canyon Golf Course	Institutional	361.42	27.86%
2	Sierra La Verne Golf Course Club	2560 Golden Hills	Commercial	139.96	10.79%
3	Paper Pak Industries	1941 White Avenue	Industrial	97.31	7.50%
4	BUSD - Bonita High School	3102 D Street	Institutional	75.16	5.79%
5	Webb Oak Mutual Water Company	Webb Oak	Residential	74.83	5.77%
6	Twin Oaks Mobile Home Park	3800 Bradford	Residential	68.35	5.27%
7	LV Business/LA Real Estate	Wright Street	Commercial	53.06	4.09%
8	BUSD - Ramona Middle School	3490 Ramona WTR3	Institutional	52.30	4.03%
9	Foothill Terrace MHP	4095 Fruit	Residential	45.87	3.54%
10	American Airport Corporation	Brackett Field	Institutional	43.77	3.37%
11	Kings Way Garden MHP	2755 Arrow Highway	Residential	36.04	2.78%
12	Coiner Nursery	3000 B Street	Open Space	35.53	2.74%
13	Briney Water Group	4524 Briney Point	Residential	31.95	2.46%
14	Damien High School	1124 Bonita Avenue	Institutional	31.28	2.41%
15	Copacabana Mobile Home Park	2717 Arrow Highway	Residential	27.32	2.11%
16	University of La Verne	1950 Third Street	Institutional	26.90	2.07%
17	Cal Trans	2000 Crown Circle	Institutional	26.49	2.04%
18	Fountain Mobile Home Park	3530 Damien WTR 3	Residential	24.75	1.91%
19	Herb Hafif	5600 Shemiran Street	Residential	23.68	1.83%
20	W. Covina Wholesale Nursery	2820 Amherst Street	Open Space	21.49	1.66%
Total:				**1,297.47**	

2.5.3 Projected Water Demand

Estimating and forecasting water demand is an essential component of understanding the baseline requirements that the distribution system must be capable of support. Development of average demand and peaking factors (PF) associated with the average demand provides the basis for quantifying the typical stresses that must be accounted for when assessing the adequacy of system capacity.

PFs represent fluctuation in demand as variation from the average. In general, water demand fluctuates on a seasonal basis and on a daily basis. Seasonal fluctuation was analyzed based on historical monthly production records, and daily fluctuation is typically analyzed based on recent SCADA data.

2.5.4 Demand Fluctuations

The purpose of understanding demand fluctuations is to accurately apply loading to the water distribution system and to evaluate whether the distribution system has sufficient capacity to withstand that loading.

Demand fluctuation is the description of demand variation over a specified time period. Fluctuation on an annual, weekly, and daily basis are important to how the City manages its distribution operations. The following sections put these concepts into perspective.

Annual Demand Fluctuations

Demand fluctuation on an annual basis is best described by PFs that compare the various extreme demand conditions to the annual average. There are no unusually high water consuming industries whose water consumption abnormally affects the system flow. According to the data collected over the past 31 years, water consumption is highest in July and August and lowest in December and January with an average of 7,977 AF. The water consumption/production average and sales average for the period of 2012-2019 is 7,447 AF and 6,903 AF, respectively with an approximate difference of 544 AF.

Typically, the highest daily consumption occurs between 7:00 pm and 9:00 pm.

Table 2-8 summarizes an analysis for the study period of 2012-2019 of actual sales and production data and PF.

For this study period, the maximum annual demand of 8,421 AF occurred in 2013. The MDD and PHD for this study period were anticipated to occur in August of 2013 and were used for the demand analysis. The day PF (used for determining the MDD) of 1.54 was determined based on the MDD of 35.28 AF/day which occurred on August 29, 2013. An additional PF of 15% was added to this factor to account for annual variation, which resulted in a 1.8 PF that will be used for estimating the maximum demands. Also, the typical day PF of 1.8 was determined based on the ADD of the entire study period of 2012 to 2019.

Table 2-8 – Peaking Factors (PF)

Duration	2013 (AF)	Average (AF)	Minimum PF	Maximum PF
Annual Consumption (sales)	8,101	6,903	0.86	1.17
Annual Production	8,421	7,447	0.88	1.13
Monthly Consumption (sales)	1,059	575	0.39	2.21
Monthly Production	1,009	621	0.40	1.73
Daily Production	35.28(2)	23.07(1)	0.53	1.53(3)
Peak Hour Consumption (PHD)				3.15(4)

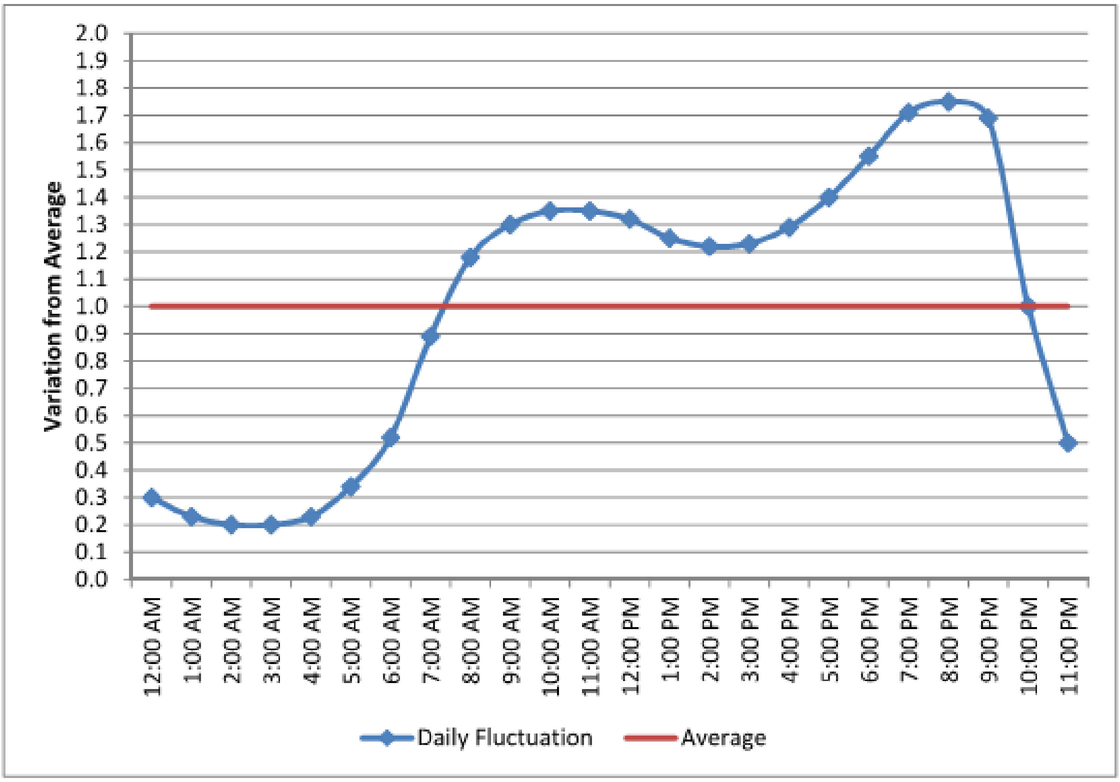
Notes:
1) The ADD was determined by dividing the annual production (8,421 AF) by 365 days.
2) The MDD occurred on August 29, 2013.
3) 1.53 represents the Maximum PF. This PF would take in account annual variation of 15% to result in the Maximum Day PF of 1.8.
4) Based on the City's 2010 WMP.

Daily Demand Fluctuations

Demand fluctuation over the course of a typical day are based primarily on Land Use. Overall, most of the water used in the City is from residential consumption. It is not an easy task to define local demand fluctuations over the course of a day; however, such fluctuation may be generalized based on industry standards and common sense. Figure 2-2 is the American Water Works Association (AWWA) standard residential demand diurnal curve.

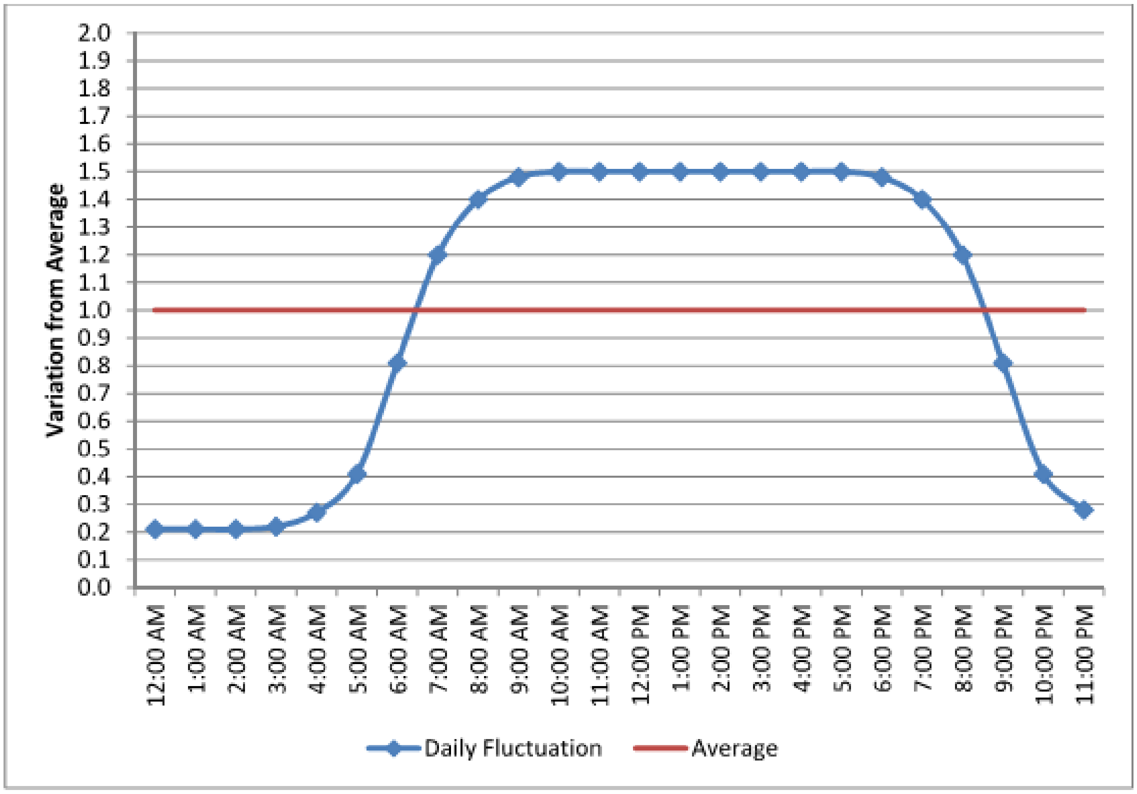
Residential demand is typified by a diurnal curve with peaks in the morning and evening occurring before and after regular work/school hours and with troughs during the night and midday when activity decreases in a residence.

Figure 2-2 – AWWA Standard Residential Diurnal Curve



CII (Commercial, Institutional and Industrial) demand closely follows typical business hours with very low demand during the night and relatively steady demand during the day. Figure 2-3 describes typical CII demand variation.

Figure 2-3 – Standard CII Diurnal Curve



Application of Demand Fluctuations

Since the City's distribution system is a pump-reservoir system, all demands must be met by a combination of booster pump stations and reservoir storage. The booster pump stations must be sized and operated to respond to the MDDs. Storage in each pressure zone should be capable of providing fire, operational, and emergency capacity. Fire storage is based on recommendations from the City's Fire Department with respect to land use. Operational storage, which compensates for hourly fluctuation in demand, shall be set at 30% of one day of MDD. Emergency storage, which accounts for planned and unplanned equipment outages, shall be set at one day of MDD.

To assist in determining how demand fluctuation impacts the system, the curves presented in Figure 2-2 and Figure 2-3 have been programmed into the Water Model, all analyses and recommendations are based on the system response to those fluctuations.

2.5.5 Water Demand Coefficients and Requirements

Water demand (water duty) consists of three components:

1. Typical customer water demand, which is the total water requirement based either on population uses or the total amount coming from the sources of land use

categories, including residential, industrial, commercial, public areas, open space, and as well as losses during system flushing;

2. Point flows, which are the relatively large water consumers; and
3. Fire protection water demand, which is in accordance with the Uniform Fire Code based on the City's General Plan.

Table 2-9 and Table 2-10 show the water duty per land use categories based upon the previous water consumption records from the City on the same land use features for the year 2013 and the period from 2012-2019. The water duty factors were used to calculate typical customer water demand.

Table 2-9 – Water Consumption Per Land Use Category
Based on the 2013 Maximum and Average Year Production for 2012-2019

Land Use Category	Existing Developed (1) (acre)	2013 Water Consumption (2) (AFY)	Max. Water Consumption (3) (AFY)	Ave. Water Consumption (4) (AFY)
Residential (total)	2,878	5,340	5,340	4,695
Commercial/Business Park	380	824	862(5)	719
Industrial	92	356(6)	356	203
Community Facility	1,254	1,518	1,518	1,253
Open Space	737	61(7)	61	33
Totals	**5,341**	**8,001**		**6,902**

Notes:

1) Land area of GSWC customers is not included. Existing developed area includes all approved areas for development and new sites for potential development with no constraints.
2) Water consumption for calendar year 2013 (the last five years' highest production year including 2019).
3) Water consumption of the individual land use categories for the period of 2012-2019. The highest water consumption for open space was in 2013 at 61 AFY.
4) Average water consumption of the period of 2012-2019.
5) The highest water demand of the Commercial land use category was in 2014 of 862 AFY.
6) The water consumption of the Industrial land use category of 2013 was exceptionally high compared to other years. The water demands for 2012, 2014, 2015,2016, 2017, 2018, and 2019 are 170, 204, 187, 185, 186, 165, and 167 AFY, respectively.
7) The water consumption of the Open Space land use category includes agriculture and temporary construction.

Table 2-10 – Water Demand Coefficient Per Land Use Category
Based on the 2013 Maximum and Average Year Production for 2012-2019

Land Use Category	2013 Water Duty (1) (AF/ acre/year)	Avg. Water Duty (2) (AF/ acre/year)	Max. Water Duty (3) (AF/acre/year)	Proposed Water Duty (AF/acre/year) (4)
Residential (total)	1.86	1.63	1.86	2.1
Commercial/Business Park	2.17	1.89	2.27	2.5
Industrial	3.87	2.20	3.87	4.4
Community Facility	1.21	1.00	1.21	1.4
Open Space/Water Losses	0.52	0.78	1.73	0.6
Totals	**9.6**	**7.5**	**10.9**	

Notes:
1) Equals actual water consumption of 2013 divided by existing developed area.
2) Equals average water consumption of the period of 2012-2019, divided by existing developed area.
3) Equals maximum water consumption of the individual land use categories for the period of 2012-2019, divided by existing developed area.
4) An additional multiplier factor of 1.15 was used to account for annual demands variation.

2.5.6 Build-Out Water Demand Requirements

Build-out water demand at 100% occupancy is based on current Land Use categories. Using the Water Duty Factor method, build-out water demand is estimated at 10,542 AFY as shown in Table 2-11 that lists future water demands for typical customer uses based on the proposed water duty.

Table 2-11 – Water Requirements at the Maximum Build-Out

Land Use Category	Proposed Build-out (1) (acres)	Water Duty(2) (AF/acre/year)	Water Demand (AF)
Residential	3,145	2.1	6,605
Business Park	562	2.5	1,405.00
Industrial	92	4.4	405
Community Facility	1,254	1.4	1756
Open Space/Water losses	742	0.5	371
Totals	**5,795**	**10.9**	**10,542**

Notes:
1) Land area of 20 acres for GSWC customers is not included.
2) An additional multiplier factor of 1.15 was used to account for annual demands variation.

2.5.7 Water Conservation

Per the City's 2015 UWMP, the target for water use efficiency is 238 gpcd by 2015 and 211 gpcd by 2020 and thereafter. Based on considering the water demands of 2016 and the analysis of the period 2012-2019, the average gpcd for the last 8 years and last 6 years are 219 gpcd and 208 gpcd, respectively. Table 2-12 indicates water target analysis for the period of 2012-2019.

Table 2-12 – Water Target Analysis for the Period of 2012-2019

Year	Demand gpcd	Total Net Pressure Zone Demands (AF)	Service Area Population
2012	252	8,138	29,382
2013	256	8,422	29,925
2014	247	8,278	30,479
2015	192	6,546	31,043
2016	198	6,779	31,142
2017	210	7,490	32,389
2018	206	7,220	31,801
2019	192	6,751	31,974
Average (2012-2019)	**219**	**7,453**	**31,017**
Average (2014-2019)	**208**	**7,177**	**31,471**

Table 2-13 indicates the water supply analysis for the period of 2012-2019 which showed that all water supplies are greater than the water demands by an average of 51 AFY. This difference represents the water to waste due to pipe leaks, breaks, reconciliation of inaccurate meters and so on.

Table 2-13 – Water Supply Analysis for the Period of 2012-2019

	2012	2013	2014	2015	2016	2017	2018	2019
Pomona Basin	1,225	1,460	1,211	1,126	1,071	1,040	1,105	1,018
Ganesha Basin	164	433	332	119	57	258	308	229
Live Oak Basin	689	619	618	662	618	773	896	447
TVMWD Import	6,025	5,914	6,089	4,661	5,039	5,481	5,117	5,223
Total (AF)	**8,103**	**8,426**	**8,250**	**6,568**	**6,787**	**7,552**	**7,426**	**6,917**

Table 2-14 indicates the projected population growth and updated water demands based on the analysis of the study period of 2012-2019. This table also includes the estimated future water demands based on the compliance with 211 gpcd target.

Table 2-14 – Projected Populations and Water Demands

	2021	2026	2031	2036
Service Area Population	32,315	33,529	34,787	36,089
Water Demands (AFY) based on 211 gpcd	7,638	7,925	8,222	8,530

2.6 Fire Flow Requirements

The fire flow requirements shall comply with the 2016 California Fire Code and 2016 Los Angeles Fire Code, Title 32.

The 2016 California Fire Code indicates that water supply for firefighting requires residual pressure at 20 pounds per square inch (psi) with minimum flow rate of 1,500 gpm and duration of two hours for residential structures. For centers of retail and office commercial, as well as manufacturing and warehousing facilities, it will require a higher fire flow and longer duration from 3,000 gpm for 3-hours to 8,000 gpm for 4-hours, depending upon the floor area square footage and usage. The City's Pressure Zones I and II are required to support the maximum fire flow rates based upon existing and proposed land uses. The remaining Pressure Zones are required to support fire flow rates for residential development.

For fire conditions, residual pressures should not fall below 20 psi when delivering the required fire flow rate. The minimum residual pressure requirement is established by Los Angeles County Fire Department and has been adopted by the City's Fire Department. Guidance on fire flow requirements for new construction is provided by the Los Angeles County Fire Department Regulation #8 (V7-C1-S8, Fire Flow and Hydrant Requirements). An exception to the 20-psi minimum is allowed for fire hydrants that are located very close to reservoirs as to not be able to 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.

The frequency of fire is a factor needed to estimate the amount of water to be used for firefighting. According to the "Statistical Abstract of the United States: 2010" (121st Edition, The National Data Book, by Economics and Statistic Administration and U.S. Census Bureau of U.S. Department of Commerce), of the 116,700,000 households in the United States in 2010, there were 384,000 home fires in the same year. For every 10,000 homes, 35 were damaged or lost by fire.

The 2010 Census Report indicated that the City has 11,686 housing units. Assuming the probability of fire is 0.35%, statistically, there may be 41 fires that require water for firefighting each year. Since there are also schools, industries, offices and public areas that may require fire protection, the exact amount of water required is somewhat unpredictable. Taking into consideration an additional 15% factor of safety for water supply, the total water requirement for an estimated 41 fires, based upon a fire flow rate of 1,500 gpm with a 2-hour duration, is 0.55 AF (180,000 gallons) each time and potentially 25.96 AF (8,460,000 gallons) each year.

2.7 Future Water Demands

Future water demand is the summation of typical water demands, point flow and the fire protection demand. Table 2-15 indicates the amount of water the City will need in the future based on the land development projection in the City's General Plan. The City does not intend to increase the supply of water to current outside users. Residents who receive water from the GSWC will continue to do so. Any future water demand increase will result from any new construction per the City's General Plan.

Per Table 2-10, the demand at the maximum build-out area is 10,542 AF. This projected water use represents the maximum demand due to expansion in developed land areas within the City's boundary.

Table 2-15 – Future Total Water Requirements

Typical Uses (AF)	Point Flow (AF)	Fire Protection (AF)	Total Demand (AF)
10,542	1,297 (Top 20)	26	11,864

By adding the maximum demand (10,542 AF) to the top 20 users demands (1,297 AF) along with the fire projection demand (26 AF), the future total water demand will be approximately 11,864 AF. The anticipated maximum future demand shall be configured by using a PF of 1.53 per Table 2-8.

Chapter 3 - SOURCES OF SUPPLY

3.1 General Description

The City uses both groundwater and imported water for its water supply. According to data provided by the City from 1986 to 2019, groundwater production has decreased in recent years and imported water production has increased. The groundwater ratio to imported water ratio changed from approximately 40%: 60% in 1986 to a 28%: 72% ratio in 2017. Since the beginning of the City's water system operations, imported water has gradually replaced groundwater as the major water source of supply.

Groundwater is pumped from the Live Oak Basin, Ganesha Basin, and Pomona Basin via 8 existing wells. The City complies with the water quality guidelines established by the DDW. Groundwater with contaminates over the maximum contaminate level (MCL) must be either treated or blended with imported water until it complies with the DDW acceptable levels, which results in a decrease in groundwater use due to blending ratios.

Imported water is delivered from the TVMWD Miramar Water Treatment Plant and from MWD Weymouth Filtration Water Treatment Plant. Imported water is received through seven connections from the TVMWD Miramar Water Treatment Plant via the Miramar Transmission System. Emergency supply is available through one connection on the Pomona Walnut Rowland Joint Feeder (PWRJF) from the MWD Weymouth Filtration Water Treatment Plant. Another connection is available from the GSWC intertie at Pattiglen and Bonita Avenues.

3.2 Groundwater Basins Overview

Local groundwater has been the City's primary source of water since the late 1800's. The City extracts groundwater from Six Basins in accordance with the Six Basins Judgment. Six Basins, as its name implies, is actually six small, interrelated basins: (1) Canyon Basin, (2) Upper Claremont Heights Basin, (3) Lower Claremont Heights Basin, (4) Pomona Basin, (5) Live Oak Basin, and (6) Ganesha Basin. The Six Basins Judgment specifically defines adjudication for the Four Basins (i.e. the first four basins listed above) and generally defines adjudication for the Two Basins (i.e. the last two basins listed above). The Six Basins Judgment is overseen by the Six Basins Watermaster, whose duties are currently being managed by Wildermuth Environmental.

The City has an adjudicated right in Four Basins for 7.601% of the OSY. Per the Six Basins Judgment, the City also has "the right to produce as much groundwater as it may reasonably withdraw from the Two Basins area on an annual basis so long as it does not substantially injure the rights of any other parties" identified in the Six Basins Judgment. The purpose behind such delineation of rights in the Two Basins involves the proximity of the City to the Two Basins and the acknowledgement of water quality issues in the Two Basins whose remediation would require substantial investment and management. The City has completed construction of the Amherst Groundwater Treatment Plant, which is capable of treating local groundwater for perchlorate and nitrate contamination and is now in a position to further define and develop its rights in the Two Basins.

The City has a total of 5,773 acres of land that overlies the Live Oak and Ganesha Basins, the northwestern portion of the Pomona Basin and the eastern portion of the Main San Gabriel Basin. Boundaries of these four basins are not 100% consistent with those of the hydrogeologic groundwater basins as defined by the California Department of Water Resources (DWR) because portions of the accepted basin boundaries are based on political, man-made, and surface features. Exhibit 4 illustrates the basins and their boundaries.

Ground surface elevations in the developed portions of the City range from 1,750 feet above mean sea level (MSL) at the northern boundary, along the base of the San Gabriel Mountains, to approximately 1,000 feet above MSL at the southwestern City boundary. The ground surface gradient is approximately 0.025 feet/foot across these groundwater basins. The areas with the steepest gradient are in the northern and eastern portions of the City.

The ground surface across the region is comprised of a coalescence of large and small alluvial fans that slope to the south across the City. These fans were created by erosion and soil deposition from the Puddingstone Wash, Marshall Canyon Wash, Emerald Wash, Live Oak Wash and Thompson Creek Wash.

Geologic formations in the region include water bearing sediments and non-water bearing sediments and generally have the ability to contain, transmit and yield groundwater to wells. Water bearing sediments within the basins vary in size depending on locality. Generally, the basins contain from coarse gravel and boulders to fine or medium-grained sand containing a large amount of silt and clay. Within each of the groundwater basins, the potential water bearing sediments are recent alluvium and older alluvium, which range in geologic age from recent to Pleistocene. These materials currently provide the majority of the groundwater extracted by wells in the local groundwater basins. Non-water bearing sediments are on the adjoining hills and mountains and are composed of older consolidated and/or cemented sedimentary rocks and/or crystalline igneous and metamorphic rocks.

The Live Oak Basin is bounded by the Sierra Madre-Cucamonga Fault on the north, (considered an active fault) and Indian Hill Fault on the south. The Indian Hill Fault separates the Live Oak Basin from the Ganesha and Pomona Basins. Subsurface ridges of relatively impermeable bedrock may act as barriers that separate the Live Oak Basin from the Main San Gabriel Basin (the San Dimas Basin) on the west and the Lower Claremont Heights Basin on the east. Total thickness of alluvium in the Live Oak Basin is from approximately 350 feet to over 500 feet (as described in the drillers' logs of La Verne Heights Well No. 1).

The shape of the underlying bedrock controls alluvium thickness, which is a factor of the ancient surface topography and tectonics. Due to the relative motion being predominantly north-side up along both basin-bounding faults; faulting, folding, and tilting associated with these structures has allowed thicker accumulations of alluvium to be deposited in the northern and northeastern portions of the Live Oak Basin. Relatively speaking, alluvial thickness in the Live Oak Basin is considered to be the thinnest with respect to the accumulation of alluvial deposits in the adjoining basins. Live Oak Basin includes five wells: the Amherst Well (450 gpm), Beach Well (500 gpm), Live Oak Well No. 1 (200 gpm), Live Oak Well No. 2 (200 gpm), and Live Oak Well No. 3 (300 gpm). The total well production capacity within the Live Oak Basin is approximately 1,650 gpm.

The Ganesha Basin is a narrow groundwater basin that lies between the Indian Hill Fault on the north, San Antonio Fault on the south, and Main San Gabriel Basin on the north and west. A depositional contact between the alluvium within the Ganesha Basin and the underlying tertiary bedrock forms the southwest boundary of the Ganesha Basin. Alluvium thickness revealed on the drillers' logs of wells in the Ganesha Basin range from as much as 750 feet in the northeast portion of the Ganesha Basin to near zero at the contact with tertiary bedrock to the southwest. The Ganesha Basin contains a high percentage of clay in the upper 100 feet of alluvium, which partially inhibits deep percolation of direct rainfall. This Ganesha Basin includes two wells: Old Baldy Well (650 gpm) and Walnut Well (450 gpm). The Old Baldy Well has been inactive since 1990 due to VOC and nitrate contamination. The total well production capacity within the Ganesha Basin is approximately 450 gpm, excluding the Old Baldy Well.

The northwestern portion of the Pomona Basin underlies the City. The Pomona Basin is south of the Live Oak Basin and is bounded on the north by the Indian Hill Fault, on the northwest by the San Antonio Fault, on the southeast by the San Jose Fault, and on the southwest by a depositional contact with tertiary bedrock. The Pomona Basin has the thickest alluvium compared with the other basins underlying the City. Within the Pomona Basin, alluvium is thickest in the southeastern portion. The thickness of alluvium at Cartwright Well is approximately 900 feet and is approximately 800 feet thick at the Mills Tract Well location. The Pomona Basin includes three wells: the Lincoln Well (1000 gpm), Mills Tract Well (950 gpm), and Cartwright Well (500 gpm). The Cartwright Well has been abandoned. The total well production capacity within the Pomona Basin is 1,950 gpm, excluding the Cartwright Well.

Generally speaking, the wells located closest to the center of the basin are likely to produce higher pumping rates than those at the boundaries. The variation of pumping efficiency is due to the age of the wells, maintenance, buildup of precipitates and biological growth on the perforations, gravel packs, surrounding native materials, rainfall, seepage, and water recharge.

To reduce its dependence on imported water, the City would like to produce more groundwater resources from the Ganesha and Live Oak Basins and develop more reliable groundwater extraction capabilities in the Pomona Basin at its maximum production allowance. To do this, the City needs to take measures to improve its groundwater quality and the artificial recharge capabilities. Recharge of groundwater levels in the Pomona Basin and Ganesha Basin is highly dependent on rainfall conditions in the region.

3.3 Administration of Basin Adjudications

The City overlies the east portion of the San Gabriel Basin, the northwestern portion of the Pomona Basin and the entire Ganesha and Live Oak Basins. The San Gabriel Basin is managed by the Main San Gabriel Basin Watermaster, and the other three basins are managed by the

Six Basins Watermaster. Any activities within the basins have to be approved through the Six Basin Watermaster before beginning operations, including the following:

- Constructing a new well or modifying the usage of an existing well
- Constructing a groundwater treatment plant
- Increasing groundwater extraction
- Spreading or recharging water into the basin
- Spreading and storing supplemental water under a cyclic storage agreement

In the fall of 1998, the parties involved with the Six Basins developed and filed a stipulated agreement with the Superior Court of California for the County of Los Angeles. A Superior Court Judge signed the stipulated Judgment. This Judgment established the Safe Yield of the Six Basins at 19,300 AFY and prescribed a Base Annual Production Right for each Party as a Percentage of the Safe Yield, based on historical groundwater production for the period of 1985 through 1996 and a safe yield study. Safe Yield is defined in the Judgment as "the amount of groundwater, including replenishment and return flows from imported water, that can be reasonably produced from the combined Two Basins and Four Basins areas on an annual basis without causing an undesirable result".

Although prior hydrologic and physical conditions limited the Safe Yield to 19,300 AFY, through the coordinated and equitable management of the Six Basins, the Physical Solution of the Judgment establishes that an OSY and Operating Plan, and Base Annual Production Rights can be established independently for the Four Basins (Canyon Basin, Upper Claremont Heights Basin, Lower Claremont Heights Basin, and Pomona Basin) and the Two Basins areas (Live Oak Basin and Ganesha Basin).

3.4 Groundwater Rights

The City sold its water rights in the Main San Gabriel Basin in the 1990s. The original 355.71 AF of pumping rights were purchased by the Covina Irrigating Company. Since the City is not currently a part of the Main San Gabriel Basin, groundwater within this portion of the San Gabriel Basin is not available to the City. If the City wants to pursue groundwater extraction from the San Gabriel Basin in the future, Section 28 Regulation with the Six Basin Watermaster must be followed.

The Live Oak, Ganesha, and Pomona Basins are available to the City for groundwater extraction. Furthermore, the City has exclusive rights to produce unlimited quantities of groundwater from the Live Oak and Ganesha Basins, as long as those extractions do not adversely impact a neighboring agency's ability to extract groundwater. All water rights including production, replenishment, storage, and recovery rights in these two basins are reserved solely for the City. According to 2019 Six Basins Watermaster data, updated in March 2020, the City also has the rights to extract 7.601% (988 AFY) of the Safe Yield per year from the adjudicated Pomona Basin (under the water rights of the Four Basins). Each year the Six Basin Watermaster establishes the Safe Yield of the Pomona Basin. In the calendar year 2019, the City had pumping rights in the Pomona Basin equal to 988 AFY. In addition to the City's share of the OSY, the following additional production rights are included:

- **Carryover Rights:** The City may carryover the unproduced portion of the OSY to be produced in the following year. The carryover right is limited to 25% of its share of the OSY.
- **Storage and Recovery:** The City has the exclusive rights to utilize unused storage capacity in the Four Basins, subject to an approved Storage and Recovery Agreement with the Six Basins Watermaster.
- **Transfers:** The City has the right to transfer any carryover rights and water stored pursuant to a storage and recovery agreement, in whole or in part, to any other agency that becomes a party on either a temporary or permanent basis.
- **Special Projects:** The City may pursue, with the Six Basins Watermaster approval, special projects for controlling groundwater levels or for the remediation of water quality problems in the Four Basins.
- **Temporary Surplus:** Watermaster, for any reason, may declare that a temporary surplus of groundwater is available for production over and above the established OSY. Temporary surplus rights are not subject to the carryover rights.
- **Replacement Water:** Each year, the City's total allowable production right is the sum of its share of the OSY including carryover rights from the previous year, total recoverable water in storage, transfers form other parties, water produced by an approved special project, and temporary surplus water. If the City exceeds its total allowable production, the City is obligated to recharge replacement water in an amount equal to the excess production.

California has recently experienced a prolonged drought. As a result, groundwater levels in the Four Basins have progressively declined, which has reduced groundwater production capacity. The OSY of the Four Basins was 17,500 AF from 2009-2013. The OSY has since been reduced because of the long-term drought conditions and the related decline in groundwater levels as shown in Table 3-1. The data for this table was extracted from the 2019 Six Basin Watermaster. A decline in groundwater levels has ultimately reduced groundwater-production capacity at numerous wells in the Four Basins. Per the March 2020 Six Rivers Watermaster Annual Report for the CY 2019, OSY will be reduced to 13,000 AF in 2020 as it was in 2019.

Table 3-1 – Production and Storage Accounting in the Four Basins (AF)

Year (a)	OSY (b)	Carryover from Prior Year (c)	OSY + Carryover (d)=(b+c)	Annual Production (e)	Under/Over Production (f)=(d-e)	Year-End Storage Account Balance (g)
2008	18,500	2,224	20,724	17,387	3,337	5,826
2009	17,500	2,987	20,487	17,508	2,979	5,920
2010	17,500	3,155	20,655	17,056	3,598	7,924
2011	17,500	3,626	21,126	17,439	3,687	10,361
2012	17,500	3,543	21,043	17,762	3,281	10,170
2013	17,500	3,563	21,063	15,120	5,943	10,496
2014	16,500	3,815	20,315	14,628	5,687	11,349
2015	16,000	4,057	20,057	12,120	7,937	11,036
2016	16,000	3,995	19,995	11,494	8,501	11,634
2017	14,000	3,995	17,995	11,467	6,528	13,732
2018	13,500	3,292	16,792	10,989	5,803	14,207
2019(est)	13,000	3,301	16,301	11,387	4,914	15,434
Average	16,545	3,477	20,023	14,816	5,207	10,241

According to the 2019 Six Basin Watermaster report data, the City has an estimated carry over from 2018 of 187.2 AF and a share of OSY at 13,000 AF of 988 AF. Therefore, the total allowable production is 1,029 AF for 2019. As suggested in the Six Basin Watermaster, based on projected pumping of calendar year 2019, the City will have carryover rights in 2020 to supplement a low OSY.

3.5 Planned Water Transfer to Puente Basin Water Authority (PBWA)

The PBWA is a partnership formed by the Rowland Water District (RWD) and Walnut Valley Water District (WVWD). RWD and WVWD are currently 100% dependent on imported water supply to achieve potable demands. The PBWA currently receives import water from two treatment plants: the MWD Weymouth Filtration Water Treatment Plant in the City and TVMWD Miramar Water Treatment Plant in Claremont. PBWA has planned and is in the process of implementing a project that would reactivate the City's Old Baldy Well and construct a new Durward Well (under design in 2020) along with a new pipeline.

The Old Baldy Well is located within the Ganesha Basin and the Durward Well is located within the Pomona Basin. The City has exclusive rights to extract unlimited quantities of groundwater from this Basin, as long as this extraction does not adversely impact a neighboring agency's ability to extract groundwater. The PBWA project is an integrated project that involves accessing, treating, and conveying water supply from Six Basins to PBWA for potable use. This project is viewed by the PBWA as an essential component of PBWA's drought preparedness portfolio and the Regional Water Supply Program to maximize local resources by adding new water supply and reducing the region's reliance on imported water.

The Old Baldy Well has been inactive since the 1990s due to water quality issues. The pursuit of the project by PBWA will not negatively impact the City's water supply portfolio.

3.6 Imported Water

3.6.1 Three Valleys Municipal Water District (TVMWD)

The TVMWD is a municipal water district organized pursuant to Division 20 of the California Water Code. The TVMWD is a water wholesaler, one of 26 public agencies that comprise the MWD. The TVMWD obtains supplies from the MWD whose two sources of supply are the Colorado River (originating at Lake Havasu) and northern California (originating at the Delta of the Sacramento and San Joaquin Rivers). The TVMWD treats northern California imported water at the Miramar Water and Hydroelectric Facility (Miramar), located on the northeastern corner of the intersection of Miramar Avenue and Padua Avenue in Claremont. The treatment process at Miramar includes chemical mixing, tapered energy flocculation, sedimentation, dual media filtration and disinfection. Miramar provides treated water to the local area and bills for water treated and distributed by the MWD Weymouth Filtration Water Treatment Plant in the City. The TVMWD Miramar Water Treatment Plant does have groundwater production facilities at the plant site. Groundwater is produced, disinfected and enters the Miramar Reservoirs on site prior to entering the Miramar Transmission System. TVMWD is committed to supplying safe drinking water that complies with or exceeds all state and federal safety standards.

The GSWC and City are each entitled to a 50% share of the available flow from Miramar. When the plant and pipeline capacities are not fully subscribed, TVMWD may sell the water to non-participant agencies on an interruptible basis, only when the plant and pipeline capacity is available in excess of the demand of the participants. It is understood by the participants that MWD or other suppliers of water, by reason of drought conditions or other emergency conditions, may require TVMWD to impose water conservation or rationing measures. The imposing operations and measurements are subject to TVMWD rules and regulations.

In the past 30 years, the City purchased water from the TVMWD Miramar Water Treatment Plant an average of 6,232 AF, but purchased 4,649 AF in 2015 at the height of the prolonged drought.

The elevation of the TVMWD Miramar Water Treatment Plant offers the benefit of providing water by gravity flow to the City's Pressure Zone I, II and III. Import water is pumped to Pressure Zone IV through low lift pumps and subsequently pumped into Pressure Zone V. There are two segments of pipeline from TVMWD to the City as follows:

- The main transmission pipeline between the TVMWD Miramar Water Treatment Plant and the intersection of Baseline Road and Williams Avenue is 36-inches in diameter and is approximately 18,750 feet in length. In this length of pipeline, the GSWC has one 15 cfs connection. At Williams Avenue and Baseline Road, the City has a 6 cfs connection that is used as a supply to Pressure Zone IV through low lift pumps at the Plateau Forebay site. A 30-inch transmission pipeline extends south in Williams Avenue from the main line to connect to TVMWD's existing 30-inch line south of Amherst Street. In this segment of pipeline, there is a 2 cfs connection for the City at the Amherst Reservoir site as well as a hydroelectric station operated by TVMWD. In the southerly City area, an 8 cfs connection is provided from the TVMWD transmission pipeline near 6th Street and White Avenue to the City's White Avenue Plant and another 3 cfs connection is provided at the 5th and "C" Streets to the City's

Old Baldy Plant. This transmission pipeline terminates at the PWRJF located at 5th and "C" Street.

- The other main transmission pipeline in the City begins at the intersection of Williams Avenue and Baseline Road where the 30-inch pipeline turns southerly and is aligned in Baseline Road to Wheeler Avenue. This length of pipeline is approximately 8,000 feet and has a 3 cfs connection to the City's Pressure Zone II at Emerald Avenue and a 2 cfs connection at Wheeler Avenue. A 12-inch pipeline ties to the Wheeler Avenue connection and extends northerly up Wheeler Avenue to the Wheeler Reservoir site. Import water can be fed by gravity into Pressure Zones I, II and III at this location.

3.6.2 Pomona Walnut Rowland Joint Feeder (PWRJF)

In 1956, the PWRJF Commission was established between Pomona, WVWD and RWD. The agreement states that the three public agencies are to jointly participate in the construction of a segment of water line constructed for the purpose of accepting delivery water from the MWD Weymouth Filtration Water Treatment Plant. The agreement was put into place until 2006 and has been extended.

In 1960, the City signed an agreement with the Rowland County Water District, regarding a portion of their capacity from the PWRJF. The City leases 2.128% of the capacity of the PWRJF, which is a portion of 19.858% owned by Rowland Water District, estimated at 4 cfs. The City can take water on a 24-hour basis from the turnout at the Hillcrest Pump Station. The initial lease started on the 1st day of July 1960 and terminated on the last day of December 2006. The lease has been extended. The City pays Rowland Water District a sum equal to 2.97% of the amounts that Rowland Water District is required to pay to the PWRJF Commission as its share of the administrative expense.

In 1962, the City signed an agreement with the Pomona. The City is leasing 2.128% of the capacity of the PWRJF, which is a portion of 51.77% owned by Pomona, estimated at 3 cfs. The lease commenced on the 1st day of February 1962 and terminated on the last day of December 2006. This lease has been extended. The City pays Pomona a sum equal to 2.9% of the amounts that Pomona is required to pay to the PWRJF Commission as its share of the administrative expense.

The City built the Hillcrest Booster Pump Station in the early 1980s. It has two 1,200 gpm pumps that boost water from the PWRJF to Pressure Zone I. The pumps are connected to the PWRJF, and pumps into a 20-inch pipeline along Wheeler Avenue that connects to the Wheeler Reservoir. Presently, the City pumps water from the line only during peak flows or emergencies.

3.7 Surface Water

The City does not plan to use self-supplied surface water as part of their overall water portfolio.

3.8 Stormwater

The City is currently not capturing stormwater as part of their overall water portfolio.

3.9 Wastewater and Recycled Water

Recycled water is not currently available within the service. The City's 2015 UWMP explains in detail the reasons of this lack of availability, potential recycled water use and incentives, and future recycled water projects.

3.10 Desalinated Water Opportunities

Per the City's 2015 UWMP, there are currently no opportunities for the City to develop desalinated water as a long-term supply.

3.11 Water Supply Reliability

Chapter Two estimates the City's maximum build-out demand to be approximately 10,542 AF or 6,536 gpm (14.6 cfs) and includes groundwater and imported water. The maximum existing wells capacity is 4,100 gpm (9.1 cfs) from the Lincoln, Mills Tract, Amherst, Walnut, Beech and La Verne Heights Nos. 1, 2 and 3 Wells, which are considered to be the most reliable wells. Based on the average mixing ratio of the period 2012-2019 of 27.4% groundwater to 72.6% imported water; groundwater supply will be approximately 1,793 gpm (4 cfs) maximum under current blending requirements. The remaining 4,742 gpm (10.57 cfs) has to be supplied through imported water sources. According to the agreements with TVMWD, Miramar can supply the City 15 cfs, which is adequate to satisfy future demand with limited groundwater resources. The PWRJF can also supply the City with 6 cfs. This supply is typically used for emergency and peaking purposes.

Refer to the City's 2015 UWMP, Chapter 6 of Water Supply Reliability Assessment for more details about groundwater storage/conjunctive use programs groundwater recovery, supply and demand assessment, and conclusions.

Chapter 4 - WATER QUALITY

4.1 General Description

This chapter details the status and potential impacts of water quality on the City's water system operations.

The EPA and DDW are the public agencies responsible for drafting and implementing regulations that ensure drinking water is safe to consume. The EPA and DDW establish drinking water standards that limit contaminant concentrations in water provided to the public.

The City regularly tests its drinking water using approved methods to ensure its safety. More than 100 constituents are monitored in the City's water supply and reported. In 2016, all water delivered by the City met or surpassed the state and federal drinking water standards.

In addition, the Six Basins Watermaster, who manages the groundwater basins where the City extracts its supply, continuously and vigilantly reviews upcoming state and federal drinking water regulations. The City's existing well production primarily originates from the Live Oak, Ganesha and Pomona Basins. The Six Basins Watermaster has been proactive in the monitoring of unregulated emerging contaminants in anticipation of new water quality standards.

4.2 Summary of Water Quality Threats and Issues

Water quality sampling from 2012 to 2019 indicates several trends in both the imported water and groundwater supplied to the City that will need to be resolved. In the 5-year span of sampling, trends in groundwater contaminants are as follows. Trichloroethylene (TCE) levels in groundwater remain just under the MCL of 5 parts per million (ppm). Total trihalomethanes (TTHM) in imported water have an upward trend, resulting in levels equal to 60% of the MCL. Total dissolved solids (TDS) levels in imported water have effectively doubled to just under 40% of the MCL while groundwater remains steadily around 55% MCL. Although all of the above trends will require future action from the City in years to come, these contaminants are safely below the legal MCL. The exceptions to this are nitrate and perchlorate. Perchlorate levels in groundwater has a downward trend while nitrate concentrations in groundwater remains constant. Both are above their MCL.

Average water quality conditions from 2013 to 2016, taken from water quality samples for each well, detail how the above trends impact the City at specific sites and where contaminants can most effectively be resolved. Presence of perchlorate in the Lincoln, Mills, Old Baldy and Beech Wells is more than double the MCL. Nitrate levels in Lincoln Mills, Walnut, Beech and La Verne Heights No. 3 Wells are significantly above the MCL. Though all wells are safely below MCL for presence of TDS, average levels in the Amherst Well are approaching the upper limit.

It is important to observe that while nitrate and perchlorate concentration levels in groundwater are above the MCL (10 ppm as N and 6 parts per billion (ppb), respectively) for several of the City's wells, the groundwater equals less than 30% of total water supplied to the City. The concentrations of these constituents at the customer tap is below the MCL after treatment or blending with imported water. However, groundwater contamination of perchlorate and nitrate are still a concern, as it necessitates the City's allocation of additional resources to ensure blending or treatment will provide safe contaminant concentration levels.

4.3 Consumer Confidence Report

Water utilities in California have been required to provide an annual report to their customers since 1991, which summarizes the prior year's water quality and explains important issues regarding their drinking water. In 1996, the U.S. Congress reauthorized the Safe Drinking Water Act (SDWA), which was originally passed in 1974 and later amended in 1986. The 1996 reauthorization called for the enhancement of nation-wide drinking water regulations to include important components such as source water protection and public information. The City's 2019 Water Quality/Consumer Confidence Report was prepared in compliance with the consumer right-to-know regulations required by the SDWA 1996 amendments and is provided in Appendix B. The City's Water Quality/Consumer Confidence Report for the calendar years 2017 and 2018 are also provided in Appendix B.

4.4 Safe Drinking Water Act (SDWA)

The Federal Government, with the passage of the SDWA (U.S. Congress, 1974) through the EPA, was given the authority to set drinking water quality standards for all drinking water delivered by community water suppliers (public and/or private). The SDWA requires two types of standards: primary and secondary. Primary standards are enforceable and intended to 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 SDWA. Primary standards include performance requirements (MCLs) and/or treatment requirements. The SDWA also contains provisions for secondary drinking water standards for MCLs on contaminants that may adversely affect odor or appearance of water. Secondary standards are not enforceable.

The SWDA has established processes for identifying and regulating drinking water contaminants to protect human health. The Candidate Contaminant List and the Unregulated Contaminant Monitoring Rule (UCMR) are scientifically rigorous processes for determining the appropriate status of currently unregulated contaminants. Regulations regarding these processes were enacted by amendment to the SDWA in 1996 to solve emerging constituents.

4.5 Current and Pending Water Quality Related Legislation

Changes to water quality regulations and standards, and the review of legislation, is closely monitored by numerous stakeholders including the EPA, DDW and AWWA. The following sections provide a summary of pressing issues cited by these agencies that may impact the City in the coming years.

4.5.1 Total Dissolved Solids (TDS)

A secondary MCL of 500 milligrams per liter (mg/l) has been set for TDS. During the period of 2007 to 2011, as reported in the 2017 Six Basins Strategic Plan, 8 out of 48 wells sampled for TDS exceeded the secondary MCL in the Six Basins. The maximum TDS concentrations ranged from 230 mg/l to 660 mg/l and averaged 368 mg/l. The highest TDS concentrations are in the Live Oak Basin, Ganesha Basin and the western-most area of the Pomona Basin, where there is less recharge of low-TDS surface water to blend with high TDS returns from irrigation uses.

TDS values in the lower to mid-600 mg/l range are not uncommon in the City's wells. Secondary MCL standards below the upper limit per Table 64449-B do not require treatment according to 22 CCR Section 64449. The upper limit of the secondary MCL for TDS is established at 1,000 mg/l. The City should continue to be mindful of the TDS limitation and seek to improve water quality for a higher degree of consumer acceptance to ensure that TDS levels from their production wells do not approach the upper secondary MCL of 1,000 mg/l. Basin management is considered a key component in limiting salt and nutrient impacts to water quality.

Figure 4-1 – TDS Groundwater (GW) and Imported Water (IM) Data

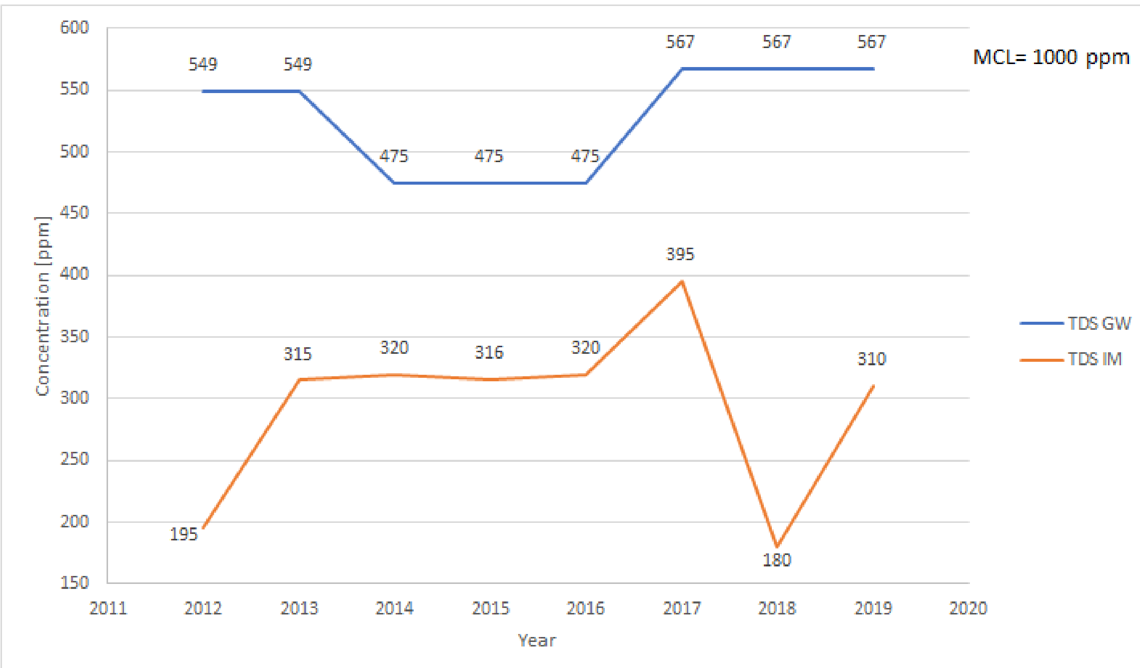


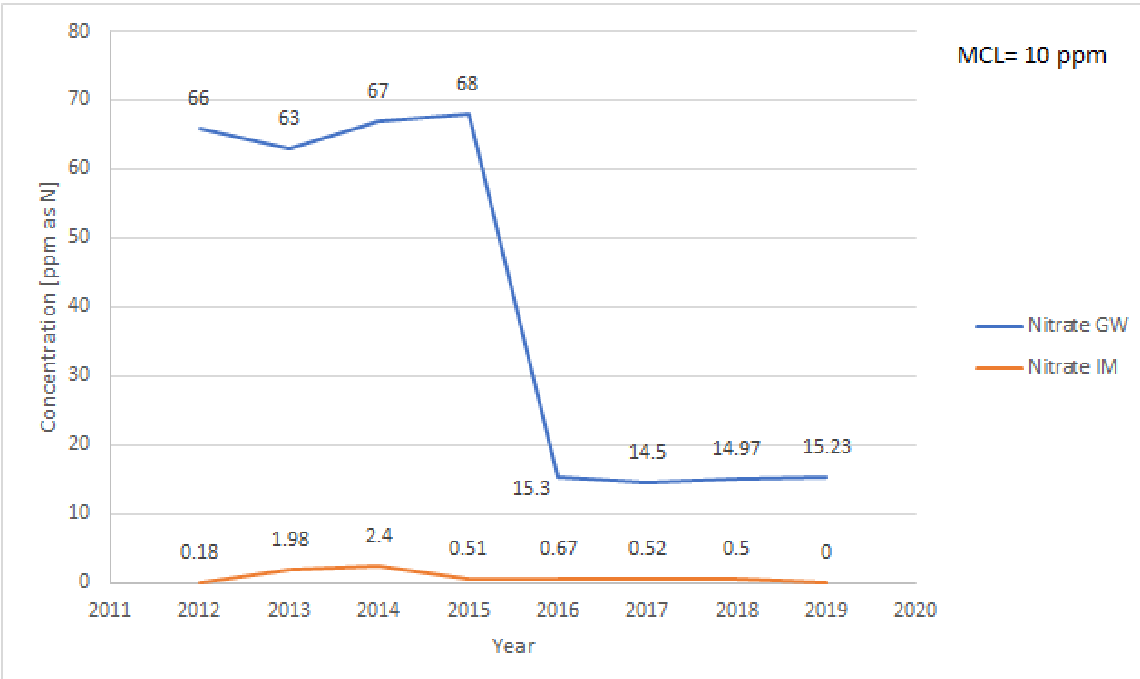
Figure 4-1 above depicts the yearly average concentrations of TDS from 2012 to 2019 for imported and groundwater. The upper limit of the secondary MCL for TDS is established at 1,000 ppm, as mentioned above. Although the MCL has not been exceeded, the City should continue to be mindful of the TDS limitation such that the secondary MCL of 500 ppm is not reached, as seen in groundwater for years 2012, 2013 and 2017 to 2019.

4.5.2 Nitrate

The DDW set the drinking water standard MCL for nitrate at 45 mg/l, as this is roughly equivalent to the federal drinking water standard of 10 mg/l as nitrogen. DDW also set a drinking water standard for nitrite at 1 mg/l. Since the toxicity of nitrate and nitrite are additive, DDW also established a standard for the sum of nitrate and nitrite at 10 mg/l as nitrogen. Drinking water containing nitrate above the MCL is not safe for human consumption, especially for infants six months of age and younger, and pregnant and nursing women. The DDW uses the MCL (and other water quality limits) as a basis for its regulatory actions regarding the protection of drinking water.

The Live Oak and Pomona Bains have the greatest number of wells with concentrations above the MCL for nitrate. In the Live Oak Basin, all wells have nitrate concentrations greater than 10 mg/l as nitrogen. In the Pomona Basin, all but the eight wells in the northeast corner of the basin have nitrate concentrations greater than 10 mg/l as nitrogen. Furthermore, the City has implemented blending solutions and ion exchange treatment for several of its wells to comply with the requirements of the DDW. The City has also observed that wells in the Ganesha Basin represent a potential for exceeding MCL levels.

Figure 4-2 – Nitrate Groundwater (GW) and Imported Water (IM) Data



The DDW has an established MCL of 10 ppm for nitrate, depicted as a concentration of total nitrogen (ppm as N). Drinking water containing nitrate above the MCL is not safe for human consumption and Figure 4-2 above shows the concentrations of imported and groundwater from 2012 to 2019. As seen, imported water concentrations are well below the 10 ppm MCL compared to groundwater concentrations that surpass the MCL every year.

4.5.3 Perchlorate

DDW was mandated by §116293(b) of the Health and Safety Code to adopt a drinking water standard for perchlorate. Health and Safety Code §116365 mandates that the MCL be set as close as possible to the public health goal (PHG), while considering cost and technical feasibility. The PHG is the concentration of a drinking water contaminant that does not pose a significant risk to human health if ingested in drinking water, established by California's EPA Office of Environmental Health Hazard Assessment (OEHHA).

In 2004, OEHHA adopted a PHG of 0.006 mg/l (6 parts per billion or ppb) for perchlorate. Pursuant to the statutory mandates, the perchlorate MCL was established at 6 ppb with a detection level for purposes of reporting (DLR) of 4 ppb, which became effective October 2007. The regulation established monitoring requirements for determining public water system compliance with the MCL and identified the appropriate analytical method for detecting perchlorate in drinking water, as well as identifying the "best available technologies" (BATs) for remediating perchlorate.

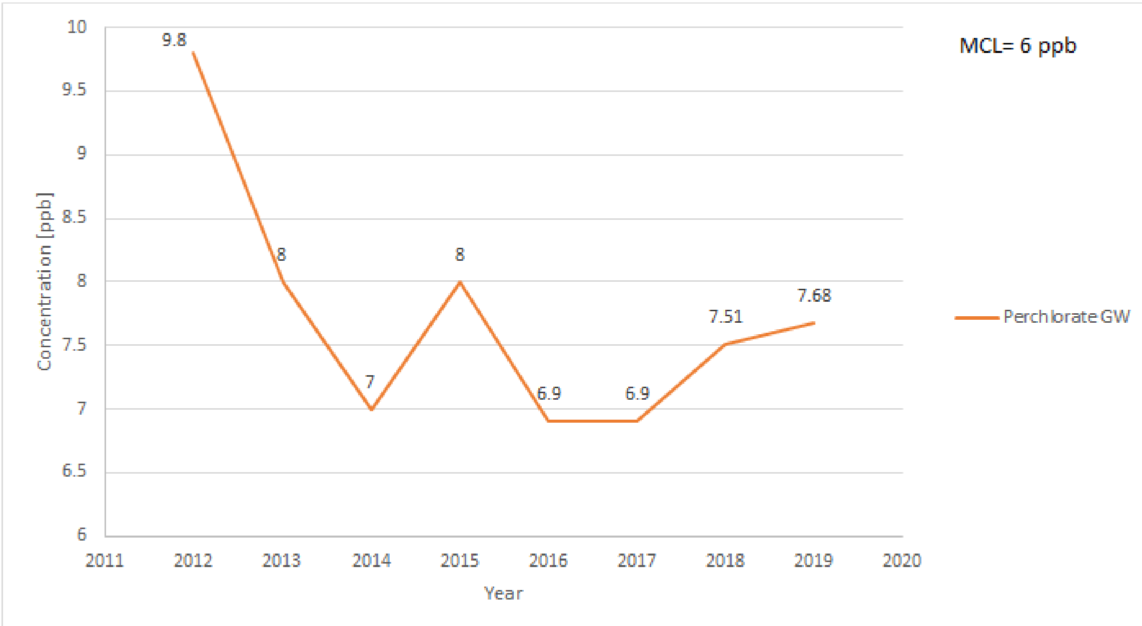
Health and Safety Code §116365(g) requires the DDW, at least once every 5-years, to review its MCLs. In the review, the DDW's MCLs are to be consistent with criteria of §116365(a) and (b). Those criteria state that the MCLs cannot be less stringent than federal MCLs and must be as close as is technically and economically feasible to the PHGs established by the OEHHA. Consistent with those criteria, the DDW is to amend any standard if any of the following occur: (1) Changes in technology or treatment techniques that permit a materially greater protection of public health or attainment of the PHG, or (2) New scientific evidence indicates that the substance may present a materially different risk to public health than was previously determined. Each year by March 1, the DDW is to identify each MCL it intends to review that year.

In 2015, OEHHA revised the PHG for perchlorate from 6 ppb to 0.2 ppb. The revised PHG prompted the review of the perchlorate MCL. Further, in July of 2017 the DDW presented its findings and recommendations related to DDW's review of the perchlorate MCL. DDW recommended to first establish a lower detection limit for purposes of reporting to gather additional occurrence data, and then revise the MCL if the new data support development of a new standard.

Perchlorate sources in groundwater can include synthetic perchlorate, such as ammonium perchlorate used in the manufacturing of solid propellants used for rockets, missiles and fireworks; and natural perchlorate such as that derived from Chilean caliche that was used as a fertilizer. It is known that Chilean nitrate fertilizer was used in Southern California in the early 1900s for the citrus industry, which covered the northern and western portions of the Six Basins. While citrus farming was almost non-existent in the Six Basins by the 1990s, like nitrate, the legacy of perchlorate contamination in groundwater still exists. As is the case with nitrate, the City requires treatment of the perchlorate contaminated groundwater in the Live Oak, Ganesha and Pomona Basins. Developments in the area of a new standard lowering the MCL to the PHG would have ramifications related to the current treatment methodologies utilized by the City.

Figure 4-3 represents the yearly average concentrations of perchlorate in groundwater from 2012 to 2019. Observations found that the concentrations of perchlorate surpassed the MCL of 6 ppb for every year. There was no detections of perchlorate for imported water from 2012 to 2019 as seen in Table 4-2 in Appendix C.

Figure 4-3 – Perchlorate Groundwater (GW)) Data



4.5.4 Trichloroethylene (TCE) and Tetrachloroethylene (PCE)

TCE is a volatile, chlorinated hydrocarbon widely used as a solvent, paint stripper and degreasing agent. Patterns of TCE contamination of drinking water generally parallel use patterns, with the highest levels and highest number of contaminated wells occurring in urban areas. Systems with contamination exceeding the MCL are required to provide treatment that lowers TCE concentrations to levels below 5 ppb.

DDW adopted the MCL of 5 ppb in 1989, based on the OEHHA risk assessment stating that it fell within the range of de minimis risk levels. The EPA adopted the same MCL as DDW in 1991. Although the updated OEHHA risk assessment has not significantly changed from the initial assessment (the PHG of 0.8 ppb falls within the de minimis range), since the PHG is almost an order of magnitude lower than the MCL and TCE is still detected in some drinking water supplies, DDW has conducted a comprehensive review.

The PHG for tetrachloroethylene (PCE) is zero. EPA has set this level of protection based on the best available science to prevent potential health problems. The EPA has set an enforceable MCL regulation for PCE at 0.005 mg/l or 5 ppb. MCLs are set as close to the health goals as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies.

The Phase II Rule, the regulation for PCE, became effective in 1992. The SDWA requires the EPA to periodically review the national primary drinking water regulation for each contaminant and revise the regulation, if appropriate. The EPA reviewed PCE as part of the second 6-Year Review and determined that it is appropriate to revise the regulation based on changes in analytical feasibility.

According to the Six Basins 2017 Strategic Plan, TCE and PCE concentrations at wells in the Six Basins from 2007 to 2011 exceeded the MCLs. During this period, 17 out of 106 wells sampled for TCE, and 18 out of 106 wells sampled for PCE, had concentrations higher than the MCL. Wells with detectable levels of TCE and PCE occur predominantly in monitoring well clusters and have represented themselves in the City wells residing in the Pomona Basin. The treatment of TCE is implemented by the City to comply with drinking water regulations.

Figure 4-4 and Figure 4-5 below depict groundwater levels of VOCs (dichloroethylene (DCE), TCE, and PCE), where the MCL for each contaminant is 5 ppb. As seen, the MCL was not surpassed between 2012 to 2019 for groundwater for DCE and PCE in Figure 1, however, Figure 2 shows TCE surpassing the MCL in 2018 and 2019. This suggests that groundwater must be closely monitored for TCE, as concentrations are at high risk for human consumption. Imported water concentrations from the TVMWD Miramar Water Treatment Plant for DCE, TCE, and PCE remained at 0 for all years, as no detection of VOCs occurred during the observed timeframe.

Figure 4-4 – DCE Groundwater (GW) Data

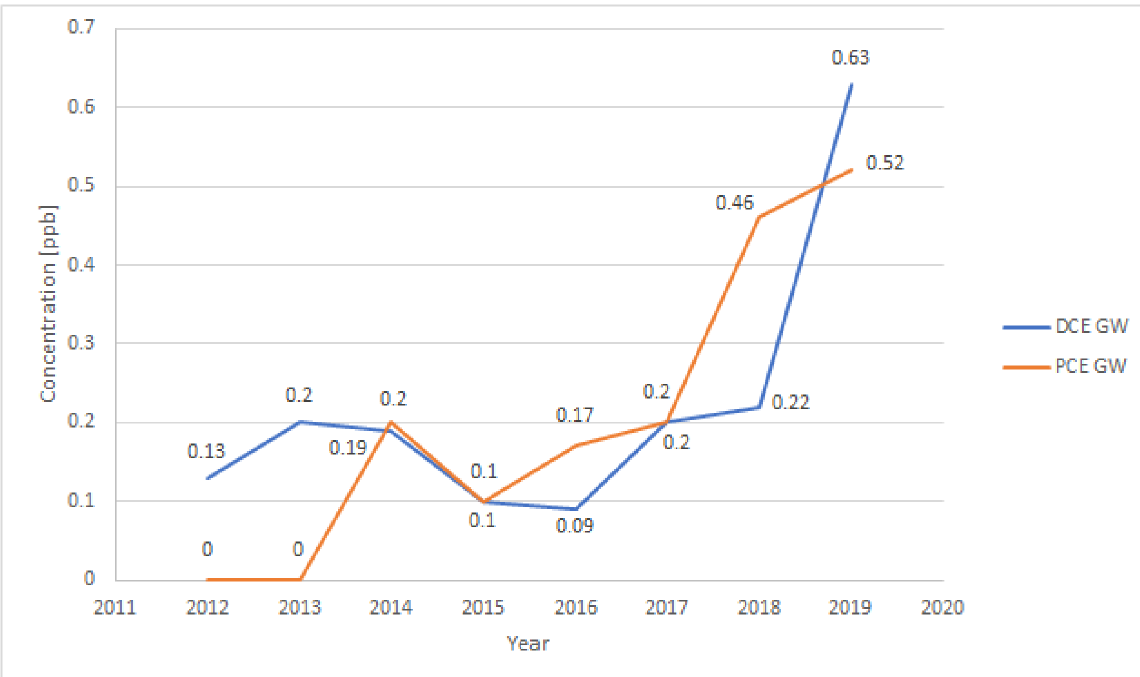
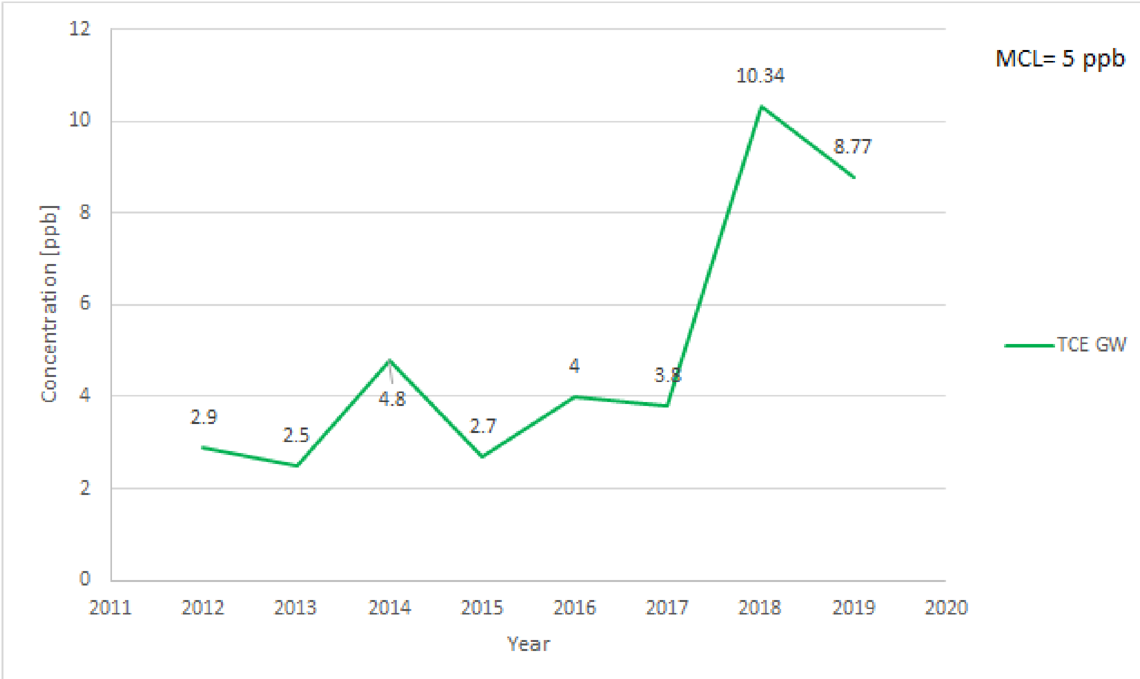


Figure 4-5 – TCE Groundwater (GW) Data



4.5.5 Hexavalent Chromium

Hexavalent chromium, also known as Chromium 6, is the subject of significant developments at the state and federal levels. OEHHA proposed a PHG of 0.02 parts per billion (20 parts per trillion) in July 2011. DDW proposed an MCL for Chromium 6 of 10 micrograms per liter (µg/l) and announced the availability of the proposed MCL for public comment. DDW reviewed the comments submitted by interested parties and responded to them in the final statement of reasons. On April 15, 2014, DDW submitted the hexavalent chromium MCL regulations package to the Office of Administrative Law (OAL) for its review for compliance with the Administrative Procedure Act. On May 28, 2014, OAL approved the regulations, which were effective on July 1, 2014.

However, on May 31, 2017 the Superior Court of Sacramento County issued a judgment invalidating the hexavalent chromium MCL for drinking water. The court ordered the DDW to take the necessary actions to delete the hexavalent chromium MCL from the California Code of Regulations and to file proof with the court that it has done so (Super. Ct. Sacramento Count, 2017. No. 34-2014-80001850) by August 15, 2017.

The change became effective, with OAL filing the change with the Secretary of State, on September 11, 2017. Thus, as of September 11, 2017, the MCL for hexavalent chromium is no longer in effect.

The DDW will not be enforcing any compliance plans that public water systems entered into for hexavalent chromium, as the MCL will no longer be in effect. However, the MCL for total chromium of 50 ppb will remain in place until such time that the DDW establishes a new MCL. This new MCL could be at the same level as the invalidated MCL. The DDW is intent on implementation of a new MCL and anticipates that adoption of a new MCL will transpire in 2018 or 2019.

Should the DDW adopt a new MCL, implementation of the MCL will most likely follow the direction made in Senate Bill 385. The primary purpose of this bill was to provide public water systems with sources that produce water with hexavalent chromium concentration above California's adopted MCL time to come into compliance without being deemed in violation of the MCL.

Samples taken from City wells in the Six Basins have reported concentration above the PHG of 0.02 µg/l. Should the MCL be placed at or near the PHG, severe limitations to the City shall be made without treatment to reduce the levels of Chromium 6 to be compliant with DDW requirements.

4.5.6 1,2,3 Trichloropropane (1,2 3-TCP)

1,2,3 Trichloropropane (1, 2, 3-TCP) is a chlorinated hydrocarbon with high chemical stability. It is a manmade chemical found at industrial or hazardous waste sites. Common uses of the chemical include a cleaning solution, degreasing solvent, and its association with pesticide products.

1,2,3-TCP causes cancer in laboratory animals (EPA, 2009). It is reasonably anticipated to be a human carcinogen (NTP, 2014), and most likely carcinogenic to humans based on sufficient evidence of carcinogenicity in experimental animals (IARC, 1995). In 1992, 1,2,3-TCP was added to the list of chemicals known to California to cause cancer, pursuant to California's Safe Drinking Water and Toxic Enforcement Act (Proposition 65).

In 1999, DDW established a 0.005 µg/l drinking water notification level for 1,2,3-TCP. This value is based on cancer risks derived from laboratory animal studies (US EPA, 1997). The notification level is at the same concentration as the analytical reporting limit. Certain requirements and recommendations apply if 1,2,3-TCP is detected above its notification level.

The 1,2,3-TCP notification level was established after its discovery at the Burbank Operable Unit (OU) (a Southern California Superfund hazardous waste site) because of concerns that the chemical may have contaminated drinking water supplies. It had already been found in several drinking water wells elsewhere in California. Subsequently 1,2,3-TCP was found in more drinking water sources.

In 2001, to obtain information about the presence of 1,2,3-TCP in drinking water sources, DDW adopted a regulation that included it as an UCMR. Given the number of sources with detections of 1,2,3-TCP under the UCMR sampling, DDW considered this chemical to be a good candidate for future regulation. Thus, in July 2004 DDW requested a PHG from the OEHHA.

In September 2007, OEHHA released a draft PHG (0.0007 µg/l) and technical support document, and in January 2009, a revised draft technical support document. In August 2009, OEHHA established a 0.0007-µg/l PHG for 1,2,3-TCP.

In April of 2017, the DDW conducted a hearing to establish an MCL for 1,2,3-TCP. DDW proposed 0.000005 mg/l as the MCL for 1,2,3-TCP. In addition, the proposed regulations set the detection limit for purposes of reporting (DLR) at 0.000005 mg/l. Furthermore, amended Section 64444 of 22 CCR establishes the MCL of 1,2,3-TCP to be 0.000005 mg/l.

According to the Six Basins 2017 Strategic Plan, as of 2011, the majority of the private and public wells in the Six Basins have not been sampled for 1,2,3-TCP using the lower detection limit of 0.000005 mg/l and so the impact of the MCL on the Six Basins cannot be characterized at this time. Current data analysis suggests 1,2,3-TCP has not been detected in the basins supplying water to the City. Sustained monitoring will ensure that the City continues to comply with DDW requirements.

4.5.7 Impacts of Climate Change

The U.S. Senate is considering the impacts of climate change on water resources while establishing a framework for a comprehensive national response to climate change per the "Lieberman-Warner Climate Security Act" (S.2191).

Water utilities are purported to be among the principal actors dealing with the challenges of climate change. Because the exact effects of climate change on water resources are uncertain and will vary by region, local utilities responsible for water resources management face daunting challenges. The stakeholders in support of climate change regulations encourage the establishment of a comprehensive and coordinated applied research program that includes:

- Predictive and decision-support tools, including necessary data resources, to help utilities plan for future impacts of climate change. These tools and resources should include access to climate modeling results that forecast precipitation changes and resolve other issues pertinent to water quantity and quality on a sub-regional scale.
- Mitigation and adaptation strategies focused specifically on impacts of climate change on water quality and quantity. Examples of areas where research is needed include methods to increase water conservation; energy efficiency management techniques that help water utilities reduce their own greenhouse gas emissions; and the development of alternative water sources such as reuse and recycling.
- Surface water and groundwater resource impacts of new energy technologies such as biofuel development and mitigation strategies such as carbon sequestration projects.
- Water utilities' abilities to adapt to climate change and resolve environmental and public health risks that could result from changes to the hydrologic environment. For example, it is anticipated that potential public health risks could result from higher water temperatures breeding higher concentrations of certain organisms, from changes in ambient water quality, or from more intense rainfall events. These factors could compromise treatment processes necessitating infrastructure enhancements to deal with regionalized impacts of these consequences.

The impact of climate change on the City is unknown at this time, but it may cause a decrease in available supplies and an increase in demand. It is recommended to maintain a dialogue with the local jurisdictions, Los Angeles County and State of California on the subject of climate change regulations.

4.5.8 Electronic Dissemination of Consumer Confidence Reports

SDWA requires public drinking water system administrators to "mail" water quality reports to all customers on an annual basis. To date, purveyors report having spent hundreds of thousands of dollars per year to distribute these reports through the mail. The U.S. Senate is considering the "End Unnecessary Costs Caused by Report Mailing Act of 2011" (S.1578, HR.1340) intended to increase the efficiency of required correspondence by utilizing modern communications technology. The intent of this initiative is to work in conjunction with EPA's "Retrospective Review of Existing Regulations," and allow electronic communications of water quality reports, which will reduce costs at the water retail level while maintaining the public's ability to access important water quality information. California water purveyors are currently able to electronically submit the CCR as of 2016.

4.5.9 "Safe Harbor" for Methyl Tertiary-Butyl Ether (MTBE)

The primary MCL for MTBE was establish in 2000. The 1999 PHG of 13 µg/l was utilized as the MCL as it corresponds to the de minimis cancer risk derived from animal studies. Pursuant to section 116365(a) and (b) of the Health and Safety Code, the DDW is charged with adopting an MCL that is as close as feasible to the corresponding PHG and "that, to the extent technologically and economically feasible" avoids any significant risk to public health. In this light, the MCL was established and a secondary MCL of 5 µg/l was determined to solve taste and odor concerns.

If MTBE is present in local groundwater, the City may become responsible for its cleanup. It is recommended that the City monitor legislation regarding the issue regarding MTBE cleanup.

4.5.10 Endocrine-Disrupting Compounds (EDCs) and Pharmaceuticals

There are increasing concerns over the detection of EDCs and other pharmaceuticals in water. Per AWWA, both non-point source runoff and sewage effluent from properly operated waste treatment plants may contain minute traces of these compounds. Some minute quantities of these products will pass through animals and humans who use them and enter the waste stream. Typically, they are not completely destroyed or removed by wastewater treatment processes. The concern does not stem from the detected concentrations of these compounds, but from their mere existence. As detection instruments become more and more sensitive, extremely low concentrations of constituents in water can be detected. Modern devices are now able to detect compounds at the parts-per-trillion level and are breaching the parts-per-quadrillion boundary in some cases. To date, however, no concentrations of EDCs or pharmaceuticals have been detected that pose a health risk. Research is ongoing.

The impact on the City is unknown at this time. It is recommended that the City monitor legislation regarding potential development of MCLs for EDCs.

4.5.11 Groundwater Replenishment and Reuse

According to the Six Basins 2017 Strategic Plan, the following is a summary of the major issues for basin management that are associated with surface-water resources in the Six Basins:

- The climate of the region is such that the Six Basins area is subject to prolonged dry periods. In years when precipitation is below average, the volumes of surface-water runoff that are available for artificial recharge at spreading grounds in the Six Basins are small, so the facilities for artificial recharge go largely un-utilized.
- The facilities to divert and recharge stormwater runoff do not capture all of the runoff that is available. Stormwater runoff that bypasses the spreading grounds is a loss of a low-cost, high-quality water resource.
- The current methods and protocols being employed by the U.S. Army Corps of Engineers (USACE), Los Angeles County Flood Control District (LACFCD) and the Pomona Valley Protective Association (PVPA) to monitor the surface-water resources may not be returning accurate data for surface-water discharges and diversions. The completeness and accuracy of these data are crucial to the development and implementation of programs to improve basin management.
- Groundwater recharge to the Six Basins primarily occurs by the following general mechanisms:
    - Infiltration of native and imported surface waters at the spreading grounds that overlie the Six Basins (San Antonio, Thompson Creek, Live Oak, Pedley and Miramar)
    - Subsurface inflow from the saturated alluvium and fractures within the bordering bedrock hills and mountains
    - Deep infiltration of precipitation and applied water (DIPAW)
    - Deep infiltration of septic tank discharge
    - Streambed infiltration in unlined channels

A major source of recharge to the Six Basins is surface-water runoff from San Antonio Canyon. This recharge occurs by spreading the runoff at the San Antonio Spreading Grounds (SASG) or as underflow beneath the San Antonio Dam. It is episodic, variable in magnitude, and dependent on precipitation. Recharge also occurs by spreading and underflow along the mountain front west of San Antonio Canyon, specifically at the mouths of Thompson Creek and Live Oak Wash, and in smaller amounts relative to recharge from San Antonio Canyon. The DIPAW includes the combination of precipitation that falls directly on a pervious land surface and precipitation that falls on impermeable land surface that subsequently flows onto pervious surface, and irrigation water applied to the land surface, all of which when combined is surplus to the evapotranspiration demand and soil water storage capacity. DIPAW migrates through the root zone and subsequently reaches the underlying groundwater reservoir. DIPAW is affected by soil type. Note that soils mapped as having rapid infiltration rates coincide with the Younger Alluvium and soils mapped as having moderate to low infiltration rates coincide with the Older Alluvium. The spreading grounds in the Six Basins are located in areas that overlie the Younger Alluvium and soils with relatively high infiltration rates.

DIPAW is an important source of recharge from a water quality standpoint because typically it is high in TDS and nitrogen from land application of fertilizers and from consumptive use by vegetation. The land-use maps developed by DWR land use surveys for 1949 through 1984 and SCAG surveys from 1990 and 2005. These maps show a change over time from mainly agricultural citrus in 1949 to mainly urban land uses today. Urbanization encroached from the south to the north. By 1963, almost all of Pomona had converted to urban land uses as did the southern portions of the City, Claremont, and Upland. By 1990, most citrus groves had been converted to urban uses. The hydrogeology of the Six Basins places certain limits on the utilization of groundwater. In addition, the hydrogeology is imperfectly understood. The physical limits and the gaps in the current understanding of the hydrogeology are summarized below, and they pose specific challenges to basin management.

- The Six Basins are situated in an area that can receive and recharge large volumes of surface water, but they are a relatively small series of groundwater sub-basins with limited storage capacity.
- The recharge of surface water is unbalanced across the Six Basins. The areas where most recharge occurs are located in San Antonio Canyon and at the SASG. The Thompson Creek and Live Oak Creek watersheds, and the spreading grounds at the mouths of these watersheds, are much smaller in comparison, and hence, the recharge of stormwater is much less in these areas.
- Areas of greatest recharge capacity do not overlie the areas with greatest groundwater storage capacity but are separated by distance and barriers to groundwater flow. The groundwater-storage capacity in the Forebay areas north of the Indian Hill Fault, where most of the surface-water recharge occurs, is small compared to the storage capacity in areas south of the Indian Hill Fault in the Pomona Basin. The storage capacity is greatest in the Pomona Basin, but there are no spreading grounds that overlie the Pomona Basin, and it is separated from the areas of surface-water recharge by groundwater barriers. Currently, groundwater levels are relatively high in the Pomona Basin which (1) means that losses via sub-surface outflow to the Chino Basin and Spadra Basin are higher than they would be if groundwater levels were lower and (2) limits its ability to "take" water in a storage program.
- Faulting and folding have created barriers to groundwater flow and, in places, have uplifted the consolidated bedrock formations and the lower-permeability sediments of the Older Alluvium to shallow depths. These geologic conditions have created:
    - Areas that are susceptible to rising groundwater during wet periods.
    - Preferential flow paths for groundwater across the groundwater barriers that is not fully understood and characterized, including (1) flow across the Indian Hill Fault, which is a source of recharge to the Pomona Basin; (2) flow across the Intermediate Fault, which has impacted groundwater levels at wells and the transport and distribution of groundwater contaminants in the Pomona Basin; and (3) flow across the San Jose Fault, which is a component of groundwater discharge from the Six Basins.
    - A partially-closed groundwater basin—the Pomona Basin—which can lead to the concentration of dissolved salts and other contaminants in groundwater.
- The aquifer-system in the Pomona Basin is multi-layered and the groundwater-flow system is complex and not well characterized. This is problematic because the most serious groundwater-quality problems are within the Pomona Basin. Effective remediation of these problems will require a better understanding of the hydrogeology and the groundwater-flow system.

- The thickness, effective porosity, and permeability of the water-bearing sediments are variable across the Six Basins, which makes some areas more productive for groundwater pumping than others. In general, the production characteristics of wells are best where the water-bearing sediments are thickest. The production characteristics of wells are poorest in areas where the water-bearing sediments are relatively thin and/or of low porosity and permeability. The following is a summary of basin management issues associated with groundwater quality in the Six Basins.
  - From a water-quality standpoint, the recharge of high-quality surface water at the SASG does not benefit the Live Oak, Ganesha, and portions of the Pomona Basins.
  - TDS and nitrate concentrations at wells in the Pomona Basin, Live Oak Basin, and Ganesha Basin suggest that there is no assimilative capacity for TDS or nitrate. A finding of no assimilative capacity could restrict the reuse and/or recharge of recycled water in the Six Basins. The DDW is requiring the development and implementation of salt and nutrient management plans (SNMPs) for all groundwater basins in the state.

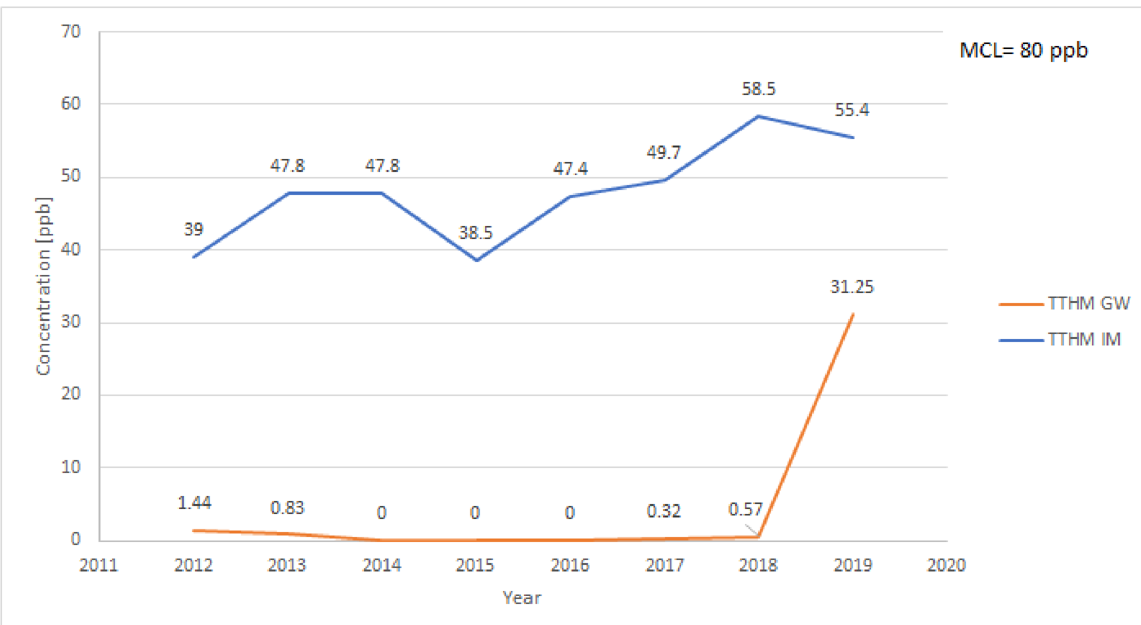
4.6 Groundwater Quality

The City has strict groundwater quality control requirements. Water sampling is conducted in accordance with Title 22 of the California Code of Regulations and DDW requirements. All samples are collected by licensed operators and are analyzed by certified laboratories.

- The results of water quality sampling as reported in the City's Consumer Confidence Reports from 2012 to 2019 are summarizes in tabular form in Appendix C and Table 4-1 describes average water quality conditions taken from water quality samples for each of the wells from 2013 to 2016.
- The average portion of water sources in the City from local groundwater and imported water is 27.5% and 72.5%, respectively.
- VOCs (DCE, PCE and TCE) have been detected from City production wells. Yearly average TCE concentrations are higher than the MCL of 5 ppm in 2018 and 2019, suggesting measures must be taken to reduce this level below the MCL. No Detection (ND) from the TVMWD Miramar Water Treatment Plant (imported water) has been observed.
- The local groundwater supply sources are limited due to elevated nitrate levels that range from 22-100 ppm as nitrate, seen in Figure 4-2 above in Section 4.5.2.
- There are some impacts from nitrification due to degradation in the quality of import water after residing in the City's system. The City has implemented a nitrification monitoring and control plan to mitigate risks associated with nitrifying conditions as well as implemented various improvements within the water system to mitigate the occurrence of these conditions.
- The values of total TTHM, fluoride, chloride, sulfate and TDS for both groundwater and imported water are less than the MCL, seen in Figure 4-6 through Figure 4-9 below.

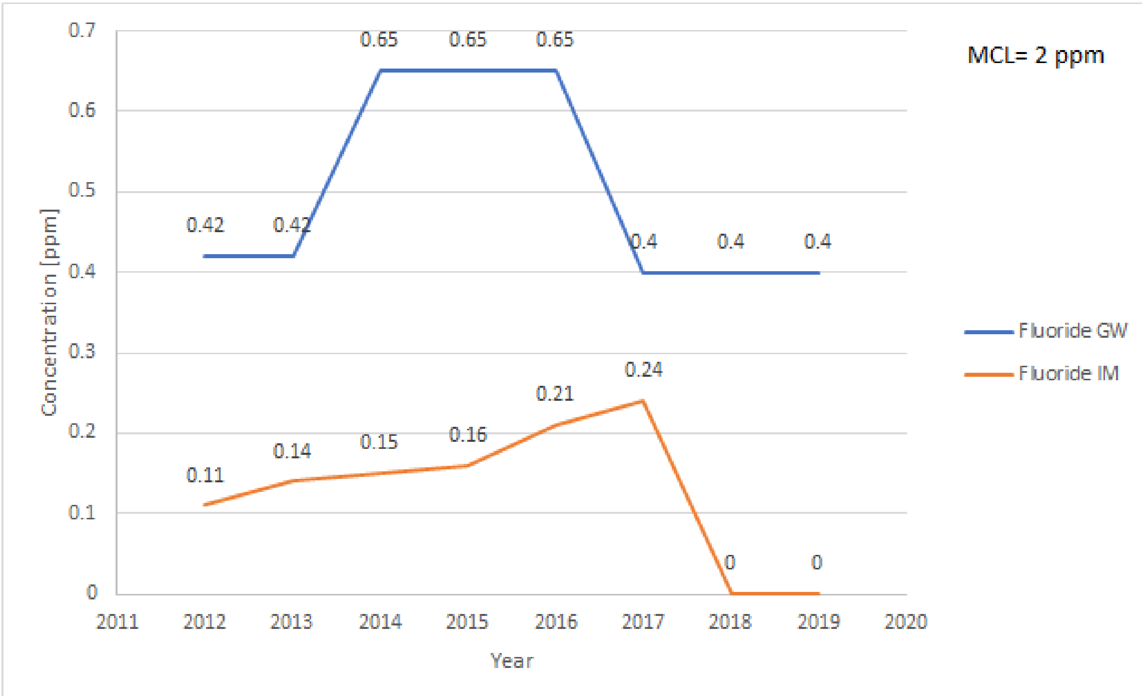
- The range of pH is 7.4 to 8.1 for groundwater and 8.3 to 8.62 for imported water, seen in Figure 4-10 below.
- Nitrate and perchlorate concentrations are greater than the MCL in a number of the City's wells, seen in Table 4-1. However, groundwater is less than 30% of total water supplied to the City and the concentrations of these constituents at the customer tap is below the MCL after treatment or blending with imported water.
- The City collects water samples at numerous locations throughout its distribution, storage, treatment and supply systems.
- The City had observed increasing lead concentration in the distribution system over the past decade that resulted in exceedances of the Lead and Copper Rule (LCR) 90th percentile limit in 2009 and 2012. Since 2012, the occurrence of exceedances of the LCR has been minimized with some occurrences having been experienced in 2013, yet no occurrences have been reported as recently as October of 2015. While the occurrence of exceedances has been minimized in recent years, the water quality of production water into the system must be maintained to achieve high standards.

Figure 4-6 – TTHM Groundwater (GW) and Imported Water (IM) Data



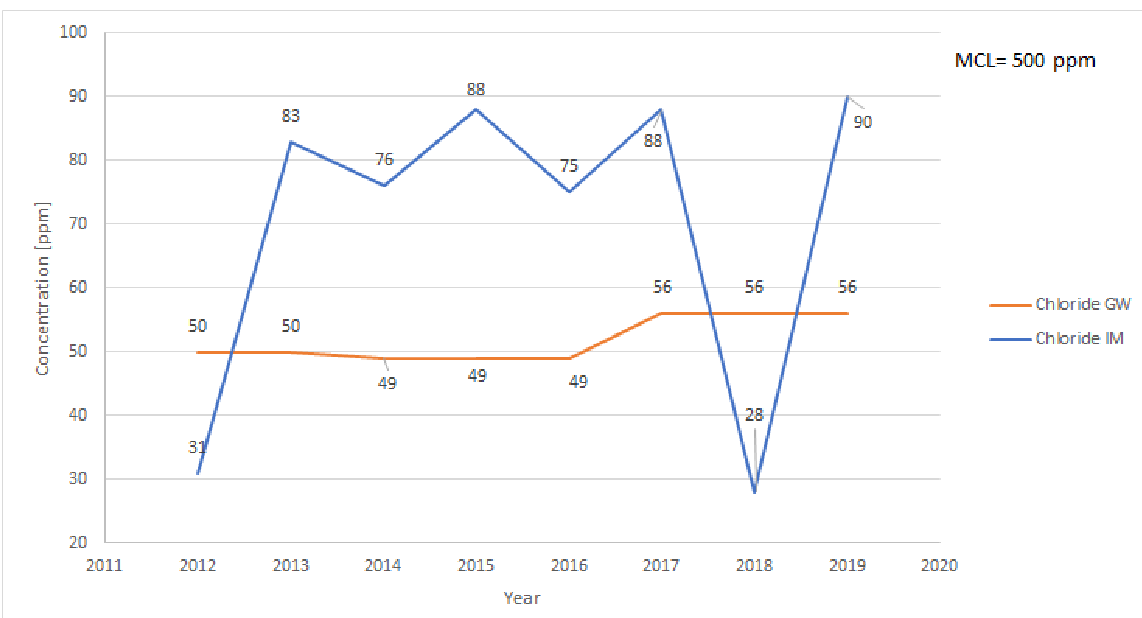
Total TTHM yearly average concentrations for 2012 through 2019 did not surpass the MCL of 80 ppb as shown in Figure 4-6. Imported water concentrations remain higher than groundwater concentrations for the timeframe of data. This is likely due to disinfection by-products having a greater presence in imported water than groundwater.

Figure 4-7 – Fluoride Groundwater (GW) and Imported Water (IM) Data



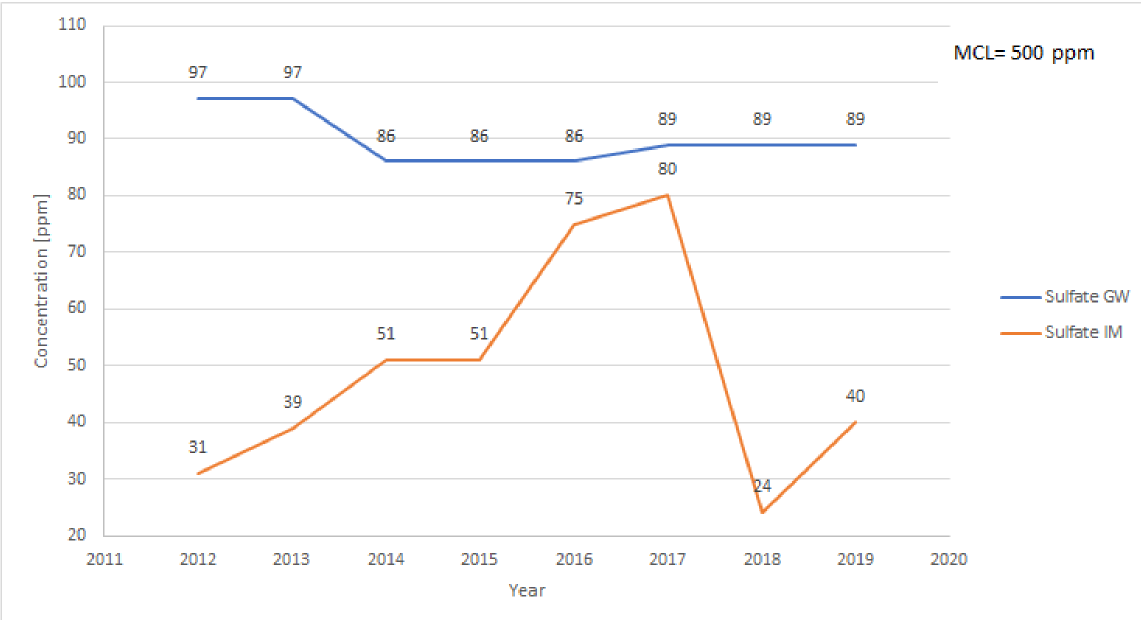
Fluoride is a chemical that is added to drinking water to help prevent tooth decay in humans. This chemical naturally reaches groundwater when weathering and leaching of fluoride-bearing minerals occurs. Figure 4-7 above represents the concentrations of fluoride in groundwater and imported water from 2012 to 2019 to the City. No yearly average concentrations surpassed the MCL of 2 ppm.

Figure 4-8 – Chloride Groundwater (GW) and Imported Water (IM) Data



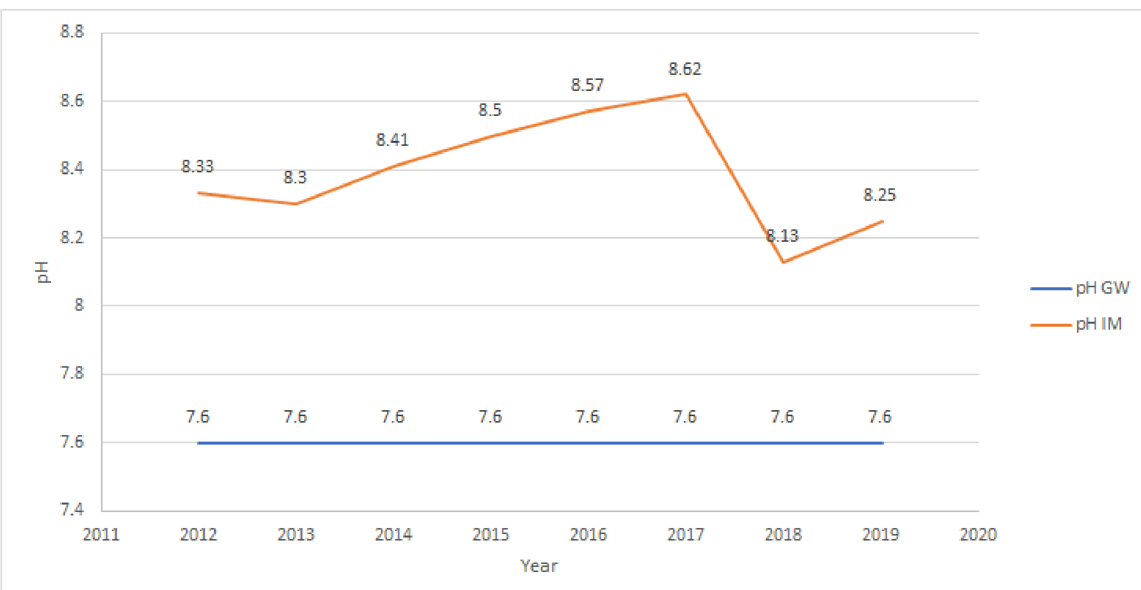
Yearly average chloride concentrations from imported water and groundwater from 2012 to 2019 can be seen in Figure 4-8 above. For all years, the MCL of 500 ppm is not surpassed.

Figure 4-9 – Sulfate Groundwater (GW) and Imported Water (IM) Data



Yearly average sulfate concentrations from imported water and groundwater from 2012 to 2019 can be seen in Figure 4-9 above. For all years, the MCL of 500 ppm is not surpassed.

Figure 4-10 – pH Groundwater (GW) and Imported Water (IM) Data



The yearly average pH of both imported and groundwater from 2012 to 2019 can be seen in Figure 4-10 above. The pH for groundwater remained at 7.6 for all years and fluctuated between 8.13 to 8.62 for imported water.

Table 4-1 – Well Water Quality Averages from 2013-2016

Well	Temperature (Field) *F	Total Hardness mg/l	Calcium (Ca) mg/l	Calcium, as CaCO3 mg/l	Total Alkalinity mg/l	Bicarbonate (HCO3) mg/l	Sulfate (SO4) mg/l+	Chloride (Cl) mg/l+	pH Units Std. Units	TDS mg/l+	Perchlorate ug/L	Nitrate (N) mg/l
Lincoln	66.6	400.0	130.0	325.0	203.3	250.0	106.7	46.7	7.7	576.7	12.9	21.0
Mills	66.6	376.7	116.7	291.7	186.7	230.0	95.7	41.0	7.6	566.7	12.9	20.0
Walnut	76.0	106.7	34.7	86.7	140.0	170.0	63.7	23.3	7.8	363.3	6.4	11.0
Old Baldy	75.0	220.0	67.0	167.5	155.0	185.0	72.5	50.0	8.1	465.0	15.1	0.0
Amherst	64.6	423.3	126.7	316.7	203.3	0.0	120.0	79.3	7.4	650.0	6.7	0.0
Beech	69.3	313.3	88.3	200.8	196.7	240.0	72.3	38.0	7.6	476.7	13.3	14.0
La Verne Heights #1	64.3	320.0	91.3	228.3	206.7	250.0	75.0	56.0	7.5	510.0	6.0	0.0
La Verne Heights #2	64.0	346.7	100.0	250.0	193.3	236.7	91.7	64.7	7.5	546.7	4.2	0.0
La Verne Heights #3	66.7	376.7	112.3	280.8	176.7	216.7	116.7	60.7	7.7	590.0	6.3	16.0

4.7 Existing Water Treatment Facilities

4.7.1 6th Street and White Avenue Treatment Facility

The **Lincoln Forebay** has a capacity of 152,620 gallons and receives water from the Lincoln and Mills Tract Wells. Water can be produced from one or any combination of the wells. Once in the Forebay, groundwater is boosted via a series of four pumps to an inline mixer just downstream of the TVMWD No. 2 connection. This TVMWD connection has a capacity of 8 cfs and is located in Lincoln Park. After mixing, water is delivered directly into the Pressure Zone I system grid. Water in excess of demand eventually flows into the Pressure Zone I Wheeler and Amherst Reservoirs. The historical blending ratio at this facility is approximately 70% imported water with 30% groundwater.

Prior to delivery to the Lincoln Forebay, the Lincoln and Mills Tract Wells deliver water through the White Avenue Treatment Plant. Generally, the well operation is dictated through alternating production depending on the time of the year. As a result, neither well is operated simultaneously under normal conditions. The Lincoln Well operates from May to November and the Mills Well operates during the remaining periods of the year. Discharge from the wells is treated 100% through the air stripper facility to remove VOCs from the well supply. When in operation, either well must also be operated in tandem with supply from TVMWD No. 2. This is required to ensure the blend of nitrates and perchlorates to be maintained within regulatory standards. A 0.5 ppm dose of chlorine is added prior to air stripping along with ortho/polyphosphate. According to the City's operations and maintenance plan, ortho/polyphosphate is dosed at approximately 4 ppm. The chlorine is added prior to the air strippers to minimize fouling of the air strippers and provides a small amount of residual. However, the high levels of calcium tend to precipitate calcium carbonate on the air stripper. The application of ortho/polyphosphate mitigates against this condition.

The Lincoln Well is operated at 1,000 gpm and blended with the TVMWD No. 2 connection to achieve the blended nitrate and perchlorate concentrations of 36 ppm and 4.8 ppb respectively. However, perchlorate concentrations at the Lincoln Well have trended down. The most recent sampling of the Lincoln Well indicated that the level of perchlorate is approximately 10 ppb with an average perchlorate concentration over the last 3-years of 13 ppb. Generally, nitrate levels (nitrate as nitrate) in the well average 105 ppm. There is a slight downward trend in nitrate levels, yet this concentration controls the blending operation. Considering this, the TVMWD No. 2 flow is delivered at approximately 2,500 gpm to achieve a blend of 33 ppm of nitrates and a perchlorate concentration of less than 4 ppm.

The Mills Tract Well is operated at 950 gpm and blended with TVMWD No. 2 connection to achieve a blended nitrate and perchlorate concentration similar to the Lincoln well. As with the Lincoln well, the concentrations of nitrate in the Mills Tract Well dictate the blending operations and the corrosion potential of the water produced from the well is very low.

4.7.2 Amherst Treatment Facility

The City currently treats for nitrates and perchlorates at the Amherst Treatment Plant. Five wells (Amherst, Beech and La Verne Heights 1, 2, 3) having a total capacity of approximately 2,000 gpm deliver raw water to the treatment plant. The treatment plant has a nominal capacity of 2,575 gpm and primarily treats for the removal of perchlorates through a perchlorate specific resin followed by removal of nitrates through a nitrate selective resin. Normally the combination of wells produces approximately 1,600 gpm of water for treatment. Generally, the production from the wells is treated through the ion exchange processes coupled with an internal blending mechanism to achieve a final blend concentration of 4 ppb for perchlorate and 8 ppm for nitrate as nitrogen. The addition of sodium hypochlorite and liquid ammonia is made to disinfect the production from the facility prior to delivery to the Amherst Reservoir. Chloramination generally occurs at this location at a 7:1 chlorine to ammonia ratio with an objective to achieve a 5:1 ratio out of the reservoir. Import water may be introduced to the treated water product from the treatment plant prior to delivery to the Amherst Reservoir through TVMWD No. 4A. While TVMWD supply has a higher pH than the well production, operations staff have indicated that deliveries through TVMWD No. 4A are rarely taken. As a result, blending of import and groundwater in the Amherst Reservoir is not performed routinely. Stored production from the treatment plant may be pumped from the Amherst Reservoir to Pressure Zone II by way of the Amherst Booster Pump Station. It is also pumped Forebay to the Plateau where it can be staged and blended with import water through TVMWD No. 4. Groundwater from the Forebay is subsequently pumped and delivered to Pressure Zone IV after blending with imported water from TVMWD No. 4.

Individually and when combined the La Verne Heights 1, 2 and 3 Wells, the Beech and Amherst Wells exhibit corrosive qualities. At low pH and temperatures, the wells have the tendency to be corrosive. Field test observations indicate a low pH of 6.8 and temperature of 14.4 degrees C, corrosive conditions can be experienced at the discharge from the Amherst Treatment Plant. Under these conditions and when considering the effects of chloramination on the water chemistry, the corrosion potential of the water is high and at times requires the addition of sodium hydroxide for pH adjustment. The City observes water quality conditions and introduces sodium hydroxide at the discharge from the nitrate treatment facility to adjust pH and minimize the risk of corrosion in the system.

4.7.3 Old Baldy Forebay

The **Old Baldy Forebay** receives water from the Walnut Well that has a production capacity of 450 gpm. Imported water is provided at the site from the TVMWD No. 3 connection and has a flow rate of 3 cfs. After blending in the Forebay, water is pumped into the Pressure Zone I system grid. The City delivers production from the Walnut Well without the addition of disinfectant to the Old Baldy Forebay, which has a capacity of approximately 13,000 gallons. The production from this well is generally conveyed to Pressure Zone I of the distribution system and blending is controlled to deliver approximately 450 gpm from the Walnut Well that is blended with approximately 500 gpm of import water.

TVMWD No. 3 supplies water to the Forebay to blend with the Walnut Well production. The City does not disinfect the water production from the Walnut Well and relies on blending with the chloraminated source of supply from TVMWD No. 3 to provide disinfection. Blending occurs in the Old Baldy Forebay. Once mixed, the blended product is pumped by way of a single 1,200 gpm variable frequency drive (VFD) pump. As a result, any combination of flows from the well and imported supply are limited to the pumping capacity of the Old Baldy Booster Station. These wells generally exhibit corrosive qualities and blending the import source from TVMWD is important in maintaining conditions within LCR requirements.

4.8 Nitrification and Lead and Copper Rule (LCR)

The City has observed some impacts from nitrification and an increase in corrosion over the past decade which have resulted in exceedances of the LCR. The City has implemented nitrification monitoring and control plans to mitigate risks associated with nitrifying conditions as well as have implemented various improvements within the water system to mitigate the occurrence of these conditions. These plans recommend the necessary steps the City should take to monitor system conditions and actions needed to mitigate against and remedy a nitrification event. These plans identified that the primary risk for low disinfectant residuals occurring in the distribution system can primarily be attributed to the use of different disinfection types in the groundwater and surface water systems. Furthermore, these plans state that converting the distribution system to chloramines to match with the imported TVMWD water is crucial to minimizing disinfectant loss. The results of these

planning efforts have been documented and the City has identified a number of capital, operational and administrative solutions that can be prioritized and implemented to mitigate against the occurrence of LCR exceedances and nitrification with the potable water distribution system. In summary the results of these studies concluded the following:

- Decrease water age in the system by minimizing operational storage in reservoirs as needed while maintaining sufficient storage for operations, emergencies and fire support.
- Review the administrative fire flow requirements with the City's Fire Department to determine if required fire flow storage may be reduced to further decrease the amount of time water is detained in the system.
- Provide static mixing systems in all reservoirs to offset the effects of thermal stratification.
- Provide mechanical mixing in selected reservoir to promote mixing and ensure water does not stagnate within reservoirs.
- Chloraminate all production well sites to match the water quality of TVMWD import water.
- Apply sodium hydroxide at appropriate levels and under certain conditions to minimize the effects of corrosion.
- Decrease water age in the system by shortening the path of production from wells or import supplies to its ultimate point of use.
- Combine pressure zones and take reservoirs offline in certain pressure zones when demand in the system does not require their operation.

Chapter 5 - EXISTING WATER SYSTEM

5.1 General

The City's municipal water system provides water to approximately 8,600 service connections; approximately 92% are residential users. Approximately 27.7% of the water supply is groundwater pumped from the Live Oak Basin, Ganesha Basin and Pomona Basin based upon 2017 production data. The remaining approximate 72.3% of the water supply is provided by the TVMWD Miramar Water Treatment Plant. Emergency water supply is supplied by the MWD Weymouth Filtration Water Treatment Plant via the PWRJF. An additional emergency connection is made to the GSWC San Dimas water system.

The TVMWD Miramar Water Treatment Plant maintains a maximum water level of 1,632 feet and is able to supply water by gravity flow to the City's Pressure Zones I, II and III. A large demand on the TVMWD system will reduce gravity flow to Pressure Zone III since this connection is located at the most westerly end of the Miramar transmission system. Imported water is boosted into Pressure Zone IV and subsequently boosted into higher pressure zones. Imported water can reach every portion of the City's water system under every type of flow condition. Imported water can be taken from six turnouts on the TVMWD Miramar transmission system that are strategically located to maintain flexible operations in the system, with redundancy.

The City owns and operates nine wells located in the Live Oak, Pomona and Ganesha Basins that can supply groundwater to the City water system with a total maximum capacity of 4,100 gpm (see Table 5-6) assuming all wells are operational (the Old Baldy Well is listed as inactive). As stated in Chapter 4, nitrate, perchlorate and TCE have been found in local groundwater higher than the EPA and DDW standards. The City presently is blending groundwater with imported water to decrease nitrate concentration to an acceptable level is also treating to reduce nitrates, is air stripping to remove TCE and is treating to reduce perchlorate before supplying water to customers.

Eleven reservoirs, with a total storage capacity of 27 MG and ten booster pump stations with a maximum pumping capacity of approximately 23,720 gpm are in service to supply water to each pressure zone through the distribution pipe network. There is also one hydropneumatic pump station in the system with a total pumping capacity of 3,280 gpm. This hydropneumatic pump station boosts water into a relatively small area that cannot be served by a gravity reservoir system. Pipe sizes in the distribution system range in size from 2-inch to 24-inch in diameter. TVMWD transmission pipelines range in size from 18-inch to 36-inch in diameter to transfer imported water to the City. The critical water supply and storage facilities are shown on Exhibit 5 and a hydraulic profile of the system is shown on Exhibit 6.

5.2 Distribution System

Beginning in 1972, the City imported water from the Pomona Valley Municipal Water District (PVMWD) through the Fulton Plant to achieve increased water demand and to reduce the nitrate content in the local groundwater through blending. The PVMWD became the TVMWD and imported water supply to the City has been shifted from the Fulton Plant to the TVMWD Miramar Water Treatment Plant. Mainline pipelines from each reservoir or pump station are 10-inch to 20-inch in diameter, depending on the size of the service area and required flow.

Common pipelines sizes in the distribution system are 8-, 10- and 12-inches. Some distribution pipelines are 4-inch and 6-inch in diameter and are typically located in Pressure Zones I and II.

The distribution system consists of approximately 132 miles of water mains ranging in size from 2-inch to 24-inch in diameter. Approximately 68% of all piping is in Pressure Zones I and II. There are approximately 1,318 fire hydrants on the system. Below in Table 5-1 is data regarding pipe size by linear footage.
Table 5-2 has data regarding linear footage of pipe per pressure zone.

Table 5-1 – Pipeline Sizes and Linear Footage

Diameter Size (in)	Linear Footage (ft)	Miles (mi)	Percentage of System
6-inch and Under	100,184	19	14%
8-inch	337,733	64	48%
10-inch	87,854	16.6	13%
12-inch	112,130	21.2	16%
14-inch and Larger	59,286	11.2	8%
TOTAL	**697,187**	**132.0**	**100%**

Table 5-2 – Pressure Zones and Linear Footage

Pressure Zone	Linear Footage (ft)	Miles (mi)	Percentage of System
I	285,457	54.1	41%
II	190,278	36	27%
IIa	7,627	1.4	1%
III	53,689	10.2	8%
IV	78,601	14.9	11%
IVa	30,675	5.8	4%
V	15,190	2.9	2%
Unknown	35,670	6.8	5%
TOTAL	**697,187**	**132.0**	**100%**

The following pipelines were installed crossing the 210 Freeway to ensure that the water supply to all pressure zones is continuous. Each pipeline crossing of the Freeway is in a casing pipe through a bridge structure that was built associated with the 210 Freeway construction in the late 1990s. Isolation valves are located on each side of the bridges. Table 5-3 shows the location and sizes of the pipelines crossing the 210 Freeway.

Table 5-3 – Pipelines Crossing Route 210 Freeway

Size (inches)	Location
24	Wheeler Avenue, Pressure Zone I (casing 32-inch)
12	Wheeler Avenue, Pressure Zone II (casing 22-inch)
12	Bixby Drive (casing 22-inch)
12	Chelsea Drive (casing 22-inch)
16	Emerald Avenue (casing 24-inch)
12	Fruit Street, West (casing 22-inch)
12	Fruit Street, East (casing 22-inch)
8	Dawn Avenue, West (casing 16-inch)
6	Dawn Avenue, East (casing 16-inch)
12	Williams Avenue, West (casing 22-inch)
16	Williams Avenue, East (casing 24-inch)
8	Ramona Avenue, East (casing 24-inch)

5.3 Pressure Zones

The five existing pressure zones and two sub-zones were developed based on the sloping topography of the City and the land development phases. Pressure Zone I was first developed around 1900 as part of the settlement of Lordsburg. It is generally the flattest land area in the City and encompasses the land area south of Foothill Boulevard within the City limits. Pressure Zone II is another relatively flat land area in the City. It flourished in the 1950's and encompasses the land area on the north side of Foothill Boulevard up to Oak Mesa and Orangewood Avenue. Pressure Zone III began expanding in the 1970's and is generally north of Pressure Zone II, up to Golden Hills Road, separated from Pressure Zone IV by ridges and canyons. Pressure Zone IV was generally developed in the 1970's and 1980's and includes the area surrounding the MWD Live Oak Reservoir up to Via Del Paraiso and Via Jacinto. Pressure Zone IV was the original Plateau System owned by the Plateau Mutual Water Company that was purchased by the City in 1972. Pressure Zone V was formed in the 1980's and 1990's and is generally north of Golden Hills Road extending to the City boundary. The pressure zones are shown in Exhibit 7

Two sub-zones were created along the eastern City limit boundary to enable the City to deliver the proper water pressure to areas slightly higher than could be supported by reservoir systems. One sub-zone is designated Pressure Zone IIa and is located between Baseline Road, Dawn Avenue, Bowdoin Street and Williams Avenue. The area is presently serviced by Pressure Zone IV through pressure regulating valves at the Plateau Pump Station. The other sub-zone is designated Pressure Zone IVa and is located along the easterly and southern side of the MWD Live Oak Reservoir. The area is serviced by the Live Oak Hydropneumatic Station.

The reservoir maximum water surface elevations (MWSE) for Pressure Zones I, II and III are lower than the maximum hydraulic grade line (HGL) of the TVMWD's Miramar system. The MWSE for Pressure Zone I is set at 1251.5, approximately 380 feet lower than the Miramar system. The MWSE for Pressure Zone II is set at 1370.75, approximately 260 feet lower. Imported water supply to Pressure Zone I and II is by gravity flow through pressure regulators. The MWSE for Pressure Zone III is set at 1553, approximately 80 feet lower than the Miramar system. When the demand on the TVMWD's system is high, imported water cannot be supplied to Pressure Zone III by gravity flow. Since the MWSE in Pressure Zones IV and V is approximately 60 feet and 270 feet higher than TVMWD's Miramar system, water has to be pumped to these Zones.

5.4 Booster Pumping Facilities

There are ten active booster pump stations in the City, one active hydropneumatic pump station and one inactive hydropneumatic pump station. Seven of the stations are in Pressure Zone I, which is the major water production and transfer zone. The White Avenue Pump Station is the primary source of blended water to Pressure Zone I and subsequently to all pressure zones through a series of other pump stations. Once groundwater is introduced into the Lincoln Forebay, it is then boosted via a series of four variable speed pumps (two 500 gpm, and two 1500 gpm) to an inline mixer that is downstream of the TVMWD No. 2 connection in Lincoln Park. At this point, groundwater is combined with imported water and delivered directly into the Zone I system grid. Water not required in the distribution system eventually makes its way to the Zone I Reservoirs (Wheeler and Amherst) and on to other pressure zones through pumps.

Another critical pumping station operated by the City is the Plateau Booster Pump Station. This station transfers imported water from the site to Pressure Zone IV and subsequently Pressure Zone IV and Zone V. Treated groundwater from Pressure Zone I can also be pumped from the Amherst Reservoir to the Plateau Forebay and is then pumped directly into the Pressure Zone IV distribution system. This station blending is not used under normal circumstances but remains available as an alternative treatment system.

The Wheeler Booster Pump Station is located at the Wheeler Reservoir site and is a critical source of supply to Pressure Zone III and a redundant source of supply to Pressure Zones IV and V through the Pressure Zone III Booster Pump Station that is located at the Pressure Zone III Reservoir site. One of the Pressure Zone II Booster Pump Stations is located at the Wheeler Reservoir site. Wheeler Avenue and Pressure Zone II stations take suction from the Wheeler Reservoir and boosts to the up-gradient pressure zones. These pump stations transfer blended water from Pressure Zone I to the upper pressure zones.

Table 5-4 lists the booster pump station data under current standard conditions. Table 5-5 lists detailed information of the hydropneumatic pump stations.

White Avenue Pump Station

Amherst Booster Pump Station

Table 5-4 – Booster Pump Station Data

Pump Station	From	To	Number of Pumps	Total Capacity (gpm)
White Avenue	Forebay	Pressure Zone I	4	4000
Old Baldy*	Forebay	Pressure Zone I	1	1250
Hillcrest	PWR	Pressure Zone I	2	2400
Damien	Pressure Zone I	Pressure Zone II	1	595
McCall	Pressure Zone I	Pressure Zone II	2	1200
Plateau	Forebay	Pressure Zone IV	3	2100
	Miramar #4	Pressure Zone IV	4	1425
Amherst	Pressure Zone I	Pressure Zone II	2	2000
	Pressure Zone I	Plateau	2	2000
Wheeler	Pressure Zone I	Pressure Zone III	3	3000
	Pressure Zone I	Pressure Zone II	1	1000
Pressure Zone III	Pressure Zone III	Pressure Zone IV	3	800
	Pressure Zone III	Pressure Zone V	2	450
Pressure Zone V	Pressure Zone IV	Pressure Zone V	3	1500
Total				**23720**

*Note – Old Baldy Pump Station is active.

Table 5-5 – Hydropneumatic Pump Station Data

Name	From	To	Number of Pumps	Total Capacity (gpm)
Williams	Pressure Zone II	Pressure Zone IIa	3	Out of Service
Live Oak	Pressure Zone IV	Pressure Zone IVa	5	3280
Mt. Springs*	Pressure Zone IV	Pressure Zone IVb	3	Out of Service
Total				**3280**

*Note: The Mt. Springs Hydropneumatic Station has never been placed into service.

5.5 Wells

The City has relied upon groundwater for water supply since the formation of the City's water department in 1911. Although groundwater is not enough to satisfy the City's water demand, it is still the most important water resource for the City. The City has acquired most of its wells through purchase of adjacent water systems. The Lincoln Well (active) was drilled in the 1929 and the Cartwright Well (inactive) was drilled in 1930. The City purchased the Old Baldy Well in 1962 (drilled in 1921 and inactive), the La Verne Heights Wells in 1964 and the Mills Tract Well in 1965. Since that time, the City has drilled the Amherst Well in 1999, the Walnut Well in 2000 and the Beech Well in 2010 to supplement supply and to provide redundancy for aging wells.

Beech Well

As described in Chapter 3 and Chapter 4, the City extracts groundwater from Six Basins in accordance with the Six Basins Judgement. The judgement specifically defines adjudication for the Four Basins (Canyon, Upper and Lower Claremont Heights, Pomona Basins) and generally defines adjudication for the Two Basins (Live Oak and Ganesha Basins). The existing well data is listed in Table 5-6.

Table 5-6 – Well Facilities Data

Well	From Basin	To	Capacity (gpm)
Lincoln	Pomona	Lincoln Forebay - Pressure Zone I	1,000
Mills Tract	Pomona	Lincoln Forebay - Pressure Zone I	950
Walnut	Ganesha	Old Baldy Forebay - Pressure Zone I	450
Amherst	Live Oak	Amherst Water Treatment Plant – Pressure Zone I	450
Beech	Live Oak	Amherst Water Treatment Plant – Pressure Zone I	500
La Verne Heights No. 1	Live Oak	Amherst Water Treatment Plant – Pressure Zone I	200
La Verne Heights No. 2	Live Oak	Amherst Water Treatment Plant – Pressure Zone I	200
La Verne Heights No. 3	Live Oak	Amherst Water Treatment Plant – Pressure Zone I	350
Total			**4,100**

*Note: The Old Baldy Well has been inactive since 1990 due to VOC and nitrate contamination.

5.6 Reservoirs

There are eleven reservoirs in the City's distribution system with a total storage capacity of 27 MG. Among them, Wheeler Reservoir have two individual storage cambers with a common wall, the Emerald Reservoir has two reservoirs on one site and the Plateau site has two reservoirs located approximately 150 feet apart. These reservoirs are necessary to equalize the pump discharge, to provide water during outages of individual components, for firefighting, and to dampen hydraulic surges in the system. Water is pumped into each reservoir and then fed into the distribution systems of its service pressure zone by gravity flow. The existing reservoir data is shown in Table 5-7.

Table 5-7 – Reservoir Data

Reservoir	Zone Served	Capacity (MG)	Max. Water Surface Elevation (feet)	Depth (feet)
Amherst	I	2.5	1251.50	18
Wheeler No. 1	I	3.0	1251.50	18
Wheeler No. 2	I	3.0	1251.50	18
Emerald No. 1	II	3.0	1370.75	23
Emerald No. 2	II	1.5	1370.75	23
Zone III	III	2.5	1553.00	26
Plateau No. 1	IV	2.5	1691.00	24
Plateau No. 2	IV	5.0	1691.00	31
Mountain Springs	IV	1.0	1691.00	30
DeWenter*	V	0.5	1899.00	24
Marshall Canyon	V	2.5	1899.00	30
Total		**27**		

*Note: The DeWenter Reservoir is currently out of service

The Lincoln Forebay receives groundwater produced from any combination of the Lincoln and Mills Tract Wells. The Forebay can also receive imported water from the TVMWD No. 2A connection. The Old Baldy Forebay receives groundwater from the Walnut Well and imported water from TVMWD's No. 3 connection. The Plateau Forebay receives treated groundwater from Pressure Zone I via the Amherst Water Treatment Plant. Table 5-8 indicates the Forebay data.

Table 5-8 – Forebay Data

Forebay	Water From	Serve to Zone	Capacity (gal)
Lincoln	Wells, TVMWD	I, II, III	152,620
Old Baldy	Wells, TVMWD	I, II, III	13,000
Plateau	Pressure Zone I, TVMWD	IV	209,440

5.7 Pressure Regulating Stations

Pressure regulating valves are used to adjust the water pressure to the proper range for customers or for proper system operation. The Uniform Plumbing Code requires that any delivery pressure over 80 psi be regulated to below 80 psi. On the operations side, pressure relief valves are installed to protect a system from excessive pressures. The City has four pressure stations in use to adjust the pressure in the water system. These stations are as follows:

- **Oak Mesa Pressure Station:** The station is located at 1370 Oak Mesa Drive (intersection of Oak Mesa and Wheeler Avenue) and reduces pressure from 125 psi to 75 psi. One 1 ½-inch pressure reduction valve and one 4-inch pressure reduction valve are installed in a vault to sustain lower pressures downstream - pressure is approximately 125 psi on the inlet side and is set at 75 psi on the outlet side.

- **Summit and Live Oak Canyon Pressure Station:** The station is located at the intersection of Williams Avenue and Summit Road and provides supply from Pressure Zone IV to Pressure Zone IVa. One 10-inch valve in a vault is used when the pressure in Pressure Zone IVa drops below 25 psi. The valve opens to supply the Wagon Horse area from the Plateau Reservoir.
- **Wheeler Reservoir site from Pressure Zone III to I:** The station is located at the Wheeler Reservoir site. One 10-inch valve is used when operations require the Pressure Zone III pumps to operate when the Pressure Zone III Reservoir is out of service, therefore maintaining supply with pressure relief for over pressurization. Once the system pressure exceeds 135 psi, the valve will open to allow the Pressure Zone III boosters to relief pressure into Wheeler Reservoir.
- **Wheeler Reservoir from TVMWD to Pressure Zone II:** The station is located at the Wheeler Reservoir site. One 10-inch valve in a vault is used manually to allow imported water to flow into Pressure Zone II. There is also a manual valve at this site that allows TVMWD water to flow directly into Pressure Zone III.
- **Pressure Zone IV to Pressure Zone IIa:** The station is located on Baseline Road near the entrance to Leroy's Boys Home. The station has replaced the Williams Avenue Hydropneumatic Pump Station with a PRV that moves water from Pressure Zone IV to Pressure Zone IIa for domestic water use and fire protection. One 2-inch PRV, one 4-inch PRV and one 6-inch PRV are installed in a vault to sustain lower pressures downstream - pressure is approximately 170 psi on the inlet side and is set at 55 psi, 51 psi and 47 psi respectively on the outlet side.

Pressure regulating valves located at the TVMWD connections to the City's water distribution systems are listed in Table 5-9. The pressure stations located at the Baseline Road and Williams Avenue connection and at the 5th and "C" Streets connection are disabled.

Table 5-9 – TVMWD Pressure Regulating Station Data

Location	Pressure Range (psi)	Pressure Setting (psi)	Valve Size (inch)
Williams Avenue and Amherst Street	150 - 175	160	6
6th Street and White Avenue	150 - 175	164	10
5th and C Streets	0 - 50	5	8
Baseline Road and Williams Avenue	125 - 160	147	8
Baseline Road and Emerald Avenue	150 - 200	192	8
Baseline Road and Wheeler Avenue	150 - 225	201	6
5th Street and White Avenues	0 - 50	5	8

5.8 Water System Interconnections

Imported water from Miramar is delivered into the City's system at seven locations to help achieve the City's water demand. All connections are within Pressure Zone I, II and III but may serve different zones other than the zone they are located within. Since the pressure of the incoming water from Miramar is greater than normal system pressure in Pressure Zones I, II and III, imported water does not need to be pumped into service areas below approximately elevation 1553 (the MWSE of the Pressure Zone III Reservoir).

Emergency water supply can be taken from the PWRJF water line that conveys water from the MWD Weymouth Filtration Water Treatment Plant, located in the City, to PWRJF. The water is pumped from a HGL of 1075 feet into the City's Pressure Zone I system (HGL 1251.5) through the Hillcrest Pump Station. TVMWD has constructed the Pump Back Station at the City's Old Baldy site. This station takes suction from the PWRJF and pumps towards the TVMWD Fulton Plant. Water from this system can be taken by the City at is 5th Street and White Avenue connection and conveyed into the Lincoln Forebay and eventually into Pressure Zone I. The above interconnection data is shown in Table 5-10.

Table 5-10 – Water System Interconnection Data

Zone	Meter Connection	Location	Flow Rate (cfs)
2	6th Street and White Avenue	Lincoln Park	8
2A	5th Street and White Avenue	5th Street and White Avenue	8
3	5th and C Streets	5th and C Streets	3
4	Williams Avenue	Baseline Road and Williams Avenue	8
4A	Amherst Street	Williams Avenue and Amherst Street	3
5	Emerald Avenue	Baseline Road and Emerald Avenue	6
6	Wheeler Avenue	Baseline Road and Wheeler Avenue	6
	Total		**42**

In addition to receiving water from the above-mentioned connections, the City also has an 8-inch connection with the GSWC Foothill District at the intersection of Pattiglen Avenue and Bonita Avenue. This emergency connection has pressure differentials between the City and GSCW and has not been used in recent years.

All zones are interconnected by manually operated zone valves located at numerous, strategic locations. These zone valve covers are painted red for proper identification. Water can be transferred from higher zones into lower zones when an emergency occurs.

5.9 SCADA System

A computerized telemetry or SCADA system was installed in 1996 to control and monitor the City's water system. The SCADA system was completely upgraded in 2006 with new hardware and software. New programmable logic controllers (PLC) were deployed at all remote locations throughout 2007 and 2008. In 2014, the SCADA program was once again upgraded and moved to the cloud using the Works Mission Critical Ignition (Inductive Automation) software program. All critical functions of the production system, excluding valve control, can be controlled and monitored from the central computer servers. These include well and pump control, reservoir level, and data management tasks. The computer also monitors all functions of the system and stores data relative to those tasks. Those functions monitored include well and pump run times/status, well and pump energy use, reservoir levels, hydropneumatic system pressure, remote communications status, and flow from all TVMWD and City meters. SCADA information is shown in Table 5-11.

Table 5-11 – SCADA Components

Component	Manufacturer	Function
Computer Operating System	(2) Dell R430 Rack Mount Servers, Windows Server 2016 with Downgrade Rights to 2012R2, The Works Mission Critical Ignition Software iPads (3) with industrial case for remote access	Monitors all system functions including pump controls and logic, reservoir levels, flows, system pressure (HP stations), power usage, data storage, alarms
Radios	Microwave Data Systems MDS 9310	Provides wireless communication between central telemetry and remote locations and operates within 902-928 MHz
Remote PLCs	Predominantly Allen Bradley	Process control and monitoring, remote data logging to central computer

The telemetry computer is maintained in the production office located at 2525 White Avenue. The computers (one primary and one backup server) and all remote locations are backed up by batteries that can supply up to 36 hours of operation in the event of a power failure.

Authorized persons can access the telemetry from the production office or from a remote location. Access to the various levels of the system is restricted based upon the following classification:

- Operators
- Data Processing
- Supervisors
- Management

The production office is also backed up by a Cummins Standby generator (85KW) that will keep the SCADA system operating in the event of a power outage.

5.9.1 Telemetry Alarms

Problems with the production system are recorded in the SCADA program database through the alarm process. Each incident is logged, including the date and time, and if necessary, a call is sent to a responsible person that is assigned a City owned cell phone for such purposes. The operator can access the system remotely, determine the alarm significance and make any needed adjustments. Most significant alarms are also sent to the Water Supervisor's cell phone.

Chapter 6 - COMPUTER ANALYSIS OF THE WATER SYSTEM

6.1 General

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

6.1.1 Water Model Development Methodology

The water system was created by using elements and nodes to generate the City's water system. An element represents a pipe within the water system and performs as a fluid conductor. Each element is connected to two nodes to represent the beginning and end of a pipe. 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 are multiple types of valves including pressure reducing, pressure sustaining and flow control.
- **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 represents physical elements of the water system that remain constant over time, such as pipes, location of 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, pump curves, and valve operations. A scenario is a predetermined combination of static and variable elements that represents a set of boundary conditions. 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: Hazen-Williams Equation, Manning's Equation, and 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.

6.2 Water Model Update

Civiltec has created several water models for the City and worked with a modeling firm in 2009 to prepare the GIS based version of the model. ***Civiltec*** has been utilizing this model since 2009 in preparation of the 2010 WMP update and numerous other specific hydraulic studies.

By using the shapefiles, geodatabase files provided by Nobel Systems and information provided by City staff, ***Civiltec*** has updated the Water Model to reflect updates to the system since 2009. After reviewing the existing model, we updated the following:

- **Pipeline Mains:** Per new developments and CIP improvement projects after year 2009 and GIS data.
- **Pump Curves:** Used most up to date SCE pump efficiency curves.
- **Demands:** Used 2013 sales data (8,101 AFY or 5,023 gpm – ADD). See Chapter 2 regarding the water demand analyses.

6.2.1 Pipeline Mains

The City currently uses ArcGIS as their platform for their GIS needs. They were able to provide a geodatabase file containing the latest potable water pipe data[3]. This geodatabase contained various shapefiles (or feature classes) that were imported into ArcGIS.

Once imported, ***Civiltec*** manually verified the installation year of the pipes within the City's water service network and updated the pipes as needed. There were new areas of development – those pipeline mains are now part of the latest hydraulic model. Along with verifying installation years, the material of the pipelines was also verified and updated as needed. The pipe length per material for the City's current system can be found in Table 6-1 for distribution mains (approximately 123.9 miles) and Table 6-2 for transmission mains (approximately 15.4 miles).

There has been approximately 68,462 linear feet (approximately 13.0 miles) of pipelines installed in the City's water system after 2009. There were no pipelines installed after 2018. Exhibits showing the location of the pipelines and approximate linear footage according to the GIS files are shown in Exhibit 8. Summary of those pipelines can be found in Table 6-3.

[3] The geodatabase provided to ***Civiltec*** was dated August 2017. The file geodatabase feature classes were extracted from this specific file to create the updated model.

Table 6-1 – Pipe Lengths and Material of Existing Pipelines (2018) Distribution Mains (LF)

Size (in)	Asbestos Cement	Cast Iron	Ductile Iron	Poly-vinyl Chloride	Steel	Steel CML&C	Unknown	Others	Totals (LF)
≤ 4	7,579	4,756	111	-	2,709	1,615	904	20	17,694
6	69,155	7,301	211	297	331	3,241	7,729	110	88,377
8	295,801	6,628	7,900	55	1,737	23,206	4,416	-	339,742
10	83,825	28	205	-	1,699	5,486	231	50	91,523
12	80,955	-	4,162	864	3,771	23,506	3,035	32	116,326
16	-	-	438	-	-	-	27	-	465
Totals	**537,314**	**18,714**	**13,027**	**1,217**	**10,247**	**57,054**	**16,342**	**212**	**654,127**

Table 6-2 – Pipe Lengths and Material of Existing Pipelines (2018) Transmission Mains

Size (in)	Asbestos Cment	Cast Iron	Ductile Iron	Steel	Steel CML&C	Unknown	Others	Totals
8	-	-	-	-	173	136	-	308
10	5,133	-	-	-	-	-	-	5,133
12	-	-	-	-	1,150	15	-	1,165
14	573	-	5	75	3,276	122	20	4,071
16	1,711	43	6,602	8,750	20,857	1,682	8,951	48,596
18	-	-	-	-	419	2,508	-	2,927
20	66	-	-	-	8,026	-	-	8,092
≥ 24	3,309	-	-	-	173	-	-	11,032
Totals	**10,792**	**43**	**6,607**	**10,470**	**37,514**	**6,929**	**8,971**	**81,326**

Table 6-3 – Pipe Lengths and Material of Pipelines Installed after 2009

Size (in)	2010	2011	2013	2015	2016	2017	2018	Totals
≤ 4	5,882	1,122	-	-	-	-	-	7,004
6	2,217	8,817	406	316	257	-	82	12,095
8	2,130	26,796	424	22	2,406	-	1,455	33,233
10	483	6,025	718	-	-	-	-	7,226
12	963	1,137	2,079	543	2,257	-	-	6,979
≥ 16	745	1,105	26	-	-	-	49	1,925
Totals	**12,420**	**45,003**	**3,653**	**880**	**4,920**	**-**	**1,586**	**68,462**

6.2.2 Pump Curves

The pump database was updated per the City's most recent SCE pump efficiency results[4]. The pumps database reflects the normal operating conditions as shown in the Booster Test

[4] SCE pump efficiency results were obtained from reports provided by the City dated between 2007 through 2017.

* These booster pumps had the same parameters within the Water Model since no SCE test was provided.

Summary sheet. The pumps indicated in Table 6-4 were updated. Some pumps did not have a recent SCE efficiency test, so those pumps contain their existing parameters from 2009 and were not updated in the hydraulic model.

Table 6-4 – Updated Pumps per SCE Results

Booster Station	Booster Pump Designation	HP	SCE Efficiency %	Working Flow (gpm)	Design Head (ft)
White	Booster 1	40	64	557	184.1
	Booster 2	30	45	271	183.1
	Booster 3	100	70	1489	207.6
	Booster 4	100	66	1451	220.3
Old Baldy	Booster 1	100	59	425	196.5
Hillcrest	Booster 1*	No recent SCE test provided.			
	Booster 2*	No recent SCE test provided.			
Damien	Booster 1	30	56	602	154.8
McCall	Booster 1	20	58	298	132.8
	Booster 2	30	61	723	137.4
Plateau - Forebay	Booster 1	125	65	909	377.9
	Booster 2	125	69	901	381.8
	Booster 3	60	66	542	378.7
Miramar	Booster 1	10	48	249	69.3
	Booster 2	10	42	212	72.8
	Booster 3	15	61	568	65.9
	Booster 4	30	52	775	67
Amherst – Pressure Zone II	Booster 1	60	60	1182	120.1
	Booster 2	60	62	1195	127.1
Amherst - Plateau	Booster 1	75	40	1487	76
	Booster 2	75	58	1370	117.9
Wheeler – Pressure Zone III	Booster 1	125	53	660	334.6
	Booster 2	125	61	930	344.6
	Booster 3	125	59	935	312.3
Wheeler – Pressure Zone I	Booster 1*	No recent SCE test provided.			
Pressure Zone III - Pressure Zone IV	Booster 1	15	66	315	134.7
	Booster 2	20	70	330	134.7
	Booster 3	15	57	330	137.1
Pressure Zone III - Pressure Zone V	Booster 1	25	64	248	335.7
	Booster 2	25	64	225	335.7
Steph - Pressure Zone V	Booster 1	40	72	440	239.1
	Booster 2	40	68	415	240.2
	Booster 3	40	69	405	237.9
Live Oak	Booster 1	10	64	325	72.8
	Booster 2	10	60	301	75.1
	Booster 3	10	61	292	75.5
	Booster 4	10	57	260	77.4
	Booster 5*	No recent SCE test provided.			

Each pump is modeled under the "design-point" curve based on the normal operating conditions per the SCE Booster Test Summary sheet. The Water Model then created design point curves which allowed the pumps to produce a shut-off head value and a shut-off flow value. The shut-off head value is 1.3 times the design head (H) of the corresponding pump and the shut-off flow value is 2 times the design flow (Q) of the corresponding pump.

6.2.3 Demand Allocation for Simulation

Demand allocation is a crucial aspect of constructing a hydraulic water model. Determining accurate consumption data (water sales) and the spatial distribution of that consumption throughout a water system is a key element of water distribution modeling.

For this WMP, ***Civiltec*** used billing records from 2012 through 2020 for consumption data as stated in Chapter 2. The annual demand used for the Water Model is 8,101 AFY or 5,023 gpm (2013 consumption demand). This demand was distributed among the Water Model with the exception of the top users identified in Table 2-7.

The top users were programmed to be a point load junction representing that meter associated with the top user. The top 20 users were programmed first and once those demands were in the system, the remaining demand was distributed in the hydraulic model as best fit. A demand set of this caliber was made for the MDD and PHD by using the respecting PF of each demand as a multiplier of the ADD set.

The multiplier for the MDD was 1.8 and for PHD was 3.15 as identified in Section 2.5.4.

6.3 Water Model Simulations

Modeling scenarios are used in the Water Model to provide means to store different facility sets, operation conditions and data sets. For the updated City Water Model, three different steady state scenarios were created for simulation. These scenarios were (1) ADD, (2) MDD, and (3) MDD+FF.

The **ADD Scenario** serves as a benchmark and as a planning tool for long-term issues at the system level, such as supply acquisition and integrated resources management. This scenario is designed to produce results when the following conditions are present:

- ADD
- Reservoirs are at 90% Capacity
- Pumps are On

The **MDD Scenario** serves as a planning tool at the pressure zone level. MDD is the peak loading for typical booster-reservoir pressure zones for analysis of supply requirements. This scenario is designed to produce results when the following conditions are present:

- MDD
- Reservoirs are at 50% Capacity
- Pumps are Off

The **MDD+FF Scenario** serves as the worst-case scenario for the system. MDD+FF is intended to determine the system capacity for fire flow requirements under a worst-case scenario while maintaining a minimum residual pressure of 20 psi throughout the system. This scenario is designed to produce results when the following conditions are present:

- MDD+FF Demand by Land Use Category
- Reservoirs are at 50% Capacity
- Pumps are Off

6.3.1 Output Data

Following a successful simulation, Water Model output data include (1) pressure at every point, (2) flow and energy losses through every pipe and (3) performance of every valve, pump and tank. Data output format may be tabular, graphic or both depending on the nature of the scenario.

6.3.2 System Pressures within the System

Under a MDD event, tanks would be at 50% capacity and no pumps would be on with the exception of the pressure regulating valves to feed Pressure Zone IIa and IVa. Each pressure zone ranges in static pressure due to its HGL. The static pressure is a great tool for planning purposes. Appendix D contains MDD pressure contours for each corresponding pressure zone.

Table 6-5 – Static Pressure Ranges by Pressure Zone

Pressure Zone	Static Pressure Range
I	50 psi to 110 psi
II and IVa	50 psi to 120 psi
III	40 psi to 140 psi
IV and IVa	30 psi to 110 psi
V	30 psi to 130 psi

6.4 Model Calibration

The Water Model was calibrated in 2009 with extensive field flow testing and utilization of SCADA data.

During 2009, IDModeling, Inc (IDM), created a technical memorandum along with input and discussions with ***Civiltec*** describing in detail the various calibration efforts performed for the existing 2009 Water Model for the City. IDM worked with the City, Nobel Systems (GIS database creators) by performing an extensive GIS audit to prepare the GIS databases used to create, and ultimately calibrate the Water Model to function under steady state and extended period simulations. IDM was able to create a functioning Water Model containing unique identification for all elements (i.e. pipelines, junctions, tanks, etc.), various valve and pump settings, and junctions containing latest elevation data using a digital elevation model (DEM).

The Water Model created by IDM was then updated by ***Civiltec*** and continually updated and calibrated with new data as available from field tests. No additional field calibration was performed for this Water Model update, except that friction values in areas of no previous calibration field tests were updated using the software recommendation for the age of pipe and material type. Calibration has been achieved by making incremental adjustments to elements in the Water Model associated with energy loss until modeled results and field data were comparable. In general, friction losses are the primary sources of energy losses in any distribution system, which is essentially comprised of relatively long and straight small diameter pipelines that carry water at low velocities.

6.4.1 Steady State Calibration

Steady state calibration focuses on verification of vertical control and energy losses due to friction in the system. Vertical control was established by two means: verification of elevations from historical maps and comparison of historical fire flow records to model results.

The base map includes elevation data at key intersections throughout the system. Water Model elements adjacent to these intersections were assigned the base map elevation and elements between these intersections were assigned an interpolated value.

Energy losses in the system are the result of friction between flowing water and the interior of the pipe walls. For purposes of the Water Model, the pipe roughness is described by a coefficient known as the Hazen-Williams roughness coefficient (aka C-factor).

6.4.2 Fire Flow Requirements

Fire flow capacity is the governing factor in pipeline design. Fire flow demand was allocated based on the land uses provided in Table 6-6.

Table 6-6 – Fire Flow Requirements

Fire Flow Demand (GPM)	Land Use
1,500	Residential
2,000 to 3,000	High Density Land Use
5,000	Commercial, Institutional

Per the Los Angeles County Fire Department Regulation #8, fire flows between 1,251 gpm and 3,500 gpm may be met by having two adjacent hydrants flowing simultaneously, and fire flows of 3,501 gpm or higher may be met by having up to three adjacent hydrants flowing simultaneously.

The Water Model was programmed to represent existing MDD under fire flow conditions (MDD+FF) with all tanks set at 50% capacity. The Water Model simulated a fire flow at each hydrant location at rates between 1500 gpm and 5000 gpm as described above. Data were returned that represented the performance of each hydrant under the above conditions with respect to maintaining a minimum residual pressure of 20 psi throughout the system. Fire flow results are provided in Chapter 8.

6.5 Final Review and Adjustments

Lastly, ***Civiltec*** verified the updated elevations at the junctions, reviewed all facilities configurations and controls, and adjusted pipe roughness based on industry standard recommendations for pipe material and age as well as previous field fire flow tests. C-Factors used to update the model are shown below in Table 6-7. ***Civiltec*** also collaborated with City staff to ensure pipelines in the model contained its correct attributes in terms of installation year and material.

Table 6-7 – Roughness Coefficients per Pipe Material

Pipe Material	C-Factor	Linear Footage of Pipe	% of Total Pipe
Asbestos Cement	130	548,106	75%
Cast Iron	110	187,57	3%
Ductile Iron	120	19,634	3%
Poly-vinyl Chloride	140	1,217	≤ 1%
Steel	120	20,717	3%
Steel CML&C	130	94,568	13%
Unknown	120	23,271	3%
Others	125	9,183	1%
Totals		**735,453**	**100%**

Once the model was updated and re-calibrated, the model was considered functional for analyses. However, the model was continually updated throughout the WMP process as new information was identified or revised if Water Model results did not match what the operation staff encountered in the field. A Water Model is a living model that must be continually refined in order to accurately reflect the existing water system and the ongoing changes to the system.

Chapter 7 - DESIGN CRITERIA

7.1 General Description

The design and planning criteria that follow have been largely taken from the City's 2010 WMP update and adapted to conform to current demand patterns and applicable sections of the 2016 California Fire Code and 2016 Los Angeles Fire Code, Title 32. The design and planning criteria are used (1) as a benchmark for evaluating the capacity of the existing water distribution system, (2) as a guideline for cyclical replacement of existing infrastructure (Asset Management) and (3) a guide for recommending improvements for future conditions.

As a convention, each criterion or set of criteria is indicated in italics followed by a detailed description of its purpose and the driving factors behind its inclusion.

7.2 Design Period

The design period is limited to a 5-year planning horizon consistent with the development of existing (2020) and near-term (2025) demand conditions as shown Chapter 2.

7.3 Design Criteria

The Design Criteria are used to evaluate the hydraulic capacity of the distribution system. Such a hydraulic evaluation is the quantitative analysis comparing field measurements or engineering calculations (specifically the results generated by the Water Model) with a series of benchmarks that reflect customer expectations, the regulatory environment, sustainable design, redundancy/reliability, functionality, emergency preparedness, efficiency, and economics.

7.4 Ratios for MDD and PHD

The following ratios have been developed from the City water use data and used to predict MDD and PHD, which the water system must be capable of supplying:

- MDD = 1.8 x (ADD)
- PHD = 3.15 x (ADD)

7.5 Water System Pressure Criteria

Goal for Normal System Pressure Range: 40 psi to 130 psi

The level of service that is provided for domestic use is based on the available water pressure. The stated goal is provided for a rather wide range of pressures. Due to the undulating terrain within the service area, a narrower goal is complicated to achieve. Establishment of a range for normal pressure is driven by customer exceptions. The Design Criteria ultimate goal for system pressures for distribution mains under normal operating conditions should be 40 to 130 psi. Individual pressure regulators should be installed on all services that could have pressure greater than 80 psi at the meter as recommended in Section 608.2 of the 2013 California Plumbing Code. It is typically the customer's responsibility to install and maintain these pressure regulators at their own expense.

Daily Pressure Fluctuation: 20 psi maximum
Stable water pressure is desirable at service connections for consistency of service delivery. Minimizing pressure fluctuation during the course of the day will result in more consistent delivery. Establishment of a range for daily pressure fluctuation is driven by costumer expectations.

Goal for Minimum Pressure During a Fire Event: 20 psi
For fire conditions, residual pressures should not fall below 20 psi when delivering the required fire flow rate. The minimum residual pressure requirement was established by Los Angeles County Fire Department and has been adopted by the City's Fire Department. This threshold provides a buffer against the possibility of negative pressure in the distribution system which could result in contamination ingress. Guidance on fire flow requirements for new construction is provided by Los Angeles County Fire Department Regulation #8 (V7-C1-S8, Fire Flow and Hydrant Requirements). An exception to the 20 psi minimum is allowed for fire hydrants that are located close to the reservoirs as to not be able to 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. It is recommended to provide a level of fire protection consistent with Los Angeles County Fire Code Regulation #8, and to examine requirements for new construction on an individual basis in cooperation with the Community Development Department and the City Fire Chief at the developer's expense. The residual pressure requirement is driven by the regulatory environment.

Goal for Maximum Pressure during Minimum Hour Demand with Respect to Facilities: 150 psi or pipeline pressure class, whichever is less
Maximum pressures typically occur (1) at production and transmission facilities such as wells, booster pumping stations, and control valves or (2) at low elevations. 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 150 psi as an ultimate goal, or the pressure rating of the pipe, whichever is lower.

During the normal operation of facilities, a surge of energy may affect the system when a pump is turned on or off or when a control valve is opened or closed. This energy surge creates a pressure wave that could potentially damage sensitive machinery or vulnerable pipelines already under high pressure. Various devices and operational techniques should be installed or implemented to mitigate the negative impacts of surge and to ensure that pressures do not exceed 150 psi or the pressure class of the pipe.

The goal for maximum system pressure is driven by sustainable design.

7.6 Supply Criteria

Combined production capacity of MDD with largest single source out of service.
The total water production capacity from the various sources of water supply that make up the supply portfolio must be capable of collectively achieving MDD with the largest single source out of service. This standby capacity provides system reliability should wells or imported water connections be out of service during MDD. This level of redundancy will allow the City to maintain normal deliveries regardless of the temporary loss of a source of supply

due to unforeseen emergency or maintenance. Minimum production capacity is driven by the merits of redundancy and economics.

Combined production capacity sufficient to refill emergency and fire storage in two days (48 hours) with all sources operating.
A depletion of emergency and fire storage creates a temporary vulnerability to immediate, ongoing or subsequent events that would otherwise be mitigated. This vulnerability can be minimized by rapid replenishment of storage. The 48-hour refill requirements are driven by emergency preparedness.

7.7 Storage Capacity

Sum of Operational, Fire, and Emergency Storage in each pressure zone.

- Operational Storage: 30% of MDD
- Fire Storage: Per 2016 Los Angeles County Fire Department Regulation #8
- Emergency Storage: 24 hours at MDD

The principal functions of storage in a water system are:

- To equalize fluctuations in hourly demand so that extreme and rapid variations in demands are not imposed on the source of supply *(Operational Storage);*
- To provide water for firefighting *(Fire Storage)*; and
- To reach demand during an emergency such as a disruption of the major source of supply, a power outage, a pipe break or other unforeseen emergency or maintenance issue *(Emergency Storage).*

Operational Storage

Operational storage describes the volume needed to equalize the difference between supply and demand over the course of a day. Maximum operational storage would typically occur under the MDD conditions. 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 and 30% of MDD. As a result, the recommended operational storage should equal to 30% of the MDD for all zones with storage. The operational storage requirement is driven by system functionality.

Fire Storage

The water system must be capable of achieving MDD and firefighting requirements simultaneously. The City's fire storage criteria are developed based on the recommendations of the Insurance Services Office (ISO), Los Angeles County Fire Department Regulation #8, and City’s Fire Department. The City is predominantly a residential community, with the fire flow requirement of 1,500 gpm for a 2-hour duration. However, within the City there are centers of retail and office commercial, as well as manufacturing and warehousing facilities, which can have a higher fire flow requirement and longer duration from 3,000 gpm for 3-hours to 8,000 gpm for 4-hours, depending upon the floor area square footage and usage.

Each pressure zone in the City must be analyzed to determine the highest fire flow requirement and duration to achieve the criterion herein.

Emergency Storage

Emergency storage is required to achieve 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 MDD conditions. This duration is based on a review of potential supply sources and their respective outages. The emergency storage requirement is driven by emergency preparedness.

Equivalent ADD Storage

Operational storage is equivalent to 30% of MDD or 0.54 ADD. Emergency storage is equivalent to 100% of MDD or 1.8 ADD. Therefore, the equivalent ADD storage requirement for the system is 2.34 ADD, not including fire flow requirements.

MWD Storage Recommendation

The MWD staff has recommended, since the late 1960's, that member agencies, and their wholesale water customers, design their systems to withstand a shutdown of MWD's facilities for a seven-day period. The MWD staff strongly recommends these 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 periods. In an emergency or water shortage, MWD will implement rationing to impacted agencies. The City is dependent on imported water year-round, therefore, it is recommended that the City water system contain, as a minimum, storage equal to seven days of average water use, for an emergency shut down of the TVMWD Miramar Water Treatment Plant while operating emergency water supply facilities. It is assumed that the City can utilize 50% of the Miramar Reservoir storage capacity, equivalent to 8 MG. The MWD Weymouth Filtration Water Treatment Plant is considered to be active if the TVMWD Miramar Water Treatment Plant is shut down, therefore the TVMWD Pump Back Station and the City's Hillcrest Booster Station can be activated.

7.8 Booster Pumping Stations

The existing City service demands are met directly by the booster pumping stations and reservoirs.

Pressure Zones with Elevated Storage

The water surface in a reservoir serves to establish the hydraulic gradient of the pressure zone. That is, system pressure fluctuates relative to the water surface in the reservoir. In pump and reservoir systems, booster pumping stations should be sized to supply MDD with the largest pump out of service. In addition, the booster pumps and storage combined should be capable of achieving PHD. If there are sources of supply other than the booster pumping stations to the pressure zones, then the capacity from the sum of the sources of supplies and the booster pumping station capacity should be able to provide MDD with the largest booster out of service. Minimum booster capacity for a pump and reservoir system is driven by redundancy.

Pressure Zones without Elevated Storage

In pressurized systems, the hydraulic gradient is established artificially. There are various means to accomplish this: (1) a balance is established between pumps which add pressure and relief valves that will reduce pressure, (2) pumps may be equipped to regulate the amount of energy they impart to the water with VFDs, or (3) pressure is established in a hydro-pneumatic tank by an air compressor. With no elevated storage to equalize supply and demand, the entire burden of supplying the pressure zone falls to the booster pumps and other supply sources (wells and imported water connections). In pressurized systems, booster pumping stations should be sized to supply MDD+FF or PHD, whichever is greater, with the largest pump out of service. If there are sources of supply other than the booster pumping stations, then the capacity from the sum of the sources of supplies and the booster pumping station capacity should be able to provide MDD+FF or PHD, whichever is greater, with the largest of each source out of service. Minimum booster pumping station capacity for a pressure sub-zone is driven by redundancy.

7.8.1 Additional Booster Pumping Criteria

Station Sizing

Each pumping station should have a minimum of two pumping units of equal capacity, each sized to provide MDD, so that service will remain uninterrupted in the event one pump is not operational. Pumping stations that have more than two units should have adequate capacity to achieve MDD with the largest unit out of service. This criterion provides system reliability and flexibility. Booster station design is driven by redundancy and efficiency.

It is also recommended that the City maintain an alternative power source for operating critical supply pump stations in case of power failure during emergencies, especially hydro-pneumatic pump stations. The City currently has two portable generators and the ability to connect them to critical facilities.

Pump Efficiency

Maintaining high overall pumping plant efficiency is essential for minimizing energy costs. All pumps are tested periodically for efficiency on a two-year basis. Any time a booster pump falls below 65% efficiency, it becomes a candidate for maintenance or replacement to increase efficiency. The importance and typical operation of a booster pump will also play a critical role in recommended improvements based on efficiency. Pumps used often or continuously have a higher priority than pumps that are rarely used or not needed for normal operations. Pump maintenance/replacement is driven by efficiency and economics.

7.9 Pressure Reducing Stations

Capacity equals MDD+FF or PHD within the continuous rating of valves. Maximum intermittent flow rating of valves is acceptable for FF. Allowance is made for low flows.

In general, pressure reducing and pressure sustaining stations should be provided when needed to supplement deliveries to lower pressure zones and pressure subzones or to supply closed pressure zones. 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 achieve MDD+FF or PHD, whichever is greater, within the continuous flow rating of the valves.

It is recommended that at least 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, including MDD and FF.

Pressure reducing stations that are intended to supply lower zones from upper zones should be analyzed for their specific tasks and sized appropriately. Three valves, staggered to deliver the required range of flows and pressure, should be installed in this typed of station.

These recommendations are driven by the need to provide consistent and stable system pressure to lower elevations.

7.10 Pipeline Design Criteria

7.10.1 Transmission Mains

Maximum Pipe Velocity Under Normal Operation Conditions: 5 feet per second (fps). Maximum Energy Loss Under Normal Operating Conditions: 10 feet of head loss per 1000 feet of pipe

Transmission mains are intended to efficiently carry large volumes of water between facilities (i.e., production, treatment, booster stations, and storage). Transmission mains should be sized in conjunction with the design of pumping stations to deliver MDD. Reservoir inlet-outlet lines should be designed for MDD+FF or PHD, whichever is greater. Transmission mains should also be sized such that the operating storage of reservoirs is replenished during minimum demand periods at night.

Energy losses along transmission mains can be managed/reduced by controlling pipe velocity. The primary methods for controlling pipe velocity are (1) increasing pipe diameter, (2) providing multiple flow pathways, and (3) reducing flow rate. Regardless of the method used, efficiency drops off rapidly when pipe velocity exceeds 5 fps. Note that velocity and energy loss (i.e., feet of head loss per 1000 feet of pipe) are indirectly related measurements of transmission efficiency and both should be examined independently.

Dramatically over-sizing the transmission mains to reduce velocity can inadvertently increase detention time leading to certain water quality issues. As time increases between the points of production and delivery, complications due to stagnation and decay of disinfectant residual outweigh improvements in energy efficiency. Therefore, a balanced system will simultaneously keep energy loss and water quality degradation in check.

Transmission mains capacity Design Criteria are driven by efficiency and water quality management.

For reservoir inlet and outlet, pipe velocity range = 4 to 6 fps.

A reservoir is a passive system that should simultaneously complement transmission and provide emergency flow. Driven by efficiency and emergency preparedness.

7.10.2 Distribution Mains

Distribution mains should be sized to satisfy three (3) conditions:

- MDD+FF with Residual Pressure of 20 psi
- PHD with a Minimum System Pressure of 40 psi
- Maximum Pipe Velocity: 10 fps

Distribution mains carry water to service connections and fire hydrants. Fire flow is typically the governing factor in sizing distribution mains, although normal operations under peak demand conditions should also be examined for efficiency. Distribution main design is driven by efficiency and emergency preparedness.

To provide adequate fire flow, the minimum water main pipeline diameter should be 8-inches throughout the system.

Use standard pipe sizes of 6-, 8-, 12-, 16-inches for distribution. The diameter of a replacement pipeline should be a minimum of 8-inches, unless hydraulic analysis demonstrates that a 6-inch pipeline will suffice. Use of nominal pipe diameters is driven by economics and standardization.

7.11 Fire Flow and Fire Hydrant Spacing Requirements

Fire hydrant spacing and flow are in accordance with the 2016 California Fire Code, City General Plan and Los Angeles County Fire Department Regulation #8 or as determined by the City's Fire Chief. Fire requirements are driven by the regulatory environment and emergency preparedness.

In general, 2016 California Fire Code provides guidance for determining the fire flow requirements for new construction that consider the following conditions:

- Occupancy and Use
- Building Materials
- Proximity to Adjacent Structures
- Ground Floor Area
- Number of Floors
- Access to Hydrants
- Allowances for the Installation of Fire Suppression Systems

The following criteria are required for the City's fire protection.

Minimum Fire Flow for Buildings

- Single-Family Residential Building – 1,500 gpm for 2-hour at 20 psi residual pressure.
- All Other Buildings – Per the 2016 California Fire Code, up to a maximum of 8,000 gpm for 4-hour at 20 psi residual pressure.

Flow from Multiple Hydrants

Per the 2016 California Fire Code, the fire flow requirement for a building may be met by multiple hydrants flowing simultaneously under the following conditions:

- One Hydrant –1,250 gpm and below
- Two Hydrants – 1,251 – 3,500 gpm flowing simultaneously
- Three Hydrants – 3,501 – 8,000 gpm flowing simultaneously

Minimum Fire Hydrant Requirement

- Residential Area – One Family DUs - Minimum number of one fire hydrant with an average spacing of 500 feet and 300 feet for on-site and off-site respectively.
- Residential Area – Multi-Family DUs - Minimum number of one fire hydrant with an average spacing of 400 feet and 300 feet for on-site and off-site respectively.
- Commercial Area – Minimum number of three fire hydrants with an average spacing of 400 feet and 300 feet for on-site and off-site respectively.
- Industrial Area – Minimum number of five fire hydrants with an average spacing of 300 feet for both on-site and off-site.

Hydrants should be of approved type and have no less than a 6-inch diameter connection with water mains. Hydrants should be placed at least 100 feet from the building being protected and along fire apparatus access roads and drives.

Sprinkler Systems

Upon approval by the City's Fire Chief, an automatic sprinkler system may be provided to reduce the fire flow requirement from public hydrants for a particular building. Water for sprinklers may be supplied by the domestic system, a pressure tank, a gravity tank, or other means in accordance with the National Fire Protection Association (NFPA) 13. Water tanks shall be installed in accordance with NFPA 22 (California Building Code, Chapter 9). According to the 2016 Los Angeles County Fire Code, a reduction in required fire flow of up to 50%, as approved, is allowed for two-family dwellings when the building is provided with an approved automatic sprinkler system. The resulting fire flow shall not be less than 2,000 gpm for 2-hour at 20 psi residual pressure.

7.12 Planning Criteria

Planning criteria deal with cyclical infrastructure replacement due to age, condition and other non-hydraulic factors. Note that it is possible for a pipeline or other equipment to achieve the hydraulic requirements established by the Design Criteria, while at the same time exhibit costly repairs or downtime due to fatigue, corrosion, normal wear, poor workmanship, incompatibility, or other issues associated with deterioration. Planning criteria provide a secondary methodology for identifying and mitigating vulnerabilities in the system by a combination of qualitative and quantitative analyses.

Planning criteria are not meant to be a rigid set of rules that narrowly define service life; rather, they provide guidance for determining those portions of the distribution system that would benefit most from replacement in advance of higher and unsustainable costs associated with maintenance and inefficiency.

Local conditions must be considered in determining planning criteria, such as water quality (low pH can accelerate corrosion, high hardness can lead to calcification), geology (some types of soil accelerate corrosion, some areas may be prone to differential settlement), access (changes in land use, easements or rights-of-way may impact future facility ingress or pipeline alignments; pipelines straddling property lines may no longer be desirable; paving moratoria may affect scheduling), etc.

Internal goals should also be incorporated into the planning criteria. Implementation of Time-of-Use energy rates, water conservation initiatives, improving customer satisfaction, attention to secondary water quality standards, operations maximization, etc. can be quantified and applied as planning criteria.

Well designed and maintained water systems will provide many years of superior performance, but at some point, replacement of individual components is necessary for sustainability. Table 7-1 provides general parameters for determining when a particular component should be replaced. A combination of time interval and indication of performance provides solid justification for replacement.

Table 7-1 – Replacement Schedules and Indications

Component	Interval (years)[(1)]	Indication
Pipeline	60	Frequent Repair History, Excessive Energy Losses
Pump/Motor Overhaul	15	Drop in Efficiency Below 65%
Pump/Motor Replacement	30	Frequent Repair History, Drop in Efficiency
Control Valve Overhaul	25	Leaks, Poor Response, Frequent Repairs
Tank Recoating	15	Evidence of Corrosion
Tank Replacement	80	Frequency/Extent of Repair History
Well Refurbishment/ Replacement	50	Decline in Effective Capacity
Production Meter Calibration	5	Drop in Accuracy
Production Meter Replacement	20	Drop in Accuracy and Reliability

[(1)] The intervals listed herein are for guidance only. The actual replacement of any facility will be based upon a detailed assessment of performance, condition, and repair history.

Chapter 8 - EXISTING SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS

8.1 General

According to the City's 1998 General Plan, the City will expand its developed land area by 10.53% and its population by 15.88% by the year 2035 (ultimate build-out term). As a result, water demand may increase 26% from a high of 8,101 AF in 2013 to an ultimate demand of 10,542 AF, based on the demand projections corresponding to the maximum built-out area as presented in Chapter 2. It is essential to compare the future total water demand and the water supply system capacity requirement with the capacities of the existing supply facilities based on the Design Criteria described in Chapter 7 to set up a step-by-step system improvement plan to ensure an adequate water supply system that will achieve future demand.

The analysis of the City's water system to determine required improvements was approached by the identification of existing water supply sources and employing computer simulation technology to assess the ability of the storage, pumping, transmission and distribution systems to achieve existing and projected demands. Although the Water Model is a key element in the determination, other major considerations are included in the development of the recommended improvements. These considerations include:

- Water Source including Wells and Imported Water from TVMWD and MWD
- Condition of Existing Facilities
- Storage
- Pumping Capacity and Efficiency
- Maintaining Proper Water Quality throughout the System
- Operational Parameters Determined by City Management and Staff

8.2 Water Demand Comparison

Water demand forecasting in this WMP and the WMP performed in 2010 has the following difference detailed in Table 8-1.

Table 8-1 – Demand Forecasting Comparison

Item	WMP 2020	WMP 2010	Difference (%)
Land Uses (acre)	5,815	5,815	0
Build-out Population	36,089	37,430	(3.58)
Top 20 Consumers (AFY)	1,297	1,328	(2.33)
MDD Factor (x ADD)	1.54*	1.8	(14.44)
Ultimate Total Demand (AF)	10,542	11,445	(7.90)
Demand Per Person (AFY capita)	0.292	0.306	3.59
Demand Per Acre (AFY acre)	1.81	1.97	3.55

*A multiplier factor of 1.15 has already been used to determine the duty factors (per Chapter 2) and estimate the future demand. To determine the MDD for future at the maximum build-out, only the 1.54 factor has been used with no additional annual variation factor.

Figure 8-1 – Historical Production

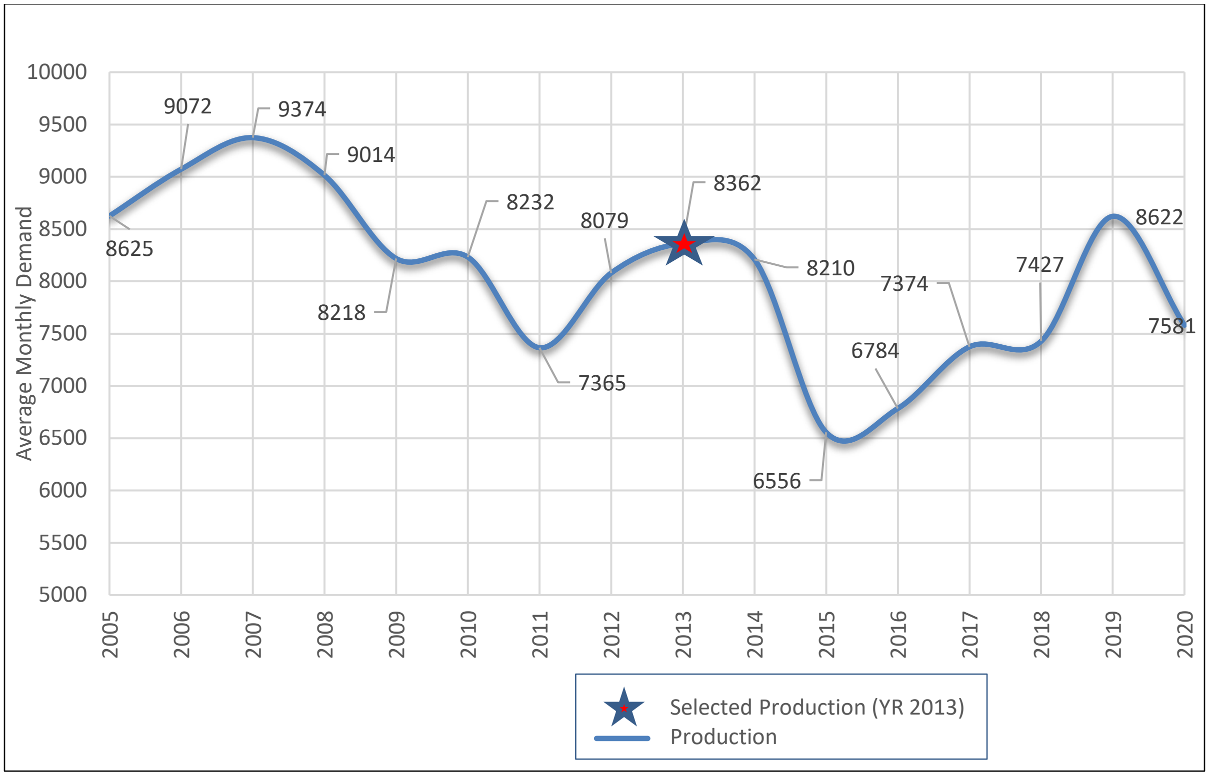


Figure 8-1 shows historical demand fluctuations as annual production totals for calendar years 2005 to 2020.

By observing the 3-year period from 2005 through 2008, the water production fluctuates between 8,625 AF and 9,014 AF with an average value of approximately 9,000 AFY; however, starting from 2009 through 2011, there is a drop in average annual production.

The average annual production started to increase again during the period 2011 through 2014, from 7,365 AF in 2011 to 8,210 AF in 2014, with the highest production of 8,362 AF being in 2013.

For purposes of long-term planning, future production is assumed to be similar to the water production pattern from 2012 to 2020. After reviewing the historical production data and reviewing its trend, the production of 8,362 AF in 2013 and the study period of 2012 to 2020 will be considered for the water production analysis.

8.3 Analysis Objective

The objective of performing the water system analysis is to determine the adequacy of storage, pumping and supply facilities to achieve existing and near-term demand scenarios. Demand analyses and demand values were determined, and included in this effort, to characterize system surpluses and deficits.

8.4 Storage Analysis

In 1972, the City began to import water from the PVMWD Fulton Plant to blend with local groundwater to achieve water quality goals and to compensate for increasing uses. In 1987, the City transitioned its import water source from the PVMWD Fulton Plant to import water from the TVMWD Miramar Water Treatment Plant. Miramar has an effluent storage capacity of 16 MG and it is assumed herein that the City has access to approximately 50% of this capacity, or 8 MG, in the event of a planned shutdown of the MWD supply to TVMWD. This storage will not be available to the City if the TVMWD Pump Back Station (located at Old Baldy Well site) is in use to supply the GSWC Claremont System.

Storage analysis compares the storage capacity to the storage requirements in each pressure zone. Storage requirements are based on ADD and MDD+FF. The storage analysis is summarized by pressure zone in Table 8-2. Fire flow requirements are discussed in Section 8.4.1.

The principal functions of storage are:

- To equalize fluctuations in instantaneous demand so that extreme and rapid variations in demands are not imposed on the sources of supply;
- To provide water for firefighting; and
- To achieve demand during an emergency such as a disruption of the major source of supply, a power outage, a pipe break or other unforeseen emergency or maintenance issue.

There are two methods of calculating the required storage to achieve the needs of the City's water system.

1st Method: Required Storage per Pressure Zone – *Operational, Fire and Emergency Storage*

2nd Method: System's Capability During Shut Down with Largest Supply Off

8.4.1 Required Storage per Pressure Zone

Under the 1st Method, water storage criteria for water systems are based on the following operational, fire and emergency storage requirements, per the Design Criteria presented in Chapter 7.

Sum of Operational, Fire, and Emergency Storage in each Pressure Zone.

- Operational Storage: 30% of MDD
- Fire Storage: Per 2019 California Fire Code and City's Fire Department
- Emergency Storage: 24 hours at MDD

Operational Storage

The volume of water required equals to 30% of one day of the MDD or 54% of one day of ADD. Table 8-2 shows the operational storage required for each pressure zone for present day use, as well as for future use.

Table 8-2 – Operation Storage Requirement by Zone

Operational	Zone I	Zone II	Zone III	Zone IV	Zone V	Totals
2013 Demand (AF)*	3,481	2,089	522	1,760	249	**8,101**
Storage (MG)	1.44	0.85	0.22	0.73	0.10	**3.34**
Ultimate Demand (AF)	4,529	2,719	679	2,290	324	**10,542**
Storage (MG)	1.87	1.12	0.28	0.94	0.13	**4.34**

*Note: The 2013 ADD is based upon the total demand as presented in Table 2-2.

Fire Flow Storage

Fire storage is based on recommendations from the City's Fire Department with respect to land use. A more refined approach was taken for the following fire flow analysis, which harnesses the new capabilities of the Water Model and draws upon guidance provided by the Los Angeles County Fire Code Regulation #8 (V7-C1-S8), ISO, and City's General Plan.

Hillside, Low and Medium Density Residential Land Use were assigned a fire flow of 1,500 gpm. Pressure Zones III, IV, and V fall under this category. High Density Land Use was assigned a fire flow on a case-by-case basis, per guidance from Table 1 of Los Angeles County Fire Code Regulation #8. Required flows ranged from 2,000 gpm to 3,000 gpm based on estimated first floor square footage, number of stories and exposure to adjacent parcels. Pressure Zone II falls under this category. All other land uses were assigned the maximum fire flow of 5,000 gpm. Pressure Zone I has a mixture of various land usage but the highest fire flow requirement governs – hence the fire flow requirement is 5,000 gpm for this pressure zone.

Table 8-3 indicates the present and future fire flow storage requirements by pressure zone.

Table 8-3 – Fire Flow Storage Requirements by Zone

Pressure Zone	Zone I	Zone II	Zone III	Zone IV	Zone V	Total (MG)
Fire Flow (gpm)	5,000	3,000	1,500	1,500	1,500	-
Duration (hours)	4	3	2	2	2	-
Fire Flow Storage (MG)	**1.20**	**0.54**	**0.18**	**0.18**	**0.18**	**2.28**

Emergency Storage

Emergency storage is required to achieve demands during times of planned and unplanned equipment outages, such as a 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 MDD conditions. This duration is based on potential supply sources and their respective outages on an individual per pressure zone basis. The volume of emergency water required equals to 1 day of MDD or 1.54 days of ADD. Table 8-4 shows the emergency storage required for each pressure zone for present day use, as well as for future use.

Table 8-4 – Emergency Storage Requirement by Zone

Emergency	Zone I	Zone II	Zone III	Zone IV	Zone V	Totals
2013 Demand (AF)	3,481	2,089	522	1,760	249	**8,101**
Storage (MG)	4.79	2.87	0.72	2.42	0.34	**11.14**
Ultimate Demand (AF)	4,529	2,719	679	2,290	324	**10,542**
Storage (MG)	6.23	3.74	0.93	3.15	0.45	**14.49**

Total Required Storage

The volume of required water equals the accumulation of operational storage, fire flow storage and emergency storage. Table 8-5indicates the total required operational, fire flow and emergency storage to achieve the Chapter 7 criterion as compared to existing storage. Additionally, Table 8-6 and Table 8-7 provide the summary of both existing and ultimate storage capacities, broken down by pressure zone based on MDD.

Table 8-5 – Total Storage Requirements by Zone

Total Storage	Zone I	Zone II	Zone III	Zone IV	Zone V	Totals
2013 ADD (AF)	3,481	2,089	522	1,760	249	8,101
Recommended Storage (MG)	7.42	4.27	1.11	3.33	0.63	16.76
Existing Storage	8.50	4.50	2.50	8.50	3.00	27.00
Surplus/(Deficiency) (MG)	1.08	0.23	1.39	5.17	2.38	10.24
Ultimate ADD (AF)	4,529	2,719	679	2,290	324	10,542
Recommended Storage (MG)	9.29	5.40	1.39	4.27	0.76	21.12
Surplus/(Deficiency) (MG)	(0.79)	(0.90)	1.11	4.23	2.24	5.88

Table 8-6 – Storage Analysis for Existing Conditions (based on MDD)

Storage Analysis by Zone	Zone I	Zone II	Zone III	Zone IV	Zone V	System
MDD (AF)	3,323	1,994	498	1,680	238	7,733
Fire Flow (gpm)	5,000	3,000	1,500	1,500	1,500	
Fire Flow Duration (hrs)	4	3	2	2	2	
Operational Storage (MG)	1.44	0.86	0.22	0.73	0.10	3.34
Emergency Storage (MG)	4.79	2.87	0.72	2.42	0.34	11.14
Fire Storage (MG)	1.20	0.54	0.18	0.18	0.18	2.28
Total Required Storage (MG)	7.42	4.27	1.11	3.32	0.63	16.76
Available Storage (MG)	8.50	4.50	2.50	8.50	3.00	27.00
Storage Surplus / Deficiency (MG)	1.08	0.23	1.39	5.18	2.37	10.24

Table 8-7 – Storage Analysis for Ultimate Conditions (based on MDD)

Storage Analysis by Zone	Zone I	Zone II	Zone III	Zone IV	Zone V	System
MDD (AF)	4,324	2,596	648	2,186	309	10,063
Fire Flow (gpm)	5,000	3,000	1,500	1,500	1,500	
Fire Flow Duration (hrs)	4	3	2	2	2	
Operational Storage (MG)	1.87	1.12	0.28	0.94	0.13	4.35
Emergency Storage (MG)	6.23	3.74	0.93	3.15	0.44	14.49
Fire Storage (MG)	1.20	0.54	0.18	0.18	0.18	2.28
Total Required Storage (MG)	9.29	5.40	1.39	4.27	0.76	21.12
Available Storage (MG)	8.50	4.50	2.50	8.50	3.00	27.00
Storage Surplus / Deficiency (MG)	(0.79)	(0.90)	1.11	4.23	2.24	5.88

According to Table 8-5 and Table 8-6, there is a system-wide surplus of 10.24 MG under existing conditions. However, the analysis indicates that Pressure Zone I and II will ultimately be deficient in storage by 0.79 and 0.90 MG of storage, respectively, to achieve the criteria presented in Chapter 7.

Pressure Zone II can be fed from Pressure Zone III by gravity to help offset the deficit. Pressure Zone III presently has a surplus of 1.38 MG that can cover the Pressure Zone II deficit entirely for existing storage and would have a 0.21 MG surplus for future storage, if considered. However, per the analysis of water quality in Chapter 4, there are associated nitrification issues with Pressure Zone IV. It is recommended that the planned Wheeler Reservoir Chloramination Station be made operational as soon as possible to assist with managing potential nitrification in all pressure zones. As recommended and detailed in the CIP section, Pressure Zone IV surplus storage capacity of 5.18 MG can accommodate the storage deficiency and aging of Pressure Zones I, II, and III for existing and ultimate conditions.

The impact of water conservation will also influence the storage deficits. Under near-term conditions and per Chapter 2, Section 2.5.7 of Water Conservation, the ultimate water demand is based on a compliance factor of 211 gpcd is 8,530 AFY. This demand is within 2% of the 2013 existing conditions demand. Per Table 8-5, there is enough storage capacity to accommodate the 2% difference.

In the short-term, there are two approaches to solving the storage deficiencies cited in Table 8-5 and Table 8-7 on an interim basis. The first is to rely on storage at the TVMWD Miramar Reservoir to make up the difference between required and future storage. The second is to provide for storage sharing among the pressure zones through the installation of emergency PRVs or other control valves.

Reliance on storage at the TVMWD Miramar Reservoir is one option the City has to offset for the need to build more storage in Pressure Zones I and II for the ultimate build-out condition. It is assumed herein that the City has access to approximately 50% of the storage capacity of the TVMWD Miramar Reservoirs, which is equivalent to 8 MG. This capacity is sufficient to satisfy both the existing and near-term deficits but should not be relied upon as a permanent solution. By extension, all surplus storage capacity in the upper pressure zones (i.e., available storage minus fire and emergency storage) will be considered as operational storage.

8.4.2 System Capability During Shut Down with Largest Supply Off

Under the 2nd Method of calculating the required water storage to achieve the needs of the City's water system, the system's capability during a shutdown with the largest supply off is verified. The City's criterion calls for the water system to have the capability to achieve a supply shut down for a duration of 7 days.

Under this particular scenario, it is assumed that Miramar would not be shutdown concurrently with the MWD Weymouth Filtration Water Treatment Plant, and that emergency water supplies would be available from the PWRJF. With that assumption, the TVMWD Miramar Water Treatment Plant is considered to be largest supply and would be considered to be "temporarily out of service" under this analysis as shown under Section 8.5, *Seven Average Day Demand*.

With the largest supply off, the systems capability to achieve a planned TVMWD supply shut down for a period of 7 days. It is assumed that Miramar would not be shut down concurrently with the MWD Weymouth Filtration Water Treatment Plant, and that emergency water supplies would be available from the PWRJF.

8.5 Storage Recommendations

The goal of recommendations herein is to provide a framework within which the operations staff can maximize the use of available operational storage. The most effective use of operational storage considers a balance of a number of interrelated factors included among others. These factors are not listed in any priority.

- Equalization and Staging
- Pressure Fluctuation
- Energy Efficiency
- Energy Rate Structure (i.e., Time-of-Use)
- Water Age and Water Quality
- MWD Storage Recommendations

Equalization and Staging

When multiple storage sites serve a single pressure zone, the behavior of each reservoir is dependent on hydraulics including, among other things, production, staging and transmission. There may be opportunities to influence that behavior in an effort to maximize capacity. The equalization of the Amherst and Wheeler Reservoirs is of particular interest to the City. In the past, equalization in Pressure Zone I had been cited as an operational issue where the water levels at the two sites do not closely match under dynamic conditions.

Pressure Fluctuation

The level of service that is provided for domestic use is based on water pressure. Excessive fluctuation in water pressure during the course of a day should be minimized.

Energy Efficiency

There may be opportunities to maximize the most efficient path for transmission of water to higher pressure zones when multiple paths exist. Such efficiency may be a function of transmission pipeline diameter, length and condition, the operational capacity and efficiency of individual booster pumps and the proximity to demands.

Pump efficiency plays a significant role in improving energy efficiency. It is recommended to consider performing rehabilitation or replacement of pumps with an efficiency rating of less than 65%. Such improvements will likely reduce operating costs and extend the service life of the equipment.

Energy Rate Structure

SCE may be able to offer a variable rate structure if such a structure is to the mutual benefit of both agencies. Typical rate structures provide a lower off-peak rate and higher peak rate, which allows for modest savings when adequate operational flexibility is available. It is understood that each facility is billed individually and may be billed under a variety of rate structures upon the City's request. For purposes of this report, off-peak is considered to be between 6 p.m. and 8 a.m., although other off-peak periods may exist and vary by season.

Water Age and Water Quality

Adequate circulation of stored water is necessary to prevent water quality issues associated with water age and deficient disinfectant residual. The Water Model has been utilized to perform a disinfectant residual analysis. ***Civiltec*** has performed a disinfectant residual analysis as part of a nitrification study conducted in March 2017 and the results are summarized in Chapter 4 of this WMP.

Table 8-8 and Table 8-9 list the operational storage available in each pressure zone under existing and near-term conditions, respectively.

Table 8-8 – Available Operational Storage Analysis for Existing Conditions

Zone	Available (MG)	Fire (MG)	Emergency (MG)	Net Operational (MG)
I	8.50	1.20	4.79	2.51
II	4.50	0.54	2.87	1.09
III	2.50	0.18	0.72	1.60
IV	8.50	0.18	2.42	5.90
V	3.00	0.18	0.34	2.48

Table 8-9 – Available Operational Storage Analysis for Ultimate Conditions

Zone	Available (MG)	Fire (MG)	Emergency (MG)	Net Operational (MG)
I	8.50	1.20	6.23	1.07
II	4.50	0.54	3.74	0.22
III	2.50	0.18	0.93	1.39
IV	8.50	0.18	3.15	5.17
V	3.00	0.18	0.45	2.37

By observation, the greatest flexibility in terms of net operational storage under the City's direct control exists in Pressure Zones III, VI and V, although the practical extent to which this storage is available may be limited by other factors.

MWD Storage Recommendations

MWD encourages their member agencies and their sub-agencies to maintain seven average demand days of storage to survive the MWD system planned shutdown. The City has a reliable alternative source of supply from the PWRJF and has the ability to move 2,400 gpm into Pressure Zone I through the Hillcrest Booster Pump Station. This capacity equals 3.456 million gallons per day (MGD) of storage. This storage is applied to Pressure Zone I.

TVMWD has constructed the Pump Back Station at the Old Baldy site, which has the ability to pump 2,000 gpm from the PWRJF to the Lincoln Forebay (1,000 gpm is available to the City). The City can boost this water into Pressure Zone I through the White Avenue Pump Station. Considering the City blends water at this location at an approximate ratio of 20% groundwater to 80% import water, groundwater can be added to the supply at 200 gpm. This blended supply equates to 1.728 MG of storage each day, of which is applied to Pressure Zone I.

TVMWD has 16 MG of storage at Miramar. The City may have access to approximately 8 MG of this storage, unless the Pump Back Station is operational. This supply may also be blended with groundwater at the Plateau Forebay site at a ratio of 20% groundwater to 80% import water equating to 1.6 MG, daily, of groundwater. This equivalent storage is 9.6 MG and has not been applied to Pressure Zone IV as a worst-case scenario.

In summary, the City has an equivalent of 5.18 MG of storage available on a daily basis to offset a planned MWD system shutdown, through emergency water supplies, which equate to 36.29 MG over 7 days.

Seven Average Demand Days

The volume of water required to survive a planned MWD shutdown equals the amount of the 7 day average water demand, assuming that the TVMWD Miramar Water Treatment Plant is temporarily out of service. Table 8-10 indicates the existing and future storage requirements to achieve this criterion for storage.

Table 8-10 – Total MWD Storage Requirement by Pressure Zone

MWD Storage	Zone I	Zone II	Zone III	Zone IV	Zone V	Totals
2013 ADD (AF)	3,481	2,089	522	1,760	249	8,101
Required Storage (MG)	21.75	13.05	3.26	11.00	1.56	50.62
Existing Storage (MG)	8.50	4.50	2.50	8.50	3.00	27.00
Emergency Supply (MG)	36.29	-	-	-	-	36.29
Difference (MG)	23.04	(8.55)	(0.76)	(2.50)	1.44	12.67
Ultimate ADD (AF)	4,529	2,719	679	2,290	324	10,541
Required Storage (MG)	28.30	16.99	4.24	14.31	2.02	65.32
Existing Storage (MG)	8.50	4.50	2.50	8.50	3.00	27.00
Emergency Supply (MG)	36.29	-	-	-	-	36.29
Difference (MG)	16.49	(12.49)	(1.74)	(5.81)	0.98	(2.58)

This analysis indicates the City presently has 12.67 MG surplus in total emergency supply and storage to comply with the MWD recommendation but is storage deficient in Pressure Zones II, III and IV.

Operationally, surplus supply can be moved from Pressure Zone I to the higher zones through the existing booster pump capacity. The City is 2.58 MG deficient to achieve this recommendation at build-out per the City's General Plan. Another potential project to consider in the future, if water rights and blending operations can accommodate, is the construction of nitrate reduction plant at the White Avenue Plant. It is critical to note the potential nitrate reduction plant would be restricted to OSY of 7.601% or replacement water only. This new plant should be sized to treat 1,000 gpm of groundwater. The 1,000 gpm treatment plant can produce approximately 1.44 MGD (10.1 MG over 7 days) of treated groundwater to offset a shutdown of imported water supplies. This new treatment plant will eliminate the ultimate build-out 2.58 MG storage deficiency. The feasibility study of a nitrate reduction plant at the White Avenue Pump Station should be conducted to determine the practicality of building the new plant and considering its use on a daily basis.

8.6 Booster Pump Analysis

Booster pump stations lift treated groundwater water and import water from lower pressure zones to the higher-pressure zones. Imported water from TVMWD has a hydraulic gradient high enough to flow via gravity from the Miramar Transmission System to Pressure Zones I and II. The hydraulic gradient of the Miramar System can also reach Pressure Zone III most of the time, but during periods of high demand on the Miramar System, the gradient falls below that of Pressure Zone III. Import water has to be pumped to pressure zones higher than Pressure Zone III and is presently pumped to Pressure Zones IV and V. The existing booster pump station data is listed in Table 5-4 and Table 5-5. The Hillcrest pumps are only for emergencies for Pressure Zone I.

Gravity storage is available in all five main pressure zones. Per the Design Criteria in Chapter 7, booster pump station capacity must be able to serve the MDD with the largest single pump out of service in each pressure zone. Table 8-11 shows the analysis using the Design Criteria in Chapter 7. Based upon the demand of calendar year 2013 (the highest demand year in the analysis period), the existing pumping capacity generally has a surplus.

Table 8-11 – Booster Pump Stations Analysis (Year 2013)

Item	Zone I	Zone II	Zone III	Zone IV (2)	Zone V
Total Water Demand (AFY)	3,481	2,089	522	1,760	249
ADD (gpm)	2,158	1,295	324	1,091	154
MDD (gpm) PF = 1.8	3,884	2,331	582	1,964	278
Well Supply (gpm) 20% of MDD	777	NA	NA	393	NA
Booster Pump Station Capacity (gpm)	5,250	4,795	3,000	7,605	1,950
Single Largest Pump Capacity (gpm)	1,500	1,000	1,000	720	500
Operational Capacity (gpm)	3,750	3,795	2,000	6,885	1,450
Minimum Pump Capacity Required (gpm)	3,884	2,331	582	1,964	278
Surplus or (Deficit) (gpm)(1)	(134) (3)	1,464	1,418	4,921	1,172

Note:
(1) Surplus or deficit equals operational capacity minus minimum pump capacity required.
(2) Pressure Zone IV consumption includes Pressure Zone IIa, Zone IVa and the Live Oak Canyon customers. The Marshall Canyon Golf Course Club House consumption has been shifted to Pressure Zone V.
(3) Pressure Zone I is supplied by gravity from TVMWD at the White Avenue Pump Station which offsets any potential deficit.

Table 8-12 shows the pumping station analysis for ultimate build-out. This analysis indicates that Pressure Zones I will ultimately be deficient in pump capacity.

Table 8-12 – Booster Pump Stations Analysis (Ultimate Conditions)

Item	Zone I	Zone II	Zone III	Zone IV (2)	Zone V
Total Water Demand (AFY)	4,529	2,719	679	2,290	324
ADD (gpm)	2,808	1,686	421	1,420	201
MDD (gpm) PF = 1.8	5,054	3,034	758	2,555	362
Well Supply (gpm) 20% of MDD	777	NA	NA	393	NA
Booster Pump Station Capacity (gpm)	5,250	4,795	3,000	7,605	1,950
Single Largest Pump Capacity (gpm)	1,500	1,000	1,000	720	500
Operational Capacity (gpm)	3,750	3,795	2,000	6,885	1,450
Minimum Pump Capacity Required (gpm)	5,054	3,034	758	2,555	362
Surplus or (Deficit) (gpm)(1)	(1,304) (3)	761	1,242	4,330	1,088

Note:
(1) Surplus or deficit equals operational capacity minus minimum pump capacity required.
(2) Pressure Zone IV consumption includes Pressure Zone IIa, Zone IVa and the Live Oak Canyon customers. The Marshall Canyon Golf Course Club House consumption has been shifted to Pressure Zone V.
(3) Pressure Zone I is supplied by gravity from TVMWD at the White Avenue Pump Station which offsets any potential deficit.

Pump Efficiency

Between 2007 and 2019, SCE performed comprehensive booster and well pump efficiency tests for all City facilities (see Table 6-3). The reports indicated that the pumps are running at efficiency between 40% and 77%. The overall average is 61%. The efficiency of each pump should be a minimum of 65% per Section 7.8.1 of the Design Criteria. When any pump falls below 65% efficient, work should be performed on the pump and motor to increase the efficiency. Table 8-13 indicates the pumps that are currently below the recommended minimum efficiency.

Table 8-13 – Booster Pump Efficiency Improvements

Booster Station	Pump	HP	SCE Efficiency %
White Avenue	Booster 2	30	64
	Booster 3	100	64
	Booster 4	100	63
Damien	Booster 1	40	64
McCall	Booster 1	20	58
	Booster 2	30	57
Miramar	Booster 1	10	48
	Booster 2	10	42
	Booster 3	15	61
	Booster 4	30	52
Amherst – Pressure Zone II	Booster 7	60	60
	Booster 8	60	62
Amherst - Plateau	Booster 4	75	40
	Booster 5	75	58
Wheeler – Pressure Zone III	Booster 1	125	53
	Booster 2	125	61
	Booster 3	125	59
Pressure Zone III – Pressure Zone IV	Booster 3	15	57
Pressure Zone III – Pressure Zone V	Booster 1	25	64
	Booster 2	25	64
Live Oak	Booster 1	10	64
	Booster 2	10	60
	Booster 3	10	61
	Booster 4	10	57

Emergency Refill of Storage

Table 8-14 provides a summary of the booster pump and imported water capacity for Pressure Zones I through V to deliver dependent MDD plus emergency refill within 48 hours under existing conditions. The surplus capacity in Pressure Zone V can be used to offset the Pressure Zone IV deficit by dropping water from Pressure Zone V to Pressure Zone IV as necessary.

Table 8-14 – Booster Pump Storage Refill Analysis - Existing

Zone	MDD (gpm)	Refill (gpm)	Requirement (gpm)	Pump Capacity (gpm)	Gravity Import Supply (gpm)	Surplus/(Deficit) (gpm)
I	3,884	2,951	6,845	5,520	6,000	**4,415**
II	2,331	1,563	3,894	4,795	4,400	**5,301**
III	582	868	1,450	3,000	-	**1,550**
IV	1,964	2,951	4,915	7,605	-	**2,690**
V	278	1,042	1,320	1,950	-	**630**

Table 8-15 provides a summary of the booster pump and imported water capacity for Pressure Zones I through Pressure Zone V to deliver dependent MDD plus emergency refill within 48 hours under ultimate conditions.

Table 8-15 – Booster Pump Storage Refill Analysis – Ultimate

Zone	MDD (gpm)	Refill (gpm)	Requirement (gpm)	Pump Capacity (gpm)	Gravity Import Supply (gpm)	Surplus/(Deficit) (gpm)
I	5,054	2,951	8,005	5,250	6,000	**3,245**
II	3,034	1,563	4,597	4,795	4,400	**4,598**
III	758	868	1,626	3,000	-	**1,374**
IV	2,555	2,951	5,506	7,605	-	**2,099**
V	362	1,042	1,404	1,950	-	**546**

8.7 Existing Wells and Import Water Connection Analysis

8.7.1 Groundwater Wells

Local groundwater resources used to be the only resource to supply water to the City until nitrate was found in the groundwater in early 1970s. There are eight existing wells (see Table 5-6) in the City's system. The Beech, Walnut and Amherst Wells are the newest wells in the system (drilled in 2010, 2000 and 1999 respectively). Table 8-16 shows the summary of maximum day groundwater production records for 1985 through 2020.

Table 8-16 – Maximum Day Groundwater Production 1985-2020

Date (M/D/Y)	Groundwater (AF)	Wells Withdrawn From										Total Production (%)
		Cartwright Well	Mills Tract Well	Lincoln Well	Old Baldy Well	LVH #1 Well	LVH #2 Well	LVH #3 Well	Beech Well	Amherst Well	Walnut Well	
7/26/1985	19	X	X	X	X	X	X	X				51
8/27/1986	15	X	X	X	X							42
8/10/1987	17	X	X	X	X	X	X					43
7/23/1988	8		X	X								24
7/23/1989	10		X	X	X	X						27
7/25/1990	11	X		X		X	X					31
8/25/1991	6		X		X	X						22
8/29/1992	7	X				X	X					21
8/25/1993	8			X	X	X		X				25
8/25/1994	8			X		X	X					23
8/30/1995	5			X		X						14
7/25/1996	7			X	X		X					18
8/25/1997	6	X					X					18
8/25/1998	1						X					3
8/21/1999	4			X								11
7/27/2000	5			X								14
8/10/2001	5			X								13
7/26/2002	7			X						X		16
8/25/2003	7			X						X		17
7/26/2004	5			X								12
8/10/2005	7			X		X	X					17
7/18/2006	6		X			X	X					15
7/06/2007	7		X			X	X					17
6/21/2008	11			X		X	X	X		X		26
7/17/2009	10			X			X			X	X	26
7/16/2010	11			X			X	X		X	X	30
8/6/2011	10			X			X	X		X	X	27
8/8/2012	7			X			X	X				18
8/28/2013	9			X		X		X			X	24
7/25/2014	8		X							X	X	22
8/23/2015	7			X		X	X	X				24
8/17/2016	6			X		X	X					20
8/31/2017	10			X		X	X	X	X	X	X	33
8/19/2018	9			X		X	X	X		X	X	30
8/26/2019	5		X	X		X	X	X	X	X	X	17
8/15/2020	8		X	X		X	X	X	X	X	X	22

The health and capacity of the groundwater basins is a key factor in this scenario. Long term decline of the basins may adversely impact the basins and increase the risk of not recovering storage capacity due to subsidence.

Making the best use of the groundwater resources is a challenge for the City. It is not only a difficult task to balance the supply of groundwater vs. imported water, but one that would be time and money consuming to extensively treat the existing groundwater aquifers that contain nitrate, VOCs, perchlorate and other contaminates that may generate long-term cleanup problems. The City not only has the rights to use the local groundwater, but also has the responsibility to develop a long-term plan to protect the water quality for the shared groundwater basins.

The City has created the Live Oak Basin Optimization Modeling Report[5] in 2011 and it used information on the well construction and basin hydrogeology to develop a model of the City's four pumping wells located at the Live Oak Internal Fault. These four pumping wells are the Amherst Well and the La Verne Heights No. 1 through No. 3 Wells.

This model was used to analyze these particular wells under a variety of scenarios and understand its effects and evaluate hypothetical pumping schedules while having the goal of optimizing well production as well as minimizing long-term exacerbated drawdown effects due to excessive well interference.

The report contains results of various scenarios in terms of hypothetical operating schedules with the wells to observe if modifications on those schedules would result in maintaining stable water levels over a long term.

8.7.2 Import Water Connections

The seven City connections to the Miramar Transmission System are maintained by TVMWD personnel. TVMWD supplies quality import water and has had enough capacity to assist in achieving the City's demands since 1987. The maximum amount of water that can be supplied from these connections to the City is 33 cfs, equaling 23,890 AFY. The historic record shows that the connections at 5th and "C" Streets and at 5th Street and White Avenue are rarely used. The 5th and "C" Streets connection is for the benefit of blending the Walnut Well production and the 5th Street and White Avenue connection is only used in a pump back scenario. Not considering these two connections, the maximum imported water capacity from the TVMWD to the City is 15,927 AFY. In 2013, TVMWD supplied 7,541.61 AF of water to the City (the maximum year on record), which is 47% of the normal maximum supplying capacity.

[5]Published March 16, 2011 by Daniel B. Stephens and Associates, Inc. for the City

8.8 Fire Flow Analysis

Fire flow analysis was conducted on a pressure zone by pressure zone basis using the Water Model under the MDD+FF Condition.

- MDD+FF
- Tanks Set to 50% Capacity
- All Pumps Off
- Steady State Analysis

Fire hydrant locations were assigned one of the three requirements based on land as shown in Table 6-6.

- Residential Areas – 1,500 gpm
- Medium/High Density Areas – 3,000 gpm
- Commercial/Institutional Areas – 5,000 gpm

There is a total of 75 out of 1,312 hydrants that resulted in deficient flows when ran individually to achieve fire flow requirements as shown in Exhibit 9-1. Eleven of the 75 hydrants have a requirement of 1,500 gpm and the rest of the 64 hydrants have a requirement of 5,000 gpm. There were no deficiencies in Pressure Zones IV and V.

As noted in Section 6.4.2, fire flows between 1,251 gpm and 3,500 gpm may be met by having two adjacent hydrants flowing simultaneously, and fire flows of 3,501 gpm or higher may be met by having up to three adjacent hydrants flowing simultaneously.

Taking the multiple fire hydrant use criterion, the remaining deficient fire hydrants were modeled with either two or three hydrants flowing simultaneously. The number of deficient fire hydrants dropped to 10 as shown in Exhibit 9-2. These 10 fire hydrants will require pipeline improvements to achieve the required fire flow. Additional detail regarding the improvements is provided in Section 8.12 showing CIP projects.

Table 8-17 – Existing Deficient Fire Hydrants

Zone	I	II	II A	III	IV	IV A	V
# of Deficient Hydrants	6	3	0	1	0	0	0

8.9 Cross-Country Pipelines

Cross-county pipelines are defined as pipelines not constructed in public right-of-way and are difficult to access which tends to make them less reliable within a water system. However, the cross-country pipelines form hydraulic loops and in the City's case, creates hydraulic loops that improves the redundancy and capacity of pipelines.

There are currently 26 existing cross-country pipeline segments that total approximately 5,190 linear feet of pipelines in the City's water system as shown in Exhibit 10. After reviewing each segment, it is apparent that these pipelines are necessary for the system to function properly with redundancy. No feasible alternative pipeline construction will provide the same redundancy.

8.10 Pipe Break Analysis

The Water Model was used to determine system redundancy and identify pipelines that would be vulnerable in the event of temporary loss of primary transmission or distribution pipelines due to emergency or maintenance.

Dead-end pipelines that serve cul-de-sacs or an isolated area are the most vulnerable to the system. After reviewing the pipeline network, there are four pipelines that would produce the most danger in terms of loss in service connections. This analysis approximates the number of service connections associated with each identified dead-end portion.

Determining the number of potentially affected parcels offers insight into the dependence of customers on specific infrastructure and into the level of redundancy the City provides to those customers. Wherever convenient and practical, the City should consider improvements, or impose improvements on developers, that would limit the number of customers on dead-ends.

There are four areas that are very vulnerable and are discussed below. A pipe break in these areas would affect numerous parcels as outlined in each section.

8.10.1 Mountain Springs Ranch Road and Melinda Lane

This dead-end is the most vulnerable to a pipe break and can affect 79 parcels as shown in Exhibit 11-1. Future development of the open space to the north of Golden Hills Road between Melinda Lane and Monterrey Street should include additional connectivity between Mountain Springs Road, Melinda Lane, Divot Drive (i.e., to the north of Golden Hills Road) and Via Vista Court.

The Mountain Spring Reservoir will be able to supply this area while the pipe break is under repaired.

8.10.2 Ridgeview Drive and Skyline Circle, South of Oak Canyon

The dead-end as shown in Exhibit 11-2 serves approximately 36 parcels.

8.10.3 Vista Del Sol, East of Avenida del Risco

The dead-end as shown in Exhibit 11-3 serves approximately 45 parcels.

8.10.4 Valentine Circle, East of Canopy Lane

The dead-end as shown in Figure Exhibit 11-4 serves approximately 28 parcels.

8.11 Transmission and Distribution System Analysis

The Water Model was used to investigate the capability of the water system under various scenarios. Transmission pipelines were identified and modeled for compliance with the

Design Criteria. The distribution piping system was also modeled for compliance with the Design Criteria.

8.11.1 Transmission Pipelines Analysis

Transmission pipeline analysis compares pipe velocities and unit headlosses under normal operating conditions to establish maximum pipe velocities and unit headlosses. Normal operating conditions are described as ADD.

The capabilities used to transport large quantities of water across the system and to higher pressure zones have been analyzed by the Water Model. Transmission pipelines are considered to be at least 12-inches in diameter and larger. There are 8-inch well discharge pipes and 10-inch reservoir inlet/outlet pipes in the system that are also considered to be transmission pipelines.

The Water Model showed that there were no high headlosses under normal operating conditions. Velocities were under 5 fps and show no velocity deficiencies were found for transmission pipelines.

Maximum Pipe Velocity under Normal Conditions (ADD)

Maximum pipe velocity under normal operation conditions: 5 feet per second.

After running the Water Model and reviewing the results, it was confirmed velocities within transmission mains do not exceed 5 fps.

Maximum Energy Loss under Normal Operating Conditions (ADD)

Maximum energy loss under normal operating conditions: 10 feet of head loss per 1000 feet of pipe.

After running the Water Model and reviewing the results, it was confirmed that maximum energy losses under normal operating conditions do not exceed 10 feet of headloss per 1000 feet of pipe.

Reservoir Inlet/Outlet Pipe Velocity

According to the Design Criteria, reservoir inlet and outlet pipe velocities should not exceed 6 fps under normal operations.

After running the Water Model and reviewing the results, it was confirmed all inlet and outlet reservoir pipelines do not exceed 6 fps.

Booster Pump Station Vulnerabilities

Pressure Zone IVa is completely reliant on the Live Oak Hydropneumatic Pump Station. All other booster stations function in conjunction with other facilities (tanks, interties, wells, control valves and other booster stations). A pipe break was simulated at each booster station and steady state modeling results were compared to base conditions under MDD conditions.

Loss of the Pressure Zone III to Pressure Zone IV, Pressure Zone III to Pressure Zone V, Pressure Zone IV to Pressure Zone V, Amherst 4 and 5, Live Oak and McCall Booster Stations due to a pipe break do not lead to any adverse system pressure conditions under steady state analysis. Loss of the other four booster stations has the following steady state results:

Loss of the White Avenue Booster Station

Junctions in Pressure Zone I in the immediate vicinity of the White Avenue Booster Station experience a drop in system pressure of up to 5 psi. No Pressure Zone I connections fall below 40 psi as result.

Loss of the Wheeler Avenue Booster Station

Junctions in Pressure Zone III immediately downstream of the Wheeler Booster Station experience a drop of up to 6 psi. No Pressure Zone III connections fall below 40 psi as result.

Loss of the Plateau Booster Station

Junctions in Pressure Zone IV immediately downstream of the Plateau Booster Station, primarily in Live Oak Canyon Road, experience a drop of up to 7 psi. Some service connections to the west of Live Oak Canyon Road fall below 40 psi. There are a number of distribution mains in this area that would benefit from reconfiguration into Pressure Zone IVa.

Loss of the Amherst 7 and 8 Booster Stations

Junctions in Pressure Zone II immediately downstream of the Amherst 7 and 8 Booster Stations experience a drop of just over 3 psi. No Pressure Zone II connections fall below 40 psi as result.

8.11.2 Distribution Pipeline Analysis

Through the Water Model, the methods and capabilities used to transport domestic and fire protection water across the system have been analyzed. Distribution pipelines are typically considered to be 12-inches in diameter and smaller.

The Water Model is able to identify areas where there may be pipelines that would experience high velocities under maximum day and average day conditions. After analyzing the system under these scenarios, no deficiencies were found in the system under these two scenarios in terms of velocities.

Under MDD+FF, there are a few locations where residual pressures are not met and are identified herein.

Residual Pressures under MDD+FF

MDD+FF with Residual Pressure of 20 psi

Refer to the fire flow analysis Section 8.8 as well as Exhibit 9-1 and Exhibit 9-2 for locations not achieving the residual pressure 20 psi requirement. Exhibit 9-2 contains a table identifying the CIP project that would mitigate the deficient fire flow hydrant capability.

Maximum Pipe Velocities under ADD and MDD

Maximum Pipe Velocity 10 fps under Average Day and Maximum Day Conditions

After running the Water Model and reviewing the results, it was confirmed all distribution pipelines experience velocities within the Design Criteria of 10 fps under both Average Day and Maximum Day Conditions.

8.12 Capital Improvement Program (CIP) Projects

The CIP projects are broken into two general categories: 5-year and 10-year.

Costs for each proposed improvement were estimated and each project was assigned a schedule for construction within one of the two 5-year periods, depending on the perceived urgency.

The total cost has been estimated at 50% above construction cost as follows:

- 25% Engineering Design and Construction Management Cost
- 15% City Administration
- 10% Contingencies

The City's financial planning and budgeting should allow the time-phased expenditures to implement the 5-year and 10-year CIPs as shown in Tables 8-19 and 8-21. These description and cost estimates are provided so City Management can prioritize expenditures, based on the funding availability. Appendix A contains a graphic representation of the proposed improvements of CIP's No.1 through CIP No.14 along with its cost estimate.

Table 8-18 and Table 8-19 provide cost estimates and descriptions for projects that fall under the 5-year CIPs. The total 5-year program is estimated at $9,469,000 in 2020 dollars and approximately $12,308,000 in 2025 dollars.

Table 8-20 and Table 8-21provide cost estimates and descriptions for projects that fall under the 10-year CIPs. The total 10-year program is estimated at $17,531,000 in 2025 dollars and approximately $22,791,000 in 2030 dollars.

Table 8-18 – Five (5) Year CIP Project Descriptions

No.	Priority	Type	Description	Justification	Project Description
1	High	Distribution	Install Ramona Avenue PRV	Improve Fire Flow	The existing loop serving Ramona Middle School is slightly undersized to deliver a combined fire flow of 5000 gpm. Replacing the existing zone valve in Ramona Avenue, south of Sentinela Drive with a pressure reducing valve programmed to respond to a drop in pressure in Pressure Zone I. This would provide additional flow to the area under emergency conditions.
2	High	Transmission	Construct 2,500 feet of 16-inch pipe between Plateau Plant and Summit	Improve System Transmission Capability	The existing 16-inch transmission pipe between the Plateau Pump Station and Summit Road is the original pipe constructed by the Plateau Mutual Water Company. The remainder of the transmission system has been replaced by development. This project will complete the Pressure Zone IV transmission system replacement.
3	High	Distribution	Construct 1,280 feet of 16-inch pipe and 1,585 feet of 8-inch pipe on E Street	Improve System Distribution Reliability	The existing 14-inch pipeline in "E" Street is a riveted thin-wall steel pipe. Portions just south of Bonita Avenue north to 8th Street along "E" Street was constructed in 2018. The remaining portion will be constructed.
4	High	Distribution	Construct 7,970 linear fee of 8-inch pipe on 2nd, 3rd, 7th and "F" Street - Phase 1 Distribution	Improve Fire Flow	Existing 4-inch mains are undersized to adequately deliver fire flow to portions of 2nd, 3rd, 7th and "F" Street. Installation of new fire hydrants is required to satisfy hydrant spacing Design Criteria.
5	High	Distribution	Upsize 1,335 linear fee of 8-inch to 12-inch pipe along Foothill Boulevard	Improve Fire Flow	Existing hydrants on Foothill Boulevard, between Bradford Street and Williams Avenue, are not achieving fire flow requirements. Upsizing the existing 8-inch pipe to 12-inch will allow the deficient fire hydrants to achieve fire flow requirements for the associated commercial land usage.
6	High	Distribution	Upsize 760 linear feet of 10-inch to 12-inch pipe along Foothill Boulevard	Improve Fire Flow	Existing hydrants on Foothill Boulevard, between Wheeler Avenue and Bixby Drive, are not achieving fire flow requirement. Upsizing the existing 10-inch pipe to 12-inch will allow the deficient fire hydrants to achieve fire flow requirement for the associated commercial land usage.
7	High	Water Quality	Construct Chloramination Trim Station at Wheeler Reservoir	Improve Water Quality in all Pressure Zones	Chlorine residuals and water age are an issue for Pressure Zones III, IV and V. Adding a Trim Station at the Pressure Zone I Wheeler Reservoir site helps to maintain chlorine residuals on the west side of the service area as well as the pressure zones supplied from all Wheeler Reservoir Site.

No.	Priority	Type	Description	Justification	Project Description
8	Medium	Supply	Construction additional 1,500 gpm Pumping Capacity for Pressure Zone I	Improve System Supply	There is an existing deficiency in Pressure Zone I for both the primary analysis (redundancy - deficit of 134 gpm) and secondary analysis (emergency preparedness - deficit of 1,304 gpm). The existing White Avenue Pump Station in Pressure Zone I should be reconfigured with additional pumps with various capacities to achieve operational needs.
9	Medium	Distribution	Two Portable Generators and Four Transfer Switches	Emergency Preparedness	Equip the White, Wheeler, Plateau and Pressure Zone V Plants with power transfer switches. Purchase two portable generators to be shared among these plants during prolonged power outages to pump water from Pressure Zone I to the higher zones. Develop generator staging scenarios.
10	Low	Transmission	Construct 3,900 linear feet of 12-inch pipe from the Old Baldy Plant to the White Avenue Forebay	Improve System Transmission Capability	Currently, Walnut Well water is discharged into the Old Baldy Site Forebay and pumped directly into Pressure Zone I. There is no way to move Walnut Well water from the Old Baldy site to the White Avenue Forebay. This pipeline provides greater operational flexibility in the use of the Walnut Well water.
11	Low	Supply	Conduct ADU study	System Supply Study	There is a possibility of single family residential dwelling units to incorporate ADUs onto existing parcels with the advancement of new California legislation. It is recommended the City conduct a study to determine if with the addition of the ADUs onto single family residential parcel would have potential impacts on the City's water and sewer system.

Table 8-19 – Five (5) Year CIP (Cost Presented x $1000)

No	Description	Justification	Construction Cost ($1,000)	Engineering Design and CM (25%)	City Admin. (15%)	Conting. (10%)	2020 Estimate ($1,000)	2025 Estimate ($1,000)
1	Install Ramona Avenue PRV	Improve Fire Flow	50	13	8	5	75	98
2	Construct 2,500 feet of 16-inch Pipe between Plateau Plant and Summit	Improve System Transmission Capability	750	188	113	75	1,125	1,463
3	Construct 1,280 feet of 16-inch Pipe and 1,585 feet of 8-inch Pipe on E Street	Improve System Distribution Reliability	500	125	75	50	750	975
4	Construct 7,970 linear feet of 8-inch pipe on 2nd, 3rd, 7th and "F" Street - Phase 1 Distribution	Improve Fire Flow	1,475	369	221	148	2,213	2,876
5	Upsize 1,335 linear feet of 8-inch to 12-inch Pipe along Foothill Boulevard	Improve Fire Flow	409	102	61	41	613	797
6	Upsize 760 linear feet of 10-inch to 12-inch pipe along Foothill Boulevard	Improve Fire Flow	240	60	36	24	360	468
7	Construct Chlorination Trim Station at Wheeler Reservoir	Improve Water Quality in all Pressure Zones	1,000	250	150	100	1,500	1,950
8	Construct additional 1,500 gpm Pumping Capacity for Pressure Zone I	Improve System Supply	600	150	90	60	900	1,170
9	Two Portable Generators and Four Transfer Switches	Emergency Preparedness	570	143	86	57	855	1,112
10	Construct 3,900 linear feet of 12-inch Pipe from the Old Baldy Plant to the White Avenue Forebay	Improve System Transmission Capability	702	176	105	70	1,053	1,369
11	ADU study	System Supply Study	25	0	0	0	25	30
TOTALS			**6,321**	**1,576**	**945**	**630**	**9,469**	**12,308**

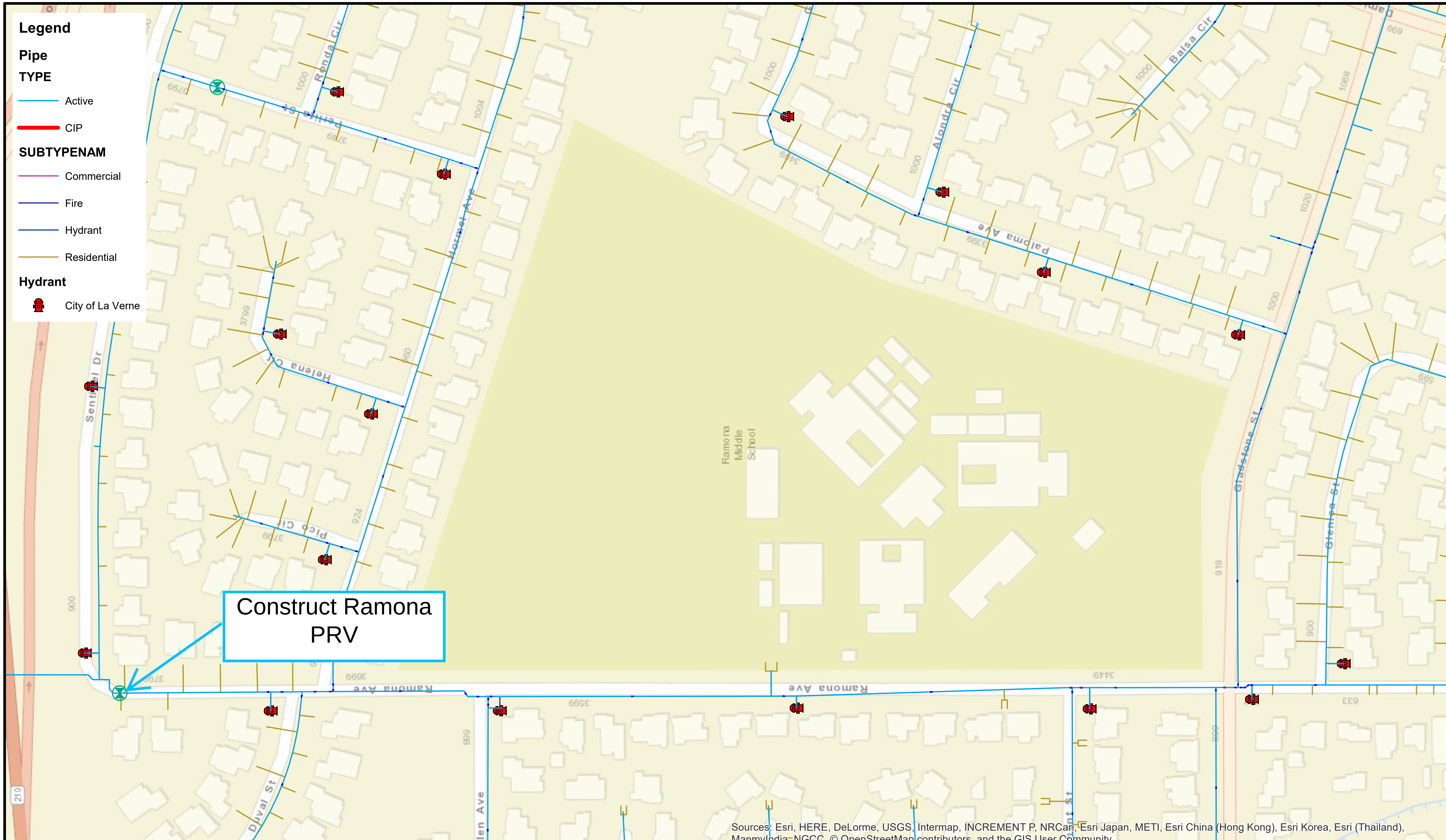
Table 8-20 – Ten (10) Year CIP – Project Descriptions

No.	Priority	Type	Description	Justification	Project Description
12	Medium	Distribution	Construct 3,525 linear feet of 6 or 8-inch Phase 2 Distribution Improvements	Improve Fire Flow	Phase 2 pipeline system replacement is along 7th, "G", Pineland, Nordland, Marco, Sherwin, Harvard, Yale, Dartmouth, Bayberry, Vassar and Princeton. These streets all have 4-inch piping and limited fire hydrants. New fire hydrants will be placed at all dead ends to allow for better firefighting and allow flushing of the system.
13	Medium	Distribution	Construct 2,350 linear feet of 6 or 8-inch Phase 3 Distribution Improvements	Improve Fire Flow	Phase 3 pipeline system replacements is along "B", Magnolia, Bonita Avenue, Maria, Pattiglen, Rosa, Wicker and Circle. These streets have 4-inch piping and limited fire hydrants. New fire hydrants will be placed at all dead ends to allow for better coverage and system flushing.
14	Medium	Distribution	Construct 615 linear feet of 8-inch near Los Flores Park	Improve Fire Flow	Existing hydrant near the border of Las Flores Park, north of Bolling Avenue is not achieving fire flow requirements. Upsizing the existing 6-inch dead-end pipe to 8-inch will allow the deficient fire hydrant to achieve fire flow requirements for the associated land usage.
15	Low	Supply	Construct a new well in the Pomona Basin to Replace the Cartwright Well	Increase Production Reliability	The Cartwright Well is at the end of its service life. The new well is to replace lost capacity in groundwater extraction. The production from the new well should be in the range of 1,000 gpm.
16	Low	Supply	Construct a 1,000 gpm Nitrate Reduction Treatment Plant at White Avenue Plant	Increase Production Reliability	A new ion exchange treatment plant is required to treat groundwater extracted from the Pomona Basin and Ganesha Basin. This plant will reduce the need to import water and will better utilize the local groundwater resources.
17	Low	Storage	3.5 MG Reservoir for Pressure Zone I at the Amherst Site	Increase Reliability to Handle MDD, Replace Aging Infrastructure	The Pressure Zone II storage deficiency was identified in the 2005 WMP and confirmed in the 2010 WMP Update. The deficiency in 2020 is estimated at ~1 MG. The existing 2.5 MG Amherst Reservoir is near the end of its useful life. Construct a new 3.5 MG reservoir at the Amherst site.
18	Low	Supply	Construct a New Well in the Live Oak Basin to Replace La Verne Heights No.1 Well	Increase Production Reliability	A new well is required to compensate for losses in specific capacity of the La Verne Heights No. 1 Well and other wells in the basin. The Beech Street Well was constructed for that purpose; however, with a capacity of only 350 gpm, the desired production reliability has not been achieved. The construction of an additional well is recommended such that, in conjunction with the Beech Street Well, a production capacity of between 500 gpm and 1,000 gpm is achieved.

Table 8-21 – Ten (10) Year CIP (Cost Presented x $1000)

No	Description	Justification	Construction Cost ($1,000)	Engineering Design and CM (25%)	City Admin. (15%)	Conting. (10%)	2025 Estimate ($1,000)	2030 Estimate ($1,000)
12	Construct 3,525 linear feet of 6 or 8-inch Phase 2 Distribution Improvements	Improve Fire Flow	800	200	120	80	1,200	1,560
13	Construct 2,350 linear feet of 6 or 8-inch Phase 3 Distribution Improvements	Improve Fire Flow	700	175	105	70	1,050	1,365
14	Construct 615 linear feet of 8-inch near Los Flores Park	Improve Fire Flow	203	31	28	19	281	366
15	Construct a New Well in the Pomona Basin to replace the Cartwright Well	Increase Production Reliability	2,500	625	375	250	3,750	4,875
16	Construct a 1,000 gpm Ion Exchange Treatment Plant at White Avenue Plant	Increase Production Reliability	1,500	375	225	150	2,250	2,925
17	Construct 3.5 MG Reservoir for Pressure Zone I at the Amherst Site	Increase Reliability to Handle MDD, Replace Aging Infrastructure	4,500	1,125	675	450	6,750	8,775
18	Construct a New Well in the Live Oak Basin to Replace La Verne Heights No.1 Well	Increase Production Reliability	1,500	375	225	150	2,250	2,925
TOTALS			**11,703**	**2,906**	**1753**	**1169**	**17,531**	**22,791**

Appendix A - Capital Improvement Project (CIP) Figures



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CIVILTEC engineering inc.

CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Ramona Avenue PRV

CIP
1

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Ramona Avenue PRV

Select: ☐ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☑ PRV

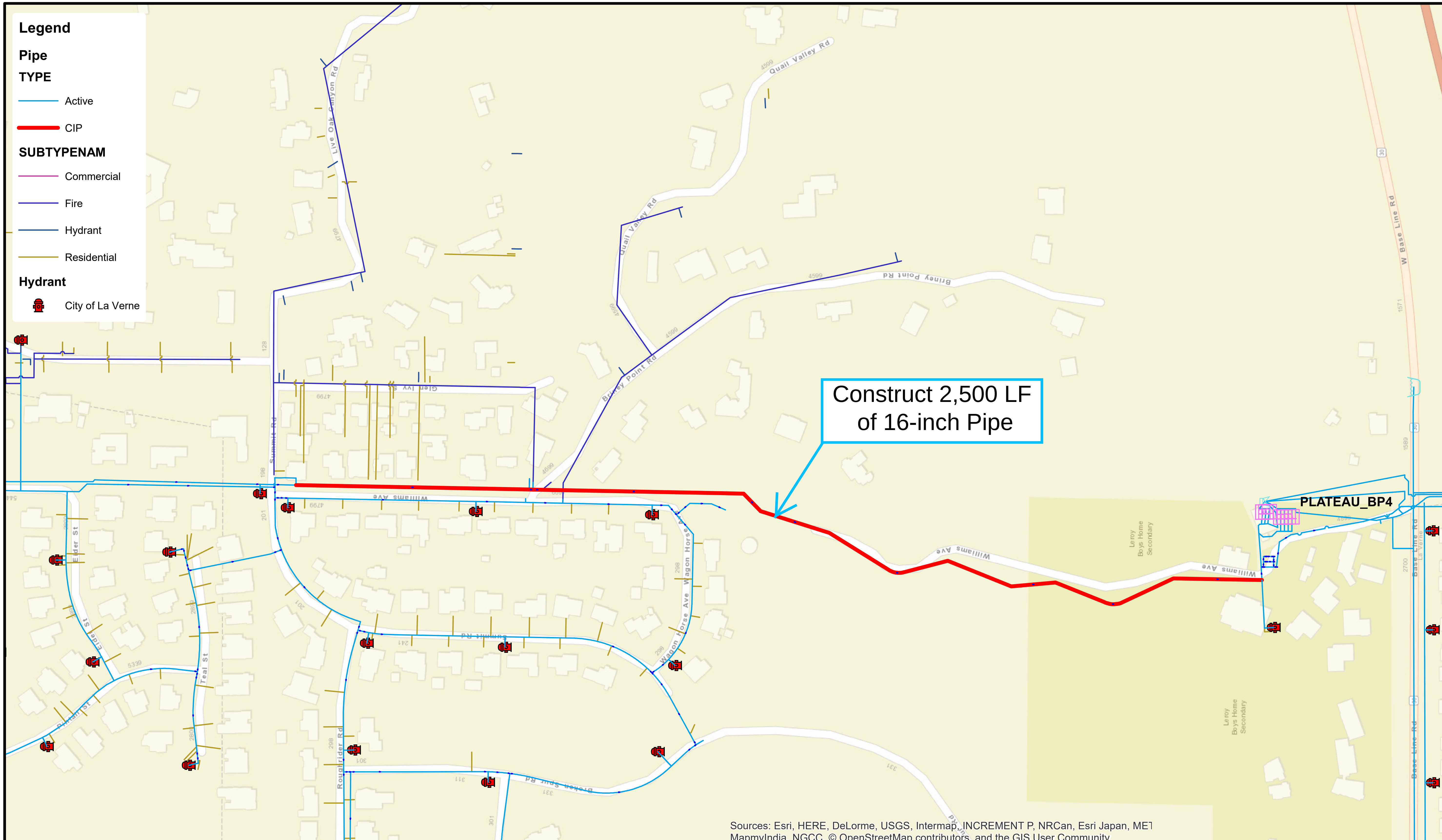
Justification:

Improve Fire Flow

Description:

The existing loop serving Ramona Middle School is slightly undersized to deliver a combined fire flow of 5000 gpm. Replacing the existing zone valve in Ramona Avenue, south of Sentinela Drive with a pressure reducing valve programmed to respond to a drop in pressure in Zone I. This would provide additional flow to the area under emergency conditions.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 7,500	$ 7,500		* Design is 15% of Construction Costs.
CEQA	0		$ -		* CEQA will not be required
Site Investigations	0		$ -		* Investigations are 2.5% of Construction Costs.
Site Acquisition	0		$ -		* Site acquisition is required.
PRV Station Construction	1	$ 50,000		$ 50,000	* Unit cost provides for station and piping
Pipeline Construction	0			$ -	* Pipeline required.
Construction Management	1	$ 5,000		$ 5,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 7,500	$ 55,000	
10	% Contingency =		$ -	$ 5,000	
15	% Admin Overhead =		$ -	$ 7,500	
		Subtotal =	$ 7,500	$ 67,500	
		2020 Grand Total =		$ 75,000	
		2025 Grand Total (+30%) =		$ 97,500	



CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Plateau Transmission Pipeline

CIP
2

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Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Transmission Pipeline Plateau Plant and Summit

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

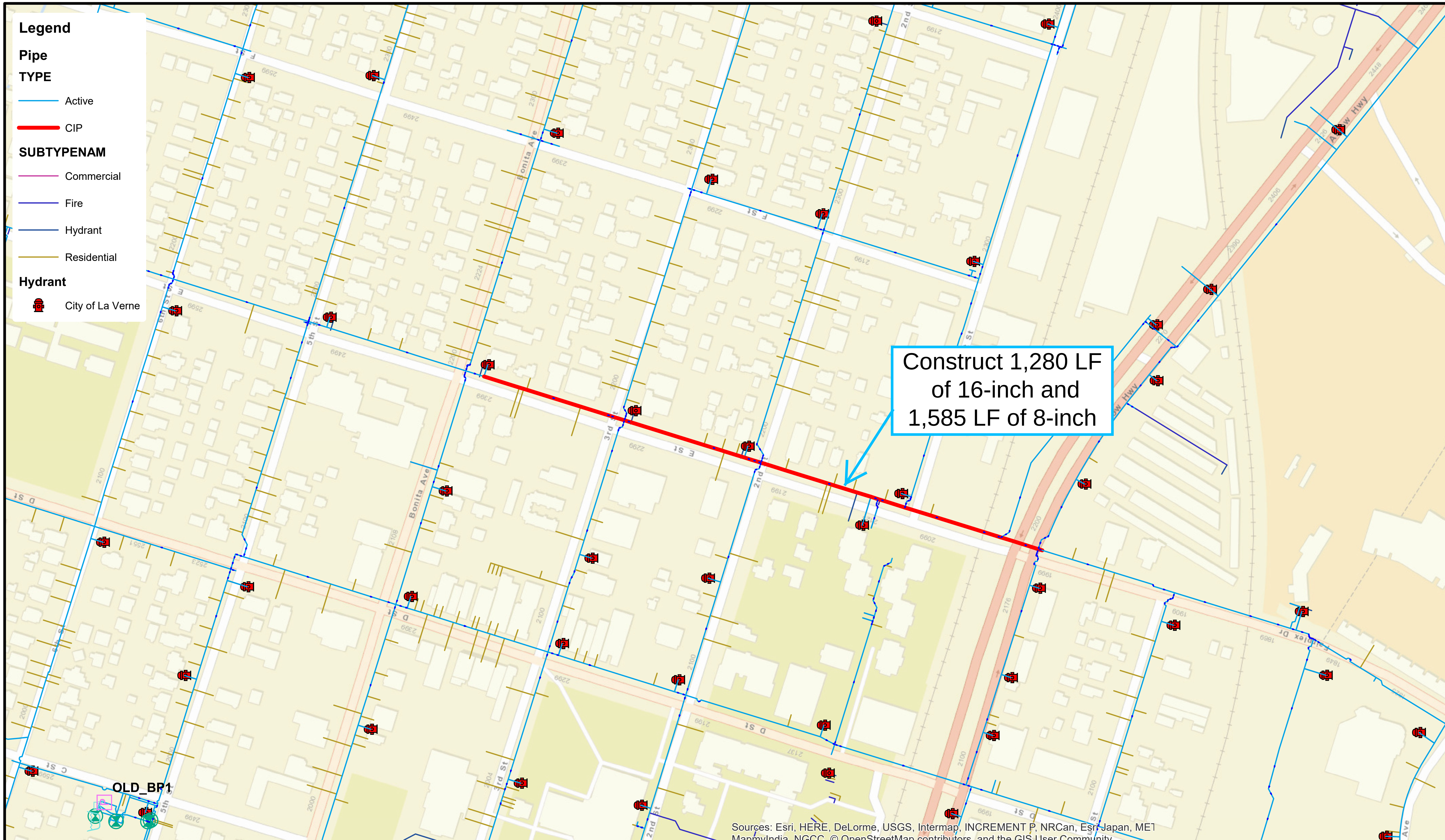
Justification:

Improve system transmission capabilty

Description:

The existing 16-inch transmission pipe between the Plateau Pump Station and Summit Road is the original pipe constructed by the Plateau Mutual Water Company. The remainde of the transmission systam has been replaced by development. This project will complete the Zone IV transmission system replacement.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 112,500	$ 112,500		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 16,500	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 2,000		$ -	Estimated # of services to transition to new pipe.
Pipeline Construction	2500	$ 300.00		$ 750,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 75,000		$ 75,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 112,500	$ 825,000	
10	% Contingency =		$ -	$ 75,000	
15	% Admin Overhead =		$ -	$ 112,500	
		Subtotal =	$ 112,500	$ 1,012,500	
		2020 Grand Total =		$ 1,125,000	
		2025 Grand Total (+30%) =		$ 1,462,500	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - E Street Pipeline

CIP
3

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: E Street Pipeline

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

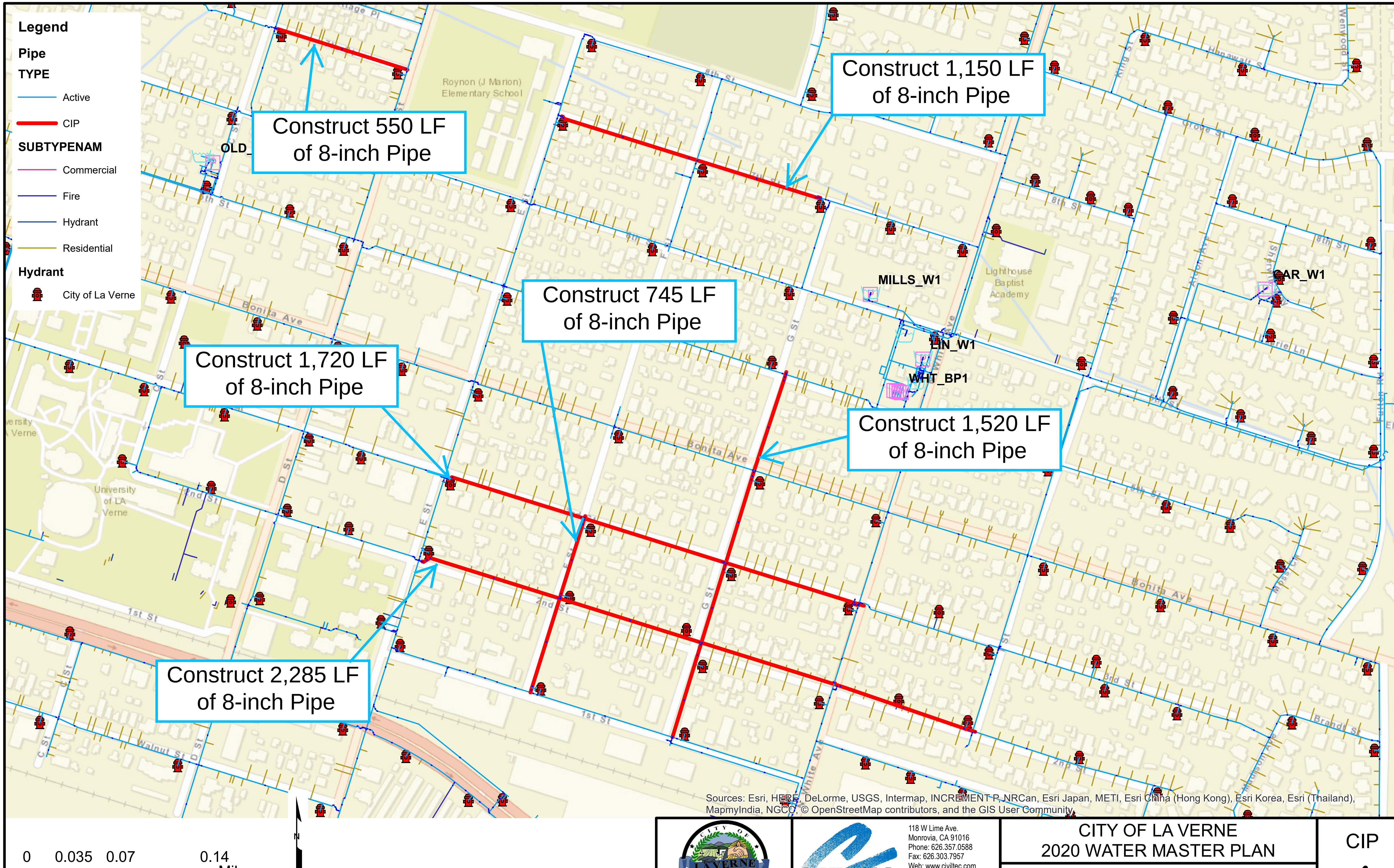
Justification:

Maintenance

Description:

The existing 14-inch pipeline in "E" Street is a riverted thin-wall steel pipe design. Portions just south of Bonita up north to 8th Street along "E" Street was constructed in 2018. The remaining portion will be constructed on a later date.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 75,000	$ 75,000		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 11,000	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	11	$ 3,000		$ 33,000	Estimated # of services to transition to new pipe.
Pipeline Construction	1280	$ 216.25		$ 276,800	
Pipeline Construction	1585	$ 120.00		$ 190,200	
Construction Management	1	$ 50,000		$ 50,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 75,000	$ 550,000	
10	% Contingency =		$ -	$ 50,000	
15	% Admin Overhead =		$ -	$ 75,000	
		Subtotal =	$ 75,000	$ 675,000	
		2020 Grand Total =		$ 750,000	
		2025 Grand Total (+30%) =		$ 975,000	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Phase 1 - 4" Pipeline Replacement Program

CIP
4

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Distribution Pipeline 2nd 3rd 7th F Street

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

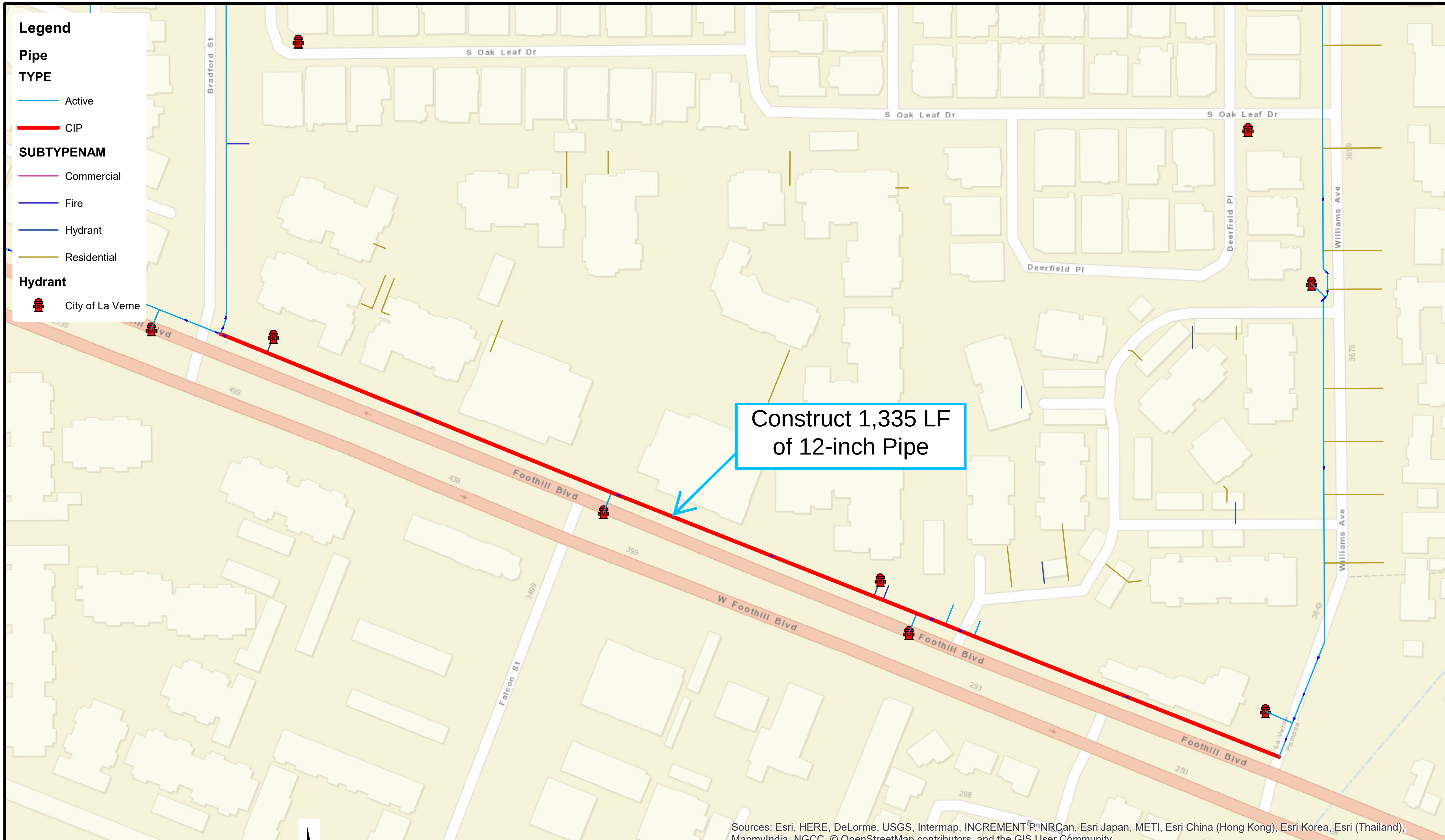
Justification:

Emergency Preparedness

Description:

Existing 4-inch mains are undersized to adequarely deliver fire flow to portions of Second, Third, Seventh and "F" Street. Installation of new fire hydrants is required to satisfy hydrant spacing design criteria.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 221,250	$ 221,250		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 32,450	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	163	$ 2,000		$ 326,000	Estimated # of services to transition to new pipe.
Pipeline Construction	7970	$ 144.17		$ 1,149,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 147,500		$ 147,500	* CM is 10% of Construction Costs.
		Subtotal =	$ 221,250	$ 1,622,500	
10	% Contingency =		$ -	$ 147,500	
15	% Admin Overhead =		$ -	$ 221,250	
		Subtotal =	$ 221,250	$ 1,991,250	
		2020 Grand Total =		$ 2,212,500	
		2025 Grand Total (+30%)=		$ 2,876,250	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Phase 1 - Foothill Blvd 12" Pipeline

CIP
5

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Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Foothill Blvd - 12-inch Pipeline - Phase 1

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

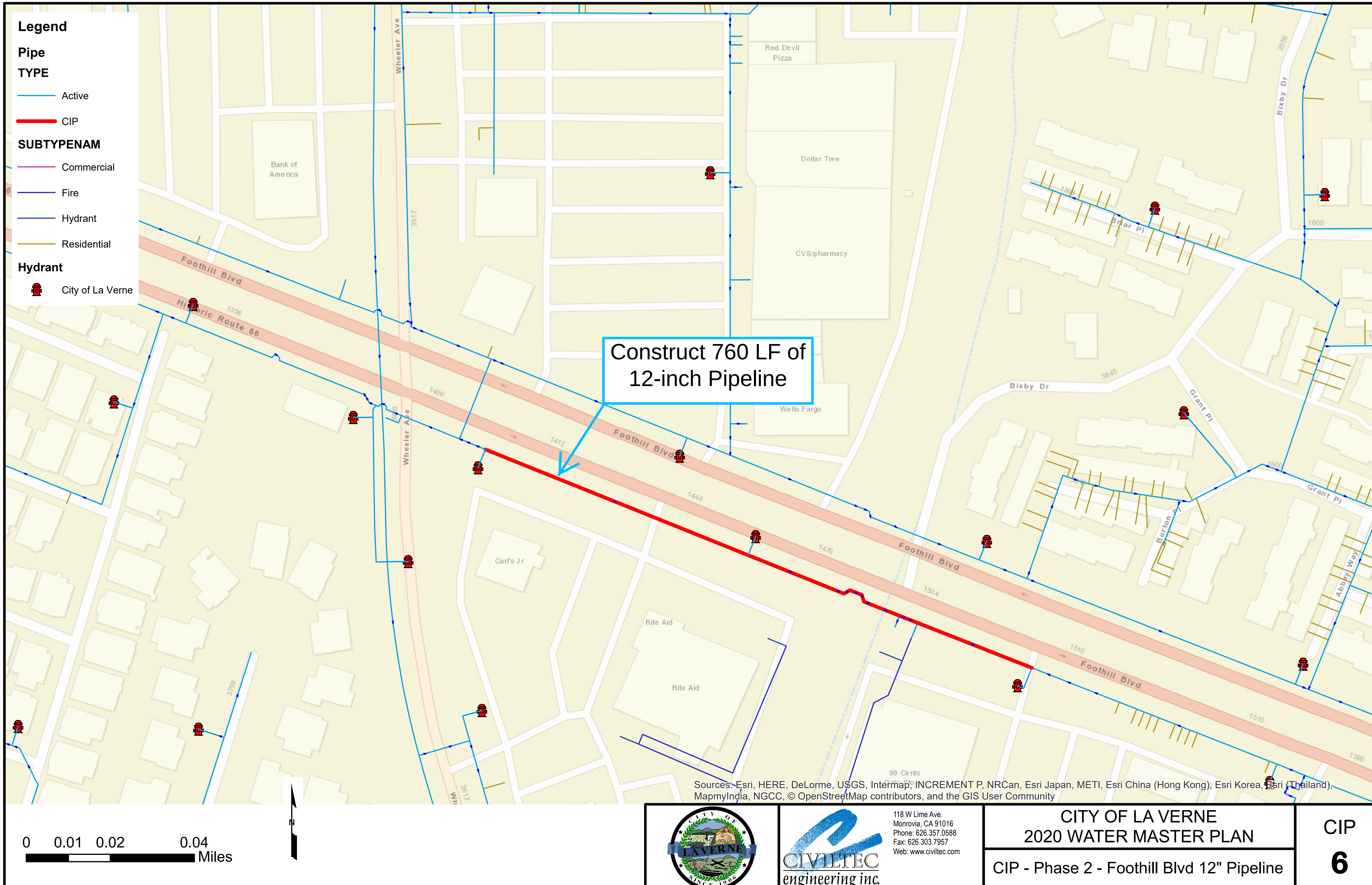
Justification:

Improve Fire Flow

Description:

Existing hydrants on Foothill Blvd, between Bradford St and Williams Ave, are not meeting fire flow requirement. Upsizing the 8-inch to 12-inch will allow the deficient fire hydrants to meet fire flow requirement for the associted land usage of commerical usage.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 61,275	$ 61,275		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 8,987	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	4	$ 2,000		$ 8,000	Estimated # of services to transition to new pipe.
Pipeline Construction	1335	$ 300.00		$ 400,500	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 40,850		$ 40,850	* CM is 10% of Construction Costs.
		Subtotal =	$ 61,275	$ 449,350	
10	% Contingency =		$ -	$ 40,850	
15	% Admin Overhead =		$ -	$ 61,275	
		Subtotal =	$ 61,275	$ 551,475	
		2020 Grand Total =		$ 612,750	
		2025 Grand Total (+30%) =		$ 796,575	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Phase 2 - Foothill Blvd 12" Pipeline

CIP
6

Name: W David Byrum Department: Engineering Date: 12/18/2020

Select: ☑ Design ☑ Build Project #: Not assigned

Project Name: Distribution Pipeline Phase 2 Foothill

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

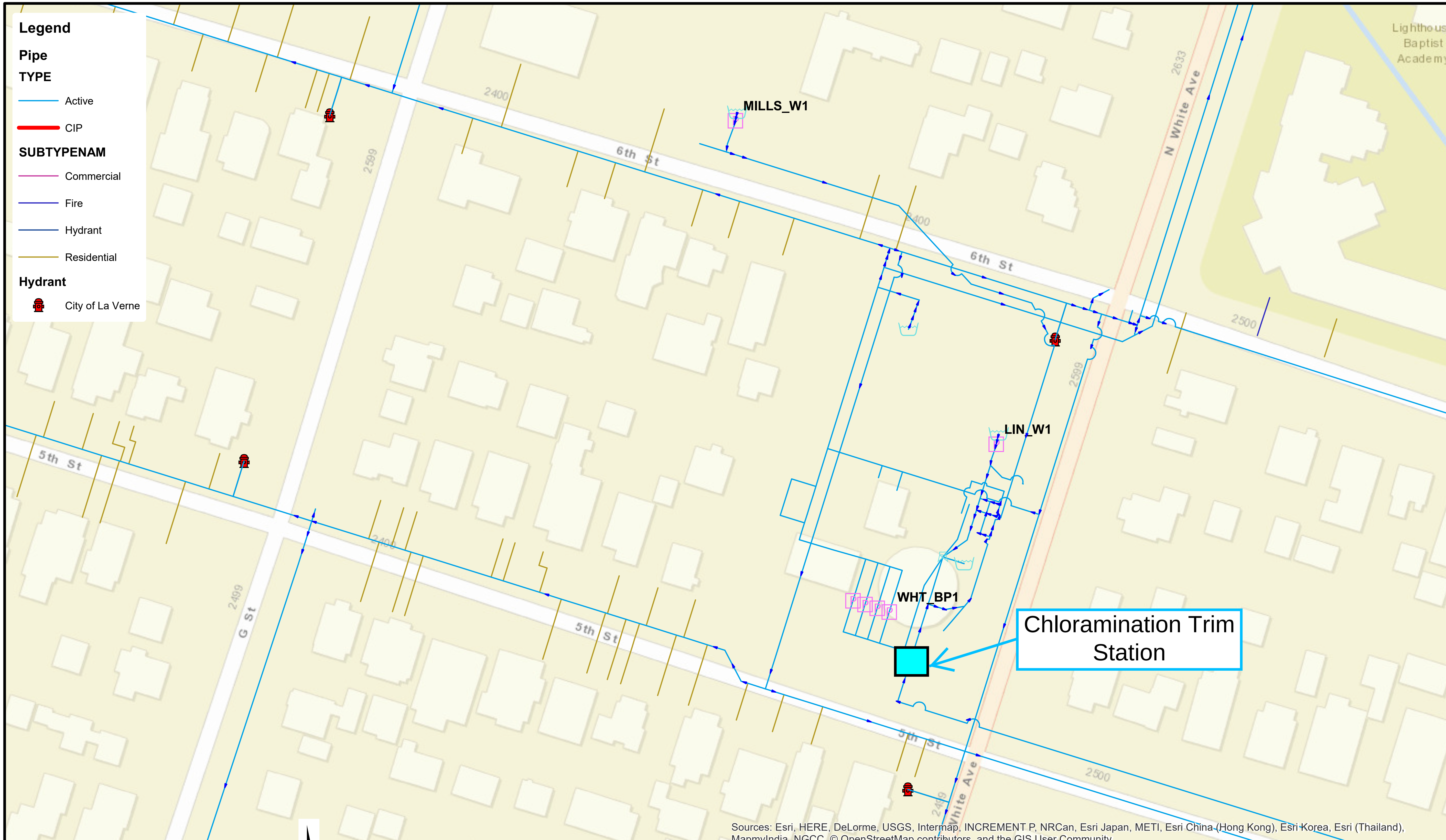
Justification:

Improve Fire Flow

Description:

Existing hydrants on Foothill Blvd, between Wheeler Ave and Bixby Drive, are not meeting fire flow requirement. Upsizing the existing 10-inch to 12-inch will allow the deficient fire hydrants to meet fire flow requirement for the associted land usage of commerical usage.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 36,000	$ 36,000		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 5,280	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	4	$ 3,000		$ 12,000	Estimated # of services to transition to new pipe.
Pipeline Construction	760	$ 300.00		$ 228,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 24,000		$ 24,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 36,000	$ 264,000	
10	% Contingency =		$ -	$ 24,000	
15	% Admin Overhead =		$ -	$ 36,000	
		Subtotal =	$ 36,000	$ 324,000	
		2020 Grand Total =		$ 360,000	
		2025 Grand Total (+30%)=		$ 468,000	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Chloramination Trim Station at Wheeler Reservoir

CIP 7

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Wheeler Chloramination Trim Station

Select: ☐ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV ☑ OTHER

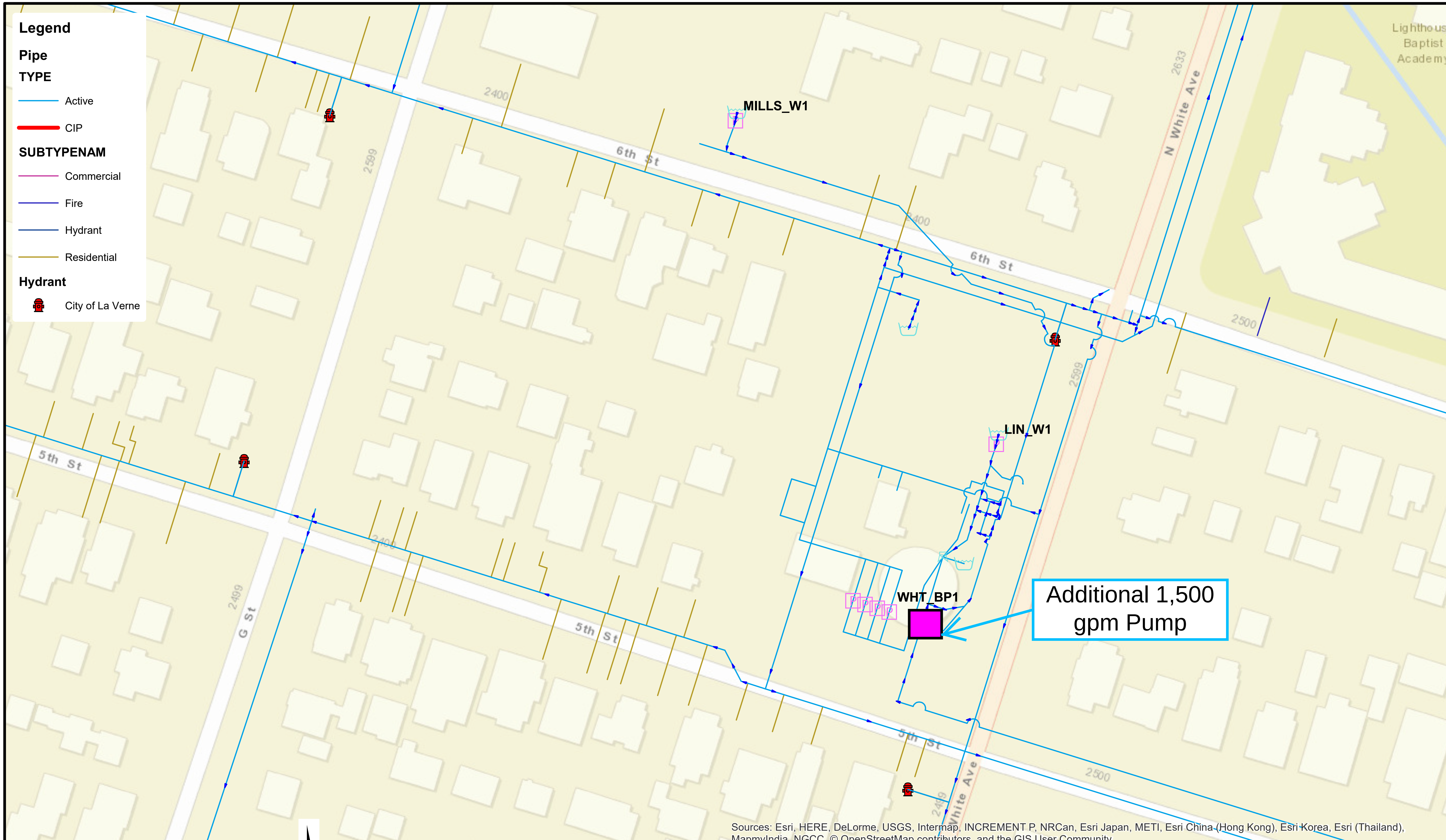
Justification:

Water Quality

Description:

Chlorine residuals and water age are an issue for Zones 3, 4 and 5. Adding a Trim Station at the Zone I Wheeler Reservoir site helps to maintain chlorine residuals on the west side of the service area as well as the Pressure Zones supplied from all Wheeler Reservoir Site.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 150,000	$ 150,000		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 22,000	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 2,000		$ -	Estimated # of services to transition to new pipe.
Treatment Equipment	1	$ 350,000		$ 350,000	
Trim Startion Building	1	$ 650,000		$ 650,000	
Construction Management	1	$ 100,000		$ 100,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 150,000	$ 1,100,000	
10	% Contingency =		$ -	$ 100,000	
15	% Admin Overhead =		$ -	$ 150,000	
		Subtotal =	$ 150,000	$ 1,350,000	
		2020 Grand Total =		$ 1,500,000	
		2025 Grand Total (+30%)=		$ 1,950,000	



0 0.0075 0.015 0.03 Miles

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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Zone 1 - 1,500 gpm Pump

CIP
8

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: White Avenue Pump Improvement

Select: ☐ Pipeline ☑ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

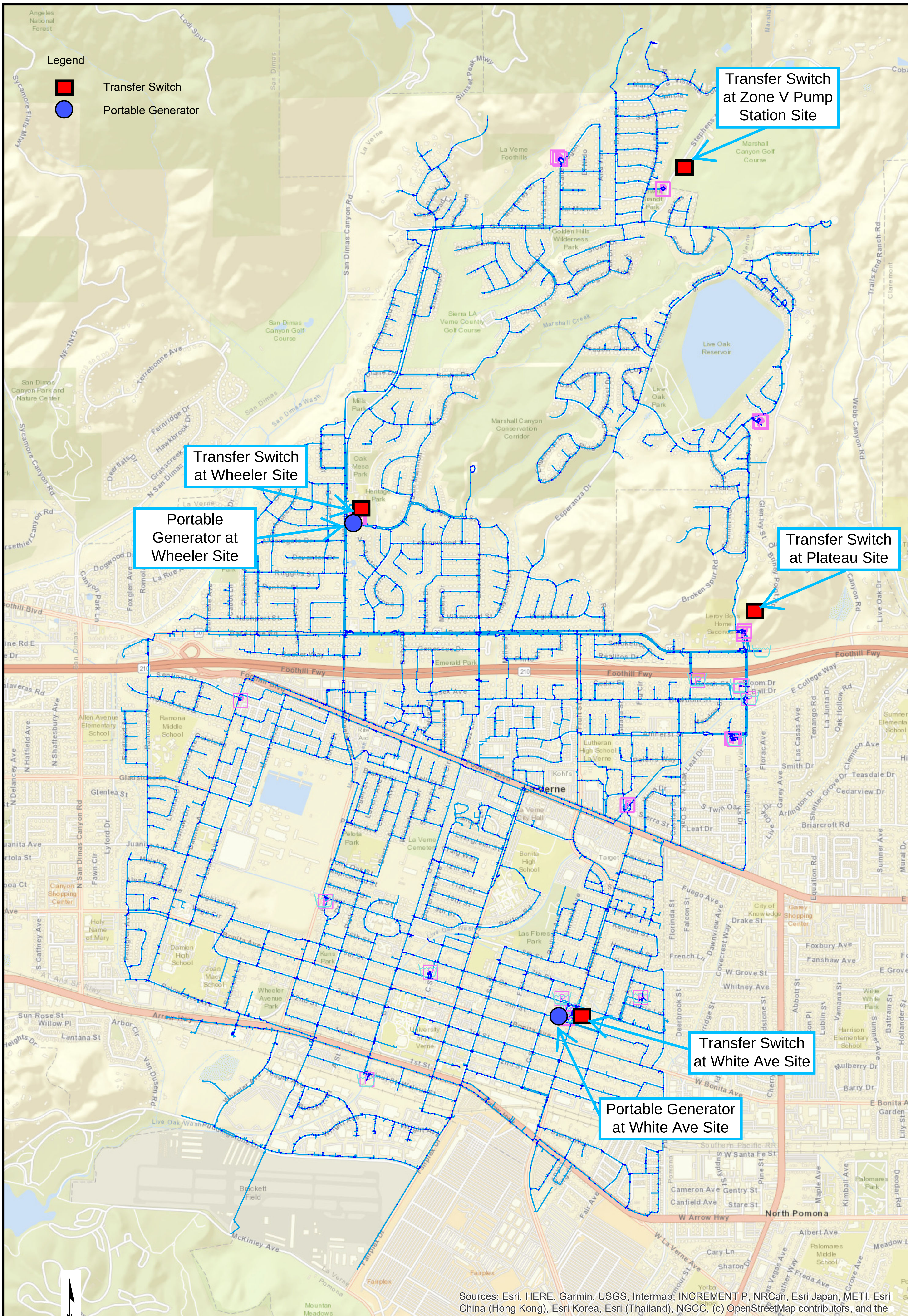
Justification:

Improve System Supply

Description:

There is an existing deficient in Zone I per both the primiary analysis (redundancy - deficit of 134 gpm) and secondary analysis (emergency preparedness - deficit of 1,304 gpm). The existing pump station in Zone 1 should be reconfigured with additional pumps with various capacities to meet operational needs.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 90,000	$ 90,000		* Design is 15% of Construction Costs.
CEQA		$ 30,000	$ -		* CEQA will not be required
Site Investigations		$ 16,500	$ -		* Investigations are 2.5% of Construction Costs.
Site Acquistion		$ 250,000	$ -		* Site acquistion is required.
Pump Station Construction	1	$ 600,000		$ 600,000	* Unit cost provides for site improvements
Pipeline Construction	0	$ 250.00		$ -	* Suction and Discharge pipeline required.
Construction Management	1	$ 60,000		$ 60,000	* CM is 10% of Construction Costs.
		Labor Total =	$ 90,000	$ 660,000	
10	% Contingency =		$ -	$ 60,000	
15	% Admin Overhead =		$ -	$ 90,000	
		Subtotal =	$ 90,000	$ 810,000	
		2020 Grand Total =		$ 900,000	
		2025 Grand Total (+30%)=		$ 1,170,000	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Two Portable Generators and Four Transfer Switches

CIP
9

Name: W David Byrum Department: Engineering Date: 12/18/2020

Select: ☑ Design ☑ Build Project #: Not assigned

Project Name: Two Portable Generators and Four Transfer Switches

Select: ☐ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV ☑ OTHER

Justification:

Emergency Preparedness

Description:

Equip the White, Wheeler, Plateau and Zone V Plants with power transfer switches. Purchase two portable generators to be shared among these plants during prolonged power outages to pump water from Zone I to the higer zones. Develop staging scenarios.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 85,500	$ 85,500		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 12,540	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 2,000		$ -	Estimated # of services to transition to new pipe.
Portable Generators	2	$ 135,000		$ 270,000	
Transfer Switches	4	$ 75,000		$ 300,000	
Construction Management	1	$ 57,000		$ 57,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 85,500	$ 627,000	
10	% Contingency =		$ -	$ 57,000	
15	% Admin Overhead =		$ -	$ 85,500	
		Subtotal =	$ 85,500	$ 769,500	
		2020 Grand Total =		$ 855,000	
		2025 Grand Total (+30%)=		$ 1,111,500	

0 0.0225 0.045 0.09 Miles

N

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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - 12" Pipeline from Old Baldy Plant to White Avenue Forebay

CIP
10

Name: W David Byrum   Department: Engineering   Date: 12/18/2020

Select: ☑ Design ☑ Build   Project #: Not assigned

Project Name: Old Baldy Transmission Pipeline

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

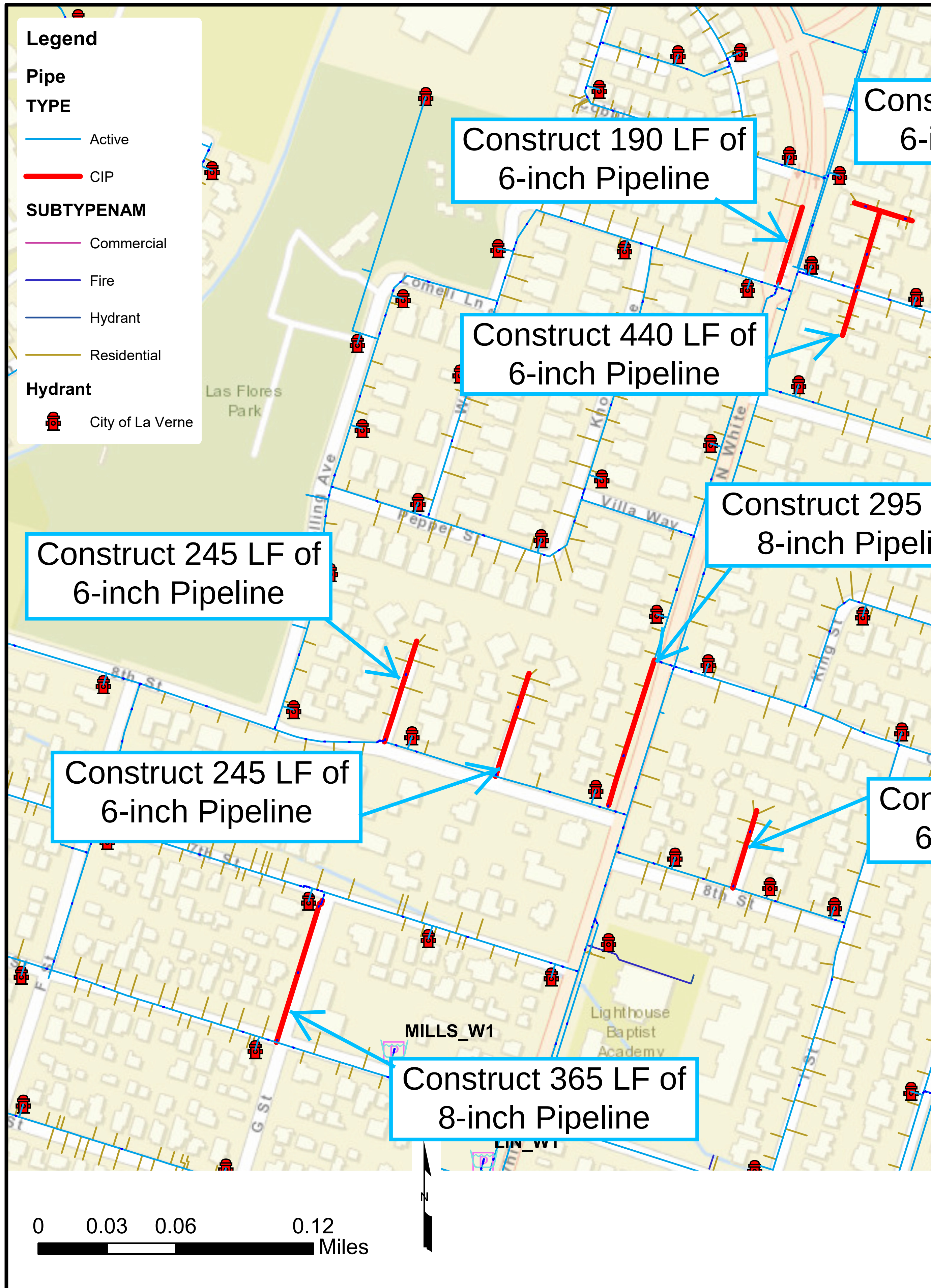
Justification:

Improve System Transmission Capability

Description:

Currently, Walnut Well water is discharged into the Old Baldy Site Forebay and pumped directly into Zone I. There is no way to move Walnut Well water from the Old Baldy site to the White Ave Forebay. This pipeline provides greater operational flexibility in the use of the Walnut Well water.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 105,300	$ 105,300		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 15,444	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 3,000		$ -	Estimated # of services to transition to new pipe.
Pipeline Construction	3900	$ 180.00		$ 702,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 70,200		$ 70,200	* CM is 10% of Construction Costs.
		Subtotal =	$ 105,300	$ 772,200	
10	% Contingency =		$ -	$ 70,200	
15	% Admin Overhead =		$ -	$ 105,300	
		Subtotal =	$ 105,300	$ 947,700	
		2020 Grand Total =		$ 1,053,000	
		2025 Grand Total (+30%)=		$ 1,368,900	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Phase 2 - Distribution Improvements

CIP
12

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Distribution Pipeline Phase 2 Improvements

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

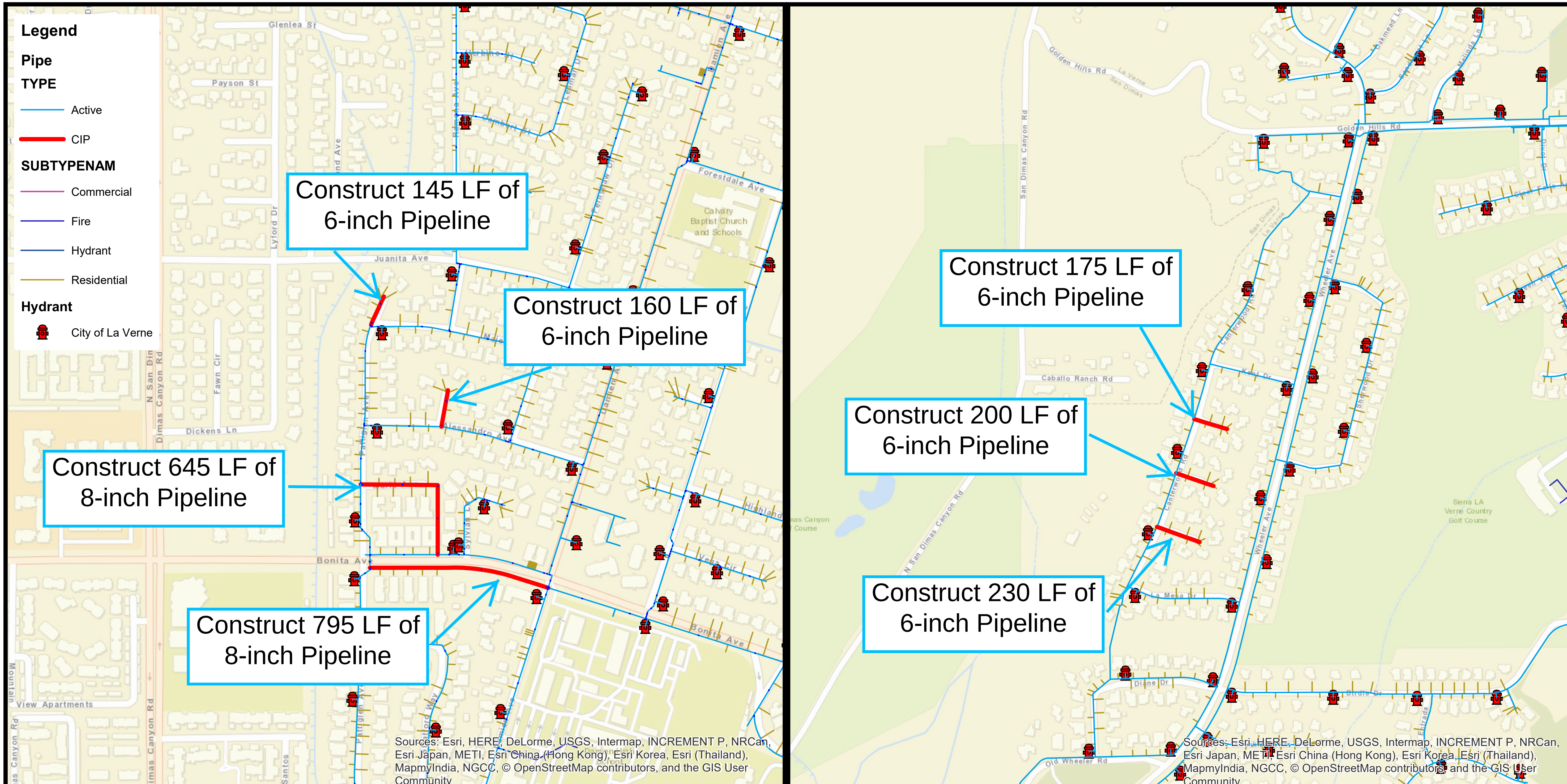
Justification:

Improve Fire Fighting Capabilities

Description:

Phase 2 pipeline system replacement is along 7th, "G", Pineland, Nordland, Marco, Sherwin, Harvard, Yale, Dartmouth, Bayberry, Vassar and Princeton. These streets all have 4-inch piping and limited fire hydrants. New fire hydrants will be placed at all dead end to allow for better fire fighting and allow flushing of the system.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 120,000	$ 120,000		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 17,600	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 2,000		$ -	Estimated # of services to transition to new pipe.
Pipeline Construction	3525	$ 226.95		$ 800,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 80,000		$ 80,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 120,000	$ 880,000	
10	% Contingency =		$ -	$ 80,000	
15	% Admin Overhead =		$ -	$ 120,000	
		Subtotal =	$ 120,000	$ 1,080,000	
		2025 Grand Total =		$ 1,200,000	
		2030 Grand Total (+30%) =		$ 1,560,000	



0 0.045 0.09 0.18
Miles

N

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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Phase 3 - Distribution Improvements

CIP
13

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Distribution Pipeline Phase 3 Improvements

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

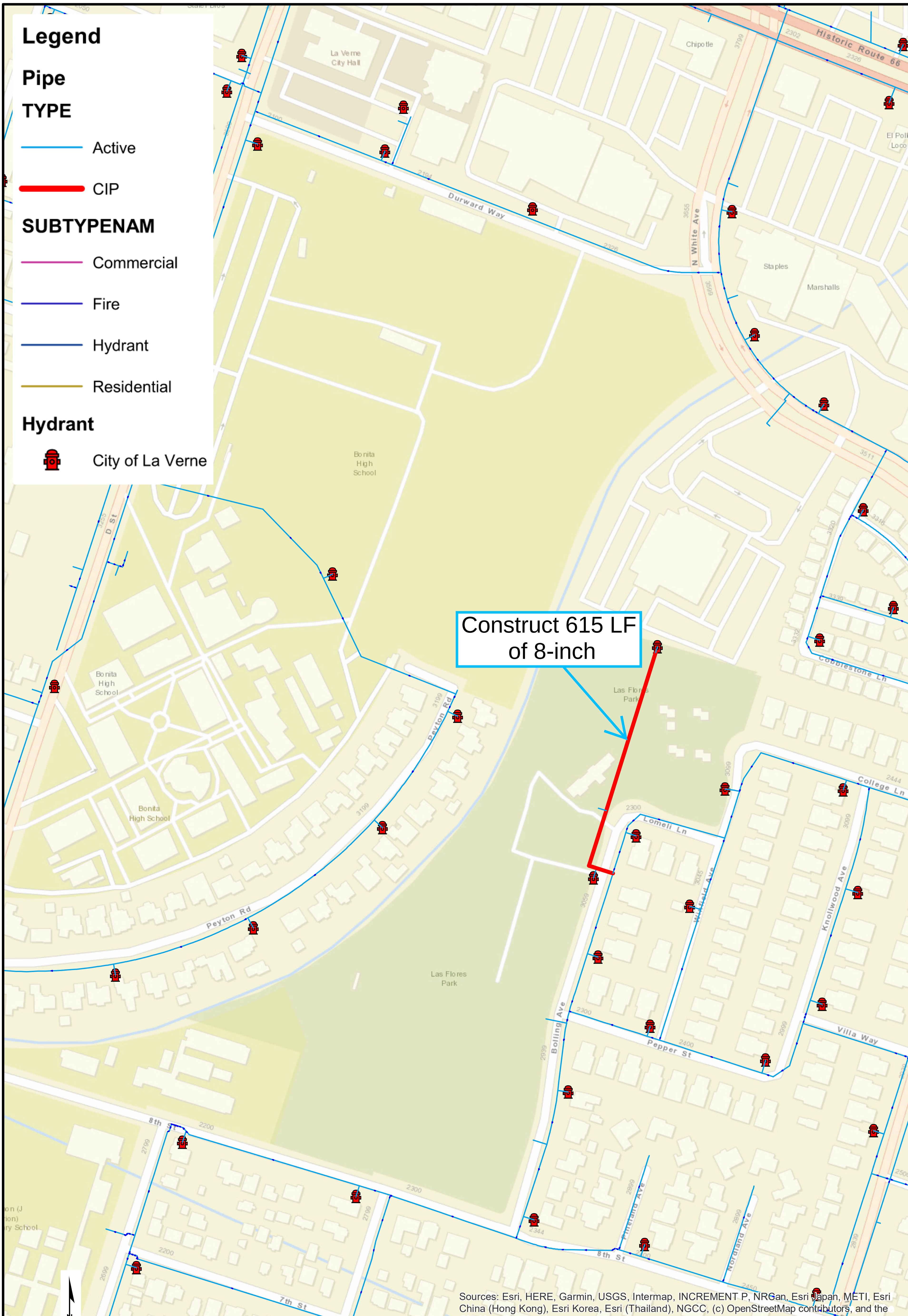
Justification:

Improve Fire Fighting Capabilities

Description:

Phase 3 pipeline system replacements is along "B", Magnolia, Bonita, Maria, Pattiglen, Rosa, Wicker and Circle. These streets have 4-inch piping and limited fire hydrants. New fire hydrants will be placed at all dead ends to allow for better coverage and system flushing.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 105,000	$ 105,000		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 15,400	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	0	$ 2,000		$ -	Estimated # of services to transition to new pipe.
Pipeline Construction	2350	$ 297.87		$ 700,000	
Pipeline Construction	0	$ 80.00		$ -	
Construction Management	1	$ 70,000		$ 70,000	* CM is 10% of Construction Costs.
		Subtotal =	$ 105,000	$ 770,000	
10	% Contingency =		$ -	$ 70,000	
15	% Admin Overhead =		$ -	$ 105,000	
		Subtotal =	$ 105,000	$ 945,000	
		2025 Grand Total =		$ 1,050,000	
		2030 Grand Total (+30%)=		$ 1,365,000	



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CITY OF LA VERNE
2020 WATER MASTER PLAN

CIP - Las Flores Park Pipeline

CIP
14

Name: W David Byrum | Department: Engineering | Date: 12/18/2020

Select: ☑ Design ☑ Build | Project #: Not assigned

Project Name: Los Flores Park Pipeline

Select: ☑ Pipeline ☐ Booster Stations ☐ Tanks ☐ Wells ☐ Pumps ☐ PRV

Justification:

Improve Fire Flow Deficiencies

Description:

The existing 6-inch pipeline that runs under the Los Flores Park is an asbestos cement pipe pipe built in the late 1960's and is currently undersized to deliever a fire flow of 1,500 gpm. Upsizing the existing 6-inch pipeline to an 8-inch will provide the additionl flow in the area to meet fire flow requirements.

Description:	Qty.	Unit Cost	YEAR 1	YEAR 2	
Design	1	$ 28,125	$ 28,125		* Design is 15% of Construction Costs.
CEQA	0	$ 30,000	$ -		* CEQA will not be required
Site Investigations	0	$ 4,125	$ -		* Investigations are 2% of Construction Costs.
Service Transitions	1	$ 3,000		$ 3,000	Estimated # of services to transition to new pipe.
Pipeline Construction	615	$ 300.00		$ 184,500	
Pipeline Construction	0			$ -	
Construction Management	1	$ 18,750		$ 18,750	* CM is 10% of Construction Costs.
		Subtotal =	$ 28,125	$ 206,250	
10	% Contingency =		$ -	$ 18,750	
15	% Admin Overhead =		$ -	$ 28,125	
		Subtotal =	$ 28,125	$ 253,125	
		2020 Grand Total =		$ 281,250	
		2025 Grand Total (+30%) =		$ 365,625	

Appendix B - City's 2017-2019 Water Quality/Consumer Confidence Reports

City of La Verne Water Division

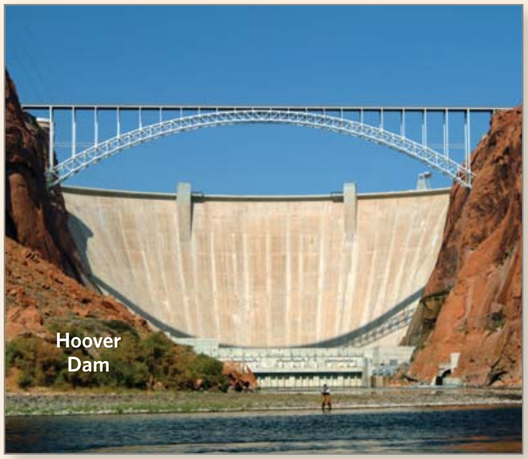
2017 Water Quality Report

DATA FOR 2016

Your 2017 Water Quality Report

Since 1990, California public water utilities have been providing annual Water Quality Reports to their customers. **This year's report**, also known as the "Consumer Confidence Report," **covers water quality testing from January to December 2016**, unless otherwise specified**.**

The City of La Verne Water Division's (City) annual Water Quality Report is prepared in compliance with the regulations called for in the 1996 reauthorization of the Safe Drinking Water Act (SDWA). The reauthorization charged the United States Environmental Protection Agency (USEPA) with updating and strengthening the tap water regulatory program. USEPA and the State Water Resources Control Board, Division of Drinking Water (DDW) are the agencies responsible for establishing water quality standards.

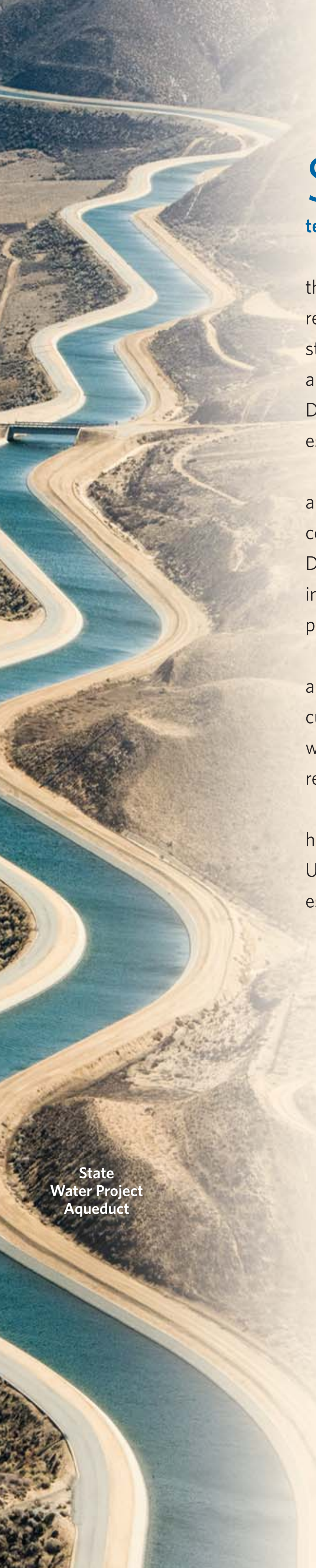

Hoover Dam

To ensure that your tap water is safe to drink, USEPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by water systems. DDW regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The State and Federal governments require that this annual Water Quality Report be provided to every customer to insure you are informed of the quality of your water. The City is committed to safeguarding its water supply and, as in years past, the water delivered to your home meets or exceeds the standards required by the state and federal regulatory agencies.

In some cases, the City goes beyond what is required by testing for unregulated chemicals that may have known health risks but do not have drinking water standards. Unregulated chemical monitoring helps USEPA and DDW determine where certain chemicals occur and whether new standards need to be established for those chemicals to protect public health.

We encourage you to read this report and to contact us with any questions you may have.


State Water Project Aqueduct

This report contains important information about your drinking water. Translate it, or speak with someone who understands it.

Este informe contiene información muy importante sobre su agua beber. Tradúzcalo ó hable con alquien que lo entienda bien.

Questions about your water? Contact us for answers.

If you would like more information, or have any questions regarding the quality or delivery of your water service, please contact Richard Martinez, Utilities Manager, City of La Verne, 3660 "D" Street, La Verne, California 91750, or by phone at (909) 596-8741.

The City Council meets on the first and third Mondays of the month in the Council Chambers at the same address above. Public attendance and participation is encouraged and welcomed.

For more information about the health effects of the listed constituents in the following tables, call the U.S. Environmental Protection Agency hotline at (800) 426-4791.

The Quality of Your Water Is Our Primary Concern

Sources of Supply

Local groundwater provides approximately 28 percent of our water; however, most of our supply (72 percent) is purchased from the Three Valleys Municipal Water District (TVMWD) who treats water received from the Metropolitan Water District of Southern California (MWD). MWD provides supplemental water to about 300 cities and unincorporated areas in Southern California, importing water from two separate sources: the Colorado River and the State Water Project. The water we purchase is treated by Three Valleys Municipal Water District at the Miramar Treatment Plant.

Basic Information About Drinking Water Contaminants

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of land or through the layers of the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animal and human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- **Inorganic contaminants**, such as salts and metals, which can be naturally occurring or result from urban storm runoff, industrial or domestic wastewater discharges, oil and gas production, mining and farming.
- **Radioactive contaminants**, which can be naturally occurring or be the result of oil and gas production or mining activities.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gasoline stations, urban stormwater runoff, agricultural application and septic systems.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff and residential uses.

More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791.

About Lead in Tap Water

Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested and/or flush your tap for 30 seconds to 2 minutes before using tap water. Additional information is available from the USEPA Safe Drinking Water Hotline (1-800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of La Verne is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.

If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/safewater/lead.

Special Risk Populations

Some individuals may be more vulnerable to the effects of possible contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, some elderly persons, infants, persons infected with HIV/AIDS, or persons with other immune system disorders can be particularly at risk from infections These persons should seek advice from their health care providers about drinking water.

The USEPA/Center for Disease Control guidelines on appropriate means to lessen the risks of infection by *Cryptosporidium* or other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Additional General Drinking Water Information

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by visiting the USEPA Safe Drinking Water website (www.epa.gov/ground-water-and-drinking-water) or by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791).

Water Quality Issues that Could Affect Your Health

Contaminants Exceeding MCL or AL

The range for nitrate and other constituents in the groundwater sample results may be above the MCL. These values are for wells only which account for approximately 28 percent of the total water supplied to our customers. The content at your tap is well below the MCL, ranging from ND — 5.9 ppm for nitrate and ND — 4.2 ppm for perchlorate. The range for trichloroethylene in the groundwater sample results may also be above the MCL; however, the groundwater goes through an air stripping process that reduces the trichloroethylene to between 0.7 to 2.0 ppb.

Nitrate as Nitrogen in drinking water at levels above 10 mg/L is a health risk for infants of less than six months of age. Such nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in a serious illness; symptoms include shortness of breath and blueness of the skin. Nitrate as Nitrogen levels above 10 mg/L may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with certain specific enzyme deficiencies.

If you are caring for an infant, or you are pregnant, you should ask advice from your healthcare provider.

Fluoride

Fluoride has been added to U.S. drinking water supplies since 1945. Of the 50 largest cities in the U.S., 43 fluoridate their drinking water. In December 2007, MWD joined a majority of the nation's public water suppliers in adding fluoride to drinking water in order to prevent tooth decay. In line with recommendations from the DDW, as well as the U.S. Centers for Disease Control and Prevention, MWD adjusted the natural fluoride level in imported treated water from the Colorado River and State Water Project to the optimal range for dental health of 0.6 to 1.2 parts per million. Our local water is not supplemented with fluoride. Fluoride levels in drinking water are limited under California state regulations at a maximum dosage of 2 parts per million.

Additional information about the fluoridation of drinking water can be found through the following sources:

U.S. Centers for Disease Control and Prevention:
www.cdc.gov/fluoridation • 1-888-CDC-INFO (1-888-232-4636)

State Water Resources Control Board, Division of Drinking Water
www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Fluoridation.shtml

American Dental Association
www.ada.org/en/public-programs/advocating-for-the-public/fluoride-and-fluoridation/ada-fluoridation-resources

American Water Works Association: www.awwa.org

For more information about MWD's fluoridation program, please contact Edgar G. Dymally at edymally@mwdh2o.com or you may call him at (213) 217-5709.

Additional Resources for Water Information

The City of La Verne cares about our customers and the water we supply to them. We always welcome any calls or questions regarding the quality or delivery of our water. Our customer service office can be reached at (909) 596-8744. For more information about water use efficiency and available rebates, please visit the City's website at www.cityoflaverne.org and look for environmental programs in the Public Works Department section.

Source Water Assessments

Imported (MWD) Water Assessment

Every five years, MWD is required by DDW to examine possible sources of drinking water contamination in its State Water Project and Colorado River source waters.

The most recent watershed sanitary surveys for MWD's source waters are the Colorado River Watershed Sanitary Survey – 2015 Update, and the State Water Project Watershed Sanitary Survey – 2011 Update.

Water from the Colorado River is considered to be most vulnerable to contamination from recreation, urban/stormwater runoff, increasing urbanization in the watershed, and wastewater. Water supplies from Northern California's State Water Project are most vulnerable to contamination from urban/stormwater runoff, wildlife, agriculture, recreation, and wastewater.

USEPA also requires MWD to complete one Source Water Assessment (SWA) that utilizes information collected in the watershed sanitary surveys. MWD completed its SWA in December 2002. The SWA is used to evaluate the vulnerability of water sources to contamination and helps determine whether more protective measures are needed.

A copy of the most recent summary of either Watershed Sanitary Survey or the SWA can be obtained by calling MWD at (800) CALL-MWD (225-5693).

Groundwater Assessment

A source water assessment was conducted for all city owned wells including Beech Street Well, La Verne Heights Well 01, La Verne Heights Well 02, La Verne Heights Well 03, Lincoln Well, Mills Tract Well, Old Baldy Well, Amherst Well, and Walnut Well for the City of La Verne Water Department in March 2002.

These sources are considered most vulnerable to the following activities not associated with any detected contaminants: hospitals, high density housing, storm drain discharge points, transportation corridors — road-right-of-ways, sewer collection systems, high density septic systems, dry cleaners, historic gas stations, confirmed leaking underground fuel tanks, automobile gas stations, and plastics/synthetics producers.

A copy of the complete assessment may be viewed at: State Water Resources Control Board, Division of Drinking Water, 500 N. Central Avenue, Suite 500, Glendale, California 91203. You may request a summary of the assessment be sent to you by contacting Chi P. Diep, District Engineer, Metropolitan District, (818) 551-2016.

Table 1 – Sampling Results Showing the Detection of Coliform Bacteria

Microbiological Contaminants	Groundwater (28%)	Miramar Plant (72%)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Total Coliform Bacteria Highest percent of positive samples in one month: 5%	No acute violation, 0 positive sample	No acute violations, 0 positive samples	More than 5% of samples collected in one month with positive detection	0	No	Naturally present in the environment
Fecal Coliform or *E. coli*	0 acute violation, 0 positive sample	No acute violations, 0 positive samples	A routine sample and a repeat sample detect total coliform and either sample also detects fecal coliform or *E. coli*	0	No	Human and animal fecal waste

Table 2 – Sampling Results Showing the Detection of Lead and Copper at Residential Taps

Lead and Copper	Action Level (AL)	Public Health Goal	90th Percentile Level Detected	Sites Exceeding AL / Number of Sites	AL (MCLG)	Typical Source of Contaminant Violation
Lead (ppb)	15	0.2	8.8	2 / 35	No	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)	1.3	0.3	0.16	0 / 35	No	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

Table 3 – Sampling Results for Sodium and Hardness

Chemical or Constituent	Groundwater (28%) (Range)	Miramar Plant (72%) (Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Sodium (ppm)	31 – 89	81	none	none	No	Generally found in ground and surface water
Hardness (as CaCo3) (ppm)	110 – 430	120	none	none	No	Generally found in ground and surface water

Table 4 – Detection of Contaminants with a Primary Drinking Water Standard

Chemical or Constituent	Groundwater (28%) (Range/Average)	Miramar Plant (72%) (Range/Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
CLARITY						
Combined Filter Effluent Turbidity (NTU)	–	.08	TT	NS	No	Soil runoff
ORGANIC CHEMICALS						
1,1 Dichloroethane (ppb)	ND – 1.1/0.2	ND	5	3	No	Extraction and degreasing solvent, fumigant
Tetrachloroethylene (PCE) (ppb)	ND – 0.78/0.2	ND	5	0.06	No	Discharge from factories, dry cleaners & auto shops
Trichloroethylene (ppb)	ND – 2.5/3.8	ND	5	1.7	No	Discharge from metal degreasing sites and other factories
Total Trihalomethanes (ppb)	ND – 1.9/0.32	32.6 – 71.4/49.7	80	N/A	No	By-product of drinking water disinfection
INORGANIC CHEMICALS						
Flouride (ppm) (naturally occurring)	0.2 – 0.8/0.4	0.24	2	1	No	Erosion of natural deposits; water additive that promotes strong teeth
Nitrate as Nitrogen (ppm)	4 – 22/14.5*	ND- 1.2/0.52	10	10	No*	Runoff & leaching from fertilizer; leaching from septic tanks & sewage; erosion of natural deposits
Perchlorates (ppm)	ND – 16/6.9*	ND	6	1	No*	Industrial waste discharge
Hexavalent Chromium (ppb)	ND-6.8/2.9	ND-1.1/0.55	10	0.02	No	Industrial waste discharge; could be naturally present as well
RADIONUCLIDES (testing required every six to nine years; last tested 2012)						
Gross Beta Particle Activity (pCi/L)	NR	ND	50	(0)	No	Decay of natural and manmade deposits
Uranium (pCi/L)	3.5-6.1/2.7	due 2019	20	(0)	No	Erosion of natural deposits
Radium 226	NR	due 2022	N/A	0.05	No	Erosion of natural deposits
Radium 228	NR	due 2022	N/A	0.019	No	Erosion of natural deposits
Tritium (pCi/L)	NR	147	20,000	400	No	Decay of natural and manmade deposits
Stronium-90	NR	0.055	8	0.35	No	Decay of natural and manmade deposits

The Presence of Contaminants Does Not Necessarily Indicate a Health Risk

The presence of contaminants in the water does not necessarily indicate that the water poses a health risk. The DDW requires the City to monitor for certain contaminants less than once per year because the concentrations of these contaminants are not expected to vary significantly from year to year. Some of the data, though representative of the water quality, are more than one year old.

The City also participated in unregulated contaminant monitoring. Unregulated contaminant monitoring helps EPA determine where certain contaminants occur and whether it needs to establish regulations for those contaminants. All constituents for this testing were non-detectable (ND) in our groundwater supply with the exception of vanadium.

Table 5 – Detection of Contaminants with a Secondary Drinking Water Standard

Chemical or Constituent (and reporting units)	Groundwater (28%) (Range/Average)	Miramar Plant (72%) (Range/Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
AESTHETIC STANDARDS						
Chloride (ppm)	25 – 95/55.6	88	500	NA	No	Runoff/leaching from natural deposits; seawater influence
Iron (ppb)	ND – 210/23.3	ND	300	NA	No	Leaching from natural deposits; industrial waste
Odor Threshold (units)	ND	1	3	NA	No	Naturally occurring organic materials
Specific Conductance (mS/cm)	620–1000/827	520-630/575	1600	NA	No	Substances that form ions when in water; seawater influence
Sulfate (ppm)	64–120/89	80	500	NA	No	Runoff/leaching from natural deposits; industrial wastes
Total Dissolved Solids (ppm)	400–730/567	344-451/395	1000	NA	No	Runoff/leaching from natural deposits; seawater influence
ADDITIONAL PARAMETERS						
Alkalinity (ppm)	140 – 240/194	61 – 92/78	NA	NA	No	Measure of water quality
Calcium (ppm)	37 – 130/94	26-31/28.5	NA	NA	No	Measure of water quality
Magnesium (ppm)	4.5 – 31/21	10	NA	NA	No	Measure of water quality
pH (units)	7.3 – 8.1/7.6	8.6/8.63/8.62	NA	NA	No	Measure of water quality
Potassium (ppm)	1.4 – 2.0/1.7	2.7	NA	NA	No	Measure of water quality
Total Organic Carbon (ppm)	–	1.6 – 2.8/2.2	NA	NA	No	Various natural and manmade sources
UNREGULATED CHEMICALS OF NOTE REQUIRING MONITORING						
Boron (ppb)	NR	210-270/240	NL=1000	NA	No	Runoff/leaching from natural deposits; industrial wastes
Vanadium	ND-5.1/2.2	7.1-9.6/8.3	NL=50	NA	No	Naturally occurring; industrial waste discharge

*While raw water may exceed the MCL for a given constituent, after treatment the City's water is well below the MCL limits.

1) MWD has developed a flavor profile analysis method that can more accurately detect odor occurrences. For more information, contact Three Valleys Municipal Water District (909) 621-5568

2) NL = Notification Level

Table Legend

What is a Water Quality Goal?

In addition to mandatory water quality standards, USEPA and the DDW have set voluntary water quality goals for some contaminants. Water quality goals are often set at such low levels that they are not achievable in practice and are not directly measurable. Nevertheless, these goals provide useful guidance and directions for water management practices. The chart in this report includes three types of water quality goals:

- **Maximum Contaminant Level Goal (MCLG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the USEPA.
- **Maximum Residual Disinfectant Level Goal (MRDLG):** The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- **Public Health Goals (PHG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

What are Water Quality Standards?

Drinking water standards established by the USEPA and DDW set limits for substances that may affect consumer health or aesthetic qualities of drinking water. The chart in this report shows the following types of water quality standards:

- **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. **Primary MCLs** are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. **Secondary MCLs** are set to protect the odor, taste, and appearance of drinking water.
- **Maximum Residual Disinfectant Level (MRDL):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- **Primary Drinking Water Standard (PDWS):** MCLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
- **Regulatory Action Level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- **Secondary Drinking Water Standards (SDWS):** MCLs for contaminants that affect taste, odor, or appearance of the drinking water. Contaminants with SDWSs do not affect the health at the MCL levels.
- **Treatment Technique (TT):** A required process intended to reduce the level of a contaminant in drinking water
- **Variances and Exemptions:** Department permission to exceed an MCL or not comply with a treatment technique under certain conditions.

Measurement Information

In order to ensure that tap water is safe to drink, USEPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by public water systems.

The tables list all the drinking water contaminants that the City detected above the reporting limits during the 2016 calendar year.

The presence of these contaminants in the water does not necessarily indicate that the water poses a health risk. Unless otherwise noted, **the data presented in this table is from testing done for the period January 1 through December 31, 2016.**

How are Contaminants Measured?

- Parts per million **(ppm)** or milligrams per liter **(mg/L)**
- Parts per billion **(ppb)** or micrograms per liter **(µg/L)**
- Parts per trillion **(ppt)** or nanograms per liter **(ng/L)**

How are Contaminants Measured?

- **pCi/L** = picoCuries per liter
- **µmho/cm** = micromhos per centimeter
- **NTU** = nephelometric turbidity units
- **ND** = not detected
- **NA** = not applicable
- **NR** = Not Required
- **NC** = not collected
- **NL** = Notification Level

The City of La Verne Water Department

3660 D Street ♦ La Verne, California 91750

(909) 596-8744 ♦ www.cityoflaverne.org

Where Does Our Water Come From?

...and How Does It Get to Us?

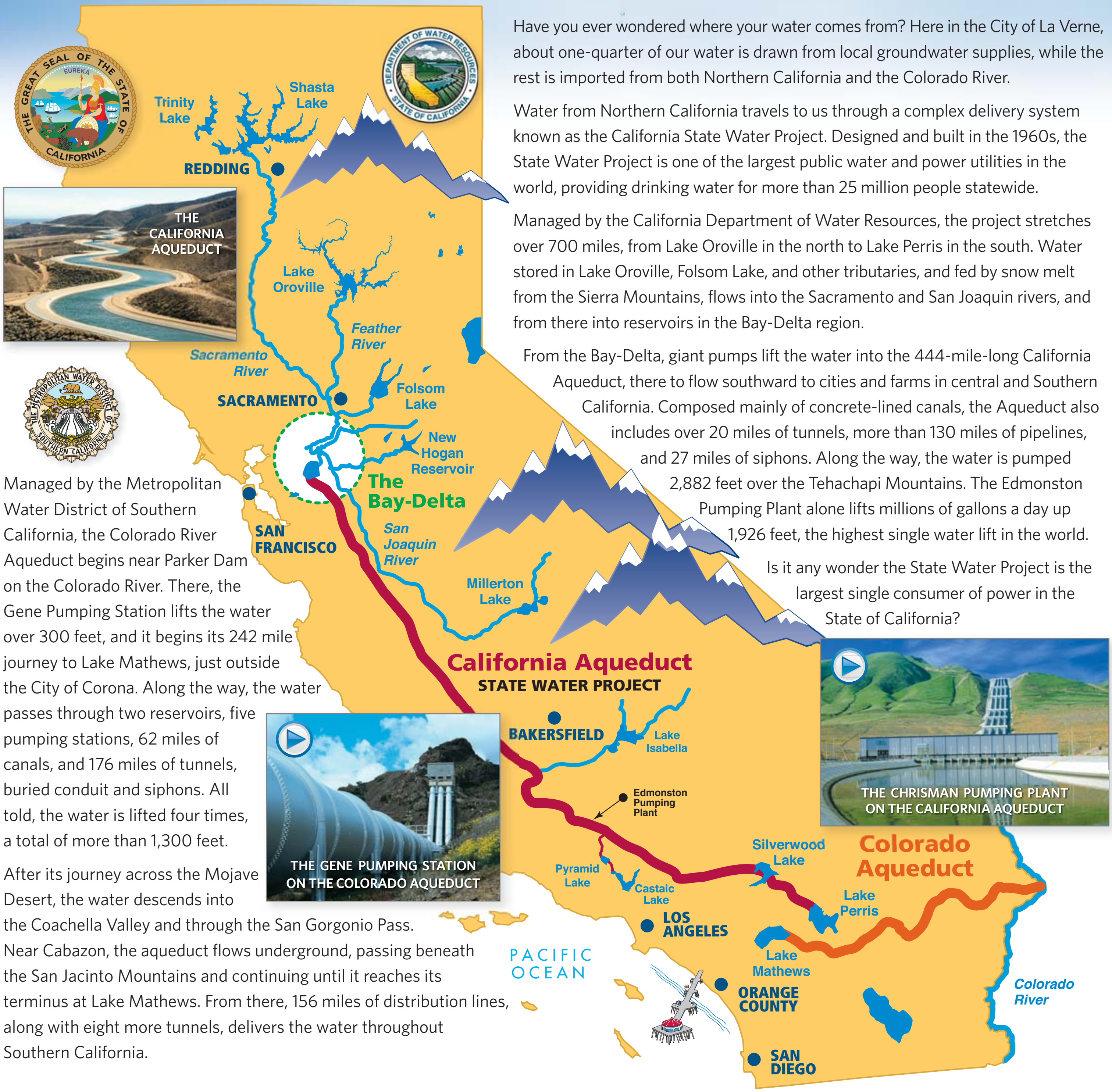
Have you ever wondered where your water comes from? Here in the City of La Verne, about one-quarter of our water is drawn from local groundwater supplies, while the rest is imported from both Northern California and the Colorado River.

Water from Northern California travels to us through a complex delivery system known as the California State Water Project. Designed and built in the 1960s, the State Water Project is one of the largest public water and power utilities in the world, providing drinking water for more than 25 million people statewide.

Managed by the California Department of Water Resources, the project stretches over 700 miles, from Lake Oroville in the north to Lake Perris in the south. Water stored in Lake Oroville, Folsom Lake, and other tributaries, and fed by snow melt from the Sierra Mountains, flows into the Sacramento and San Joaquin rivers, and from there into reservoirs in the Bay-Delta region.

From the Bay-Delta, giant pumps lift the water into the 444-mile-long California Aqueduct, there to flow southward to cities and farms in central and Southern California. Composed mainly of concrete-lined canals, the Aqueduct also includes over 20 miles of tunnels, more than 130 miles of pipelines, and 27 miles of siphons. Along the way, the water is pumped 2,882 feet over the Tehachapi Mountains. The Edmonston Pumping Plant alone lifts millions of gallons a day up 1,926 feet, the highest single water lift in the world.

Is it any wonder the State Water Project is the largest single consumer of power in the State of California?



Managed by the Metropolitan Water District of Southern California, the Colorado River Aqueduct begins near Parker Dam on the Colorado River. There, the Gene Pumping Station lifts the water over 300 feet, and it begins its 242 mile journey to Lake Mathews, just outside the City of Corona. Along the way, the water passes through two reservoirs, five pumping stations, 62 miles of canals, and 176 miles of tunnels, buried conduit and siphons. All told, the water is lifted four times, a total of more than 1,300 feet.

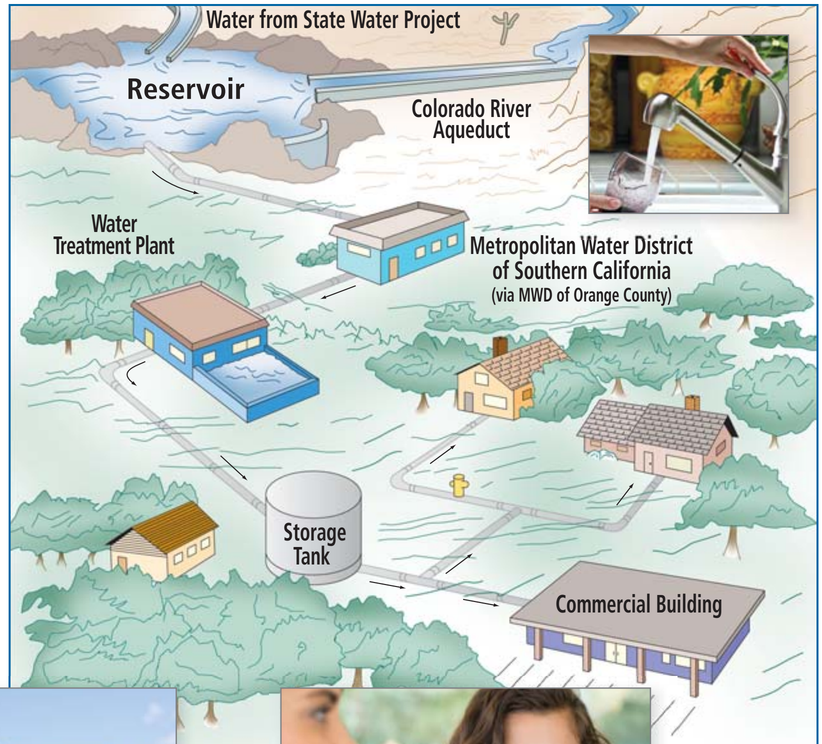
After its journey across the Mojave Desert, the water descends into the Coachella Valley and through the San Gorgonio Pass. Near Cabazon, the aqueduct flows underground, passing beneath the San Jacinto Mountains and continuing until it reaches its terminus at Lake Mathews. From there, 156 miles of distribution lines, along with eight more tunnels, delivers the water throughout Southern California.

How Does Our Water Get to Us?

Importing water from hundreds of miles away is only the start to providing you clean, fresh water. Once the water is in the southland, the Three Valleys Municipal Water District, in partnership with the Metropolitan Water District of Southern California, pumps the water to individual cities in our area.

This imported water meets — or exceeds — all state and federal regulations. And it is kept safe from the treatment plant to your tap by constant testing throughout the distribution network.

The City of La Verne Water Department monitors the water quality at all sources, reservoirs, and various points on the distribution system. All told, between the many agencies responsible for providing your water, it is tested more times, and for more compounds, than is required by state and federal laws and regulations. This constant surveillance ensures your drinking water stays within the requirements mandated by the federal Safe Drinking Water Act.



The Need to Conserve Water Remains A High Priority Throughout California

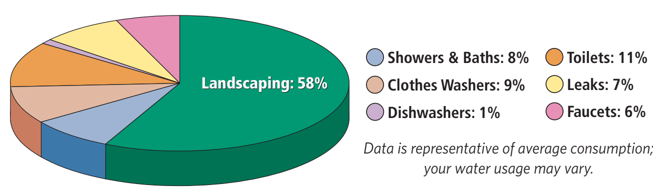
This winter's wet weather, while welcome, has not alleviated the State's water situation. One good season can't overcome the effects of five dry years. Southern California has an arid climate and the need for wise water use must remain a part of everyone's daily lives. Simple water saving acts like the ones listed here can save countless gallons of water every day.

- Soak pots and pans instead of letting water run while you scrub them clean. ***This both saves water and makes the job easier.***
- Keep a pitcher of drinking water in the refrigerator. ***This can save gallons of water every day and it's always cold!***
- Plug the sink instead of running water to rinse your razor or wet your toothbrush. ***This can save upwards of 300 gallons of water a month.***
- Use a broom instead of a hose to clean off sidewalks and driveways. ***It takes very little time to sweep and the water savings quickly adds up.***
- Check your sprinkler system for leaks, overspray, and broken sprinkler heads and repair promptly. ***This can save countless gallons each time you water.***
- Water plants in the early morning. ***It reduces evaporation and ensures deeper watering.***

Where Do We Use Water the Most?

Outdoor watering of lawns and gardens makes up approximately 60% of home water use. By reducing your outdoor water use — by either cutting back on irrigation or planting more drought tolerant landscaping — you can dramatically reduce your overall water use.

Save the most where you use the most: Make your outdoor use efficient.



Data is representative of average consumption; your water usage may vary.

Where Can You Learn More?

There's a wealth of information on the internet about Drinking Water Quality and water issues in general. Some good sites to begin your own research are:

Metropolitan Water District of So. California: www.mwdh2o.com
California Department of Water Resources: www.water.ca.gov
The Water Education Foundation: www.watereducation.org

To learn more about **Water Conservation & Rebate Information**:
www.bewaterwise.com • www.SoCalWaterSmart.com

And to see the Aqueducts in action, checkout these two videos:
Wings Over the State Water Project: youtu.be/8A1v1Rr2neU
Wings Over the Colorado Aqueduct: youtu.be/KipMQh5t0f4

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2018 Water Quality Report

City of
LaVerne
Water Division

DATA FOR 2017

The City of La Verne 2018 Water Quality Report

Since 1990, California public water utilities have been providing annual Water Quality Reports to their customers. **This year's report**, also known as the "Consumer Confidence Report," **covers water quality testing from January to December 2017**, unless otherwise specified**.**

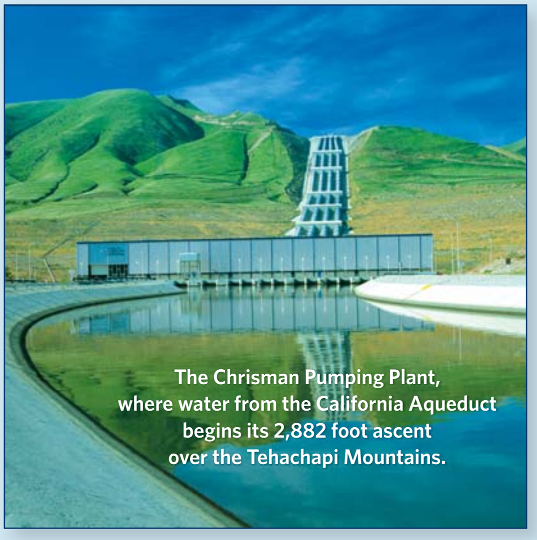
The City of La Verne Water Division's (City) annual Water Quality Report is prepared in compliance with the regulations called for in the 1996 reauthorization of the Safe Drinking Water Act (SDWA). The reauthorization charged the United States Environmental Protection Agency (USEPA) with updating and strengthening the tap water regulatory program. USEPA and the State Water Resources Control Board, Division of Drinking Water (DDW) are the agencies responsible for establishing water quality standards.

To ensure that your tap water is safe to drink, USEPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by water systems. DDW regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The State and Federal governments require that this annual Water Quality Report be provided to every customer to insure you are informed of the quality of your water. The City is committed to safeguarding its water supply and, as in years past, the water delivered to your home meets or exceeds the standards required by the state and federal regulatory agencies.

In some cases, the City goes beyond what is required by testing for unregulated chemicals that may have known health risks but do not have drinking water standards. Unregulated chemical monitoring helps USEPA and DDW determine where certain chemicals occur and whether new standards need to be established for those chemicals to protect public health.

We encourage you to read this report and to contact us with any questions you may have.



The Chrisman Pumping Plant, where water from the California Aqueduct begins its 2,882 foot ascent over the Tehachapi Mountains.

This report contains important information about your drinking water. Translate it, or speak with someone who understands it.

Este informe contiene información muy importante sobre su agua beber. Tradúzcalo ó hable con alquien que lo entienda bien.

Questions about your water? Contact us for answers.

If you would like more information, or have any questions regarding the quality or delivery of your water service, please contact Richard Martinez, Utilities Manager, City of La Verne, 3660 "D" Street, La Verne, California 91750, or by phone at (909) 596-8741.

The City Council meets on the first and third Mondays of the month in the Council Chambers at the same address above. Public attendance and participation is encouraged and welcomed.

For more information about the health effects of the listed constituents in the following tables, call the U.S. Environmental Protection Agency hotline at (800) 426-4791.

Additional Resources for Water Information

The City of La Verne cares about our customers and the water we supply to them. We always welcome any calls or questions regarding the quality or delivery of our water. Our customer service office can be reached at (909) 596-8744. For more information about water use efficiency and available rebates, please visit the City's website at www.cityoflaverne.org and look for environmental programs in the Public Works Department section.

The Quality of Your Water Is Our Primary Concern

Sources of Supply

Local groundwater provides approximately 28 percent of our water; however, most of our supply (72 percent) is purchased from the Three Valleys Municipal Water District (TVMWD) who treats water received from the Metropolitan Water District of Southern California (MWD). MWD provides supplemental water to about 300 cities and unincorporated areas in Southern California, importing water from two separate sources: the Colorado River and the State Water Project. The water we purchase is treated by Three Valleys Municipal Water District at the Miramar Treatment Plant.

Basic Information About Drinking Water Contaminants

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of land or through the layers of the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animal and human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- **Inorganic contaminants**, such as salts and metals, which can be naturally occurring or result from urban storm runoff, industrial or domestic wastewater discharges, oil and gas production, mining and farming.
- **Radioactive contaminants**, which can be naturally occurring or be the result of oil and gas production or mining activities.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gasoline stations, urban stormwater runoff, agricultural application and septic systems.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff and residential uses.

More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791.

About Lead in Tap Water

Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested and/or flush your tap for 30 seconds to 2 minutes before using tap water. Additional information is available from the USEPA Safe Drinking Water Hotline (1-800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of La Verne is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.

If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/safewater/lead.

Special Risk Populations

Some individuals may be more vulnerable to the effects of possible contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, some elderly persons, infants, persons infected with HIV/AIDS, or persons with other immune system disorders can be particularly at risk from infections. These persons should seek advice from their health care providers about drinking water.

The USEPA/Center for Disease Control guidelines on appropriate means to lessen the risks of infection by *Cryptosporidium* or other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Additional General Drinking Water Information

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by visiting the USEPA Safe Drinking Water website (www.epa.gov/ground-water-and-drinking-water) or by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791).

Water Quality Issues that Could Affect Your Health

Contaminants Exceeding MCL or AL

The range for Nitrate and other constituents in the groundwater sample results may be above the MCL. These values are for wells which account for approximately 28 percent of the total water supplied to our customers. The content at your tap is well below the MCL, ranging from ND — 7.2* parts per million (ppm) for Nitrate with an average of 4.22 ppm and ND — 4.9* parts per billion (ppb) for Perchlorate with an average of 0.37 ppb. The range for Trichloroethylene in the groundwater sample results may also be above the MCL; however, the groundwater goes through an air stripping process that reduces the Trichloroethylene to between 0.56 to 2.1 ppb with an average of 1.26 ppb.

Nitrate as Nitrogen in drinking water at prolonged levels above 10 ppm is a health risk for infants of less than six months of age. Such nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in a serious illness; symptoms include shortness of breath and blueness of the skin. Nitrate as Nitrogen in drinking water at prolonged levels above 10 ppm may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with certain specific enzyme deficiencies. If you are caring for an infant, or you are pregnant, you should ask advice from your healthcare provider.

Perchlorate in drinking water at prolonged levels above 6 ppb can disrupt the normal function of the thyroid gland in both children and adults. In adults, the thyroid plays an important role in metabolism, making and storing hormones that help regulate the heart rate, blood pressure, body temperature, and the rate at which food is converted into energy. In fetuses and infants, thyroid hormones are critical for normal growth and development of the central nervous system. Perchlorate can interfere with the human body's ability to absorb iodine into the thyroid gland which is a critical element in the production of thyroid hormones.

Fluoride

Fluoride has been added to U.S. drinking water supplies since 1945. Of the 50 largest cities in the U.S., 43 fluoridate their drinking water. In December 2007, MWD joined a majority of the nation's public water suppliers in adding fluoride to drinking water in order to prevent tooth decay. In line with recommendations from the DDW, as well as the U.S. Centers for Disease Control and Prevention, MWD adjusted the natural fluoride level in imported treated water from the Colorado River and State Water Project to the control range for dental health of 0.6 to 1.2 parts per million. Our local water is not supplemented with fluoride. Fluoride levels in drinking water are limited under California state regulations at a maximum dosage of 2 parts per million.

Additional information about the fluoridation of drinking water can be found through the following sources:

U.S. Centers for Disease Control and Prevention:
www.cdc.gov/fluoridation • 1-800-CDC-INFO (1-800-232-4636)

State Water Resources Control Board, Division of Drinking Water
www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Fluoridation.html

For more information about MWD's fluoridation program, please contact Edgar G. Dymally at edymally@mwdh2o.com or you may call him at (213) 217-5709.

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*On July 26, 2017, a routine water quality sample obtained from the Old Baldy Well blending station exceeded the State water quality standards for perchlorate. The State has established a Maximum Contaminant Level (MCL) of 6 ppb and the sample analysis received contained 7 ppb.

Additionally, on August 2, another routine water quality sample obtained from the City's Old Baldy Well blending station exceeded the State water quality standard for Nitrate. The State has established an MCL of 10 ppm and the sample analyis received contained 11 ppm.

These exceedances were caused by an abnormally high and unexpected spike in Perchlorate and Nitrate levels from the Old Baldy Well.

Immediately upon learning of the sample results on August 9, the City removed the Old Baldy Well from service and conducted additional testing throughout the City's water distribution system. This additional testing of 20 sampling sites throughout the community found waters within the entire distribution system to be under the MCL for both Perchlorate and Nitrate. This additional testing demonstrated that the water was safe to consume as of August 9, however, it's possible that consumers within the immediate vicinity of the Old Baldy Well site, located on the corner of Fifth and C Streets, may have received water above the MCL for Percholorate during the period from July 26 to August 9, and Nitrate during the period from August 2 to August 9.

All affected consumers received letters notifying them of the incident.

Source Water Assessments

Imported (MWD) Water Assessment

Every five years, MWD is required by DDW to examine possible sources of drinking water contamination in its State Water Project and Colorado River source waters.

The most recent watershed sanitary surveys of its source water supplies from the Colorado River was updated in 2015 and the State Water Project was updated in 2016.

Water from the Colorado River is considered to be most vulnerable to contamination from recreation, urban/stormwater runoff, increasing urbanization in the watershed, and wastewater. Water supplies from Northern California's State Water Project are most vulnerable to contamination from urban/stormwater runoff, wildlife, agriculture, recreation, and wastewater.

USEPA also requires MWD to complete one Source Water Assessment (SWA) that utilizes information collected in the watershed sanitary surveys. MWD completed its SWA in December 2002. The SWA is used to evaluate the vulnerability of water sources to contamination and helps determine whether more protective measures are needed.

A copy of the most recent summary of either Watershed Sanitary Survey or the SWA can be obtained by calling MWD at (800) CALL-MWD (225-5693).

Groundwater Assessment

A source water assessment was conducted for all city owned wells including Beech Street Well, La Verne Heights Well 01, La Verne Heights Well 02, La Verne Heights Well 03, Lincoln Well, Mills Tract Well, Old Baldy Well, Amherst Well, and Walnut Well for the City of La Verne Water Department in March 2002.

These sources are considered most vulnerable to the following activities not associated with any detected contaminants: hospitals, high density housing, storm drain discharge points, transportation corridors — road-right-of-ways, sewer collection systems, high density septic systems, dry cleaners, historic gas stations, confirmed leaking underground fuel tanks, automobile gas stations, and plastics/synthetics producers.

A copy of the complete assessment may be viewed at: State Water Resources Control Board, Division of Drinking Water, 500 N. Central Avenue, Suite 500, Glendale, California 91203. You may request a summary of the assessment be sent to you by contacting Chi P. Diep, District Engineer, Metropolitan District, (818) 551-2016.

Table 1 – Sampling Results Showing the Detection of Coliform Bacteria

Microbiological Contaminants	Groundwater (28%)	Miramar Plant (72%)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Total Coliform Bacteria Highest percent of positive samples in one month: 5%	No acute violation, 0 positive sample	No acute violations, 0 positive samples	More than 5% of samples collected in one month with positive detection	0	No	Naturally present in the environment
Fecal Coliform or *E. coli*	0 acute violation, 0 positive sample	No acute violations, 0 positive samples	A routine sample and a repeat sample detect total coliform and either sample also detects fecal coliform or *E. coli*	0	No	Human and animal fecal waste

Table 2 – Sampling Results Showing the Detection of Lead and Copper at Residential Taps

Lead and Copper Last sampled 2015; next sampling due 2018	Action Level (AL)	Public Health Goal	90th Percentile Level Detected	Sites Exceeding AL / Number of Sites	AL (MCLG)	Typical Source of Contaminant Violation
Lead* (ppb)	15	0.2	8.8	2 / 35	No	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)	1.3	0.3	0.16	0 / 35	No	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

*In 2017, nine schools submitted requests and were sampled for lead.

Table 3 – Sampling Results for Sodium and Hardness

Chemical or Constituent	Groundwater (28%) (Range)	Miramar Plant (72%) (Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Sodium (ppm)	31 – 89	28	none	none	No	Generally found in ground and surface water
Hardness (as $CaCo_3$) (ppm)	110 – 430	74	none	none	No	Generally found in ground and surface water

Table 4 – Detection of Contaminants with a Primary Drinking Water Standard

Chemical or Constituent	Groundwater (28%) (Range/Average)	Miramar Plant (72%) (Range/Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
CLARITY						
Combined Filter Effluent Turbidity (NTU)	—	0.14	TT	NS	No	Soil runoff
ORGANIC CHEMICALS						
1,1 Dichloroethane (ppb)	ND – 0.66 / 0.22	ND	5	3	No	Extraction and degreasing solvent, fumigant
Tetrachloroethylene (PCE) (ppb)	ND – 0.76 / 0.46	ND	5	0.06	No	Discharge from factories, dry cleaners & auto shops
Trichloroethylene (ppb)	3.9 – 21 / 10.34	ND	5	1.7	No	Discharge from metal degreasing sites and other factories
Total Trihalomethanes (ppb)	ND – 0.64 / 0.57	28.7 – 65.9 / 58.5	80	N/A	No	By-product of drinking water disinfection
INORGANIC CHEMICALS						
Fluoride (ppm) (naturally occurring)	0.2 – 0.8 / 0.4	ND	2	1	No	Erosion of natural deposits; water additive that promotes strong teeth
Nitrate as Nitrogen (ppm)	6.1 – 23 / 14.97	ND – 0.8 / 0.5	10	10	Yes	Runoff & leaching from fertilizer; leaching from septic tanks & sewage; erosion of natural deposits
Perchlorates (ppb)	ND – 21 / 7.51	ND	6	1	Yes	Industrial waste discharge
Hexavalent Chromium (ppb)	ND – 6.8 / 3.0	ND	None	0.02	No	Industrial waste discharge; could be naturally present as well
RADIONUCLIDES (testing required every six to nine years; last tested 2012)						
Gross Beta Particle Activity (pCi/L)	NR	ND	50	(0)	No	Decay of natural and manmade deposits
Uranium (pCi/L)	3.5 – 6.1 / 2.7	due 2019	20	(0)	No	Erosion of natural deposits
Radium 226	NR	due 2022	N/A	0.05	No	Erosion of natural deposits
Radium 228	NR	due 2022	N/A	0.019	No	Erosion of natural deposits
Tritium (pCi/L)	NR	89.5	20,000	400	No	Decay of natural and manmade deposits
Strontium-90	NR	0.137	8	0.35	No	Decay of natural and manmade deposits

The Presence of Contaminants Does Not Necessarily Indicate a Health Risk

The presence of contaminants in the water does not necessarily indicate that the water poses a health risk. The DDW requires the City to monitor for certain contaminants less than once per year because the concentrations of these contaminants are not expected to vary significantly from year to year. Some of the data, though representative of the water quality, are more than one year old.

The City also participated in unregulated contaminant monitoring. Unregulated contaminant monitoring helps EPA determine where certain contaminants occur and whether it needs to establish regulations for those contaminants. All constituents for this testing were non-detectable (ND) in our groundwater supply with the exception of vanadium.

Table 5 – Detection of Contaminants with a Secondary Drinking Water Standard

Chemical or Constituent (and reporting units)	Groundwater (28%) (Range/Average)	Miramar Plant (72%) (Range/Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
AESTHETIC STANDARDS						
Chloride (ppm)	25 – 95 / 55.6	28	500	NA	No	Runoff/leaching from natural deposits; seawater influence
Iron (ppb)	ND – 210 / 23.3	ND	300	NA	No	Leaching from natural deposits; industrial waste
Odor Threshold (units)	ND	1	3	NA	No	Naturally occurring organic materials
Specific Conductance (mS/cm)	620 – 1000 / 827	240 – 290 / 265	1600	NA	No	Substances that form ions when in water; seawater influence
Sulfate (ppm)	64 – 120 /89	24	500	NA	No	Runoff/leaching from natural deposits; industrial wastes
Total Dissolved Solids (ppm)	400 – 730 / 567	180	1000	NA	No	Runoff/leaching from natural deposits; seawater influence
ADDITIONAL PARAMETERS						
Alkalinity (ppm)	140 – 240 / 194	49 – 64 / 57	NA	NA	No	Measure of water quality
Calcium (ppm)	37 – 130 / 94	13 – 17 / 15	NA	NA	No	Measure of water quality
Magnesium (ppm)	4.5 – 31 / 21	7.6	NA	NA	No	Measure of water quality
pH (units)	7.3 – 8.1 / 7.6	7.7 – 8.59 / 8.13	NA	NA	No	Measure of water quality
Potassium (ppm)	1.4 – 2.0 / 1.7	1.5 – 2.9 / 2.2	NA	NA	No	Measure of water quality
Total Organic Carbon (ppm)	—	1.8 – 3.3 / 2.3	NA	NA	No	Various natural and manmade sources
UNREGULATED CHEMICALS OF NOTE REQUIRING MONITORING						
Boron (ppb)	NR	120 – 150 / 135	NL = 1000	NA	No	Runoff/leaching from natural deposits; industrial wastes
Vanadium	ND-5.1 / 2.2	ND	NL = 50	NA	No	Naturally occurring; industrial waste discharge

1) MWD has developed a flavor profile analysis method that can more accurately detect odor occurrences. For more information, contact Three Valleys Municipal Water District (909) 621-5568

2) NL = Notification Level

Table Legend

What is a Water Quality Goal?

In addition to mandatory water quality standards, USEPA and the DDW have set voluntary water quality goals for some contaminants. Water quality goals are often set at such low levels that they are not achievable in practice and are not directly measurable. Nevertheless, these goals provide useful guidance and directions for water management practices. The chart in this report includes three types of water quality goals:

- **Maximum Contaminant Level Goal (MCLG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the USEPA.
- **Maximum Residual Disinfectant Level Goal (MRDLG):** The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- **Public Health Goals (PHG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.

What are Water Quality Standards?

Drinking water standards established by the USEPA and DDW set limits for substances that may affect consumer health or aesthetic qualities of drinking water. The chart in this report shows the following types of water quality standards:

- **Maximum Contaminant Level (MCL):** The highest level of a contaminant that is allowed in drinking water. **Primary MCLs** are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. **Secondary MCLs** are set to protect the odor, taste, and appearance of drinking water.
- **Maximum Residual Disinfectant Level (MRDL):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- **Primary Drinking Water Standard (PDWS):** MCLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
- **Regulatory Action Level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
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- **Treatment Technique (TT):** A required process intended to reduce the level of a contaminant in drinking water
- **Variances and Exemptions:** Department permission to exceed an MCL or not comply with a treatment technique under certain conditions.

Measurement Information

In order to ensure that tap water is safe to drink, USEPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by public water systems.

The tables list all the drinking water contaminants that the City detected above the reporting limits during the 2017 calendar year.

The presence of these contaminants in the water does not necessarily indicate that the water poses a health risk. Unless otherwise noted, **the data presented in this table is from testing done for the period January 1 through December 31, 2017**.

How are Contaminants Measured?

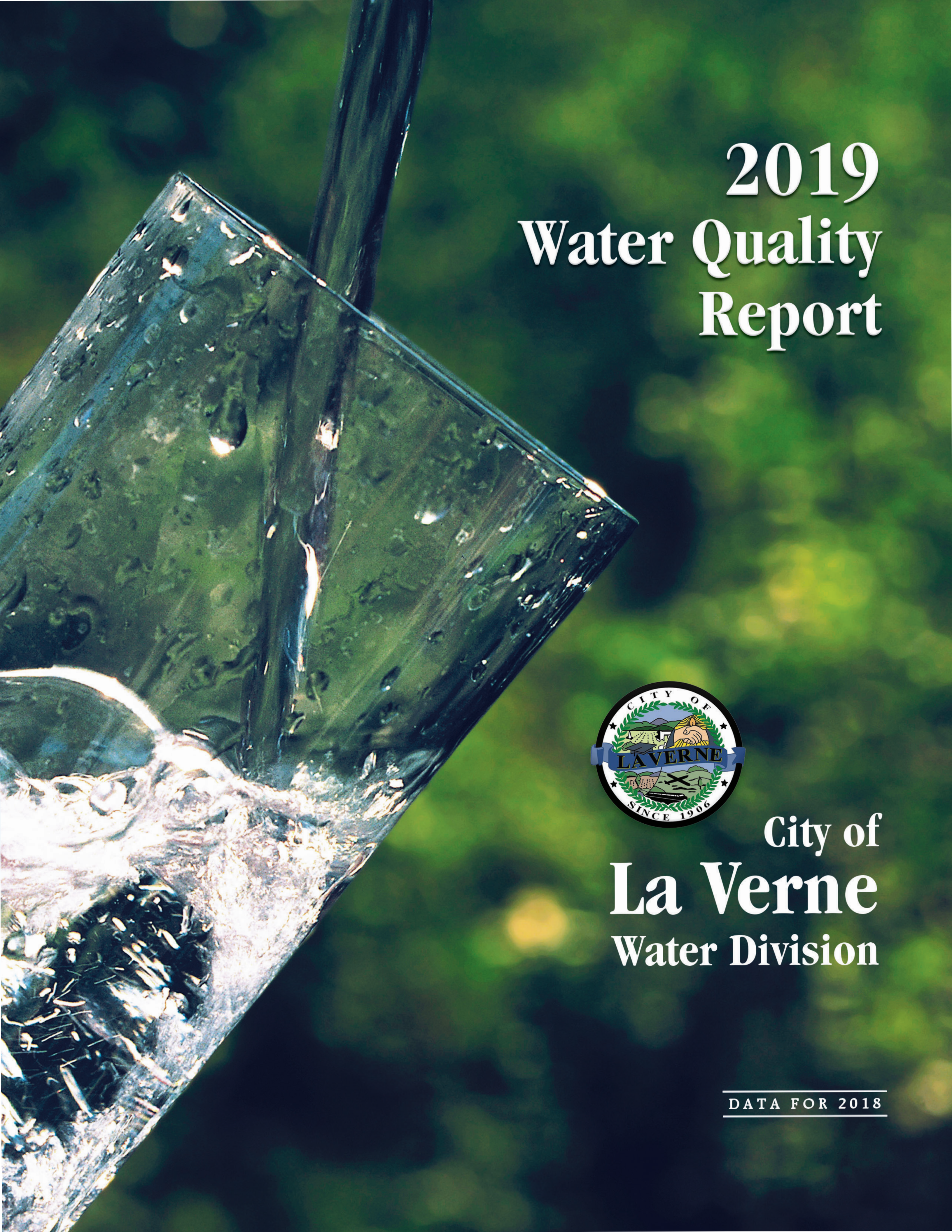
- Parts per million **(ppm)** or milligrams per liter **(mg/L)**
- Parts per billion **(ppb)** or micrograms per liter **(µg/L)**
- Parts per trillion **(ppt)** or nanograms per liter **(ng/L)**

What Do the Abbreviations Represent?

- **pCi/L** = picoCuries per liter
- **µmho/cm** = micromhos per centimeter
- **NTU** = nephelometric turbidity units
- **ND** = not detected
- **NA** = not applicable
- **NR** = Not Required
- **NC** = not collected
- **NL** = Notification Level

The City of La Verne Water Department

3660 D Street ♦ La Verne, California 91750
(909) 596-8744 ♦ www.cityoflaverne.org



2019 Water Quality Report

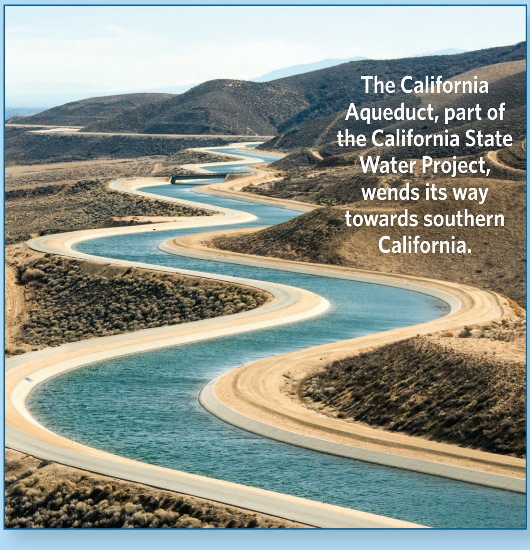
City of La Verne Water Division

DATA FOR 2018

The City of La Verne 2019 Water Quality Report

Since 1990, California public water utilities have been providing annual Water Quality Reports to their customers. **This year's report**, also known as the "Consumer Confidence Report," **covers water quality testing from January to December 2018**, unless otherwise specified**.**

The City of La Verne Water Division's (City) annual Water Quality Report is prepared in compliance with the regulations called for in the 1996 reauthorization of the Safe Drinking Water Act (SDWA). The reauthorization charged the United States Environmental Protection Agency (USEPA) with updating and strengthening the tap water regulatory program. USEPA and the State Water Resources Control Board, Division of Drinking Water (DDW) are the agencies responsible for establishing water quality standards.



The California Aqueduct, part of the California State Water Project, wends its way towards southern California.

To ensure that your tap water is safe to drink, USEPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by water systems. DDW regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The State and Federal governments require that this annual Water Quality Report be provided to every customer to insure you are informed of the quality of your water. The City is committed to safeguarding its water supply and, as in years past, the water delivered to your home meets or exceeds the standards required by the state and federal regulatory agencies.

In some cases, the City goes beyond what is required by testing for unregulated chemicals that may have known health risks but do not have drinking water standards. Unregulated chemical monitoring helps USEPA and DDW determine where certain chemicals occur and whether new standards need to be established for those chemicals to protect public health.

We encourage you to read this report and to contact us with any questions you may have.

This report contains important information about your drinking water. Translate it, or speak with someone who understands it.

Este informe contiene información muy importante sobre su agua beber. Tradúzcalo ó hable con alquien que lo entienda bien.

Questions about your water? Contact us for answers.

If you would like more information, or have any questions regarding the quality or delivery of your water service, please contact Richard Martinez, Utilities Manager, City of La Verne, 3660 "D" Street, La Verne, California 91750, or by phone at (909) 596-8741.

The City Council meets on the first and third Mondays of the month in the Council Chambers at the same address above. Public attendance and participation is encouraged and welcomed.

For more information about the health effects of the listed constituents in the following tables, call the U.S. Environmental Protection Agency hotline at (800) 426-4791.

Additional Resources for Water Information

The City of La Verne cares about our customers and the water we supply to them. We always welcome any calls or questions regarding the quality or delivery of our water. Our customer service office can be reached at (909) 596-8744. For more information about water use efficiency and available rebates, please visit the City's website at www.cityoflaverne.org and look for environmental programs in the Public Works Department section.

The Quality of Your Water Is Our Primary Concern

Sources of Supply

Local groundwater provides approximately 30 percent of our water; however, most of our supply (70 percent) is purchased from the Three Valleys Municipal Water District (TVMWD) who treats water received from the Metropolitan Water District of Southern California (MWD). MWD provides supplemental water to about 300 cities and unincorporated areas in Southern California, importing water from two separate sources: the Colorado River and the State Water Project. The water we purchase is treated by Three Valleys Municipal Water District at the Miramar Treatment Plant.

Basic Information About Drinking Water Contaminants

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of land or through the layers of the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animal and human activity.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- **Inorganic contaminants**, such as salts and metals, which can be naturally occurring or result from urban storm runoff, industrial or domestic wastewater discharges, oil and gas production, mining and farming.
- **Radioactive contaminants**, which can be naturally occurring or be the result of oil and gas production or mining activities.
- **Organic chemical contaminants**, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gasoline stations, urban stormwater runoff, agricultural application and septic systems.
- **Pesticides and herbicides**, which may come from a variety of sources such as agriculture, urban stormwater runoff and residential uses.

More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791.

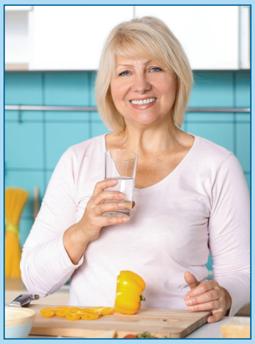
About Lead in Tap Water

Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested and/or flush your tap for 30 seconds to 2 minutes before using tap water. Additional information is available from the USEPA Safe Drinking Water Hotline (1-800-426-4791).

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City of La Verne is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.

If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/safewater/lead.

Special Risk Populations



Some individuals may be more vulnerable to the effects of possible contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, some elderly persons, infants, persons infected with HIV/AIDS, or persons with other immune system disorders can be particularly at risk from infections. These persons should seek advice from their health care providers about drinking water.

The USEPA/Center for Disease Control guidelines on appropriate means to lessen the risks of infection by *Cryptosporidium* or other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Additional General Drinking Water Information

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by visiting the USEPA Safe Drinking Water website (www.epa.gov/ground-water-and-drinking-water) or by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791).

Water Quality Issues that Could Affect Your Health

Contaminants Exceeding MCL or AL

The range for Nitrate and other constituents in the groundwater sample results may be above the MCL. These values are for wells which account for approximately 30 percent of the total water supplied to our customers. The Nitrate content at your tap is well below the MCL of 10 parts per million (ppm), ranging from 3.2 to 7.1 ppm with an average of 4.84 ppm. The Perchlorate content at your tap is well below the MCL of 6 parts per billion (ppb), ranging from ND to 5.4 ppb with an average of 0.35 ppb. The range for Trichloroethylene in the groundwater sample results may also be above the MCL of 5 parts per billion (ppb); however, the groundwater goes through an air stripping process that reduces the Trichloroethylene to between 0.52 to 1.4 ppb with an average of 1.10 ppb.

Nitrate as Nitrogen in drinking water at prolonged levels above 10 ppm is a health risk for infants of less than six months of age. Such nitrate levels in drinking water can interfere with the capacity of the infant's blood to carry oxygen, resulting in a serious illness; symptoms include shortness of breath and blueness of the skin. Nitrate as Nitrogen in drinking water at prolonged levels above 10 ppm may also affect the ability of the blood to carry oxygen in other individuals, such as pregnant women and those with certain specific enzyme deficiencies. If you are caring for an infant, or you are pregnant, you should ask advice from your healthcare provider.

Perchlorate in drinking water at prolonged levels above 6 ppb can disrupt the normal function of the thyroid gland in both children and adults. In adults, the thyroid plays an important role in metabolism, making and storing hormones that help regulate the heart rate, blood pressure, body temperature, and the rate at which food is converted into energy. In fetuses and infants, thyroid hormones are critical for normal growth and development of the central nervous system. Perchlorate can interfere with the human body's ability to absorb iodine into the thyroid gland which is a critical element in the production of thyroid hormones.

Fluoride

Fluoride has been added to U.S. drinking water supplies since 1945. Of the 50 largest cities in the U.S., 43 fluoridate their drinking water. In December 2007, MWD joined a majority of the nation's public water suppliers in adding fluoride to drinking water in order to prevent tooth decay. In line with recommendations from the DDW, as well as the U.S. Centers for Disease Control and Prevention, MWD adjusted the natural fluoride level in imported treated water from the Colorado River and State Water Project to the control range for dental health of 0.6 to 1.2 parts per million. Our local water is not supplemented with fluoride. Fluoride levels in drinking water are limited under California state regulations at a maximum dosage of 2 parts per million.

Additional information about the fluoridation of drinking water can be found through the following sources:

U.S. Centers for Disease Control and Prevention:
www.cdc.gov/fluoridation • 1-800-CDC-INFO (1-800-232-4636)

State Water Resources Control Board, Division of Drinking Water
www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Fluoridation.html

For more information about MWD's fluoridation program, please contact Edgar G. Dymally at edymally@mwdh2o.com or you may call him at (213) 217-5709.

Source Water Assessments

Imported (MWD) Water Assessment

Every five years, MWD is required by DDW to examine possible sources of drinking water contamination in its State Water Project and Colorado River source waters.

The most recent watershed sanitary surveys of its source water supplies from the Colorado River was updated in 2015 and the State Water Project was updated in 2016.

Water from the Colorado River is considered to be most vulnerable to contamination from recreation, urban/stormwater runoff, increasing urbanization in the watershed, and wastewater. Water supplies from Northern California's State Water Project are most vulnerable to contamination from urban/stormwater runoff, wildlife, agriculture, recreation, and wastewater.

USEPA also requires MWD to complete one Source Water Assessment (SWA) that utilizes information collected in the watershed sanitary surveys. MWD completed its SWA in December 2002. The SWA is used to evaluate the vulnerability of water sources to contamination and helps determine whether more protective measures are needed.

A copy of the most recent summary of either Watershed Sanitary Survey or the SWA can be obtained by calling MWD at (800) CALL-MWD (225-5693).

Groundwater Assessment

A source water assessment was conducted for all city owned wells including Beech Street Well, La Verne Heights Well 01, La Verne Heights Well 02, La Verne Heights Well 03, Lincoln Well, Mills Tract Well, Old Baldy Well, Amherst Well, and Walnut Well for the City of La Verne Water Department in March 2002.

These sources are considered most vulnerable to the following activities not associated with any detected contaminants: hospitals, high density housing, storm drain discharge points, transportation corridors — road-right-of-ways, sewer collection systems, high density septic systems, dry cleaners, historic gas stations, confirmed leaking underground fuel tanks, automobile gas stations, and plastics/synthetics producers.

A copy of the complete assessment may be viewed at: State Water Resources Control Board, Division of Drinking Water, 500 N. Central Avenue, Suite 500, Glendale, California 91203. You may request a summary of the assessment be sent to you by contacting Chi P. Diep, District Engineer, Metropolitan District, (818) 551-2016.

Table 1 – Sampling Results Showing the Detection of Coliform Bacteria

Microbiological Contaminants	System Water	Miramar Plant	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Total Coliform Bacteria Highest percent of positive samples in one month: 5%	No acute violation, 3 positive sample	No acute violations, 0 positive samples	More than 5% of samples collected in one month with positive detection	0	No	Naturally present in the environment
Fecal Coliform or *E. coli*	0 acute violation, 0 positive sample	No acute violations, 0 positive samples	A routine sample and a repeat sample detect total coliform and either sample also detects fecal coliform or *E. coli*	0	No	Human and animal fecal waste

Table 2 – Sampling Results Showing the Detection of Lead and Copper at Residential Taps

Lead and Copper Last sampled 2018; next sampling due 2021	Action Level (AL)	Public Health Goal	90th Percentile Level Detected	Sites Exceeding AL / Number of Sites	AL (MCLG)	Typical Source of Contaminant Violation
Lead* (ppb)	15	0.2	9.4	2 / 30	No	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)	1.3	0.3	0.13	0 / 30	No	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

*In 2018, 0 (zero) schools submitted requests to be sampled for lead.

Table 3 – Sampling Results for Sodium and Hardness

Chemical or Constituent	Groundwater (30%) (Range)	Miramar Plant (70%) (Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
Sodium (ppm)	31 – 89	62	none	none	No	Generally found in ground and surface water
Hardness (as $CaCo_3$) (ppm)	110 – 430	110	none	none	No	Generally found in ground and surface water

Table 4 – Detection of Contaminants with a Primary Drinking Water Standard

Chemical or Constituent	Groundwater (30%) (Range/Average)	Miramar Plant (70%) (Range/Average)	MCL	PHG (MCLG)	MCL Violation	Typical Source of Contaminant
CLARITY						
Combined Filter Effluent Turbidity (NTU)	—	0.14	TT	N/A	No	Soil runoff
ORGANIC CHEMICALS						
1,1 Dichloroethane (ppb)	ND – 1 / 0.63	ND	5	3	No	Extraction and degreasing solvent, fumigant
Tetrachloroethylene (PCE) (ppb)	ND – 0.74 / 0.52	ND	5	0.06	No	Discharge from factories, dry cleaners & auto shops
Trichloroethylene (TCE) (ppb)	ND – 21 / 8.77	ND	5	1.7	No	Discharge from metal degreasing sites and other factories
Total Trihalomethanes (ppb)	17 – 49 / 31.25	44.2 – 64.9 / 55.4	80	N/A	No	By-product of drinking water disinfection
INORGANIC CHEMICALS						
Fluoride (ppm) (naturally occurring)	0.2 – 0.8 / 0.4	ND	2	1	No	Erosion of natural deposits; water additive that promotes strong teeth
Nitrate as Nitrogen (ppm)	5 – 22 / 15.23	ND – 0.5 / ND	10	10	Yes	Runoff & leaching from fertilizer; leaching from septic tanks & sewage; erosion of natural deposits
Perchlorates (ppb)	ND – 22 / 7.68	ND	6	1	Yes	Industrial waste discharge
Hexavalent Chromium (ppb)	ND – 6.8 / 3.0	ND	None	0.02	No	Industrial waste discharge; could be naturally present as well
RADIONUCLIDES (testing required every six to nine years; last tested 2012)						
Gross Beta Particle Activity (pCi/L)	NR	ND – 0.071 / 0.024	50	(0)	No	Decay of natural and manmade deposits
Uranium (pCi/L)	3.5 – 6.1 / 2.7	due 2019	20	(0)	No	Erosion of natural deposits
Radium 226	NR	due 2022	N/A	0.05	No	Erosion of natural deposits
Radium 228	NR	due 2022	N/A	0.019	No	Erosion of natural deposits
Tritium (pCi/L)	NR	ND	20,000	400	No	Decay of natural and manmade deposits
Strontium-90	NR	ND	8	0.35	No	Decay of natural and manmade deposits

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AESTHETIC STANDARDS						
Chloride (ppm)	25 – 95 / 55.6	90	500	NA	No	Runoff/leaching from natural deposits; seawater influence
Iron (ppb)	ND – 210 / 23.3	ND	300	NA	No	Leaching from natural deposits; industrial waste
Odor Threshold (units)	ND	1	3	NA	No	Naturally occurring organic materials
Specific Conductance (mS/cm)	620 – 1000 / 827	500	1600	NA	No	Substances that form ions when in water; seawater influence
Sulfate (ppm)	64 – 120 /89	40	500	NA	No	Runoff/leaching from natural deposits; industrial wastes
Total Dissolved Solids (ppm)	400 – 730 / 567	290 – 330 / 310	1000	NA	No	Runoff/leaching from natural deposits; seawater influence
ADDITIONAL PARAMETERS						
Alkalinity (ppm)	140 – 240 / 194	49 – 76 / 66.25	NA	NA	No	Measure of water quality
Calcium (ppm)	37 – 130 / 94	21 – 23 / 22	NA	NA	No	Measure of water quality
Magnesium (ppm)	4.5 – 31 / 21	13	NA	NA	No	Measure of water quality
pH (units)	7.3 – 8.1 / 7.6	8.1 – 8.4 / 8.25	NA	NA	No	Measure of water quality
Potassium (ppm)	1.4 – 2.0 / 1.7	3.0 – 3.3 / 3.1	NA	NA	No	Measure of water quality
Total Organic Carbon (ppm)	—	1.8 – 2.8 / 2.35	NA	NA	No	Various natural and manmade sources
UNREGULATED CHEMICALS OF NOTE REQUIRING MONITORING						
Boron (ppb)	NR	180 – 190 / 185	NL = 1000	NA	No	Runoff/leaching from natural deposits; industrial wastes
Vanadium	ND-5.1 / 2.2	ND	NL = 50	NA	No	Naturally occurring; industrial waste discharge

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- Parts per billion **(ppb)** or micrograms per liter **(µg/L)**
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- **pCi/L** = picoCuries per liter
- **NTU** = nephelometric turbidity units
- **NR** = Not Required
- **µmho/cm** = micromhos per centimeter
- **ND** = not detected
- **NC** = not collected
- **NA** = not applicable
- **NL** = Notification Level

Appendix C - Water Quality Data (2012-2019)

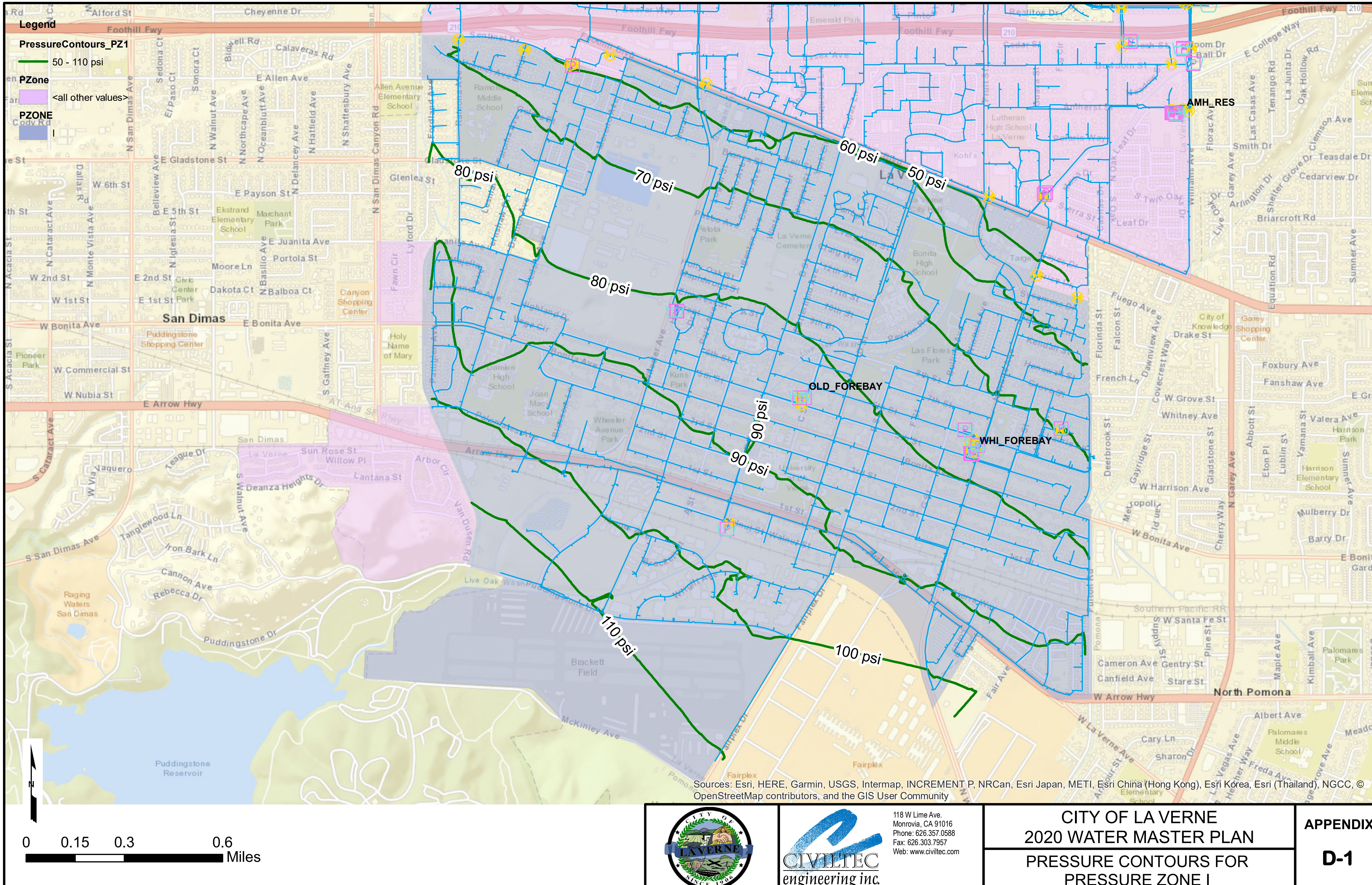
Table 4-2: Water Quality Data (2012-2019)

Contamination	2012		2013		2014		2015		2016		2017		2018		2019		MCL
	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	Ground water	Imported Water	
DCE (ppb)	0.13	ND	0.20	ND	0.19	ND	0.10	ND	0.09	ND	0.20	ND	0.22	ND	0.63	ND	5
PCE (ppb)	-	-	-	-	0.20	ND	0.10	ND	0.17	ND	0.20	ND	0.46	ND	0.52	ND	5
TCE (ppb)	2.90	ND	2.50	ND	4.80	ND	2.70	ND	4.00	ND	3.80	ND	10.34	ND	8.77	ND	5
TTHM (ppb)	1.44	39.00	0.83	47.80	-	47.80	-	38.50	-	47.40	0.32	49.70	0.57	58.50	31.25	55.40	80
Fluoride (ppm)	0.42	0.11	0.42	0.14	0.65	0.15	0.65	0.16	0.65	0.21	0.40	0.24	0.40	ND	0.40	ND	2
Nitrate (ppm as N)	66*	0.18	63*	1.98	67*	2.40	68*	0.51	15.30	0.67	14.50	0.52	14.97	0.50	15.23	ND	10
Perchlorate (ppb)	9.8*	ND	8*	ND	7*	ND	8*	ND	6.9*	ND	6.9*	ND	7.51	ND	7.68	ND	6
Chloride (ppm)	50	31	50	83	49	76	49	88	49	75	56	88	56	28	56	90	500
Sulfate (ppm)	97	31	97	39	86	51	86	51	86	75	89	80	89	24	89	40	500
TDS (ppm)	549	195	549	315	475	320	475	316	475	320	567	395	567	180	567	310	1000
pH	7.60	8.33	7.60	8.30	7.60	8.41	7.60	8.50	7.60	8.57	7.60	8.62	7.60	8.13	7.60	8.25	NS

* = values are above the Maximum Contaminant Level (MCL)

ND = Not Detectable at testing limit

Appendix D - System Pressure Contours -MDD Scenario



CIVILTEC engineering inc.

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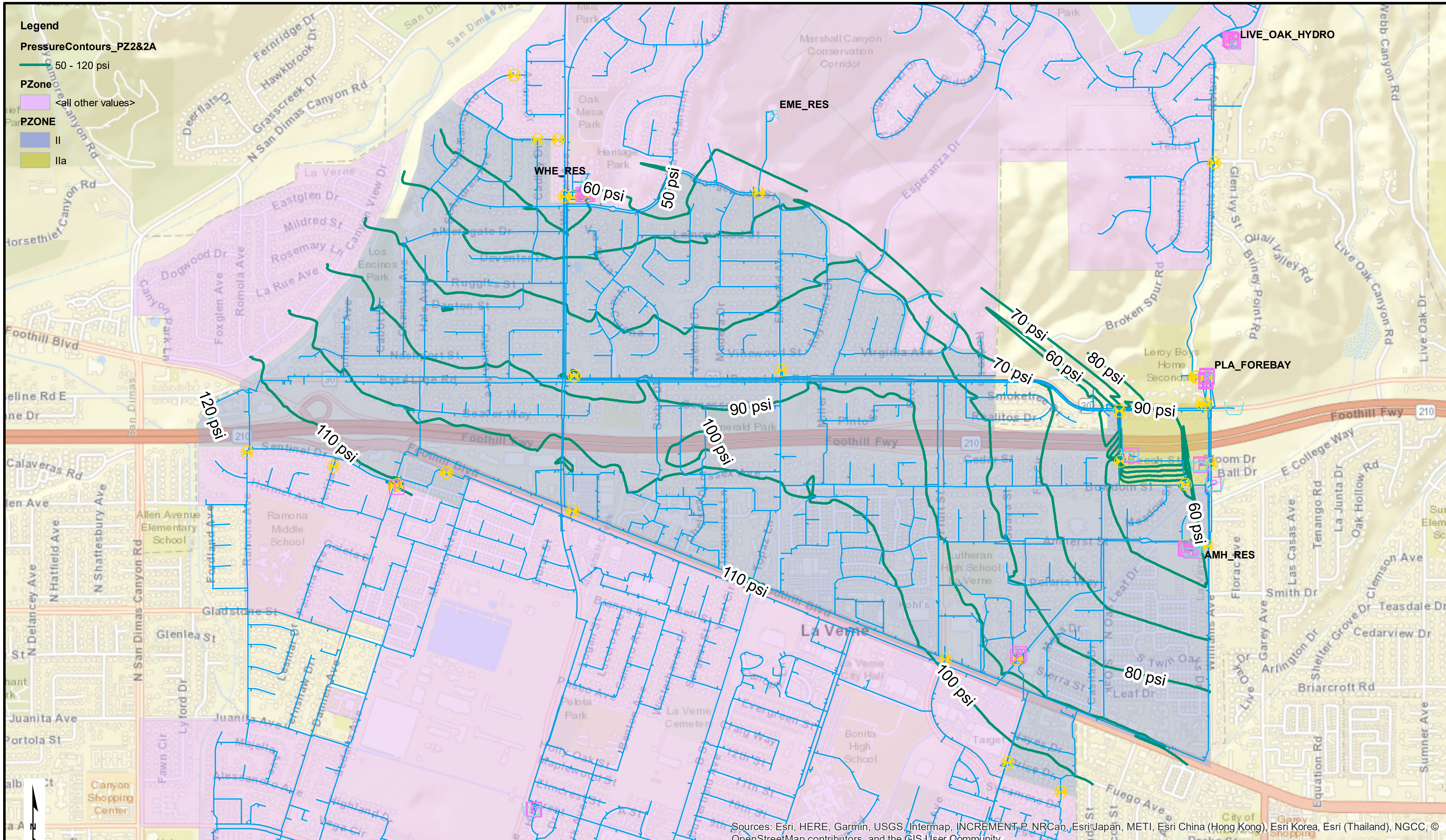
2020 WATER MASTER PLAN

PRESSURE CONTOURS FOR
PRESSURE ZONE I

APPENDIX

D-1

P: X:\2016\2016168.00-La Verne-2016 Water Master Plan\GIS\Model\In_Progress_LaVerne_v3.mxd D: 6/10/2019



0 0.1 0.2 0.4 Miles

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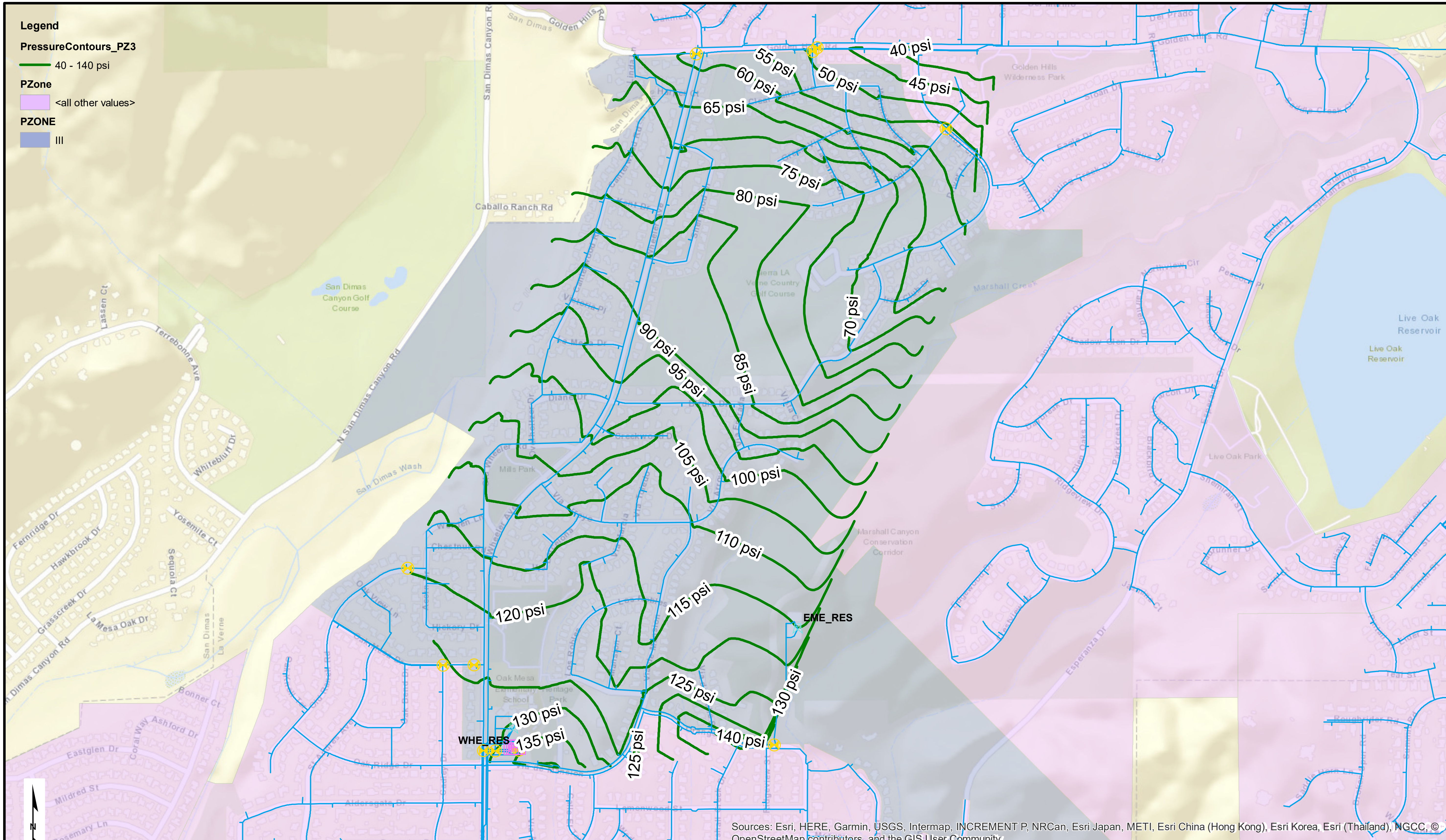
2020 WATER MASTER PLAN

PRESSURE CONTOURS FOR
PRESSURE ZONE II & IIA

APPENDIX
D-2



0 0.075 0.15 0.3 Miles

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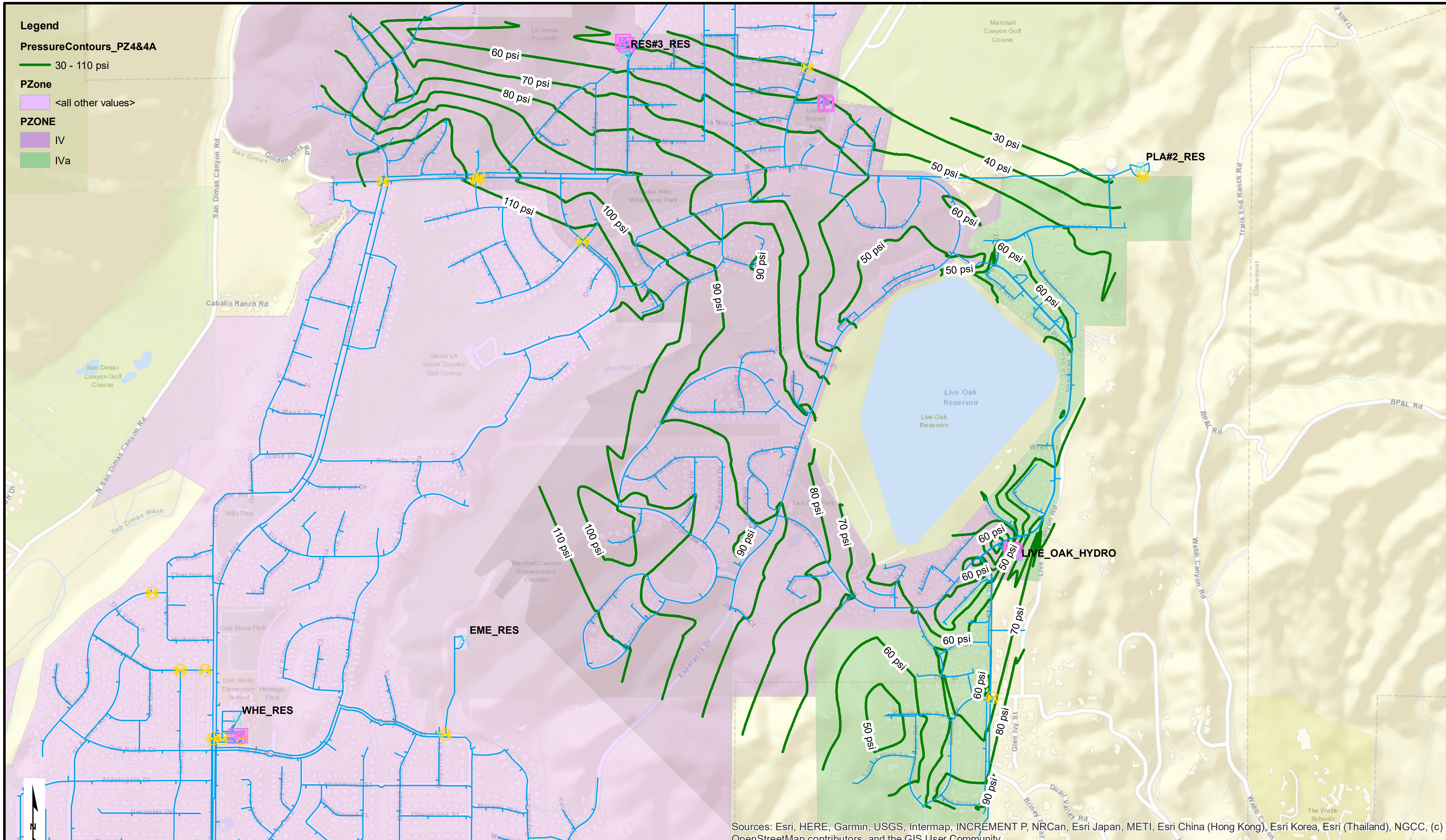
PRESSURE CONTOURS FOR
PRESSURE ZONE III

APPENDIX
D-3



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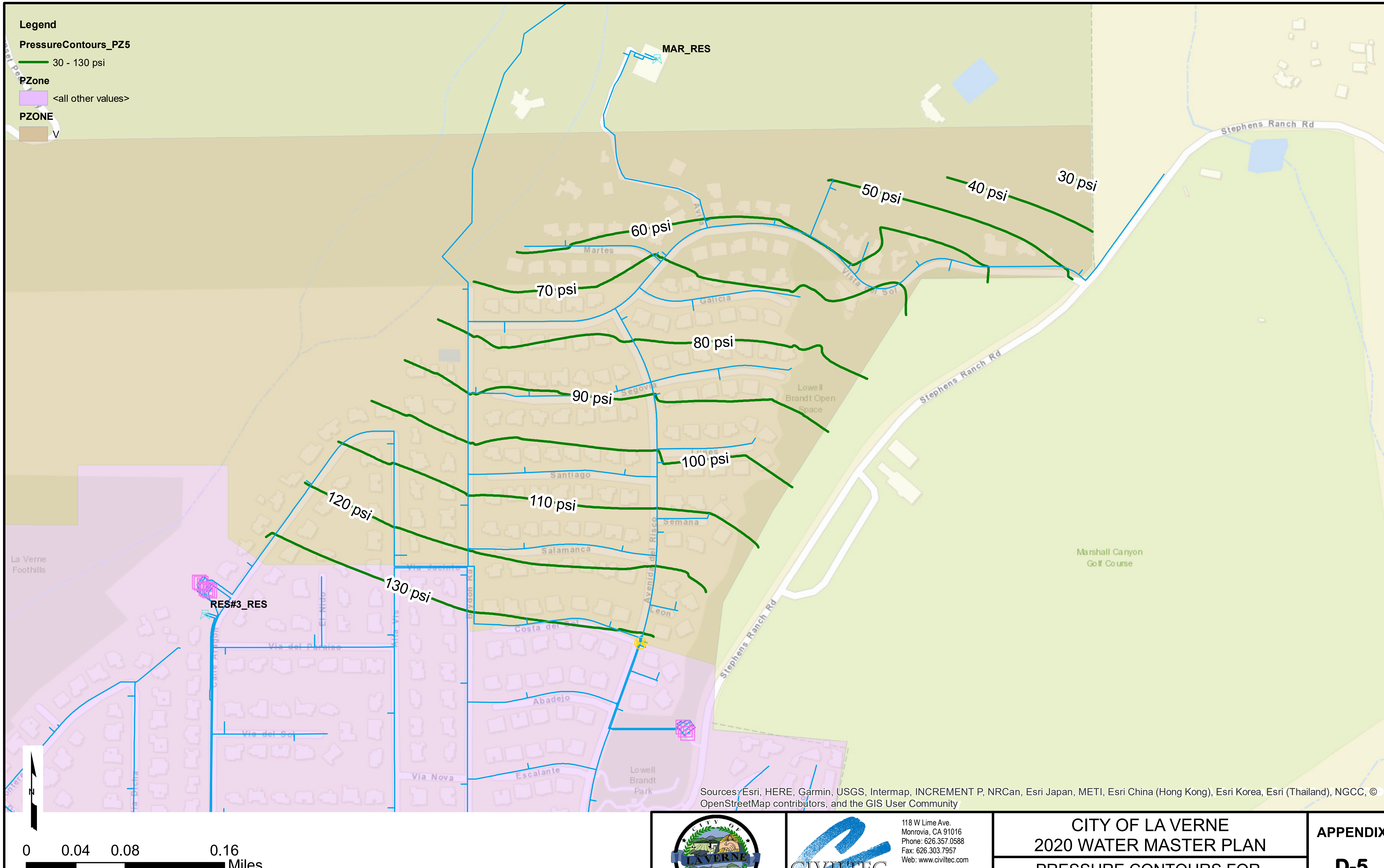
2020 WATER MASTER PLAN

PRESSURE CONTOURS FOR
PRESSURE ZONE IV & IVA

APPENDIX
D-4



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2020 WATER MASTER PLAN

PRESSURE CONTOURS FOR
PRESSURE ZONE V

APPENDIX
D-5