2013 Water Master Plan Update

May 2014

Prepared for the
Valley County Water District
14512 Ramona Boulevard, Baldwin Park, Ca 91706
Tel: (626) 338-7301 Fax: (626) 8142973

Prepared by
CIVILTEC engineering inc.
General Civil, Municipal, Water and Wastewater Engineering,
Planning, Construction Management and Surveying
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VCWD Board of Directors

President - Lenet Pacheco
Vice President - Margarita Vargas
Director - Alfonso Contreras
Director - Paul C. Hernandez
Director - Mariana Lake

General Manager - Lynda Noriega

Operations and Maintenance Manager - Tom Mortenson

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Prepared Under the Supervision of:

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Planning Services Manager

Prepared by

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EXECUTIVE SUMMARY

Summary

Purpose

This Water Master Plan represents a periodical update to two previous studies: (1) Water System Master Plan, prepared by Civiltec Engineering, Inc. (Civiltec) in 1999 and (2) Water Master Plan Update, prepared by Gateway Science and Engineering, Inc. in 2005.

Population

A comprehensive population analysis summarized below was conducted as part of the 2010 VCWD Urban Water Management Plan, and serves as the basis for estimating the impact of growth of the distribution system.

<table>
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<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
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<td>69,784</td>
<td>71,003</td>
<td>72,319</td>
<td>73,588</td>
<td>74,810</td>
<td>75,978</td>
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Land Use

Land Use is a primary driver of water demand, and the decisions of the city and county planners with jurisdictions overlapping the VCWD service area will ultimately shape the environment and demographics that VCWD will have to adapt to in the future.

The VCWD Service Area overlies four planning jurisdictions, each with its own set of Land Use designations and definitions: Irwindale, Baldwin Park, West Covina and Azusa. For purposes of this Water Master Plan and to establish a unified consistent planning approach, analysis of Land Use was performed using data compiled and managed by the Southern California Association of Governments (SCAG).
The table below shows a summary of the number of acres within the VCWD service area broken down by city and primary SCAG Land Use designation.

### Acreage by City and Land Use Designation

<table>
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<th>Description</th>
<th>Baldwin Park</th>
<th>Azusa</th>
<th>Duarte</th>
<th>Irwindale</th>
<th>West Covina</th>
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<td>1,331.21</td>
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<td>Multi-Family Residential</td>
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<td>0</td>
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<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>1.82</td>
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<td>Retail/Commercial Services</td>
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<td>129.63</td>
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<td>Public Facilities</td>
<td>58.66</td>
<td>0</td>
<td>41.77</td>
<td>12.73</td>
<td>2.11</td>
<td>115.26</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>220.01</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>220.01</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>222.61</td>
<td>11.04</td>
<td>0</td>
<td>301.77</td>
<td>13.05</td>
<td>548.47</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>26.11</td>
<td>12.49</td>
<td>0</td>
<td>908.66</td>
<td>0.33</td>
<td>947.58</td>
</tr>
<tr>
<td>Transportation</td>
<td>14.58</td>
<td>3.52</td>
<td>0</td>
<td>20.02</td>
<td>1.82</td>
<td>39.94</td>
</tr>
<tr>
<td>Utility Facilities</td>
<td>62.51</td>
<td>21.59</td>
<td>0</td>
<td>28.75</td>
<td>0</td>
<td>112.85</td>
</tr>
<tr>
<td>Open Space</td>
<td>22.93</td>
<td>0</td>
<td>0</td>
<td>2,171.64</td>
<td>0</td>
<td>2,194.57</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.74</td>
<td>0</td>
<td>0</td>
<td>16.32</td>
<td>0</td>
<td>17.06</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>2,341.22</strong></td>
<td><strong>48.64</strong></td>
<td><strong>41.77</strong></td>
<td><strong>3,653.01</strong></td>
<td><strong>103.47</strong></td>
<td><strong>6,188.11</strong></td>
</tr>
</tbody>
</table>
**Water Demand**

Production data from 2009 to 2011 were considered generally representative of current demand conditions. The figure below contains all daily production data for this period in terms of millions of gallons of water produced per day (MGD).

### Historical Production Data

![Graph showing daily production data from January 2009 to October 2011]

Statistical analysis performed on the above data resulted in the demand peaking factors\(^1\) shown below.

#### Peaking Factors

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>Code</th>
<th>MGD</th>
<th>GPM</th>
<th>PF</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Demand</td>
<td>ADD</td>
<td>7.23</td>
<td>5,021</td>
<td>1.00</td>
<td>2009 to 2011</td>
</tr>
<tr>
<td>Maximum Daily Demand</td>
<td>MDD</td>
<td>11.50</td>
<td>7,987</td>
<td>1.59</td>
<td>August 28, 2009</td>
</tr>
<tr>
<td>Minimum Daily Demand</td>
<td>Min Day</td>
<td>3.69</td>
<td>2,565</td>
<td>0.51</td>
<td>February 19, 2010</td>
</tr>
<tr>
<td>Peak Hour Demand</td>
<td>PHD</td>
<td>23.00</td>
<td>15,973</td>
<td>3.18</td>
<td>Per Industry Standard</td>
</tr>
</tbody>
</table>

\(^1\) A peaking factor is the ratio of a demand condition of interest to the average daily demand.
Build-out of current Land Use and population growth were considered to project future water demand. The existing and projected average demands are listed below.

**Existing and Projected Water Demand**

<table>
<thead>
<tr>
<th>Average Demand</th>
<th>AFY</th>
<th>gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (2012)</td>
<td>8,098</td>
<td>5,021</td>
</tr>
<tr>
<td>Projected (2035)</td>
<td>9,846</td>
<td>6,105</td>
</tr>
<tr>
<td>Increase</td>
<td>1,748</td>
<td>1,084</td>
</tr>
<tr>
<td>% Increase</td>
<td></td>
<td>21.6%</td>
</tr>
</tbody>
</table>

**Supply**

VCWD has access to potable water from multiple sources; however, the preferred mixture of sources includes local groundwater and a small amount of imported water from Covina Irrigation Company (CIC).

VCWD has an adjudicated right to 3.01517% of the operating safe yield (OSY) of the Main San Gabriel Basin. Based on a ten-year average OSY of 198,800 AFY\(^2\), VCWD’s average groundwater allocation is 5,994.2 AFY.

As a party to the Main San Gabriel Basin adjudication, there is no limit to the quantity of groundwater that may be extracted, although replacement water must be purchased from USGVMWD for any volume beyond the sum of VCWD’s share of the OSY and any temporary leases or purchases from other parties to the judgment that VCWD may arrange on its customers’ behalf. Based on historical data related to groundwater production, VCWD has successfully produced up to 9,565.6 AFY of groundwater beyond its transfer commitments, which occurred in FY 2006-07. VCWD is confident that it can successfully obtain a combination of prescriptive rights, groundwater leases and purchases, and replenishment water to achieve this level production in any given year.

Imported water is available from two sources: USGVMWD and CIC:

- VCWD maintains no long-term contracts or commitments with USGVMWD. Historically, imported water from USGVMWD has been used for emergency purposes or when groundwater production was temporarily unavailable.

- Currently, VCWD is a shareholder of CIC with 111 shares. Each share translates to approximately 1 AFY. Typically, VCWD only imports water from CIC in an

---

\(^2\) Main San Gabriel Basin Watermaster 2010-2011 Annual Report, page 4
amount equal to its allotment; however, the exact amount imported in any given year may be vary according to use of a carry-over account, direct purchase of excess water from CIC, lease of water rights from another agency, or other types of transfers and transactions.

Water Quality

The United States Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH) are the public agencies responsible for drafting and implementing regulations that ensure drinking water is safe to drink. EPA and CDPH establish drinking water standards that limit contaminant concentration in water provided to the public.

VCWD regularly tests its drinking water using approved methods to ensure its safety. Over 100 compounds are monitored in VCWD’s water supply, and detected constituents are reported. In 2011, all water delivered by VCWD met or surpassed State and Federal drinking water standards.

In addition, the Main San Gabriel Basin Watermaster (Watermaster), who manages the groundwater basin where VCWD extracts its supply, continuously and vigilantly reviews upcoming State and Federal drinking water regulations. Watermaster has been proactive in the monitoring of unregulated emerging contaminants in anticipation of new water quality standards.

According to MWD’s 2007 groundwater basin report for the Main San Gabriel and Puente Basins, constituents of concern include TDS, nitrate, TCE, PCE, perchlorate and NDMA.

Water quality within the Main San Gabriel Basin is good in most areas. TDS concentrations range from 90 to 4,288 mg/L and average about 367 mg/L in the Main San Gabriel Basin.

VCWD prefers to rely entirely on groundwater extracted from the Main San Gabriel Basin. Most wells operated by VCWD exhibit some level of contamination and must be treated to meet drinking water standards prior to introduction into the distribution system.

VCWD currently operates three water treatment facilities which mitigate local groundwater contamination using liquid phase granulated active carbon (LPGAC). Through these water treatment facilities, VCWD has considerable capacity and flexibility in the use and management of its groundwater rights in the Main San Gabriel Basin.
Infrastructure

The distribution system consists of a series of interdependent subsystems that work together to meet the needs of VCWD’s customers. Following is a brief summary:

- Four active wells
- Five inactive wells
- Gravity flow of imported water from MWD and CIC
- Nine emergency interconnections
- Five booster pumping stations which include a total of 17 booster pumps
- Four pressure reducing stations
- Six storage tanks containing a total of 10 million gallons.
- 630,000 feet of pipe (119 miles)
- Three LPGAC treatment facilities
- Three disinfection stations

Water Model

A water model is an important tool for assessing the distribution system with respect to capacity. It is ideally suited for evaluating alternative mitigation to hydraulic issues and for performing time-based analyses. As part of this master planning effort, the VCWD Water Model was completely reprogrammed based on the 2009 update to the District’s Water Atlas and the available data for pump efficiency, operational control, system performance and demand allocation.

The Water Model was programmed to perform multiple types of simulations (steady state, extended period, fire flow, surge, water age, chemical decay) under varying demand conditions (ADD, MDD, PHD). The results of the simulations were evaluated against design criteria to determine the nature and magnitude of any hydraulic issues.
Conclusions

The performance or capacity of the distribution system was evaluated against established design and planning criteria. Design criteria are intended to evaluate hydraulic capacity, and planning criteria are intended to establish a replacement protocol for system components based on age and condition.

Hydraulic Recommendations

- Construct or acquire additional groundwater production capacity equivalent to the future deficit under the primary criteria (approximately 1,500 gpm).
- Increase booster capacity in the Morada Zone by 3,200 gpm to support MDD+FF requirements.
- In the long term, add the equivalent 1,200 gpm of continuous PRV capacity to the LBPZ.
- One emergency PRV and 34 pipeline projects were identified that would bring certain fire hydrants up to current fire flow standards. Regarding recommendations to mitigate fire flow issues, it should be noted that the standards applied during analysis represent the general requirements of the Los Angeles County Fire Department for (1) land subdivision, (2) construction or (3) installation/alteration of the water system according to the County Fire Code. If none of these three conditions exists, it is assumed that the hydrant (or group of hydrants) was subject to a lower standard at the time of installation and this lower standard has been “grandfathered in” (aka allowable nonconformity). As such, projects recommended herein for fire flow issues should be considered contingent upon (1) land subdivision, (2) construction or (3) the installation/alteration of the water system.
EXECUTIVE SUMMARY

VALLEY COUNTY WATER DISTRICT

Cyclical Replacement Recommendations

Budgeting for cyclical replacement is a statistical process. Over the next ten years, the following numbers of items should be scheduled for replacement:

- 9,900 feet of pipe
- 8 pump overhauls
- 8 pump replacements
- 5 control valve refurbishments
- 4 tank recoatings
- 1 well refurbishment
- 6,250 water meters

Additional Recommendations

It is recommended to expand the existing SCADA system to include all pumps, tanks and non-emergency pressure reducing stations.

Capital Improvement Program

The CIP considers a 10-year planning horizon. Relative priority for individual projects or groups of projects is provided. Prioritization is not meant to be rigid, rather to assist with scheduling and implementation. It is recommended to corroborate conditions in the field with operations prior to implementation. Projects have been separated as Capital Projects and Maintenance Projects to be consistent with VCWD’s budgeting allocations.
## Capital Projects

<table>
<thead>
<tr>
<th>Category</th>
<th>Project</th>
<th>Priority</th>
<th>Justification</th>
<th>Estimate ($1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nixon Plant Improvements</td>
<td>Phase 1 Pump Station</td>
<td>High</td>
<td>Storage &amp; Booster Hydraulics</td>
<td>2,009</td>
</tr>
<tr>
<td></td>
<td>Phase 2 Well</td>
<td>High</td>
<td></td>
<td>795</td>
</tr>
<tr>
<td></td>
<td>Phase 3 Reservoir</td>
<td>High</td>
<td></td>
<td>5,844</td>
</tr>
<tr>
<td></td>
<td>Phase 4 Reservoir</td>
<td>High</td>
<td></td>
<td>2,678</td>
</tr>
<tr>
<td>Supply</td>
<td>New Well</td>
<td>Low</td>
<td>Preferred Supply</td>
<td>1,350</td>
</tr>
<tr>
<td></td>
<td>1 Well Replacement</td>
<td>Medium</td>
<td>Well Cyclic Maintenance</td>
<td>1,350</td>
</tr>
<tr>
<td>Boosters</td>
<td>2 Morada Booster Pumps</td>
<td>Medium</td>
<td>Booster Hydraulics</td>
<td>405</td>
</tr>
<tr>
<td></td>
<td>New LBPZ PRV</td>
<td>Low</td>
<td>Distribution Hydraulics</td>
<td>68</td>
</tr>
<tr>
<td>Valves</td>
<td>Azusa Canyon Road PRV</td>
<td>High</td>
<td>Fire Flow Hydraulics</td>
<td>68</td>
</tr>
<tr>
<td>Storage</td>
<td>4 Tank Recoatings</td>
<td>Medium</td>
<td>Tank Cyclic Maintenance</td>
<td>1,944</td>
</tr>
<tr>
<td>Telemetry</td>
<td>25 Registers</td>
<td>Medium</td>
<td>Operational Control</td>
<td>169</td>
</tr>
<tr>
<td>Pipeline</td>
<td>Paddy Lane</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>Dutch Street</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td>Navilla Place</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>Jeremie Street</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>232</td>
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<tr>
<td></td>
<td>6,850 ft of Pipe Replacement</td>
<td>Medium</td>
<td>Pipeline Cyclic Replacement</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>19,873</strong></td>
</tr>
</tbody>
</table>

## Maintenance Projects

<table>
<thead>
<tr>
<th>Category</th>
<th>Project</th>
<th>Priority</th>
<th>Justification</th>
<th>Estimate ($1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boosters</td>
<td>4 Pump Overhauls</td>
<td>Medium</td>
<td>Booster Cyclic Maintenance</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>4 Pump Replacements</td>
<td>Medium</td>
<td>Booster Cyclic Maintenance</td>
<td>330</td>
</tr>
<tr>
<td>Valves</td>
<td>5 Control Valve Overhauls</td>
<td>Medium</td>
<td>Valve Cyclic Maintenance</td>
<td>83</td>
</tr>
<tr>
<td>Meters</td>
<td>6,250 Meter Replacements</td>
<td>Medium</td>
<td>Meter Cyclic Replacement</td>
<td>3,014</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>3,493</strong></td>
</tr>
</tbody>
</table>
CHAPTER 1 – INTRODUCTION

1.1 General Description

This Water Master Plan represents a periodical update to two previous studies: (1) Water System Master Plan, prepared by Civiltec Engineering, Inc. (Civiltec) in 1999 and (2) Water Master Plan Update, prepared by Gateway Science and Engineering, Inc. in 2005.

1.2 Study Area

VCWD was formed in 1925 and incorporated in January 1926 under the name Baldwin Park County Water District. On January 1, 1978, its name was officially changed to Valley County Water District.

VCWD is located in the San Gabriel Valley in the eastern portion of Los Angeles County. The District’s sphere of influence (SOI) consists of approximately 9.4 square miles made up of portions of the cities of Baldwin Park, Irwindale, West Covina and Azusa. Land Use within the service area consists mainly of residential, commercial, industrial and open space designations.

The SOI and Land Use are discussed in greater detail in Chapter 2. Figure 1.1 provides a general overview of the area being served by VCWD.

1.3 Study Period

Historical data for the three-year period of calendar years 2009, 2010 and 2011 is considered as representative of existing conditions. This period has been referenced herein as the Study Period.
Figure 1.1 is an excerpt from the 2009 VCWD Atlas Map showing the general locations of all pipelines and facilities maintained by VCWD to provide service to its customers. The Study Area includes all areas receiving service from VCWD via this infrastructure. A complete Atlas Map is provided in Appendix A for further reference.
1.4 Scope of Report

The Scope of Report briefly describes tasks completed in the preparation of this Water Master Plan:

**TASK I  Meetings and Project Management**

A. A kick-off meeting was conducted at *Civiltec’s* main office in Monrovia on February 8, 2012 with Lynda Noriega in attendance on behalf of VCWD and David W. Byrum, P.E.; C. Shem Hawes, P.E. and Anthony M. Herda, P.E. in attendance on behalf of *Civiltec*. The purpose and scope of the project were delineated and discussed in detail, and the principle lines of communication were established.

B. An operations workshop was conducted at the VCWD Clinton O. Nixon Facility field office in Baldwin Park on July 25, 2012 with Anthony M. Herda, P.E. and Brian Sandona, EIT in attendance on behalf of *Civiltec* and Lynda Noriega, Tom Mortenson and Bill Wilson in attendance on behalf of VCWD. The primary focus of the meeting was establishment of design and planning criteria delineated in a technical memorandum issued by *Civiltec* on July 11, 2012. Other items discussed included:

   i. Status of Report and Water Model construction
   ii. Status of data collection
   iii. Understanding of system configuration
   iv. Emergency preparedness
   v. Questions regarding base map clarification

C. A draft of the Water Master Plan was provided on a chapter by chapter basis for District review.

D. A final draft of the Water Master Plan was provided for District review.

E. *A final Water Master Plan was provide for adoption.*

**TASK II  Research, Data Collection and System Review**

A. A comprehensive Request-for-Information was issued to VCWD on May 21, 2012. Data collection proceeded throughout the planning process and was generally conducted by electronic and hard copy data transfer between VCWD staff and *Civiltec*. 
B. Data were reviewed by Civiltec and incorporated appropriately in the Water Master Plan including relevant maps, water use records, water supply records, water quality data, previous studies, and currently planned or designed capital improvement projects.

### TASK III  Population and Land Use Assessment

A. An exhaustive population analysis was conducted in 2011 for preparation of the VCWD 2010 Urban Water Management Plan (UWMP). To promote consistency among these planning documents and to assist with the monitoring of the impact of water conservation efforts at the District level, the UWMP population analysis was incorporated directly into this Water Master Plan.

B. Land Use categories within the District’s boundary and the location and acreage of each were assessed using a Geographic Information System (GIS). For purposes of this Water Master Plan and to establish a unified consistent planning approach, analysis of Land Use was performed using GIS data compiled and managed by the Southern California Association of Governments (SCAG). The SCAG Land Use database, which was most recently updated in 2008, was developed by Aerial Information Systems, Inc. (AIS) as a Modified Anderson Land Use Classification system.

C. The feasibility of absorbing or consolidating smaller water districts, water mutuals or areas serviced by other purveyors in the vicinity was evaluated.

### TASK IV  Water Demand Analysis

A. System demands were determined based on historical consumption and production data provided by the District. Average Day Demand (ADD) and Maximum Day Demand (MDD) were taken from historical records through statistical analysis. Peak Hour Demand (PHD) was predicted based on industry standards and Civiltec’s experience in analyzing typical demand attenuation and diurnal fluctuation.

B. The 34 highest users by volume were identified based on historical consumption data and their influence was programmed directly into the Water Model (see Task VI).

C. Water duty factors and unit demand factors were developed for nine primary Land Use types.

D. Build-out demand was projected based on analysis of the population growth trend assuming continued compliance with the California Water Conservation Act of 2009.
CHAPTER 1 - INTRODUCTION

VALLEY COUNTY WATER DISTRICT

TASK V  Water Quality

A. The availability, reliability and quality of water accessible for purchase from the Upper San Gabriel Valley Municipal Water District was reviewed and documented.

B. Groundwater quality trends were reviewed including a discussion of the status and capacity of treatment at the District’s disposal and access to additional and diverse sources.

C. Based on our understanding of current and pending legislation related to water quality, we evaluated water quality trends and the District’s capacity to maintain compliance while providing adequate supply.

TASK VI  Computer Modeling

A. A water model is an important tool for assessing the distribution system with respect to capacity. It is ideally suited for evaluating alternative mitigation to hydraulic issues and for performing time-based analyses. As part of this master planning effort, the VCWD Water Model was completely reprogrammed based on the 2009 update to the District’s Water Atlas and the available data for pump efficiency, operational control, system performance and demand allocation.

B. The Water Model was programmed to perform multiple types of simulations (steady state, extended period, fire flow, surge, water age, chemical decay) under varying demand conditions (ADD, MDD, PHD). The results of the simulations were evaluated against design criteria to determine the nature and magnitude of any hydraulic issues.

C. The existing operations plans for the Maine, Nixon, Arrow Highway/Lante, Morada and Paddy Lane Plants were reviewed by Civiltec and incorporated appropriately into the functionality of the Water Model.

TASK VII  System Analysis

A. A redundant and reliable supply portfolio is the foundation of a robust water distribution system. Existing supply capacity and reliability from the District’s wells and wholesalers were analyzed with respect to (1) capacity to deliver adequate supply per design and planning criteria, and (2) access to adequate sources of supply based on water rights and agreements.

B. A storage analysis was performed focusing on the adequacy of existing storage capacity to provide for emergency, firefighting and operational purposes as defined by designed criteria.
C. A transmission system analysis was performed focusing 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.

D. A distribution system analysis was performed focusing on two key aspects: system pressure and fire flow capacity. The Water Model was used to examine system pressure in every pipeline throughout the system under normal operating conditions. The Water Model was also used to assess the fire flow capacity at every fire hydrant location in the system.

E. An age and condition evaluation was performed applying Planning Criteria to all components of the distribution system in order to develop a comprehensive replacement schedule. The Water Model database was enhanced to include information related to planning criteria including year of installation and material for all model elements, as available.

F. Emergency preparedness was evaluated. The system was assessed for its ability to withstand various emergency and planned shutdown conditions including power failure, earthquake, drought and cyclical MWD maintenance.

**TASK VIII  Capital Improvement Plan**

A. A list of capital improvements was developed based on the results of analysis and evaluation. For each recommended project, the following were provided:

   i. Priority
   ii. Justification
   iii. Description
   iv. Other alternatives considered, if any
   v. Cost estimate

B. An implementation projection was developed for the recommended improvements over a 10-year planning horizon.

C. Typical methods of financing were identified and a recommendation was provided for initiation of various funding options.
1.5 **Abbreviations**

As a matter of convenience and convention, the following list of abbreviations and acronyms is use in this report. Generally, the first time a term is used, its abbreviation or acronym will follow in parentheses.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>average day demand</td>
</tr>
<tr>
<td>AF</td>
<td>acre-feet</td>
</tr>
<tr>
<td>AFY</td>
<td>acre-feet per year</td>
</tr>
<tr>
<td>AIS</td>
<td>Aerial Information Systems, Inc.</td>
</tr>
<tr>
<td>ATP</td>
<td>Asset Transfer Program</td>
</tr>
<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
</tr>
<tr>
<td>BPOU</td>
<td>Baldwin Park Operable Unit</td>
</tr>
<tr>
<td>C</td>
<td>Hazen-Williams roughness coefficient</td>
</tr>
<tr>
<td>CCF</td>
<td>hundreds of cubic feet</td>
</tr>
<tr>
<td>CDPH</td>
<td>California Department of Public Health</td>
</tr>
<tr>
<td>CI</td>
<td>cast iron</td>
</tr>
<tr>
<td>CIC</td>
<td>Covina Irrigation Company</td>
</tr>
<tr>
<td>CII</td>
<td>Commercial, Industrial, Institutional</td>
</tr>
<tr>
<td>CLCS</td>
<td>cement lined and coated steel</td>
</tr>
<tr>
<td>COP</td>
<td>Certificates of Participation</td>
</tr>
<tr>
<td>CWS</td>
<td>community water system</td>
</tr>
<tr>
<td>DI</td>
<td>ductile iron</td>
</tr>
<tr>
<td>dia.</td>
<td>diameter</td>
</tr>
<tr>
<td>DU</td>
<td>dwelling unit</td>
</tr>
<tr>
<td>DWR</td>
<td>California Department of Water Resources</td>
</tr>
<tr>
<td>DWSRF</td>
<td>Drinking Water State Revolving Fund</td>
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<tr>
<td>EDC</td>
<td>endocrine-disrupting compound</td>
</tr>
<tr>
<td>Eff.</td>
<td>efficiency</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>FF</td>
<td>fire flow</td>
</tr>
<tr>
<td>fps</td>
<td>feet per second</td>
</tr>
<tr>
<td>FY</td>
<td>fiscal year</td>
</tr>
<tr>
<td>GIS</td>
<td>geographic information system</td>
</tr>
<tr>
<td>GPCD</td>
<td>gallons per capita per day</td>
</tr>
<tr>
<td>gpm</td>
<td>gallons per minute</td>
</tr>
<tr>
<td>GRRR</td>
<td>Groundwater Replenishment Reuse Project</td>
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<tr>
<td>HAA5</td>
<td>five Haloacetic Acids</td>
</tr>
<tr>
<td>HP</td>
<td>horsepower</td>
</tr>
<tr>
<td>IDSE</td>
<td>Initial Distribution System Evaluation</td>
</tr>
<tr>
<td>in.</td>
<td>inches</td>
</tr>
<tr>
<td>LAFCo</td>
<td>Local Agency Formation Commission</td>
</tr>
<tr>
<td>LBPZ</td>
<td>Lower Baldwin Park Zone</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>LPA</td>
<td>Local Primacy Agency</td>
</tr>
<tr>
<td>LPGAC</td>
<td>Liquid Phase Granulated Activated Carbon</td>
</tr>
<tr>
<td>LRAA</td>
<td>Locational Running Annual Average</td>
</tr>
<tr>
<td>LU</td>
<td>land use</td>
</tr>
<tr>
<td>MCL</td>
<td>maximum contaminant level</td>
</tr>
<tr>
<td>MDD</td>
<td>maximum day demand</td>
</tr>
<tr>
<td>MFR</td>
<td>manufacturer</td>
</tr>
<tr>
<td>MG</td>
<td>millions of gallons</td>
</tr>
<tr>
<td>mg/L</td>
<td>milligrams per liter (aka parts per million)</td>
</tr>
<tr>
<td>MGD</td>
<td>millions of gallons per day</td>
</tr>
<tr>
<td>Min Day</td>
<td>minimum day demand</td>
</tr>
<tr>
<td>MRDL</td>
<td>Maximum Residual Disinfectant Level</td>
</tr>
<tr>
<td>MTBE</td>
<td>methel tertiary-butyl ether</td>
</tr>
<tr>
<td>MWD</td>
<td>Metropolitan Water District of Southern California</td>
</tr>
<tr>
<td>NDMA</td>
<td>nitrodimethylamine</td>
</tr>
<tr>
<td>No.</td>
<td>number</td>
</tr>
<tr>
<td>OSY</td>
<td>operating safe yield</td>
</tr>
<tr>
<td>PCE</td>
<td>perchloroethylene</td>
</tr>
<tr>
<td>PHD</td>
<td>peak hour demand</td>
</tr>
<tr>
<td>PRV</td>
<td>pressure reducing valve</td>
</tr>
<tr>
<td>psi</td>
<td>pressure per square inch</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
</tr>
<tr>
<td>Q</td>
<td>flow rate</td>
</tr>
<tr>
<td>RUWMP</td>
<td>Regional Urban Water Management Plan</td>
</tr>
<tr>
<td>SCAG</td>
<td>Southern California Association of Governments</td>
</tr>
<tr>
<td>SCE</td>
<td>Southern California Edison</td>
</tr>
<tr>
<td>SDWA</td>
<td>Safe Drinking Water Act</td>
</tr>
<tr>
<td>sf</td>
<td>square feet</td>
</tr>
<tr>
<td>SGVWC</td>
<td>San Gabriel Valley Water Company</td>
</tr>
<tr>
<td>SOI</td>
<td>sphere of influence</td>
</tr>
<tr>
<td>STL</td>
<td>steel</td>
</tr>
<tr>
<td>SWS</td>
<td>Suburban Water Systems</td>
</tr>
<tr>
<td>TCE</td>
<td>trichloroethylene</td>
</tr>
<tr>
<td>TDS</td>
<td>Total Dissolved Solids</td>
</tr>
<tr>
<td>TTHM</td>
<td>Total Trihalomethanes</td>
</tr>
<tr>
<td>UBPZ</td>
<td>Upper Baldwin Park Zone</td>
</tr>
<tr>
<td>USGVMWD</td>
<td>Upper San Gabriel Valley Municipal Water District</td>
</tr>
<tr>
<td>UWMP</td>
<td>Urban Water Management Plan</td>
</tr>
<tr>
<td>VCWD</td>
<td>Valley County Water District</td>
</tr>
<tr>
<td>VFD</td>
<td>variable frequency drive</td>
</tr>
<tr>
<td>VOC</td>
<td>volatile organic compound</td>
</tr>
<tr>
<td>VVMWC</td>
<td>Valley View Mutual Water Company</td>
</tr>
<tr>
<td>Watermaster</td>
<td>Main San Gabriel Basin Watermaster</td>
</tr>
</tbody>
</table>
1.6 Acknowledgments

We, at Civiltec engineering inc., would like to express our appreciation for the cooperation and valuable assistance of the Valley County Water District management and staff. In particular, the efforts of the following individuals proved to be invaluable:

- Lynda Noriega – General Manager
- Tom Mortenson – Operations and Maintenance Manager
- Bill Wilson – Treatment and Operations
- Tara Robinson – Water Quality Specialist
CHAPTER 2 – LAND USE, POPULATION AND WATER REQUIREMENTS

2.1 General Description

The purpose of Chapter 2 is to lay out the context for Land Use planning as it influences the District. Land Use is a primary driver of water demand, and the decisions of the city and county planners with jurisdictions overlapping the VCWD service area will ultimately shape the environment and demographics that VCWD will have to adapt to in the future.

2.2 Sphere of Influence

A Sphere of Influence (SOI) is a legal description of the probable physical boundaries and service area of a local agency, as regulated by the Local Agency Formation Commission (LAFCo) at the county level. In its 2005 Municipal Service Review of water service in the East San Gabriel Valley, Los Angeles County LAFCo noted:

> The Valley County Water District’s boundary map is different from LAFCo’s map in some areas. This should be reconciled during the District’s sphere of influence update. Also, the District is interested in serving the area to the northwest and west of its existing boundary. This would need to be evaluated with Azusa Light & Water which serves the majority of that area.

The boundary differences cited by LAFCo refer to the divergence of the service area boundary from the District boundary in the southern portion of the District. Several parcels within the VCWD District boundary are served by an adjacent water purveyor, and several parcels outside of the VCWD District boundary are served by VCWD in the vicinity of the I-10 Freeway between Baldwin Park Boulevard and Puente Avenue. In the next SOI review, these differences can be easily reconciled. Such changes were practical and/or necessary to (1) accommodate large infrastructure projects such as the construction of the I-10 Freeway and to (2) assure a high level of system integrity and redundancy by avoiding dead-end service pipeline near the District boundary.

The VCWD service area is essentially built out according to current Land Use planning at the city and county level. Also, VCWD is surrounded on all sides by neighboring water purveyors making expansion of the District into areas unclaimed by another purveyor highly unlikely. Nonetheless, there are three issues that should be brought to LAFCo’s attention: (1) the practical extent of continuous boundaries, (2) response to the needs of industrial development, and (3) the actual and potential dependency of the Valley View Mutual Water Company on the District’s supplies.
In addition to reconciliation of the southern boundary, the next SOI review should consider the following:

1. Several significant continuous physical boundaries impact Land Use, Planning and access in and around the vicinity of VCWD including: the I-10 Freeway, the I-605 Freeway, the I-210 Freeway, numerous railroads, the San Gabriel River and earthworks associated with the river (the Santa Fe Dam and numerous spreading grounds). Any future development that may occur on VCWD’s side of these continuous boundaries, or within the current SOI such that supply can be provided by VCWD via a redundant hydraulic loop, should be considered as within VCWD’s SOI.

2. Irwindale is composed primarily of industrial and commercial Land Use. These parcels tend to be very large and the associated businesses tend to evolve with changing economic conditions. The portion of the VCWD distribution system serving Irwindale was designed to support the typical demand requirements of the industrial and commercial sectors. Its robust nature makes the VCWD distribution system well suited for expansion to meet future industrial and commercial demands as they materialize.

3. The Valley View Mutual Water Company (VVMWC) is geographically isolated from sources of supply other than its own wells and a connection with VCWD. In the long-term, annexation of VVMWC into VCWD is probable and would be mutually beneficial to both parties.

Figure 2.1 is a map showing the existing and potential VCWD SOI as a basis for discussion with Los Angeles County LAFCo at the next SOI review. Additional detail is provided in Figure 2.2.
Figure 2.1 – Potential Expansion of SOI
2.3 Population – Existing and Projected

A comprehensive population analysis was conducted as part of the 2010 VCWD Urban Water Management Plan, and is summarized in Table 2.1.

Table 2.1 - Population

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Estimate</td>
<td>69,784</td>
<td>71,003</td>
<td>72,319</td>
<td>73,588</td>
<td>74,810</td>
<td>75,978</td>
</tr>
</tbody>
</table>
2.4 Land Use – Existing and Proposed

The VCWD Service Area overlies four planning jurisdictions, each with its own set of Land Use designations and definitions: Irwindale, Baldwin Park, West Covina and Azusa. There are as many as 57 different Land Use designations for customers served by VCWD. For purposes of this Water Master Plan and to establish a unified consistent planning approach, analysis of Land Use was performed using data compiled and managed by the Southern California Association of Governments (SCAG). The SCAG Land Use database, which was most recently updated in 2008, was developed by Aerial Information Systems, Inc. (AIS) as a Modified Anderson Land Use Classification system (See Appendix B for detailed documentation on Land Use Code Descriptions). The dataset is disseminated as a Geographic Information System (GIS) database with the primary data at the parcel level basis being location, acreage, city and Land Use designation.

The Land Use data relevant to the VCWD service area were broken down into 12 categories. Each category consists of a number of sub-categories, as follows:

1. Single Family Residential
   a. High Density Single Family Residential
   b. Low Density Single Family Residential
2. Multi-Family Residential
   a. Duplexes, Triplexes, and 2- Or 3-Unit Condominiums and Townhouses
   b. Low-Rise Apartments, Condominiums, And Townhouses
   c. Medium-Rise Apartments and Condominiums
   d. Mixed Residential
3. Mobile Homes and Trailer Parks
4. General Office Use
   a. Low- To Medium-Rise Major Office Use
   b. Retail Stores and Commercial Services
   c. Retail Centers (Non-Strip With Contiguous Interconnected Off-Street Parking)
   d. Modern Strip Development
   e. Older Strip Development
   f. Other Commercial
   g. Hotels And Motels
5. Public Facilities
   a. Government Offices
   b. Fire Stations
   c. Major Medical Health Care Facilities
   d. Religious Facilities
   e. Other Public Facilities
   f. Non-Attended Public Parking Facilities
   g. Special Care Facilities
6. Educational Institutions  
   a. Elementary Schools  
   b. Junior High Schools  
   c. Senior High Schools  
   d. Trade Schools  
7. Light Industrial  
   a. Manufacturing, Assembly, and Industrial Services  
   b. Mixed Commercial and Industrial  
   c. Mixed Urban  
8. Heavy Industrial  
   a. Manufacturing  
   b. Open Storage  
   c. Major Metal Processing  
   d. Wholesaling and Warehousing  
9. Transportation  
   a. Airports  
   b. Railroads  
   c. Freeways and Major Roads  
   d. Park and Ride Lots  
   e. Bus Terminals and Yards  
   f. Truck Terminals  
   g. Communication Facilities  
10. Utility Facilities  
    a. Electrical Power Facilities  
    b. Water Storage Facilities  
    c. Water Transfer Facilities  
    d. Improved Flood Waterways and Structures  
    e. Maintenance Yards  
11. Open Space  
    a. Local Parks and Recreation  
    b. Developed Local Parks And Recreation  
    c. Regional Parks and Recreation  
    d. Other Open Space and Recreation  
    e. Vacant  
    f. Vacant, Undifferentiated  
    g. Water  
    h. Agriculture  
    i. Nurseries  
12. Unknown, No Photo Coverage  

A comprehensive breakdown of parcels by the individual categories listed above is provided in Appendix C. For purposes of projecting water demand at build-out, the twelve primary categories were determined to provide sufficient accuracy and are referred to hereafter as including all associate sub-categories.
Table 2.2 shows a summary of the number of parcels within the VCWD service area broken down by city and primary Land Use designation.

### Table 2.2 – Parcels by City and Land Use Designation

<table>
<thead>
<tr>
<th>Description</th>
<th>Baldwin Park</th>
<th>Azusa</th>
<th>Duarte</th>
<th>Irwindale</th>
<th>West Covina</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>8,123</td>
<td>0</td>
<td>0</td>
<td>283</td>
<td>292</td>
<td>8,698</td>
</tr>
<tr>
<td>Multi-Family Residential</td>
<td>634</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>635</td>
</tr>
<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Retail/Commercial Services</td>
<td>416</td>
<td>0</td>
<td>0</td>
<td>68</td>
<td>12</td>
<td>496</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>45</td>
<td>0</td>
<td>4</td>
<td>9</td>
<td>3</td>
<td>61</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>405</td>
<td>15</td>
<td>0</td>
<td>138</td>
<td>16</td>
<td>574</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>19</td>
<td>7</td>
<td>0</td>
<td>88</td>
<td>1</td>
<td>115</td>
</tr>
<tr>
<td>Transportation</td>
<td>25</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>Utility Facilities</td>
<td>40</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>Open Space</td>
<td>27</td>
<td>0</td>
<td>0</td>
<td>35</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>Unknown</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Totals</td>
<td>9,774</td>
<td>25</td>
<td>4</td>
<td>635</td>
<td>328</td>
<td>10,766</td>
</tr>
</tbody>
</table>

Table 2.3 shows a summary of the number of acres within the VCWD service area broken down by city and primary Land Use designation.

### Table 2.3 – Acreage by City and Land Use Designation

<table>
<thead>
<tr>
<th>Description</th>
<th>Baldwin Park</th>
<th>Azusa</th>
<th>Duarte</th>
<th>Irwindale</th>
<th>West Covina</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>1,331.21</td>
<td>0</td>
<td>0</td>
<td>62.48</td>
<td>57.55</td>
<td>1,451.24</td>
</tr>
<tr>
<td>Multi-Family Residential</td>
<td>156.85</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3.21</td>
<td>160.06</td>
</tr>
<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>1.82</td>
<td>0</td>
<td>0</td>
<td>1.01</td>
<td>11.44</td>
<td>14.27</td>
</tr>
<tr>
<td>Retail/Commercial Services</td>
<td>223.21</td>
<td>0</td>
<td>0</td>
<td>129.63</td>
<td>13.97</td>
<td>366.81</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>58.66</td>
<td>0</td>
<td>41.77</td>
<td>12.73</td>
<td>2.11</td>
<td>115.26</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>220.01</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>220.01</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>222.61</td>
<td>11.04</td>
<td>0</td>
<td>301.77</td>
<td>13.05</td>
<td>548.47</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>26.11</td>
<td>12.49</td>
<td>0</td>
<td>908.66</td>
<td>0.33</td>
<td>947.58</td>
</tr>
<tr>
<td>Transportation</td>
<td>14.58</td>
<td>3.52</td>
<td>0</td>
<td>20.02</td>
<td>1.82</td>
<td>39.94</td>
</tr>
<tr>
<td>Utility Facilities</td>
<td>62.51</td>
<td>21.59</td>
<td>0</td>
<td>28.75</td>
<td>0</td>
<td>112.85</td>
</tr>
<tr>
<td>Open Space</td>
<td>22.93</td>
<td>0</td>
<td>0</td>
<td>2,171.64</td>
<td>0</td>
<td>2,194.57</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.74</td>
<td>0</td>
<td>0</td>
<td>16.32</td>
<td>0</td>
<td>17.06</td>
</tr>
<tr>
<td>Totals</td>
<td>2,341.22</td>
<td>48.64</td>
<td>41.77</td>
<td>3,653.01</td>
<td>103.47</td>
<td>6,188.11</td>
</tr>
</tbody>
</table>
It should be noted that the preceding tables represent actual Land Use as of 2008 and do not take into account recent or pending Land Use changes, planned development, type of industry or occupancy. Proposed Land Use assumes 100% occupancy and complete build-out.

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 water quality sampling, flushing, pumping to waste, hydrant testing, fire suppression, unmetered construction water, street cleaning water, and so on. Water losses also include other forms of unaccounted for water such as leaks, reconciliation of inaccurate meters, unauthorized uses, pipe breaks, undocumented maintenance, and so on.

For purposes of this Water Master Plan, 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 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.
2.5.1 Existing Water Demand

The best available data that describe total water demand are daily production reports.

Figure 2.3 contains all daily production data for the Study Period in terms of millions of gallons of water produced per day (MGD).

**Figure 2.3 – Historical Production Data**

The data in Figure 2.3 exhibit the following general trends and statistics:

- During the first quarter when irrigation demand is lowest (i.e. winter), production stabilizes at an average of 5.72 MGD.
- During the third quarter when irrigation demand is highest (i.e. summer), production stabilizes at an average of 9.18 MGD.
- During the second and fourth quarters, daily production transitions steadily between the winter and summer conditions.
- The average daily production for the Study Period is 7.23 MGD.
- The maximum daily production occurred on August 28, 2009 at 11.50 MGD.
- The minimum daily production occurred on February 19, 2010 at 3.69 MGD.
2.5.2 Top Water Users

The basis for identifying the top water users was a 24-month billing cycle concurrent with the Study Period. Figure 2.4 shows the distribution of water use sorted by volume per account from left to right for the 24-month billing cycle in terms of hundreds of cubic feet (CCF) delivered.

![Figure 2.4 – Distribution of Water Use by Volume per Account](image)

The vast majority of accounts show relatively low and consistent water demand. However, a number of accounts show very high water use. 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. 10,000 CCF per account over the 24-month billing cycle was chosen as a cut-off point for direct allocation of high user demand data to the Water Model.
There were 38 accounts that met the high water user criteria, as shown in Table 2.4.

**Table 2.4 – Top Users**

<table>
<thead>
<tr>
<th>Account No.</th>
<th>Address</th>
<th>Class</th>
<th>ZONE</th>
<th>24-Mo Usage (CCF)</th>
<th>Percent of Total</th>
<th>Allocation (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>283-28177-00</td>
<td>3600 Frazier St</td>
<td>School District</td>
<td>L</td>
<td>52,554</td>
<td>0.80%</td>
<td>40.41</td>
</tr>
<tr>
<td>282-28109-02</td>
<td>5555 Irwindale Ave</td>
<td>Commercial</td>
<td>M</td>
<td>36,231</td>
<td>0.55%</td>
<td>27.86</td>
</tr>
<tr>
<td>281-28044-00</td>
<td>13701 Olive St</td>
<td>School District</td>
<td>U</td>
<td>32,942</td>
<td>0.50%</td>
<td>25.33</td>
</tr>
<tr>
<td>283-28147-00</td>
<td>3900 Puente Ave</td>
<td>School District</td>
<td>L</td>
<td>31,465</td>
<td>0.48%</td>
<td>24.19</td>
</tr>
<tr>
<td>282-28869-02</td>
<td>15800 Tapia St #19</td>
<td>Commercial</td>
<td>M</td>
<td>28,740</td>
<td>0.44%</td>
<td>22.10</td>
</tr>
<tr>
<td>281-28027-00</td>
<td>13245 Los Angeles St</td>
<td>Industrial</td>
<td>U</td>
<td>24,531</td>
<td>0.38%</td>
<td>18.86</td>
</tr>
<tr>
<td>282-28477-03</td>
<td>5539 Ayon Ave</td>
<td>Commercial</td>
<td>M</td>
<td>24,414</td>
<td>0.37%</td>
<td>18.77</td>
</tr>
<tr>
<td>282-28069-00</td>
<td>5050 Irwindale Ave</td>
<td>City</td>
<td>M</td>
<td>19,408</td>
<td>0.30%</td>
<td>14.92</td>
</tr>
<tr>
<td>283-28146-00</td>
<td>3900 Puente Ave</td>
<td>School District</td>
<td>L</td>
<td>19,364</td>
<td>0.30%</td>
<td>14.89</td>
</tr>
<tr>
<td>283-28544-04</td>
<td>14635 Bp Towne Center</td>
<td>Commercial</td>
<td>L</td>
<td>19,353</td>
<td>0.30%</td>
<td>14.88</td>
</tr>
<tr>
<td>281-28040-00</td>
<td>4733 Landis Ave</td>
<td>School District</td>
<td>U</td>
<td>19,277</td>
<td>0.30%</td>
<td>14.82</td>
</tr>
<tr>
<td>281-28039-00</td>
<td>4701 Walnut St</td>
<td>School District</td>
<td>U</td>
<td>18,957</td>
<td>0.29%</td>
<td>14.58</td>
</tr>
<tr>
<td>281-28850-03</td>
<td>4800 Merced Ave (LIL LGE)</td>
<td>School District</td>
<td>U</td>
<td>18,860</td>
<td>0.27%</td>
<td>13.73</td>
</tr>
<tr>
<td>283-28149-00</td>
<td>3609 Vineland Ave</td>
<td>School District</td>
<td>L</td>
<td>17,523</td>
<td>0.27%</td>
<td>13.47</td>
</tr>
<tr>
<td>281-28056-00</td>
<td>14900 Nubia St</td>
<td>School District</td>
<td>U</td>
<td>17,160</td>
<td>0.26%</td>
<td>13.19</td>
</tr>
<tr>
<td>281-28744-01</td>
<td>15300 Arrow Hwy</td>
<td>Industrial</td>
<td>M</td>
<td>16,796</td>
<td>0.26%</td>
<td>12.91</td>
</tr>
<tr>
<td>282-28630-01</td>
<td>16321 Arrow Hwy</td>
<td>Industrial</td>
<td>M</td>
<td>15,093</td>
<td>0.23%</td>
<td>11.60</td>
</tr>
<tr>
<td>283-28133-00</td>
<td>4275 Elton St</td>
<td>County</td>
<td>U</td>
<td>15,084</td>
<td>0.23%</td>
<td>11.60</td>
</tr>
<tr>
<td>281-05622-01</td>
<td>4303 Maine Ave</td>
<td>Commercial</td>
<td>U</td>
<td>14,513</td>
<td>0.22%</td>
<td>11.16</td>
</tr>
<tr>
<td>283-28148-00</td>
<td>14741 Central Ave</td>
<td>School District</td>
<td>L</td>
<td>14,350</td>
<td>0.22%</td>
<td>11.03</td>
</tr>
<tr>
<td>281-28313-03</td>
<td>4900 Rivergrade Rd</td>
<td>Commercial</td>
<td>U</td>
<td>14,085</td>
<td>0.22%</td>
<td>10.83</td>
</tr>
<tr>
<td>282-28467-01</td>
<td>2 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>13,236</td>
<td>0.20%</td>
<td>10.18</td>
</tr>
<tr>
<td>282-28466-01</td>
<td>1 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>13,059</td>
<td>0.20%</td>
<td>10.04</td>
</tr>
<tr>
<td>282-28757-01</td>
<td>13631 Live Oak Ln</td>
<td>Commercial</td>
<td>U</td>
<td>12,907</td>
<td>0.20%</td>
<td>9.92</td>
</tr>
<tr>
<td>282-28469-01</td>
<td>4 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>12,671</td>
<td>0.19%</td>
<td>9.74</td>
</tr>
<tr>
<td>281-28042-00</td>
<td>14321 School St</td>
<td>School District</td>
<td>U</td>
<td>12,634</td>
<td>0.19%</td>
<td>9.71</td>
</tr>
<tr>
<td>281-28914-02</td>
<td>12901 Lower Azusa Rd</td>
<td>Commercial</td>
<td>U</td>
<td>12,170</td>
<td>0.19%</td>
<td>9.36</td>
</tr>
<tr>
<td>283-28160-00</td>
<td>13900 Foster Ave</td>
<td>School District</td>
<td>L</td>
<td>11,766</td>
<td>0.18%</td>
<td>9.05</td>
</tr>
<tr>
<td>281-28852-04</td>
<td>13852 Los Angeles St #B</td>
<td>Commercial</td>
<td>U</td>
<td>11,519</td>
<td>0.18%</td>
<td>8.86</td>
</tr>
<tr>
<td>282-28666-03</td>
<td>13631 Live Oak Ln</td>
<td>Industrial</td>
<td>U</td>
<td>11,313</td>
<td>0.17%</td>
<td>8.70</td>
</tr>
</tbody>
</table>

3 U = Upper Baldwin Park Zone, L = Lower Baldwin Park Zone, M = Morada Zone
CHAPTER 2 – LAND USE, POPULATION AND WATER REQUIREMENTS

2.5.3 Demand Fluctuations

The purpose of understanding demand fluctuation 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 VCWD manages its distribution operations. The following sections put these concepts into perspective.

2.5.3.1 Annual Demand Fluctuation

Demand fluctuation on an annual basis is best described by Peaking Factors (PF) that compare the various extreme demand conditions to the annual average. Table 2.5 summarized an analysis of actual production data during the Study Period. Average Daily Demand (ADD) is the statistical average for the Study Period. Maximum Daily Demand (MDD) and Minimum Daily Demand (Min Day) were found by sorting the data set. Since there is no direct data describing fluctuation on an hourly basis, Peak Hour Demand (PHD) is taken as the conservative industry standard of two times MDD.

Table 2.5 – Peaking Factors

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>Code</th>
<th>MGD</th>
<th>GPM</th>
<th>PF</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Demand</td>
<td>ADD</td>
<td>7.23</td>
<td>5,021</td>
<td>1.00</td>
<td>2009 to 2011</td>
</tr>
<tr>
<td>Maximum Daily Demand</td>
<td>MDD</td>
<td>11.50</td>
<td>7,987</td>
<td>1.59</td>
<td>August 28, 2009</td>
</tr>
<tr>
<td>Minimum Daily Demand</td>
<td>Min Day</td>
<td>3.69</td>
<td>2,565</td>
<td>0.51</td>
<td>February 19, 2010</td>
</tr>
<tr>
<td>Peak Hour Demand</td>
<td>PHD</td>
<td>23.00</td>
<td>15,973</td>
<td>3.18</td>
<td>Per Industry Standard</td>
</tr>
</tbody>
</table>
2.5.3.2 Weekly Demand Fluctuation

Daily demands were analyzed on a weekly basis to look for trends. According to daily production records, the highest demands tend to occur on Sunday, and Thursday and the lowest demands tend to occur on Friday and Saturday. Figure 2.5 shows how demand fluctuates by day of the week relative to the daily average.

Figure 2.5 – Weekly Fluctuation Trend

Two factors appear to influence demand fluctuation on a weekly basis.

1. Due to the large number of commercial and industrial customers served by VCWD, weekly demand fluctuation tends to coincide with the typical work week for these customers.

2. Residential irrigation demand peaks on Sunday

2.5.3.3 Daily Demand Fluctuation

Demand fluctuations over the course of a typical day are based primarily on Land Use. For VCWD, Land Use falls under two general categories: residential and CII (commercial, industrial, institutional). VCWD does not collect sufficient continuous historical data to define local demand fluctuation over the course of a day; however, such fluctuation may be generalized based on industry standards and common sense.
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 tends to be away from the residence. Figure 2.6 is the AWWA standard residential demand diurnal curve.

Figure 2.6 – AWWA Standard Residential Diurnal Curve

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4 AWWA Manual M32, 1989
CII demand closely follows typical business hours with very low demand during the night and relatively steady demand during the day. Figure 2.7 describes typical CII demand variation.

**Figure 2.7 – CII Diurnal Curve**

2.5.3.4 Application of Demand Fluctuation

Since the VCWD distribution system is a closed system, all demands must be met by booster pumps. The booster must be sized and operated to respond to the maximum expected demand at any moment. To assist in determining how demand fluctuation impacts the system, the curves presented in Figure 2.5, Figure 2.6 and Figure 2.7 have been programmed into the Water Model, all analyses and recommendations are based on the system’s response to those fluctuations.
2.5.4 Water Duty and Unit Demand Factors

By statistical analysis of billing and Land Use records, water duty factors and unit demand factors as shown in Table 2.6 and Table 2.7 were calculated.

Table 2.6 – Water Duty and Unit Factors in AFY

<table>
<thead>
<tr>
<th>Land Use</th>
<th>AFY per Acre</th>
<th>AFY per Unit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>2.92</td>
<td>0.47</td>
<td>DU</td>
</tr>
<tr>
<td>Multi-Family Residential</td>
<td>5.15</td>
<td>0.17</td>
<td>DU</td>
</tr>
<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>0.82</td>
<td>0.064</td>
<td>DU</td>
</tr>
<tr>
<td>Retail &amp; Commercial Services</td>
<td>1.88</td>
<td>0.068</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>2.77</td>
<td>0.27</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>1.19</td>
<td>0.41</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>1.26</td>
<td>0.13</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>0.65</td>
<td>0.055</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Irrigation</td>
<td>4.33</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 2.7 – Water Duty and Unit Factors in GPM

<table>
<thead>
<tr>
<th>Land Use</th>
<th>gpm per Acre</th>
<th>gpm per Unit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>1.81</td>
<td>0.29</td>
<td>DU</td>
</tr>
<tr>
<td>Multi-Family Residential</td>
<td>3.19</td>
<td>0.11</td>
<td>DU</td>
</tr>
<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>0.51</td>
<td>0.040</td>
<td>DU</td>
</tr>
<tr>
<td>Retail &amp; Commercial Services</td>
<td>1.17</td>
<td>0.042</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>1.72</td>
<td>0.17</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>0.74</td>
<td>0.26</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>0.78</td>
<td>0.082</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>0.40</td>
<td>0.034</td>
<td>1,000 sf</td>
</tr>
<tr>
<td>Irrigation</td>
<td>4.33</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
2.5.5 Use of Water Duty and Unit Factors

One of the purposes of this Water Master Plan is to provide a basis for the analysis of the impact of development on the distribution system. To determine the demand associated with a new development, use of the following procedure is recommended:

1. Determine the type or types of Land Use to be included in the development.

2. Determine the acreage of each Land Use and multiply those acreages by the appropriate Water Duty Factor (i.e. AFY per Acre or gpm per Acre) to find the demands, then sum up all the demands.

3. Determine the number of units of each Land Use and multiply those units by the appropriate Unit Factor (i.e. AFY per Unit or gpm per Unit) to find the demands, then sum up the demands (separately from step 2).

4. Take the higher of the two sums computed above as the demand for the development.

2.5.6 Proposed Water Demand

Proposed water demand attempts to accommodate a wide range of future needs and issues including:

- Build out of current Land Use planning
- Compliance with water conservation legislation
- Maximum occupancy of residential and CII units and parcels
- Regional Housing Needs Allocation (RHNA) requirements
- Increases in high water use for commercial and industrial needs such as food processing and nurseries
2.5.6.1 Build Out Demand

Build out demand at 100% occupancy based on current Land Use planning was estimated using the Water Duty Factor method as follows:

1. the acreage associated with each Land Use category (see Table 2.3) was estimated

2. To obtain annual demand by Land Use category, the acreages were multiplied by the associated Water Duty Factor\(^5\) (see Table 2.6)

3. the annual demands for each Land Use category were summed

Using the Water Duty Factor method, build out demand is estimated at 8,307 AFY (5,150.6 gpm) as shown in Table 2.8.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Acres</th>
<th>AFY per Acre</th>
<th>AFY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>1,451.24</td>
<td>2.92</td>
<td>4,243.25</td>
</tr>
<tr>
<td>Multi-Family Residential</td>
<td>160.06</td>
<td>5.15</td>
<td>824.49</td>
</tr>
<tr>
<td>Mobile Homes/Trailer Parks</td>
<td>14.27</td>
<td>0.82</td>
<td>11.76</td>
</tr>
<tr>
<td>Retail/Commercial Services</td>
<td>366.81</td>
<td>1.88</td>
<td>690.14</td>
</tr>
<tr>
<td>Public Facilities</td>
<td>268.05</td>
<td>2.77</td>
<td>742.95</td>
</tr>
<tr>
<td>Educational Institutions</td>
<td>220.01</td>
<td>1.19</td>
<td>261.32</td>
</tr>
<tr>
<td>Light Industrial</td>
<td>548.47</td>
<td>1.26</td>
<td>692.99</td>
</tr>
<tr>
<td>Heavy Industrial</td>
<td>947.58</td>
<td>0.65</td>
<td>615.28</td>
</tr>
<tr>
<td>Agriculture(^6)</td>
<td>22.00</td>
<td>4.33</td>
<td>95.33</td>
</tr>
<tr>
<td>Parks</td>
<td>29.97</td>
<td>4.33</td>
<td>129.89</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,307.40</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note that the Water Duty Factor method is limited by existing Land Use planning. City planners are constantly adapting to the needs and requests of the community, which makes Land Use planning fluid and transient. As such, this method provides only a short-term vision of the potential impact to the distribution system.

\(^5\) Water Duty Factors are discussed in detail in Section 2.5.3.4

\(^6\) Estimate of acreage available for use as a nursery at the base of Santa Fe Dam.
2.5.6.2 Water Conservation

Per the 2010 VCWD Urban Water Management Plan, VCWD’s target for water use efficiency is 119.6 gallons per capita per day (GPCD) by 2015 and 118.3 GPCD by 2020 and thereafter. Based on projected population growth (see Table 2.1), this water use efficiency target is equivalent to the demand projection shown in Table 2.9.

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand (AFY)</td>
<td>8,313</td>
<td>9,201</td>
<td>9,372</td>
<td>9,536</td>
<td>9,695</td>
<td>9,846</td>
</tr>
</tbody>
</table>

2.5.6.3 Projected Water Demand Conclusions

Comparing the build out demand estimate in Table 2.8 and the 2010 demand estimate in Table 2.9, VCWD’s service area is already at or near build out for current Land Use. However, Table 2.9 indicates continuous growth through 2035. This means that significant changes in current Land Use are required to accommodate the projected growth in population. Such changes are the purview of the respective city governments, and details regarding such changes are not yet available. For purposes of this Water Master Plan, proposed water demand will be considered as the 2035 projected demand as shown in Table 2.9 distributed proportionally among the three pressure zones. The existing and projected average demands are listed in Table 2.10.

<table>
<thead>
<tr>
<th>Average Demand</th>
<th>AFY</th>
<th>gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (2012)</td>
<td>8,098</td>
<td>5,021</td>
</tr>
<tr>
<td>Projected (2035)</td>
<td>9,846</td>
<td>6,105</td>
</tr>
<tr>
<td>Increase</td>
<td>1,748</td>
<td>1,084</td>
</tr>
<tr>
<td>% Increase</td>
<td>21.6%</td>
<td></td>
</tr>
</tbody>
</table>
3.1 General Description

VCWD has access to potable water from multiple sources; however, the preferred mixture of sources includes local groundwater and a small amount of imported water from Covina Irrigation Company (CIC). Following is an examination of VCWD’s current supply portfolio, and an evaluation of other sources to consider in the event of a supply deficiency.

3.2 Water Rights and Agreements

In general, VCWD prefers to rely on groundwater pumped from the Main San Gabriel Basin as its sole source of supply. As a party to the Main San Gabriel Basin adjudication7, there is no limit to the quantity of groundwater that may be extracted, although replacement water must be purchased from USGVMWD for any volume beyond the sum of VCWD’s share of the Operating Safe Yield (OSY) of the Main San Gabriel Basin and any leases or purchases from other parties to the judgment that VCWD may arrange on its customers’ behalf. Historically, VCWD has dealt with the issue of exceeding its adjudicated rights to Main San Gabriel Basin water with various combinations, on an as-needed basis, of (1) purchasing replacement water for the difference, (2) leasing additional rights on a short-term basis, (3) acquiring additional rights on a permanent basis, (4) purchasing surface water from MWD via USGVMWD who acts as the local wholesaler and (5) purchasing potable water from the Covina Irrigation Company (CIC). This business model serves VCWD very well. As a result, VCWD has not opted to enter into any long-term supply commitments beyond its existing rights in the Main San Gabriel Basin.

3.2.1 Imported Water Agreements

Imported water is available from two sources: USGVMWD and CIC.

3.2.1.1 Imported Water from USGVMWD

VCWD maintains no long-term contracts or commitments with USGVMWD. Historically, imported water from USGVMWD has been used for emergency purposes or when groundwater production was temporarily unavailable.

Large scale improvements to groundwater treatment equipment and capacity in the early 2000’s necessitated the temporary shutdown of certain groundwater production facilities as part of the inspection process with the California Department of Public Health (CDPH). During this time, imported water from USGVMWD was purchased to make up for the temporary loss of groundwater production. Following the inspection and authorization to return groundwater production to sustainable levels, imported water purchases from USGVMWD were dramatically curtailed. Nonetheless, imported water from USGVMWD

7 The Adjudication is provided as an Appendix to the VCWD 2010 Urban Water Management Plan.
has historically contributed to the VCWD supply portfolio and is anticipated to be available in an amount equivalent to recent historical deliveries at 941 AFY, according to the VCWD 2010 Urban Water Management Plan (UWMP).

### 3.2.1.2 Imported Water from CIC

CIC has been a frequent business partner of VCWD, and this relationship is anticipated to continue. Currently, VCWD is a shareholder of CIC with 111 shares. Each share translates to approximately 1 AFY. Typically, VCWD only imports water from CIC in an amount equal to its allotment; however, the exact amount imported in any given year may be vary according to use of a carry-over account, direct purchase of excess water from CIC, lease of water rights from another agency, or other types of transfers and transactions. According the UWMP, historical records indicate that VCWD imports an average of 256 AFY from CIC. Generally, CIC has excess groundwater and surface water treatment capacity and their distribution system is in the immediate vicinity of VCWD, which makes this relationship reliable and convenient.

### 3.2.2 Groundwater Rights

VCWD has an adjudicated right to 3.01517% of the OSY of the Main San Gabriel Basin. Based on a ten-year average OSY of 198,800 AFY, VCWD’s average groundwater allocation is 5,994.2 AFY.

As a party to the Main San Gabriel Basin adjudication, there is no limit to the quantity of groundwater that may be extracted, although replacement water must be purchased from USGVMWD for any volume beyond the sum of VCWD’s share of the Operating Safe Yield and any temporary leases or purchases from other parties to the judgment that VCWD may arrange on its customers’ behalf. Based on historical data related to groundwater production, VCWD has successfully produced up to 9,565.6 AFY of groundwater beyond its transfer commitments, which occurred in FY 2006-07. VCWD is confident that it can successfully obtain a combination of prescriptive rights, groundwater leases and purchases, and replenishment water to achieve this level production in any given year.

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8 Main San Gabriel Basin Watermaster 2010-2011 Annual Report, page 4
3.3 Water Supply Reliability

VCWD prefers to provide all supply to its customers as groundwater extracted from the Main San Gabriel Basin. VCWD uses its rights as a party to the Main San Gabriel Basin judgment to best manage these local assets and to avoid reliance on imported water from USGVMWD. Furthermore, VCWD defers to USGVMWD regarding administration of issues related to acquiring replenishment water for purposes of recharging the Basin, a task which USGVMWD is ideally positioned for and suited to accomplishing in a manner consistent with the continued stewardship of the Basin.

3.3.1 Imported Water Reliability

According to the USGVMWD 2010 Urban Water Management Plan (UWMP),

"Upper District recognizes the reliability of future supplies of imported supplemental water to Upper District from [the Metropolitan Water District of Southern California (MWD)] is directly dependent upon the sources of supply available to [MWD], and is subject to [MWD]’s WASP (Water Supply Assessment ...) allocation..."

"...Upper District intends to implement conservation activities to ensure long-term reliable replenishment capabilities."

The USGVMWD 2010 UWMP went on to describe elements of the MWD 2010 Regional Urban Water Management Plan (RUWMP) intended to strengthen availability and reliability of projected sources. Such efforts have been complicated by recent events and legislation including the economic downturn, management of the State Water Project and the Colorado River Aqueduct, a delay in the issuance of the Governor’s proposed water bond, and the implementation of the Bay Delta Conservation Plan. Nonetheless, the RUWMP projects supply surpluses for all potential demand conditions through 2035.

VCWD, a retailer, is a member agency of USGVMWD, a local wholesaler. And USGVMWD is a member agency of MWD, a regional wholesaler. As such, USGVMWD acts as an intermediary on VCWD’s behalf regarding securing projected imported water supplies.

3.3.2 Groundwater Reliability

VCWD operates four active wells, all of which extract groundwater from the Main San Gabriel Basin, designated: Maine West, Maine East, Nixon West and Nixon East. Six other VCWD wells are currently out of service due to local contaminant levels, designated: Big Dalton, Paddy Lane, Lante, Arrow, Morada and Palm. Figure 3.1 is an excerpt from materials made available by the Main San Gabriel Basin Watermaster (Watermaster) showing the extent of the VOC plume in groundwater in the vicinity of VCWD. The well locations and the VCWD service area have been superimposed on the map.
Figure 3.1 – Location of VOC Contaminant Plume
The VOC plume follows a distinctive southwesterly path toward Whittier Narrows, the primary interface between the Main San Gabriel Basin and the Central Basin. The wells currently in operation are located in zones with VOC Maximum Contaminant Levels (MCL) below the Action Level (AL). The Big Dalton, Paddy Lane, Lante, Arrow and Palm wells do not appear to be located in areas conducive to minimizing treatment costs. The Morada well appears to be on the eastern edge of the plume in an area designated as above the detection limit and below the Action Level. VCWD should consider locating any new wells outside the VOC plume, if possible, to avoid excessive costs associated with the removal VOCs and other contaminants which may be following a path similar to the plume.

The Maine and Nixon Plants include continuously monitored and maintained groundwater extraction and treatment equipment. Backup power is available at these sites in case of a power outage or other emergency.

3.3.3 Basin Description

Per DWR (Bulletin 118), the Main San Gabriel Valley Groundwater Basin is located in eastern Los Angeles County and includes the water-bearing sediments underlying most of the San Gabriel Valley and includes a portion of the upper Santa Ana Valley that lies in Los Angeles County. This basin is bounded on the north by the Raymond fault and the contact between Quaternary sediments and consolidated basement rocks of the San Gabriel Mountains. Exposed consolidated rocks of the Repetto, Merced, and Puente Hills bound the basin on the south and west, and the Chino fault and the San Jose fault form the eastern boundary. The Rio Hondo and San Gabriel drainages have their headwaters in the San Gabriel Mountains, then surface water flows southwest across the San Gabriel Valley and exit through the Whittier Narrows, a gap between the Merced and Puente Hills.

The water-bearing materials of this basin are dominated by unconsolidated to semi-consolidated alluvium deposited by streams flowing out of the San Gabriel Mountains. These deposits include Pleistocene and Holocene alluvium and the lower Pleistocene San Pedro Formation.

Holocene alluvium generally forms alluvial fans along the San Gabriel Mountains and stream deposits that follow the course of the major streams and rivers across the valley. This young alluvium reaches 100 feet in thickness and although is typically above the water table, allows effective percolation of surface water in the basin. Upper Pleistocene alluvium deposits form most of the productive water-bearing deposits in this basin. They consist of unsorted, angular to sub-rounded sedimentary deposits ranging from boulder-bearing gravels near the San Gabriel Mountains to sands and silts in the central and western parts of the basin. Thickness varies from 40 feet in the north to about 4,100 feet in the central portion of the basin.

The lower Pleistocene San Pedro Formation consists of inter-bedded marine sand, gravel, and silt. This formation bears fresh water and reaches a maximum thickness of about 2,000
feet and may grade eastward into continental deposits indistinguishable from the overlying Pleistocene age alluvium.

The exposed consolidated rocks in the Merced, Repetto, and Puente Hills form barriers to groundwater flow to the south and southwest. South Hill, in the northeastern portion of the basin, is emergent basement that diverts groundwater flow around it. The Raymond fault is an east-northeast trending structure forming the boundary between the Raymond Groundwater Basin and this Basin. This fault is a complete barrier along its western end and becomes less effective east of Santa Anita Wash allowing groundwater flow into the Basin. The Lone Hill–Way Hill fault system trends northeast and displaces the water table about 150 feet down to the south. The Sierra Madre fault system trends east along the front of the San Gabriel Mountains and displaces the water table about 250 feet down to the south. Along the eastern boundary of the basin, the Chino and San Jose faults also are partial water barriers, separating groundwater flow within the Basin and the Chino subbasin of the Upper Santa Ana River Valley Groundwater Basin.

3.4 Other Potential Sources of Supply

VCWD’s current supply portfolio is very stable. However, in the event of unforeseen changes in reliability, availability and cost, VCWD should be prepared to incorporate new sources of supply. The following sources should be considered, as needed:

- additional groundwater rights
- direct use of recycled water
- indirect use of recycled water
- beneficial use of superfund-related production
- agreements with neighboring agencies

3.4.1 Additional Groundwater Rights

It is understood that the acquisition of additional groundwater rights in the Main San Gabriel Basin is an ongoing pursuit of VCWD. Two promising sources include Los Angeles County and Valley View Mutual Water Company (VVMWC).

- VCWD currently has an agreement with the County to provided water on an as needed basis for use at the Santa Fe Dam Recreation Area. Expansion of this facility in the future may include the transfer of groundwater water rights to VCWD to support its ongoing needs.

- Consolidation of VVMWC into the VCWD service area in the future would logically include transfer of VVMWC’s groundwater water rights.
The Los Angeles County Flood Control District has cited stormwater capture as a viable groundwater replenishment source that it intends to develop. VCWD is located in a watershed designated as the Upper San Gabriel and Rio Hondo Subregion. It may be possible for VCWD to work in cooperation with Los Angeles County in the implementation of stormwater capture projects to meet the County’s goals for the local watershed, and to receive credit toward its Main San Gabriel Basin replenishment requirement/cyclical account for the volume of stormwater captured.

3.4.2 Direct Use of Recycled Water

Per Title 22, recycled water is restricted for direct use to certain irrigation and industrial uses. There are notable opportunities for direct use by the following VCWD customers:

- 12 schools
- 3 rock quarries
- 2 city parks
- 1 nursery
- Municipal and commercial landscaping
- Santa Fe Dam Recreation Area
- Numerous industrial applications

USGVMWD is working on behalf of its member agencies, including VCWD, to improve the availability of recycled water. Unfortunately, no current recycled water projects will directly impact VCWD. Depending on the success of the current projects, VCWD may have an opportunity for continued development of recycled water distribution in coordination with USGVMWD.

Source availability, source distance and infrastructure costs remain the primary hurdles to implementation of direct use of recycled water. As the importance of recycled water as a resource has been realized, its value as a commodity has risen. The water reclamation plants (WRP) nearest to VCWD include the San Jose Creek WRP (5 miles away), the Whittier Narrows WRP (7 miles away) and the Pomona WRP (10 miles away). Agreements are in place to reuse nearly 100% of the recycled water generated at Whittier Narrows and Pomona, but only about 50% of the capacity of San Jose Creek is currently being reused. This is where USGVMWD is concentrating its efforts. The enormous cost of constructing dedicated distribution infrastructure is not feasible for VCWD to take on alone, but work in coordination with USGVMWD may eventually become more realistic.
3.4.3 Indirect Use of Recycled Water

Per a memo released by USGVMWD in 2011 (see Appendix D), an Integrated Resources Plan is being prepared to demonstrate the feasibility of and benefits associated with infrastructure improvements to transport recycled water from San Jose Creek WRP to spreading grounds in and around Santa Fe Dam for purposes of indirect potable reuse (i.e. groundwater replenishment). The results of these efforts should be greater stability and amount of the Main Gabriel Basin’s OSY.

Given that the project is planned to cross portions of the VCWD service area, there may be opportunities to work in coordination with USGVMWD that would benefit both parties.

There do not appear to be any feasible opportunities for VCWD to independently implement indirect reuse of recycled water.

3.4.4 Superfund Beneficial Use

The Baldwin Park Operable Unit (BPOU) is a Superfund site administered by the EPA whose goal is the remediation of contaminated groundwater in the vicinity of Baldwin Park. Remediation is accomplished through extraction of groundwater followed by treatment for VOCs. A secondary provision is the beneficial use of the treated groundwater. VCWD is working in conjunction with EPA, other public agencies and Cooperating Respondents (CRs) under the BPOU Project Agreement to fulfill the objectives of remediation. BPOU remediation occurs at VCWD’s Lante Treatment Facility.

It is understood that production from BPOU is a function of groundwater remediation and not a function of water demand. Currently, the facility at the Lante Plant is operating below design capacity with no production entering the VCWD system. Figure 3.2 is an excerpt from the EPA’s Superfund website⁹, which shows that treated groundwater production in the Main San Gabriel Basin has been generally static since 2007 at about 10 billion gallons per year (or 30,700 AFY).

⁹ [Link](http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/cad980818512?OpenDocument)
As such, BPOU should not be considered a viable source supply under the current implementation of the agreement. It should be noted that there are ongoing efforts by the CRs to adjust certain treatment processes at the Lante Treatment Facility to increase remediation efficiency and lower costs. VCWD is a party to the CRs’ efforts and should be prepared to revisit the terms of the agreement to establish a more equitable distribution of treated water from BPOU for beneficial use. For purposes of this Water Master Plan, supply from BPOU is considered to be unavailable.
3.4.5 Agreements with Other Agencies

Apart from connections with USGVMWD, VVMWC and CIC, VCWD has currently inactive connections with Azusa Light & Water\textsuperscript{10} (ALW), San Gabriel Valley Water Company (SGVWC) and Suburban Water Systems (SWS). When active, these interconnections create a network that may be potentially used for the delivery of water in emergencies or by agreement. There may be opportunities to develop agreements with neighboring agencies (or with their neighbors, by extension) to the mutual benefit of all parties.

\textsuperscript{10} The connections were originally with Azusa Valley Water Company, which was purchased by Azusa Light & Water in 1993.
CHAPTER 4 – WATER QUALITY

4.1 General Description

The United States Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH) are the public agencies responsible for drafting and implementing regulations that ensure drinking water is safe to drink. EPA and CDPH establish drinking water standards that limit contaminant concentration in water provided to the public.

Valley County Water District (VCWD) regularly tests its drinking water using approved methods to ensure its safety. Over 100 compounds are monitored in VCWD’s water supply, and detected constituents are reported. In 2011, all water delivered by VCWD met or surpassed State and Federal drinking water standards.

In addition, the Main San Gabriel Basin Watermaster (Watermaster), who manages the groundwater basin where VCWD extracts its supply, continuously and vigilantly reviews upcoming State and Federal drinking water regulations. Watermaster has been proactive in the monitoring of unregulated emerging contaminants in anticipation of new water quality standards.

4.2 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 United States 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 nationwide drinking water regulations to include important components such as source water protection and public information. The VCWD 2011 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 E.

4.3 Safe Drinking Water Act

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

### 4.4 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 EPA, CDPH and AWWA. The following sections provide a summary of pressing issues cited by these agencies that may impact VCWD.

#### 4.4.1 Hexavalent Chromium

Hexavalent chromium, also known as chromium 6, is the subject of significant developments at the state and federal levels. Though there are currently no existing or proposed drinking water standards specifically targeting chromium 6, the California Office of Environmental Health Hazard Assessment has proposed a public health goal of 0.02 parts per billion (20 parts per trillion). The EPA and members of Congress have signaled their intent to focus on chromium 6 in drinking water. It should be noted that chromium 6 is currently indirectly monitored under the total chromium MCL of 50 µg/L at the state level and 100 µg/L at the federal level.

#### 4.4.2 Impacts of Climate Change

The US 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 regulation encourage the following:

Establish a comprehensive and coordinated applied research program that addresses:

- Predictive and decision-support tools, including necessary data resources, to help utilities plan for the future impacts of climate change. These tools and resources should include climate models that forecast precipitation changes and address other issues pertinent to water quantity and quality on a national, regional, and sub-regional scale; and assessments to determine the vulnerability of different regions to the anticipated impacts of climate change over different timeframes.
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; the development of alternative water sources such as reuse, recycling, and desalination.

Surface water and groundwater resource impacts of new energy technologies such as biofuel development and mitigation strategies such as carbon sequestration projects.

Assist water utilities to adapt to climate change and address 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 on VCWD is unknown at this time. It is recommended to maintain a dialogue with Watermaster and USGVMWD on the subject of climate change regulation.

4.4.3 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 US Senate is considering the “End Unnecessary Costs Caused by Report Mailing Act of 2011” (S.1578) intended to increase the efficiency of required correspondence by utilizing modern communications technology. If enacted, this initiative, in conjunction with EPA’s “Retrospective Review of Existing Regulations” will allow electronic communication 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.

4.4.4 “Safe Harbor” for MTBE

The U.S. House of Representatives is considering the “Domestic Fuels Protection Act” (HR.4345) whose provisions would allow polluters to pass on to communities and their customers the cost of cleaning up drinking water sources contaminated by MTBE (methel tertiary-butyl ether). This issue of “safe harbor” for contamination by MTBE came up previously, and the House and Senate ultimately did not include such provisions in the comprehensive energy bill enacted in 2005.

VCWD tests for MTBE at its four active well sites on a regular basis as part of the testing protocol required by CDPH. The CDPH operating permit for wells Maine East, Maine West, Nixon East and Nixon West requires monthly water quality sampling. These samples are analyzed for VOCs under EPA Method 524.2, which includes the analyte MTBE. Test
results for MTBE have been Non-detect (ND) at all four well sites. It is unlikely that VCWD will be impacted by this proposed legislation given its water quality record for MTBE.

4.4.5 EDCs and Pharmaceuticals

There are increasing concerns over the detection of endocrine-disrupting compounds (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. They are typically not completely destroyed or removed by waste water 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 which pose a health risk. Research is ongoing.

The impact on VCWD is unknown.

4.4.6 Disinfectant Residual & Disinfection Byproducts

Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors (aka DPH-09-004) became effective June, 2012 (See Appendix F). This legislation may potentially affect VCWD as follows:

Community water systems (CWS) using a primary or residual disinfectant other than ultraviolet light would be required to:

1. Conduct an Initial Distribution System Evaluation (IDSE) to characterize locations with high Total Trihalomethanes (TTHM) and five Haloacetic Acids (HAA5) concentrations.

2. Report TTHM and HAA5 results with respect to revised detection limits.

3. Comply with new routine, reduced, and increased monitoring requirements for TTHM and HAA5.

4. Comply with TTHM and HAA5 Maximum Contaminant Levels (MCLs) on a Locational Running Annual Average (LRAA) basis at each monitoring location.

5. Conduct an operational evaluation and submit a report to the Department if the operational evaluation level for TTHM or HAA5 is exceeded.
(6) Update and submit to the Department monitoring plans to specify TTHM and HAA5 monitoring locations, where MCL compliance is determined on a LRAA basis at each monitoring location.

(7) Report to the Department information on TTHM and HAA5 monitoring and MCL compliance, where MCL compliance is determined on a LRAA basis at each monitoring location.

(8) Comply with additional criteria based on disinfectant used (criteria vary for chlorine, chloramines, chlorine dioxide and ozone).

(9) Conduct Tier 1 public notification for acute violation of the chlorite MCL or chlorine dioxide Maximum Residual Disinfectant Level (MRDL).

(10) Conduct Tier 2 public notification for non-acute violation of the chlorite MCL or chlorine dioxide MRDL.

(11) Conduct Tier 2 public notification for violation of other monitoring and testing procedure requirements as determined by the Department.

(12) Maintain records for microbiological (in lieu of bacteriological) analyses, turbidity analyses, and monitoring plans.

(13) Include in their Consumer Confidence Report, if applicable, detections and violations of Chapter 15.5 contaminants, violations of regulatory action levels and recycled provisions.

(14) Include in their Consumer Confidence Report, if applicable, health effects language for surface water treatment, Chapter 15.5 contaminants, and copper.

Furthermore, the following provisions describe changes to regulatory authority:

(1) Local Primacy Agencies (LPAs) would be granted the responsibility and authority to implement and enforce Chapter 15.5.

(2) Public water systems would be allowed to use U.S. EPA approved alternative test methods for analysis of chapter 15.5 contaminants.

(3) The Department would no longer be required to regulate its activities when considering and issuing permits.

4.4.7 Groundwater Replenishment Reuse

CDPH has proposed updated regulations for groundwater replenishment with recycled municipal wastewater (See Appendix G). These regulations would provide guidance, standards and requirements for the implementation of a Groundwater Replenishment Reuse
Project (GRRP). A GRRP sponsor would be responsible for demonstrating project feasibility, compliance and monitoring.

These regulations may impact the conclusions of the feasibility study being undertaken by USGVMWD regarding its Indirect Reuse Groundwater Replenishment Project, per the U.S. Dept. of the Interior:

*The Upper San Gabriel Valley Municipal Water District will investigate and seek solutions to reverse diminishing groundwater supplies in the main San Gabriel Basin. The objective is to offset current interruptible imported supplies with 10,000 to 20,000 acre-feet annually of locally supplied recycled water within the next 8 to 13 years. The feasibility study will evaluate multiple sources of reclaimed water and compare these alternatives against a "no project" alternative in order to determine the best method for replenishment for the study area.*

No direct impact on VCWD is anticipated.

### 4.5 The Need for Water Treatment

According to MWD’s 2007 groundwater basin report for the Main San Gabriel and Puente Basins, constituents of concern include TDS, nitrate, TCE, PCE, perchlorate and NDMA.

Water quality within the Main San Gabriel Basin is good in most areas. TDS concentrations range from 90 to 4,288 mg/L and average about 367 mg/L in the Main San Gabriel Basin.

During the late 1970s and early 1980s, significant groundwater contamination associated with various VOCs was discovered in the Main San Gabriel Basin. The EPA established Operable Units for areas within the basin that have been contaminated by VOCs and require groundwater cleanup, defined as Area 3, Whittier Narrows, Puente, Baldwin Park, El Monte and South El Monte Operable Units. Cleanup operations are currently underway in Whittier Narrows, Puente, Baldwin Park, El Monte and South El Monte Operable Units.

2007 VOC concentrations are shown in Figure 4.1. The location and concentration of the VOC contamination plume provides insight into the viability of existing and future groundwater extraction sites. The sites of the existing Lante, Arrow, Palm, Paddy Lane and Big Dalton wells overlie portions of the plume with concentrations above the alarm level, which means groundwater extracted at these sites would likely have to be treated for multiple constituents.
Figure 4.1 – VOC Concentration within VCWD

Examination
• Non-Detect Well
• Well Sampled More Than 5 Years Prior to Last Sample Date (03/01/08)
• Well Above Non-Detect

VOCs Contamination Potentially Ranging
From Laboratory Detection Limits To AL
VOCs Contamination Potentially Ranging
From AL To < 10X AL
VOCs Contamination Potentially Ranging
From 10X To < 20X AL
VOCs Contamination Potentially Ranging
From 20X To < 100X AL
Spreading Grounds
4.6 Treatment Facility Adequacy

VCWD prefers to rely entirely on groundwater extracted from the Main San Gabriel Basin. Most wells operated by VCWD exhibit some level of contamination and must be treated to meet drinking water standards prior to introduction into the distribution system.

VCWD currently operates three water treatment facilities which mitigate local groundwater contamination. Table 4.1 provides a brief summary of these facilities and their current and cumulative performance per the Main San Gabriel Basin Watermaster Annual Report.

Table 4.1 – Groundwater Treatment Facilities

<table>
<thead>
<tr>
<th>Groundwater Source</th>
<th>Start Date</th>
<th>Total Water Treated</th>
<th>Contaminants Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FY 2009-10 (AFY)</td>
<td>Cumulative (AFY)</td>
</tr>
<tr>
<td>Lante</td>
<td>June 1984</td>
<td>-</td>
<td>7,720</td>
</tr>
<tr>
<td>BPOU SA1-1 &amp; SA1-2</td>
<td>December 2004</td>
<td>8,063</td>
<td>33,603</td>
</tr>
<tr>
<td>Maine East &amp; West</td>
<td>June 1990</td>
<td>1,849</td>
<td>30,978</td>
</tr>
<tr>
<td>Nixon East &amp; West</td>
<td>January 2004</td>
<td>3,434</td>
<td>14,742</td>
</tr>
</tbody>
</table>

Note that production from the Baldwin Park Operable Unit is regulated by an agreement overseen by the EPA in which the beneficial use of treated groundwater is allocated to area purveyors based on production level. At this time, no BPOU production is allocated to VCWD.

Nonetheless, with the remaining water treatment facilities, VCWD has considerable capacity and flexibility in the use and management of its groundwater rights in the Main San Gabriel Basin.

4.6.1 Lante Treatment Facility and BPOU

The Lante Treatment Plant functions as part of the Baldwin Park Operable Unit (BPOU), a Superfund site, whose purpose is to mitigate the spread of a contaminant plume in the Main San Gabriel Basin while promoting the beneficial use of treated water produced during the mitigation process. According to EPA, BPOU (aka San Gabriel Valley Area 2 Superfund Site) is one of four Superfund sites addressing groundwater contamination in the San Gabriel Valley. The four sites address the need for remediation of multiple areas of contamination in the Main San Gabriel Basin aquifer. The Superfund sites include areas

11 Treatment capacity at the Lante plant was upgraded in 2004 as part of the Super Fund site called the Baldwin Park Operable Unit (BPOU). Treatment equipment installed in 1984 is currently offline.

of groundwater contamination generally underlying portions of the cities of Alhambra, Arcadia, Azusa, Baldwin Park, Industry, Irwindale, El Monte, La Puente, Monrovia, Rosemead, South El Monte, and West Covina.

Groundwater contamination was first detected in the San Gabriel Valley in 1979. By 1984, 59 wells were found to be contaminated with volatile organic compounds (VOCs). In the late 1990s, perchlorate, NDMA\textsuperscript{13}, and 1,4-Dioxane were discovered in the groundwater. Water utilities in the San Gabriel Valley, including VCWD, have continued to provide their customers with clean water by blending contaminated water with clean water to meet drinking water standards, obtaining water from neighboring utilities, and installing wellhead treatment systems, such as those at the Maine and Nixon Plants.

Groundwater from three wells, designated SA1-1, SA1-2 and SA1-3, is treated at the Lante Treatment Plant. The plant has a design capacity of 7,800 gpm. Currently, VCWD receives no treated water from BPOU. Recently, the plant has not run at full capacity, and all treated water is currently diverted to other purveyors for distribution. If production increases in the future, VCWD may agree to receive treated water from BPOU for beneficial use.

### 4.6.2 Maine Street Treatment Facility

The Maine Street Treatment Facility treats groundwater at a design capacity of 3,000 gpm from two wells designated as Maine East and Maine West. The process consists of LPGAC\textsuperscript{14} treatment, which is effective and reliable in removing water contaminants because its chemical and physical properties provide tremendous adsorption capacity and an affinity for a wide variety of dissolved organics and chlorine. LPGAC effectively reduces TCE, PCE, nitrate and other contaminants known to exist in the Main San Gabriel Basin to suitable concentrations levels.

### 4.6.3 Clinton O. Nixon Treatment Facility

The Nixon Treatment Facility treats groundwater at a total design capacity of 5,100 gpm from two wells designated as Nixon East and Nixon West. Treated water from Nixon West is discharged to storage in the Nixon Reservoirs. Treated water from Nixon East is discharged directly into the system. The process consists of LPGAC treatment, as described above in §4.6.2.

\textsuperscript{13} NDMA = nitrodimethylamine

\textsuperscript{14} LPGAC = Liquid Phase Granulated Activated Carbon
CHAPTER 5 – EXISTING WATER SUPPLY SYSTEM

5.1 General Description

The distribution system consists of a series of interdependent subsystems that work together to meet the needs of VCWD’s customers. For purposes of analysis, each subsystem is described below in terms of inventory, capacity, functionality, location and other pertinent data.

5.2 Supply System

Supply enters the VCWD distribution system from wells or from imported sources. VCWD prefers to use 100% groundwater produced from its wells as its source of supply.

Groundwater is currently extracted from four wells at two locations in the Upper Baldwin Park Zone (UBPZ): two wells each at the Nixon Plant and the Maine Plant. All four wells are relatively close together, within one quarter of a mile. This is convenient for treatment purposes since certain aspects of treatment management and processing have been consolidated. Specifically, all production at the Maine Plant is treated in a common facility; whereas, at the Nixon Plant treatment is provided separately for each well and all other ancillary processes are consolidated, such as testing equipment, chemical delivery, operations staff, backup power generation, security, etc. However, the convenience of consolidation also means that distribution originates from a central point making the reliability and redundancy associated with a diversity of sources more of a challenge.

Imported water production is currently limited to deliveries associated with an agreement with Covina Irrigation Company (CICo). Imported water is also available via a connection with the Metropolitan Water District of Southern California (MWD) but is not currently required to meet typical demands.
5.2.1 Groundwater Wells

VCWD has four active wells with details as shown in Table 5.1.

Table 5.1 – Active Well Data

<table>
<thead>
<tr>
<th>Well</th>
<th>State No.</th>
<th>Year Drilled</th>
<th>Year Pump Replaced</th>
<th>Depth (feet)</th>
<th>Casing Dia. (in.)</th>
<th>HP</th>
<th>Recent Test H^{15} (feet)</th>
<th>Recent Test Q^{16} (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nixon East</td>
<td>1S-10W/07A02</td>
<td>1966</td>
<td>02/2009</td>
<td>600</td>
<td>20</td>
<td>400</td>
<td>407</td>
<td>2,783</td>
</tr>
<tr>
<td>Nixon West</td>
<td>1S-10W/07A01</td>
<td>1966</td>
<td>02/2011</td>
<td>600</td>
<td>20</td>
<td>350</td>
<td>387</td>
<td>2,503</td>
</tr>
<tr>
<td>Maine East</td>
<td>1S-10W/07A06</td>
<td>1961</td>
<td>10/2012</td>
<td>600</td>
<td>20</td>
<td>200</td>
<td>330</td>
<td>1,791</td>
</tr>
<tr>
<td>Maine West</td>
<td>1S-10W/07A07</td>
<td>1962</td>
<td>06/1997</td>
<td>600</td>
<td>20</td>
<td>200</td>
<td>325</td>
<td>1,116</td>
</tr>
</tbody>
</table>

In addition, there are five inactive wells as shown in Table 5.2.

Table 5.2 – Inactive Wells

<table>
<thead>
<tr>
<th>Well</th>
<th>State No.</th>
<th>Year Drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lante^{17}</td>
<td>1S-10W/08A03</td>
<td>1971</td>
</tr>
<tr>
<td>Arrow</td>
<td>1S-10W/08A02</td>
<td>1952</td>
</tr>
<tr>
<td>Morada</td>
<td>1S-10W/04A02</td>
<td>1961</td>
</tr>
<tr>
<td>Paddy Lane</td>
<td>1S-10W/19C01</td>
<td>1965</td>
</tr>
<tr>
<td>Palm</td>
<td>1S-10W/18F02</td>
<td>1972</td>
</tr>
<tr>
<td>Big Dalton</td>
<td>1S-10W/17N01</td>
<td>1955</td>
</tr>
</tbody>
</table>

There is interest in bringing one or more inactive wells back on line, if it can be determined to be a benefit in terms of supply reliability, emergency preparedness, cost reduction or distribution efficiency. Of note is the Big Dalton Well which a relatively new facility but would require local water quality issues to be addressed.

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^{15} H = Total Dynamic Head in feet, test data are from 2012

^{16} Q = Flow Rate in gpm, test data are from 2012

^{17} Note that a former VCWD well (Lante - 1S-10W/08A03) is now part of the BPOU. This means that the Lante Well is active, but not available for direct use as a source of supply.
5.2.2 Imported Water

VCWD is equipped to receive gravity flow of imported water from MWD and CICo via interconnections in UBPZ with details as shown in Table 5.3.

<table>
<thead>
<tr>
<th>Source</th>
<th>Location</th>
<th>Connection Elevation (feet)</th>
<th>Approx. Inlet Pressure (psi)</th>
<th>Approx. Discharge Pressure (psi)</th>
<th>Maximum Capacity(^{18}) (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWD</td>
<td>Ramona Blvd, east of Baldwin Park Blvd</td>
<td>392</td>
<td>160</td>
<td>100</td>
<td>9,000</td>
</tr>
<tr>
<td>CICo</td>
<td>San Bernardino Rd, west of Azusa Canyon Rd.</td>
<td>398</td>
<td>90</td>
<td>72</td>
<td>3,500</td>
</tr>
</tbody>
</table>

Imported water from MWD is delivered via the Upper San Gabriel Valley Municipal Water District (USGVMWD), who acts as a local wholesaler. This source is available for purchase as needed; however, VCWD prefers to use groundwater.

Imported water from CICo is available on a limited basis through VCWD’s ownership of shares in CICo. This interconnection also serves as an emergency interconnection. Although the capacity if the CICo connection is listed as 3,500 gpm, VCWD imports water based on demand and CICo availability, usually at a flow rate of approximately 1,500 gpm. Refer to §3.2.1.2 for more detail on imported water from CICo.

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\(^{18}\) Note that the maximum capacities of the imported water connections are theoretical and may not be representative of preferred operational control of these sources.
5.2.3 Emergency Interconnections

Historically, VCWD has installed and maintained emergency interconnections with neighboring water purveyors as shown in Table 5.4. Several of these interconnections have not been used recently and their current status is unknown (noted as inactive).

**Table 5.4 – Emergency Interconnection Data**

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Location</th>
<th>Status</th>
<th>Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWD</td>
<td>UBPZ</td>
<td>Ramona Blvd. east of Baldwin Park Blvd.</td>
<td>Active</td>
<td>9,000</td>
</tr>
<tr>
<td>CICo</td>
<td>UBPZ</td>
<td>San Bernardino Rd. west of Azusa Canyon Rd.</td>
<td>Active</td>
<td>3,500</td>
</tr>
<tr>
<td>UBPZ</td>
<td>VVMWC</td>
<td>Olive St. &amp; Center St.</td>
<td>Active</td>
<td>2,000</td>
</tr>
<tr>
<td>MWD</td>
<td>UBPZ</td>
<td>Badillo St. west of Puente Ave.</td>
<td>Inactive</td>
<td>3,500</td>
</tr>
<tr>
<td>SGVWC</td>
<td>LBPZ</td>
<td>Ramona Blvd. &amp; Rhodes Ln.</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td>LBPZ</td>
<td>SGVWC</td>
<td>Ramona Blvd. &amp; Rhodes Ln.</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td>LBPZ</td>
<td>SWS</td>
<td>Willow Ave. northeast of Channing St.</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td>ALW</td>
<td>Morada Zone</td>
<td>Vincent Ave. north of Arrow Highway</td>
<td>Inactive</td>
<td></td>
</tr>
<tr>
<td>Morada Zone</td>
<td>ALW</td>
<td>Vincent Ave. north of Arrow Highway</td>
<td>Inactive</td>
<td></td>
</tr>
</tbody>
</table>
5.3 Booster Pumps

The VCWD pressure zones are designed as a series of closed systems. As such, VCWD relies on continuous operation of its booster pumps to establish an artificial hydraulic gradient. The pumps work in coordination to maintain a preset pressure range and to respond to the impact of fire flow, as needed.

5.3.1 Booster Pumping Stations

There are five booster pumping stations. In general, each station includes a surface level reservoir which acts as a forebay, a number of booster pumps in parallel which discharge to a common pressure zone, and a relief valve to bypass the booster pumps from the pressure zone back to the reservoir. The sections below describe functionality of each station.

5.3.1.1 Lante/Arrow Highway

The Lante/Arrow Highway Booster Station is located on Arrow Highway east of Lante Street. The station consists of three booster pumps in parallel which take suction from the Lante Reservoir and discharge to the Morada Zone. A booster pump designated as the Lante Booster Pump is configured to take suction from the Lante Reservoir and discharge to UBPZ; however, this pump is not used for normal operations. The primary function of the station is to establish the hydraulic gradient of and supply the Morada Zone. A relief valve is set to relieve excess pressure in the Morada Zone by bypassing the booster pumps back to the Lante Reservoir.

5.3.1.2 Maine

The Maine Booster Station is located at Maine Ave. and Joanbridge St. The station consists of four booster pumps in parallel that take suction from the Maine Reservoir and discharge to UBPZ. The primary functions of the stations are to establish the hydraulic gradient of the UBPZ and to distribute groundwater production from the Maine East and Maine West wells to meet demands and to fill reservoirs at other plants, as needed. A relief valve can be set to refill the Maine Reservoir by bypassing the booster pumps when they are inactive.

5.3.1.3 Morada

The Morada Booster Station is located at the northern terminus of Morada St. The station consists of three booster pumps in parallel that take suction from the Morada Reservoir and discharge to the Morada Zone. The primary function of the station is to support industrial fire flow in the Morada Zone. Under normal operations, this station is inactive with normal demand being provided by the Lante/Arrow Highway Booster Station. To maintain water quality in the Morada Reservoir, the station is activated by timer twice per week to assure sufficient storage turnover. A relief valve is set to refill the Morada Reservoir by bypassing the booster pumps when they are inactive.
5.3.1.4 Clinton O. Nixon

The Clinton O. Nixon (Nixon) Booster Station is located at Joanbridge St. and Baldwin Park Blvd. The station consists of five booster pumps in parallel that take suction from the two Nixon Reservoirs and discharge to UBPZ. One of the pumps is gas powered and designated as an emergency pump. The primary functions of the station are to establish the hydraulic gradient of UBPZ and to distribute groundwater production from the Nixon West well to meet demands and to fill the reservoirs at other plants. A relief valve can be set to refill the Nixon Reservoirs by bypassing the booster pumps when they are inactive.

5.3.1.5 Paddy Lane

The Paddy Lane Booster Station is located on Paddy Lane northeast of Durness St. The station consists of two booster pumps in parallel that take suction from the Paddy Lane Reservoir and discharge to the Lower Baldwin Park Zone (LBPZ). The primary function of the station is to supplement supply entering the zone via a series of four active pressure reducing stations that receive flow from UBPZ. To maintain water quality in the Paddy Lane Reservoir, the station is activated nightly by timer to assure sufficient storage turnover. A relief valve is set to refill the Paddy Lane Reservoir by bypassing the booster pumps when they are inactive.

5.3.2 Pump Efficiency

Pump performance is described by a curve relating head (i.e. the energy imparted to the water) and flow rate. Pumps are designed to operate most efficiently over their anticipated loading range (e.g. typical suction pressure and discharge pressure). Normal wear and adverse changes to loading conditions may result in a drop in efficiency. Examples of changes to loading conditions include changes in demand (e.g. new development) or changes in system configuration (e.g. adding a new tank, adding a new pump, change of a pressure zone boundary, replacing a pipe, adding a source of supply, etc.). Southern California Edison (SCE) provides pump efficiency testing on a regular basis to assist water purveyors in understanding the energy consumption of their pump facilities for purposes of justifying and calculating the cost of improvements. VCWD tests the pump efficiency of all its booster and well pumps on a two-year basis. Table 5.5 provides a summary of pertinent information from the most recent SCE pump efficiency tests.
### Table 5.5 – Pump Efficiency

<table>
<thead>
<tr>
<th>Type</th>
<th>Pump Name</th>
<th>HP</th>
<th>Test</th>
<th>Head (ft)</th>
<th>Q (gpm)</th>
<th>Eff. (%)</th>
<th>Date</th>
<th>SCE Rate</th>
<th>Motor MFR</th>
<th>Pump MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booster</td>
<td>Lante Booster</td>
<td>50</td>
<td>1</td>
<td>78.5</td>
<td>1,659</td>
<td>55.7</td>
<td>10/5/2010</td>
<td>TOU-8-CPP</td>
<td>Aurora</td>
<td>Marathon</td>
</tr>
<tr>
<td></td>
<td>Paddy 1</td>
<td>50</td>
<td>1</td>
<td>112.8</td>
<td>890</td>
<td>50.8</td>
<td>8/9/2012</td>
<td>PA-1</td>
<td>Fairbanks</td>
<td>Morse Baldor</td>
</tr>
<tr>
<td></td>
<td>Paddy 2</td>
<td>50</td>
<td>1</td>
<td>131.0</td>
<td>1,091</td>
<td>68.5</td>
<td>8/9/2012</td>
<td>PA-1</td>
<td>Peerless</td>
<td>Morse Baldor</td>
</tr>
<tr>
<td></td>
<td>Maine 1</td>
<td>30</td>
<td>1</td>
<td>123.1</td>
<td>461</td>
<td>66.8</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Peerless</td>
<td>GE</td>
</tr>
<tr>
<td></td>
<td>Maine 2</td>
<td>40</td>
<td>1</td>
<td>120.4</td>
<td>720</td>
<td>68.3</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Fairbanks</td>
<td>Morse GE</td>
</tr>
<tr>
<td></td>
<td>Maine 3</td>
<td>75</td>
<td>1</td>
<td>124.3</td>
<td>1,196</td>
<td>59.6</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Fairbanks</td>
<td>Morse GE</td>
</tr>
<tr>
<td></td>
<td>Maine 4</td>
<td>75</td>
<td>1</td>
<td>121.3</td>
<td>2,172</td>
<td>77.5</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Fairbanks</td>
<td>Morse US</td>
</tr>
<tr>
<td></td>
<td>Morada 1</td>
<td>75</td>
<td>1</td>
<td>117.3</td>
<td>585</td>
<td>55.7</td>
<td>10/5/2010</td>
<td>PA-1</td>
<td>Aurora</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>127.1</td>
<td>631</td>
<td>59.5</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>Morada 2</td>
<td>75</td>
<td>1</td>
<td>135.9</td>
<td>470</td>
<td>47.7</td>
<td>8/30/2012</td>
<td>PA-1</td>
<td>Aurora</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>188.9</td>
<td>946</td>
<td>59.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morada 3</td>
<td>75</td>
<td>1</td>
<td>133.0</td>
<td>580</td>
<td>53.8</td>
<td>8/24/2012</td>
<td>PA-1</td>
<td>Aurora</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>183.4</td>
<td>1,160</td>
<td>64.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nixon 2</td>
<td>30</td>
<td>1</td>
<td>102.8</td>
<td>727</td>
<td>60.1</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>Worthing</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>94.1</td>
<td>802</td>
<td>59.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nixon 3</td>
<td>40</td>
<td>1</td>
<td>111.8</td>
<td>1,160</td>
<td>70.6</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>Goulds</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td>Nixon 4</td>
<td>50</td>
<td>1</td>
<td>108.8</td>
<td>1,256</td>
<td>63.9</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>Goulds</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>114.6</td>
<td>1,192</td>
<td>64.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nixon 5</td>
<td>75</td>
<td>1</td>
<td>117.8</td>
<td>1,812</td>
<td>67.0</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>Worthing</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>133.7</td>
<td>587</td>
<td>56.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arrow Highway 1</td>
<td>50</td>
<td>1</td>
<td>158.2</td>
<td>1,019</td>
<td>73.0</td>
<td>8/3/2012</td>
<td>TOU-8-CPP</td>
<td>Johnston</td>
<td>GE</td>
</tr>
<tr>
<td></td>
<td>Arrow Highway 2</td>
<td>50</td>
<td>1</td>
<td>162.9</td>
<td>919</td>
<td>66.6</td>
<td>8/3/2012</td>
<td>TOU-8-CPP</td>
<td>Johnston</td>
<td>GE</td>
</tr>
<tr>
<td></td>
<td>Arrow Highway 3</td>
<td>50</td>
<td>1</td>
<td>162.6</td>
<td>886</td>
<td>67.0</td>
<td>8/3/2012</td>
<td>TOU-8-CPP</td>
<td>Johnston</td>
<td>GE</td>
</tr>
<tr>
<td></td>
<td>Maine East</td>
<td>200</td>
<td>1</td>
<td>329.8</td>
<td>1,791</td>
<td>65.0</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Inger</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>213.0</td>
<td>2,093</td>
<td>66.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maine West</td>
<td>200</td>
<td>1</td>
<td>325.1</td>
<td>1,116</td>
<td>63.9</td>
<td>8/1/2012</td>
<td>TOU-PA-B</td>
<td>Fairbanks</td>
<td>Morse US</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>270.7</td>
<td>1,451</td>
<td>64.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nixon East</td>
<td>400</td>
<td>1</td>
<td>407.3</td>
<td>2,783</td>
<td>73.6</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>Goulds</td>
<td>US</td>
</tr>
<tr>
<td></td>
<td>Nixon West</td>
<td>350</td>
<td>1</td>
<td>387.3</td>
<td>2,503</td>
<td>77.4</td>
<td>7/13/2012</td>
<td>TOU-PA-B</td>
<td>L &amp; B</td>
<td>US</td>
</tr>
</tbody>
</table>

Pumps with an efficiency rating below 65% are considered as candidates for improvement or replacement.
5.4 Pressure Reducing Stations

The primary source of supply to LBPZ is by way of a series of pressure reducing stations along the pressure zone boundary with UBPZ. Table 5.6 provides data on these stations.

Table 5.6 – Pressure Reducing Station Data

<table>
<thead>
<tr>
<th>Location</th>
<th>Size (in)</th>
<th>Max. Continuous (gpm)</th>
<th>Max. Intermittent (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badillo St. &amp; Willow Ave.</td>
<td>8</td>
<td>3,100</td>
<td>3,900</td>
</tr>
<tr>
<td>Stewart Ave. &amp; Ramona Blvd.</td>
<td>6</td>
<td>1,800</td>
<td>2,250</td>
</tr>
<tr>
<td>Sterling Way &amp; Ramona Blvd.</td>
<td>10</td>
<td>4,900</td>
<td>6,150</td>
</tr>
<tr>
<td>Bogart Ave. &amp; Ramona Blvd.</td>
<td>6</td>
<td>1,800</td>
<td>2,250</td>
</tr>
</tbody>
</table>

For planning purposes, the AWWA standards for continuous and intermittent flow rates are provided above. Continuous flow is considered to be limited to normal demand and intermittent flow is considered to be normal demand plus fire flow.

5.5 Storage

VCWD maintains surface level storage capacity of 10.0 million gallons in six tanks at five sites as shown in Table 5.7. Functionally, all storage facilities serve as forebays to booster stations which pump water into the distribution system.

Table 5.7 – Storage Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Lante</th>
<th>Maine</th>
<th>Morada</th>
<th>Nixon East</th>
<th>Nixon West</th>
<th>Paddy Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone Served</td>
<td>Morada</td>
<td>UBPZ</td>
<td>Morada</td>
<td>UBPZ</td>
<td>UBPZ</td>
<td>LBPZ</td>
</tr>
<tr>
<td>Base Elevation (feet)</td>
<td>454</td>
<td>425</td>
<td>481</td>
<td>420</td>
<td>420</td>
<td>349</td>
</tr>
<tr>
<td>HWL (feet)</td>
<td>494</td>
<td>457</td>
<td>521</td>
<td>460</td>
<td>460</td>
<td>381</td>
</tr>
<tr>
<td>Height (feet)</td>
<td>40</td>
<td>32</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>32</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>93</td>
<td>90</td>
<td>80</td>
<td>93</td>
<td>93</td>
<td>74</td>
</tr>
<tr>
<td>Nominal Capacity (MG)</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

19 Water can also be pumped from the Lante Reservoir to the Upper Baldwin Park Zone by Lante Booster Pump; however, the Lante Booster Pump is not used during normal operations.
5.6 Transmission and Distribution Pipelines

To support and promote efficient movement of large volumes of water between facilities and to areas of demand, VCWD maintains a comprehensive network of large diameter pipelines that serve as a backbone to the distribution system. According to the Water Model database, more than 188,500 feet (35.7 miles) of pipelines are between 10 inches and 24 inches in diameter. These pipelines are designed specifically to minimize energy losses by effectively reducing pipe velocity.

Distribution pipelines are designed to effectively deliver domestic demand within a reasonable pressure range and to deliver fire flow demand within the requirements of system performance established by the Fire Marshal and CDPH.

Table 5.8 breaks down existing pipelines by diameter and material.

<table>
<thead>
<tr>
<th>Size (in.)</th>
<th>STL</th>
<th>PVC</th>
<th>DI</th>
<th>PLASTIC</th>
<th>CI</th>
<th>CLCS</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4,696</td>
<td>248</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4,944</td>
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<tr>
<td>4</td>
<td>79,377</td>
<td>1,411</td>
<td>83</td>
<td>0</td>
<td>520</td>
<td>0</td>
<td>81,391</td>
</tr>
<tr>
<td>6</td>
<td>204,170</td>
<td>7,730</td>
<td>274</td>
<td>0</td>
<td>474</td>
<td>361</td>
<td>213,009</td>
</tr>
<tr>
<td>8</td>
<td>126,816</td>
<td>3,118</td>
<td>8,930</td>
<td>1,912</td>
<td>0</td>
<td>0</td>
<td>140,776</td>
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<tr>
<td>10</td>
<td>5,133</td>
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<td>5,133</td>
</tr>
<tr>
<td>12</td>
<td>160,776</td>
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<td>2,854</td>
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<td>0</td>
<td>0</td>
<td>163,630</td>
</tr>
<tr>
<td>16</td>
<td>10,865</td>
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<td>430</td>
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<td>0</td>
<td>0</td>
<td>11,295</td>
</tr>
<tr>
<td>20</td>
<td>7,635</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7,635</td>
</tr>
<tr>
<td>24</td>
<td>872</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>872</td>
</tr>
<tr>
<td>Totals</td>
<td>600,341</td>
<td>12,506</td>
<td>12,571</td>
<td>1,912</td>
<td>995</td>
<td>361</td>
<td>628,685</td>
</tr>
</tbody>
</table>
Table 5.9 breaks down existing pipelines by diameter and pressure zone.

Table 5.9 – Pipes Referenced by Size and Zone (in feet)

<table>
<thead>
<tr>
<th>Size (in.)</th>
<th>UBPZ</th>
<th>LBPZ</th>
<th>Morada</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2,243</td>
<td>1,492</td>
<td>1,209</td>
<td>4,944</td>
</tr>
<tr>
<td>4</td>
<td>43,634</td>
<td>32,309</td>
<td>5,448</td>
<td>81,391</td>
</tr>
<tr>
<td>6</td>
<td>98,519</td>
<td>97,803</td>
<td>16,687</td>
<td>213,009</td>
</tr>
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<td>8</td>
<td>65,471</td>
<td>58,047</td>
<td>17,258</td>
<td>140,776</td>
</tr>
<tr>
<td>10</td>
<td>1,128</td>
<td>1,350</td>
<td>2,655</td>
<td>5,133</td>
</tr>
<tr>
<td>12</td>
<td>79,551</td>
<td>56,733</td>
<td>27,346</td>
<td>163,630</td>
</tr>
<tr>
<td>16</td>
<td>4,863</td>
<td>0</td>
<td>6,432</td>
<td>11,295</td>
</tr>
<tr>
<td>20</td>
<td>7,604</td>
<td>0</td>
<td>31</td>
<td>7,635</td>
</tr>
<tr>
<td>24</td>
<td>872</td>
<td>0</td>
<td>0</td>
<td>872</td>
</tr>
<tr>
<td>Totals</td>
<td>303,885</td>
<td>247,735</td>
<td>77,066</td>
<td>628,685</td>
</tr>
</tbody>
</table>

5.7 Treatment

All groundwater extracted by VCWD is treated by LPGAC prior to discharging it to the distribution system. Details of the various treatment facilities are shown in Table 5.10.

Table 5.10 – Treatment Capacity Data

<table>
<thead>
<tr>
<th>Facility</th>
<th>Groundwater Source</th>
<th>Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine Treatment Plant</td>
<td>Maine East and Maine West</td>
<td>3,000</td>
</tr>
<tr>
<td>Nixon West Treatment Plant</td>
<td>Nixon West</td>
<td>2,700</td>
</tr>
<tr>
<td>Nixon East Treatment Plant</td>
<td>Nixon East</td>
<td>2,750</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8,450</td>
</tr>
</tbody>
</table>
5.8 Disinfection

There are three disinfection stations located at the groundwater production sites with discharge concentrations as show in Table 5.11.

Table 5.11 – Disinfection Data

<table>
<thead>
<tr>
<th>Location</th>
<th>Discharge Concentration (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine Reservoir</td>
<td>0.65</td>
</tr>
<tr>
<td>Nixon East Well</td>
<td>0.65</td>
</tr>
<tr>
<td>Nixon West Well</td>
<td>0.65</td>
</tr>
</tbody>
</table>
CHAPTER 6 – COMPUTER MODEL

6.1 General Description

This chapter discusses the concept of hydraulic modeling, the construction of the VCWD Water Model, and the calibration of the Water Model.

6.2 Modeling Software

The VCWD Water Model uses H2ONET Version 10.0 software by Innovyze to perform hydraulic calculations. This software package uses AutoCAD Version 12 as a graphic interface. These software packages are maintained at Civiltec. Civiltec is licensed by Innovyze to create water models of unlimited size and to receive technical support from Innovyze staff in Arcadia, California. All references to hydraulic modeling in this Water Master Plan are made with respect to the H2ONET software platform. The subsections that follow provide insight into the functionality and application of the software.

6.2.1 Basis for the Calculation

A Water Model is a calculator. Like any other calculator, the user provides input data, the calculator performs a function using the input data, and the calculator produces the resulting output data. More specifically, based on a set of boundary conditions (input), the Water Model calculates a Steady State solution (output).

The basis for the calculation performed by the Water Model is in three parts: (1) conservation of mass, (2) conservation of energy and (3) energy loss due to friction.

Conservation of Mass

Conservation of mass is assumed to be equivalent to conservation of volume (i.e. under normal system pressures and temperatures, water behaves as an incompressible liquid). Flow (Q) is defined as volume divided by time. The Water Model is programmed using gallons per minute (gpm) to describe all flows. Conservation of mass dictates that for a given time interval or at any point in time (i.e. an infinitely small time interval), the flow entering and leaving any point in the system must equal zero (i.e. mass cannot be spontaneously destroyed or created).
Figure 6.1 represents a pipe intersection in a distribution system with flow directions as indicated. According to conservation of mass, the inflows to and outflows from the intersection must equal zero.

**Figure 6.1 – Conservation of Mass Schematic**

![Conservation of Mass Schematic](image)

Figure 6.2 is an excerpt from an actual Water Model. Junctions (i.e. connections between pipes) are shown as green dots and pipes are shown as lines.

**Figure 6.2 – Water Model Excerpt Showing Conservation of Mass**

![Water Model Excerpt Showing Conservation of Mass](image)

The pipes indicated in red include output data for flow and flow direction. In this example, conservation of mass holds at the point where the four pipes come together:
Conservation of Energy

The Water Model is programmed to provide output in terms of pressure in pounds per square inch (psi) and hydraulic head in feet to describe energy at any point in the system. Conservation of energy (aka Bernoulli’s theorem) dictates that the net change in energy between two hydraulically linked points must be equivalent to the energy gains and losses in the connecting pipes (i.e. energy cannot be spontaneously lost or gained). For simplicity, the Water Model considers the energy of momentum component of Bernoulli’s theorem to be negligible for the velocities and configuration of a typical water distribution system.

Figure 6.2 represents a length of pipe in a distribution system with a flow direction as indicated (for purposes of this demonstration, assume no change in elevation between the ends of the pipe length). According to conservation of energy, the difference in pressure at either end of the length of pipe plus the energy loss in the pipe must equal zero.

\[ Q_{in} - Q_{out} = 97.6 + 0.2 - 7.2 - 90.6 = 0 \]
Figure 6.4 is an excerpt of the same model as the previous example, this time including output data for energy and flow.

**Figure 6.4 – Water Model Excerpt Showing Conservation of Energy**

The pipe indicated in red includes output data for flow, and the dots indicated in red include output data for energy. In this example, conservation of energy holds for the length of pipe shown in red:

\[
P_{out} - P_{in} + P_{loss} = 82.54 - 82.72 + 0.18 = 0
\]

**Energy Loss Due to Friction**

The Water Model is programmed to calculate head loss due to friction using the Hazen-Williams Equation for head loss in pipes. The Hazen-Williams Equation is an empirical formula which describes with reasonable accuracy the head loss in a pipe for the typical range of diameters and velocities in a water distribution system.
If pipe length, diameter, and roughness are known, then the relationship between flow rate and energy loss due to friction can be predicted with reasonable accuracy, per the following formula:

\[
H_{\text{loss}} = 208.3L \left( \frac{100}{C} \right)^{1.852} \frac{Q^{1.852}}{D^{4.8655}}
\]

Where,

- \(H_{\text{loss}}\) is the head loss due friction in feet
- \(L\) is the length of the pipe in feet
- \(C\) is the Hazen-Williams roughness coefficient
- \(Q\) is the flow rate in gallons per minute
- \(D\) is the diameter of the pipe in inches

Per the VCWD Water Atlas, the length and diameter of every pipe is known. The roughness can be estimated based on pipe material and age.

**An Iterative Solution**

Application of the calculation and its three parts requires an iterative approach. The Water Model assumes a flow in every pipe and a pressure at every node, and then calculates a steady state solution. If the solution meets a predetermined tolerance (i.e. the sum of the errors of each individual calculation is sufficiently low), the simulation ends and the output data are provided. If the tolerance is not achieved, the Water Model makes incremental changes to every flow and pressure, and then recalculates the solution. The process is repeated until either (1) an acceptable solution is achieved or (2) the Water Model determines that no solution is forthcoming. The latter case typically indicates that further refinement of the input data is required to achieve a solution.

### 6.2.2 Input Data and Simulation Conditions

Input data (aka boundary conditions) are broken down into fixed data and variable data.

**Fixed data** do not change with time, and are generally described as infrastructure (i.e. the location, alignment, geometry and connectivity of pipes, pumps, valves, tanks and aquifers). The Water Model stores fixed data as Element Databases, and the user selects precisely which elements to include in a simulation by defining a Facility Set (i.e. a collection of Element Databases).

**Variable data** are subject to change with time, including pump or valves settings and controls, demand and demand fluctuation, supply availability, aquifer depth, etc. The
Water Model stores variable data as Data Subsets, and the user selects precisely which variable data to include in a simulation by defining a Data Set (i.e. a collection of Data Subsets).

Prior to initiating the simulation, the user defines the conditions of the simulation (i.e. the calculation to be performed). Conditions used in the preparation of this Water Master Plan include:

- Steady State Simulation (a single solution at a moment in time)
- Extended Period Simulation (EPS – a dynamic solution that describes incremental acceleration within the system over a designated time period at predetermined time intervals)
- Fire Flow Simulation (a series of steady state solutions assuming a fire flow demand is applied to designated hydrant locations in turn)
- Multi-Fire Flow Simulation (a steady solution describing the performance of multiple hydrants flowing simultaneously)
- Surge Analysis (a dynamic solution describing the pressure wave generated in the moment following the application of a hydraulic transient20).

The power of the Water Model is to save and recall any combination of fixed data, variable data and simulation conditions. These are referred to as Scenarios in the Water Model.

### 6.2.3 Output Data

Following a successful simulation, the Water Model returns output data including:

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 Model Construction

Model construction consisted of database programming of all fixed data and variable data required to perform hydraulic calculations on the VCWD system.

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20 A hydraulic transient describes the acceleration of water in a pipe from one steady state condition to another, typically due the activation or deactivation of a pump or the operation of a valve. High acceleration induces a pressure wave (aka surge or water hammer) in the water column which may damage sensitive equipment or burst pipes.
6.3.1 Fixed Data

The bulk of Water Model construction revolves around programming fixed data into the databases. These fixed data were drawn largely from plans and maps of infrastructure provided by VCWD and other publicly available documents and files.

In particular, the VCWD Atlas Map contained detailed information on:

- Political data – lot lines, rights-of-way, identification of institutions and continuous structures, political boundaries
- Pipes – alignments, materials, diameters, years of installation and connectivity
- Plants – layouts, components (tanks, wells, pumps, valves), connection to the grid
- PRVs – locations, configurations
- Pressure zones – zone boundaries (facilities, valves)

Supplemental vertical control data for Water Model construction were acquired from Google Earth, which uses a digital elevation model (DEM) based on data collected by NASA’s Shuttle Radar Topography Mission.

6.3.2 Variable Data

Variable data consist of aspects of the water distribution system that change with time. Some of these data are within VCWD’s power to control, such as pump activity and valve settings. Other data are outside of VCWD’s direct control, including the pumping surface of the aquifer and customer demand. The subsections that follow provide insight into the analysis required to develop accurate variable data.

6.3.3 Use of Pump Efficiency Test Data

To assure the Water Model corresponds as closely as possible to field conditions and operational preferences, all pumps were programmed per data provided by VCWD including the most recent SCE pump efficiency tests for all well and booster pumps, and operational settings for pumping facilities and control valves.

The Water Model requires each pump to be programmed to respond to variation in intake and discharge pressure according to a performance curve. A performance curve describes the relationship between flow (Q) and total hydraulic head $^{21}$ (H) inherent in the physical properties of the pump mechanism.

The performance curves used in this update are called design point curves. A design point curve uses a single point (i.e. head and flow) to generate a generic curve approximating the

---

$^{21}$ Head refers to the energy transferred from the pump to the water. It is typically given in units of feet, which may be thought of as the energy required to raise the water a certain number of feet above its current level.
pump’s actual performance. These points were taken directly from the most recent pump efficiency tests. The Water Model calculates a parabola that passes through the following set of points to approximate the curve:

- design point (H, Q)
- shut-off head (1.3H, 0)
- shut-off flow (0, 2Q)

For example, the Maine 4 Booster Pump was rated by SCE to have a flow of 2,172 gpm at a total dynamic head of 121.3 feet. The Water Model computed the second-degree polynomial curve for the Maine 4 Booster Pump based on that design point as shown in Table 6.1 and Figure 6.5.

Table 6.1 – Input Data for Maine 4 Booster Pump

<table>
<thead>
<tr>
<th>Point</th>
<th>H (feet)</th>
<th>Q (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shut-off Head</td>
<td>157.7</td>
<td>0</td>
</tr>
<tr>
<td>Design Point</td>
<td>121.3</td>
<td>2,172</td>
</tr>
<tr>
<td>Shut-off Flow</td>
<td>0.0</td>
<td>4,344</td>
</tr>
</tbody>
</table>

Figure 6.5 – Design Point Curve for Maine 4 Booster Pump
Similar curves were calculated for all the other booster and well pumps in the distribution system. The Water Model uses these curves in its iterative steady state solution to determine the energy imparted to the water by the pump when the pump is active.

6.3.4 Demand Allocation

Water demand was allocated to the Water Model on a pressure zone by pressure zone basis taking into account the 38 top users, residential demand and commercial demand. The basis for allocation was a 24-month billing cycle concurrent with the Study Period.

6.3.4.1 Top Water Users

Figure 6.6 shows the distribution of water use by volume per account for the 24-month billing cycle in terms of hundreds of cubic feet (CCF) delivered.

![Figure 6.6 – Distribution of Water Use by Volume per Account](image)

The vast majority of accounts show relatively low and consistent water demand. However, a number of accounts (adjacent to the vertical axis) show very high water use. 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. 10,000 CCF per account over the 24-month billing cycle was chosen as a cut-off point for direct allocation of high user demand to the Water Model. There were 38 accounts that met these criteria, as shown in Table 6.2. The usages shown were converted to percentages of total water demand for the 24-month period, and then allocated to the corresponding model node as a percentage of ADD as determined in Chapter 2.
### Table 6.2 – Top Users

<table>
<thead>
<tr>
<th>Address</th>
<th>Class</th>
<th>ZONE</th>
<th>24-Mo Usage (CCF)</th>
<th>Percent of Total</th>
<th>Allocation (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3600 Frazier St</td>
<td>School District</td>
<td>L</td>
<td>52,554</td>
<td>0.80%</td>
<td>40.41</td>
</tr>
<tr>
<td>5555 Irwindale Ave</td>
<td>Commercial</td>
<td>M</td>
<td>36,231</td>
<td>0.55%</td>
<td>27.86</td>
</tr>
<tr>
<td>13701 Olive St</td>
<td>School District</td>
<td>U</td>
<td>32,942</td>
<td>0.50%</td>
<td>25.33</td>
</tr>
<tr>
<td>3900 Puente Ave</td>
<td>School District</td>
<td>L</td>
<td>31,465</td>
<td>0.48%</td>
<td>24.19</td>
</tr>
<tr>
<td>15800 Tapia St #19</td>
<td>Commercial</td>
<td>M</td>
<td>28,740</td>
<td>0.44%</td>
<td>22.10</td>
</tr>
<tr>
<td>13245 Los Angeles St</td>
<td>Industrial</td>
<td>U</td>
<td>24,531</td>
<td>0.38%</td>
<td>18.86</td>
</tr>
<tr>
<td>5539 Ayon Ave</td>
<td>Commercial</td>
<td>M</td>
<td>24,414</td>
<td>0.37%</td>
<td>18.77</td>
</tr>
<tr>
<td>5050 Irwindale Ave</td>
<td>City</td>
<td>M</td>
<td>19,408</td>
<td>0.30%</td>
<td>14.92</td>
</tr>
<tr>
<td>3900 Puente Ave</td>
<td>School District</td>
<td>L</td>
<td>19,364</td>
<td>0.30%</td>
<td>14.89</td>
</tr>
<tr>
<td>14635 Bp Towne Center</td>
<td>Commercial</td>
<td>L</td>
<td>19,353</td>
<td>0.30%</td>
<td>14.88</td>
</tr>
<tr>
<td>4733 Landis Ave</td>
<td>School District</td>
<td>U</td>
<td>19,277</td>
<td>0.30%</td>
<td>14.82</td>
</tr>
<tr>
<td>4701 Walnut St</td>
<td>School District</td>
<td>U</td>
<td>18,957</td>
<td>0.29%</td>
<td>14.58</td>
</tr>
<tr>
<td>4800 Merced Ave (LIL LGE)</td>
<td>School District</td>
<td>U</td>
<td>17,860</td>
<td>0.27%</td>
<td>13.73</td>
</tr>
<tr>
<td>3609 Vineland Ave</td>
<td>School District</td>
<td>L</td>
<td>17,523</td>
<td>0.27%</td>
<td>13.47</td>
</tr>
<tr>
<td>14900 Nubia St</td>
<td>School District</td>
<td>U</td>
<td>17,160</td>
<td>0.26%</td>
<td>13.19</td>
</tr>
<tr>
<td>15300 Arrow Hwy</td>
<td>Industrial</td>
<td>M</td>
<td>16,796</td>
<td>0.26%</td>
<td>12.91</td>
</tr>
<tr>
<td>16321 Arrow Hwy</td>
<td>Industrial</td>
<td>M</td>
<td>15,093</td>
<td>0.23%</td>
<td>11.60</td>
</tr>
<tr>
<td>4275 Elton St</td>
<td>County</td>
<td>U</td>
<td>15,084</td>
<td>0.23%</td>
<td>11.60</td>
</tr>
<tr>
<td>4303 Maine Ave</td>
<td>Commercial</td>
<td>U</td>
<td>14,513</td>
<td>0.22%</td>
<td>11.16</td>
</tr>
<tr>
<td>14741 Central Ave</td>
<td>School District</td>
<td>L</td>
<td>14,350</td>
<td>0.22%</td>
<td>11.03</td>
</tr>
<tr>
<td>4900 Rivergrade Rd</td>
<td>Commercial</td>
<td>U</td>
<td>14,085</td>
<td>0.22%</td>
<td>10.83</td>
</tr>
<tr>
<td>2 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>13,236</td>
<td>0.20%</td>
<td>10.18</td>
</tr>
<tr>
<td>1 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>13,059</td>
<td>0.20%</td>
<td>10.04</td>
</tr>
<tr>
<td>13631 Live Oak Ln</td>
<td>Commercial</td>
<td>U</td>
<td>12,907</td>
<td>0.20%</td>
<td>9.92</td>
</tr>
<tr>
<td>4 Arrow Hwy &amp; Heintz (Ir)</td>
<td>Commercial</td>
<td>M</td>
<td>12,671</td>
<td>0.19%</td>
<td>9.74</td>
</tr>
<tr>
<td>14321 School St</td>
<td>School District</td>
<td>U</td>
<td>12,634</td>
<td>0.19%</td>
<td>9.71</td>
</tr>
<tr>
<td>12901 Lower Azusa Rd</td>
<td>Commercial</td>
<td>U</td>
<td>12,170</td>
<td>0.19%</td>
<td>9.36</td>
</tr>
<tr>
<td>13900 Foster Ave</td>
<td>School District</td>
<td>L</td>
<td>11,766</td>
<td>0.18%</td>
<td>9.05</td>
</tr>
<tr>
<td>13852 Los Angeles St #B</td>
<td>Commercial</td>
<td>U</td>
<td>11,519</td>
<td>0.18%</td>
<td>8.86</td>
</tr>
<tr>
<td>13631 Live OakLn</td>
<td>Industrial</td>
<td>U</td>
<td>11,313</td>
<td>0.17%</td>
<td>8.70</td>
</tr>
<tr>
<td>3000 Baldwin Park Blvd #F</td>
<td>Commercial</td>
<td>L</td>
<td>11,273</td>
<td>0.17%</td>
<td>8.67</td>
</tr>
<tr>
<td>16125 Ornelas St</td>
<td>Industrial</td>
<td>M</td>
<td>11,250</td>
<td>0.17%</td>
<td>8.65</td>
</tr>
<tr>
<td>13648 Ramona Blvd</td>
<td>Commercial</td>
<td>L</td>
<td>11,247</td>
<td>0.17%</td>
<td>8.65</td>
</tr>
</tbody>
</table>

22 U = Upper Baldwin Park Zone, L = Lower Baldwin Park Zone, M = Morada Zone
6.3.4.2 Residential and Commercial Demands

After the allocation of top users, the remaining residential and commercial demands were allocated proportionally to their respective pressure zones.

Residential demands were allocated to model nodes at intersections in areas designated as residential land use. Similarly, commercial demands were allocated to nodes at intersections in areas designated as commercial, industrial and institutional land use.

In addition, all demands were assigned a residential diurnal curve or a commercial diurnal based on their designation in the billing data set.

6.3.4.3 Summary of Demand Allocation

Demands were allocated by demand type and zone according to their percentage breakdown relative to the 24-month billing cycle as shown in Table 6.3.

Table 6.3 – Demand Allocation by Percentage

<table>
<thead>
<tr>
<th>Zone</th>
<th>Top Users</th>
<th>Residential</th>
<th>CII</th>
<th>All Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper BP Zone</td>
<td>3.76%</td>
<td>30.91%</td>
<td>8.13%</td>
<td>42.79%</td>
</tr>
<tr>
<td>Lower BP Zone</td>
<td>3.37%</td>
<td>35.33%</td>
<td>5.71%</td>
<td>44.41%</td>
</tr>
<tr>
<td>Morada Zone</td>
<td>2.92%</td>
<td>3.84%</td>
<td>6.03%</td>
<td>12.80%</td>
</tr>
<tr>
<td>District</td>
<td>10.05%</td>
<td>70.08%</td>
<td>19.87%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

The percentages shown above were then applied to the ADD of 5,021 gpm as determined in Chapter 2.
For purposes of establishing existing conditions, the demands shown in Table 6.4 were allocated to the Water Model.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Top Users (gpm)</th>
<th>Residential (gpm)</th>
<th>CII (gpm)</th>
<th>All Types (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper BP Zone</td>
<td>188.5</td>
<td>1,552.0</td>
<td>408.2</td>
<td>2,148.7</td>
</tr>
<tr>
<td>Lower BP Zone</td>
<td>169.3</td>
<td>1,773.9</td>
<td>286.5</td>
<td>2,229.7</td>
</tr>
<tr>
<td>Morada Zone</td>
<td>146.8</td>
<td>192.8</td>
<td>303.0</td>
<td>642.6</td>
</tr>
<tr>
<td>District</td>
<td>504.6</td>
<td>3,518.7</td>
<td>997.7</td>
<td>5,021.0</td>
</tr>
</tbody>
</table>

6.4 Model Calibration

Calibration was achieved by making incremental adjustments to elements in the Water Model associated with energy loss until modeled results and field data were comparable. Energy losses occur due to friction between flowing water and pipe walls, and due to changes in the momentum of flowing water. 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.

Production, treatment and booster facilities also experience energy losses caused by changes in momentum due to plant components that influence the flow stream such as control valves, tank inlets and outlets, bends, meters, manifolds and treatment vessels.

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

Each fire flow record contains a static pressure measurement at a specific point and time. A comparison was made between the historical records and model output, and adjustments were made to the Water Model elevations to bring model output into agreement with these field data.

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). Flow tests were conducted to measure energy losses in a number of pipes in the VCWD system. The most conclusive test indicated that the 8-inch steel cement mortar-lined main in Pacific Avenue between Puente Avenue and Ardilla Avenue had a C-factor of 123. Per the American Water Works Association (AWWA), the C-factor for new steel cement mortar-lined pipe is 130. This field value is consistent with the AWWA value considering the effects of minor deterioration due to age.

Pipe roughness is known to deteriorate with age and is also subject to deterioration due to water quality and sedimentation. The U.S. Army Corps of Engineers (Walski, et.al., 1988) has developed a methodology for predicting pipe roughness as a function of age that takes into account the local deterioration rate (aka the roughness growth rate) per the following equation:

\[ C = 18.0 - 37.2 \left[ \log_{10} \left( 0.0006 + \frac{a}{d} \Delta T \right) \right] \]

Where:

- \( C \) is the Hazen-Williams roughness coefficient
- \( d \) is the pipe diameter in feet
- \( a \) is the roughness growth rate
- \( \Delta T \) is the age of the pipe in years
Based on the field test described above, the roughness growth rate was calculated and a predicted C-factor was applied to all pipes in the Water Model as a function of age and diameter. Figure 6.7 shows how roughness is predicted to deteriorate over the life cycle of a pipe in the VCWD system for the most common pipe diameters.

Generally, pipes in the VCWD system maintain a high degree of hydraulic capacity over their life cycle and do not experience excessive deterioration due to adverse water quality of sedimentation issues.

6.4.2 Dynamic Calibration

Dynamic calibration focuses on system performance over time.

Each booster station’s individual performance was programmed using the latest SCE pump efficiency tests as a baseline. The SCE tests indicate individual pump performance under a stated operational setting. The operational setting was simulated in the Water Model, and energy losses through each booster train were adjusted until modeling results matched field results according to the SCE tests.

At the system level, additional energy loss refinements were made to bring modeling results into agreement with recorded booster station discharge pressure and tank level data for the 48-hour period of July 16-17, 2012. For the period in question, average daily
demand was estimated at 6,539 gpm based on daily production records and diurnal fluctuation was applied per §2.5.3. Booster pumps were programmed to activate as indicated by field data.

For example, consider the performance of the Paddy Lane Plant according to field data for July 16-17 as shown in Figure 6.8.

**Figure 6.8 – Paddy Lane Plant Performance on July 16-17**

![Paddy Lane Plant Field Data](image)

The blue curve indicates the water level in the Paddy Lane Tank. The green curve represents the highest pressure recorded on the discharge side of the Paddy Lane Booster Pumps over the course of an hour, and the red curve represents the lowest pressure. The following three observed conditions assisted in dynamic calibration:

1. When the Paddy Boosters are inactive and the inlet valve is closed (for example between 12:00 AM and 10:00 AM on July 16), the pressure fluctuates in response
to supply entering the Lower Baldwin Park Zone via the PRVs in Ramona Blvd. and to demand throughout the Lower Baldwin Park Zone.

2. When the Paddy Boosters are inactive and the inlet valve is open (for example between 10:00 AM and 12:00 PM on July 16), the tank level rises and there is a pressure drop due to the increase in velocity needed to fill the tank.

3. When the Paddy Boosters are active and the inlet valve is closed (for example between 8:00 PM and 11:00 PM on July 16), the tank level drops and there is a slight increase in pressure as water is pumped from the Paddy Lane Tank into the distribution system.

The operational characteristics of July 16-17 were programmed into the Water Model and calibrated to achieve the simulation results for Paddy Lane Plant tank level and discharge pressure as shown in Figure 6.9.

**Figure 6.9 – Paddy Lane Plant Simulation Results**
Figure 6.10 compares the field data to the modeled results for the Paddy Lane Plant. (Note that the high and low pressure spikes in the field data represent the impact of the inlet valve opening and closing and the pumps turning on and off; these pressure spikes last only a few seconds and the impact system pressure is considered negligible.)

The modeled discharge is consistently within the field data pressure range. This indicates that the Water Model is returning representative results.

The dynamic calibration process was similarly applied to all existing facilities where field data were available.
CHAPTER 7 – DESIGN AND PLANNING CRITERIA

7.1 General Description

Design and planning criteria are used (1) as a benchmark for evaluating the capacity of the existing water distribution system and (2) as a guide for recommending improvements to meet 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 Study Period

Production data from 2009 to 2011 were instrumental in the development of the demand projection equation. SCADA data for the same period were instrumental in developing an understanding of demand fluctuation. No demand data beyond calendar year 2011 was considered in this report.

7.3 Design Criteria

Design criteria are used to evaluate the hydraulic capacity of the distribution system. Such an evaluation is a 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.

7.3.1 System Pressure

*Goal for normal system pressure range: 40 psi to 80 psi.*

The level of service that is provided for domestic use is based on the available water pressure. Typical water industry design criteria have an ultimate goal of 40 to 80 psi for system pressures in distribution mains under normal operating conditions. Due to the relatively flat terrain within the service area, this goal is readily achievable at VCWD. Establishment of a range for normal system pressure is driven by customer expectations.

Individual pressure regulators should be installed on all services that could have pressure greater than 80 psi at the meter as recommended in Section 1007 (b) of the current Uniform 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 customer expectations.

**Goal for minimum pressure during fire:** 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 is established by CDPH and the 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, see Appendix H). Note that individual jurisdictions may have varying fire flow requirements. It is recommended to provide a level of fire protection consistent with Regulation #8, and to examine requirements for new construction on an individual basis in cooperation with the local planning jurisdiction and the local Fire Marshal at the developer’s expense. The residual pressure requirement is driven by the regulatory environment.

**Goal for maximum pressure during minimum hour:** 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 200 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 assure that pressures do not exceed 200 psi or the pressure class of the pipe.

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

### 7.3.2 Supply

VCWD’s supply portfolio includes groundwater extracted from the Main San Gabriel Basin and surface imported from CICo and MWD. However, VCWD prefers to be 100% reliant on groundwater for normal operations. If it is available, VCWD will receive groundwater from CICo before it receives imported surface water from MWD. For purposes of applying the following criteria, groundwater production only is considered for normal operations and all sources combined are considered for emergency operations.
Combined production capacity of maximum day demand with largest single source out of service.

The total groundwater production capacity must be capable of collectively meeting MDD with the largest single groundwater source out of service. This level of redundancy will allow VCWD to maintain normal deliveries and maximize its groundwater rights regardless of the temporary loss of a single well due to unforeseen emergency or maintenance. MDD 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. 48-hour refill requirements are driven by emergency preparedness.

7.3.3 Storage Capacity

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

- Operational Storage: 30 percent of maximum day demand
- Fire Storage: per LA County Fire Dept. Regulation #8
- Emergency Storage: 24 hours at maximum day demand

The principal functions of storage are:

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

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 maximum day demand conditions. The volume of operational storage, as an industry standard, averages between 20 and 30 percent of maximum day demand. As a result, the recommended operational storage should be equal to 30 percent of maximum day demand for all pressure zones with storage. The operational storage requirement is driven by system functionality.
Fire Storage: The water system must be capable of meeting maximum day demand and firefighting requirements simultaneously. Fire storage represents one maximum event in terms of fire flow and duration. The fire storage requirement is driven by Los Angeles County Fire Department Regulation #8 and is based upon the worst case scenario of fire flow requirement and duration in each pressure zone. The fire storage requirements is driven by emergency preparedness.

Emergency Storage: Emergency storage is required to meet demands during times of planned and unplanned equipment outages such as pump breakdown, power failure, pipeline rupture, etc. Emergency storage equivalent to 24 hours under maximum day demand means that VCWD will have 24 hours to repair the emergency or secure alternative storage. The emergency storage requirement is driven by emergency preparedness.

Additional Storage Criteria

For water retailers dependent on imported water, MWD recommends sufficient storage be maintained to withstand a planned shutdown of seven average days for purposes of routine maintenance, inspection, retrofit, etc. Wholesalers try to schedule such routine events during low demand periods to minimize impact. The responsibility for such storage is typically shared by the retailer and the local wholesaler by mutual agreement.

Since VCWD has no dependency on imported water at this time, the additional storage criteria are considered not to apply. If VCWD becomes partially or completely dependent on imported water in the future, it is recommended to reconsider these criteria scaled to the appropriate level of dependency.

Shutdown storage criteria are driven by regional supply reliability planning.

7.3.4 Booster Pumping Stations

*Booster pumping stations should be sized to supply maximum day demand plus fire flow or peak hour demand, 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 station capacity should be able to provide maximum day demand plus fire flow or peak hour demand, whichever is greater, with the largest of each source type out of service.*

Flow and pressure are provided to each pressure zone by a combination of booster pumps, well pumps and/or pressure reducing valves. In pressurized systems such as VCWD, the hydraulic gradient is established artificially by a balance between pumps which add pressure and relief valves which reduce pressure. Alternatively, pumps may be equipped to regulate the amount of energy they impart to the water with variable frequency drives (VFDs). With no elevated storage to act as an equalizing source between 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). Booster station requirements are driven by redundancy.
Maintain alternative power source to operate fire pumps

Under the current system configuration, booster pumps must be in operation at all times to maintain system pressure. To protect against a power outage, alternative sources of power should be dispersed in such a way as to provide adequate fire flow coverage on a temporary basis until the grid is restored. The need for alternative power sources is driven by emergency preparedness.

Additional Booster Pumping Criteria

Station Sizing

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

Pump Efficiency

Maintaining high overall pumping plant efficiency is essential for minimizing energy costs. All pumps should be tested periodically for efficiency on a two- or three-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. Driven by efficiency and economics.

7.3.5 Pressure Reducing Stations

Capacity equals MDD plus Fire Flow or PHD within the continuous rating of valves. Maximum intermittent flow rating of valves is acceptable for fire flows. Allowance made for low flows.

In general, pressure reducing stations should be provided when needed to supplement deliveries to lower pressure zones or pressure sub-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 meet peak hour demand or maximum day demand plus fire flow, whichever is greater, within the continuous flow rating of the valves.

It is recommended that three valves be installed within each pressure reducing station that is intended to feed a small closed pressure zone. Two smaller valves should be installed that, combined, can provide MDD. One larger valve should be installed that can provide all flow required in the zone.
Pressure reducing station recommendations are driven by the need to provide consistent and stable system pressure to lower elevations.

### 7.3.6 Pipeline Sizes

Use standard pipe sizes for distribution. The diameter of a replacement pipeline should be a minimum of 8 inches.

Driven by economics and standardization.

### 7.3.7 Transmission Mains

*Maximum pipe velocity under normal operating conditions: 5 feet per second. Maximum energy loss under normal operating conditions: 10 feet of head loss per 1000 feet of pipe*

Transmission mains are intended to efficiently carry water at a high flow rate between facilities (i.e. production, treatment, booster stations and storage). Energy losses along transmission corridors 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 of rapidly when pipe velocity exceeds 5 feet per second. 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 should both 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 main capacity 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.
7.3.8 Distribution Mains

Sized to satisfy two conditions:

(1) Maximum day demand plus fire flow with residual pressure of 20 psi

(2) Peak hour demand with system pressure between 40 psi and 80 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. Driven by efficiency and emergency preparedness.

7.3.9 Fire Flow and Fire Hydrant Spacing Requirements

Per Los Angeles County Fire Department Regulation #8 (see Appendix H). Fire requirements are driven by the regulatory environment and emergency preparedness.

The scope of Regulation #8 is to provide guidance to all entities engaged in (1) land subdivision, (2) construction or (3) the installation/alteration of a water system intended to provide fire protection.

In general, Regulation #8 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

In addition, rules concerning meeting high fire flow requirements with multiple hydrants flowing simultaneously are made explicit.
For purposes of testing the adequacy of the existing system, the following fire flows are applied based on Land Use:

- **1,250 gpm**: Single Family Residential
- **3,500 gpm**: Multi-Family Residential, Mobile Homes/Trailer Parks, Retail/Commercial Services, Agriculture
- **5,000 gpm**: Public Facilities, Educational Institutions, Light Industrial, Heavy Industrial, Transportation, Utility Facilities

If a hydrant (or group of adjacent hydrants as provided in Regulations #8) cannot meet the above applications, it means the capacity of the hydrant (or group of hydrants) should be brought up to current requirements prior to (1) land subdivision, (2) construction or (3) the installation/alteration of the water system. If none of these three conditions exists, it is assumed that the hydrant (or group of hydrants) was subject to a lower standard at the time of installation and this lower standard has been “grandfathered in” (aka allowable nonconformity). In such cases, any recommendations resulting strictly from hydraulic analysis of fire flow capacity should be considered contingent upon (1) land subdivision, (2) construction or (3) the installation/alteration of the water system.

### 7.4 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 piece of equipment to meet the hydraulic requirements established by 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.

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. Components that exceed both the time interval and performance indicator should be considered as high priority replacement projects.

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. Components that exceed both the time interval and performance indicator should be considered as high priority replacement projects.
## Table 7.1 – Replacement Schedules and Indications

<table>
<thead>
<tr>
<th>Component</th>
<th>Interval (years)</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>60</td>
<td>Frequent repair history, excessive energy losses</td>
</tr>
<tr>
<td>Pump/Motor Overhaul</td>
<td>15</td>
<td>Drop in efficiency below 65%</td>
</tr>
<tr>
<td>Pump/Motor Replacement</td>
<td>30</td>
<td>Frequent repair history, drop in efficiency</td>
</tr>
<tr>
<td>Control Valve Overhaul</td>
<td>25</td>
<td>Leaks, poor response, frequent repairs</td>
</tr>
<tr>
<td>Tank Recoating</td>
<td>15</td>
<td>Evidence of corrosion</td>
</tr>
<tr>
<td>Tank Replacement</td>
<td>80</td>
<td>Frequency/extent of repair history</td>
</tr>
<tr>
<td>Well Refurbishment/Replacement</td>
<td>50</td>
<td>Decline in effective capacity</td>
</tr>
<tr>
<td>Production meter calibration</td>
<td>5</td>
<td>Drop in accuracy</td>
</tr>
<tr>
<td>Production meter replacement</td>
<td>20</td>
<td>Drop in accuracy and reliability</td>
</tr>
</tbody>
</table>
CHAPTER 8 – SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS

8.1 General Description

The VCWD distribution system is highly integrated. All groundwater production occurs within a relatively small area in the Upper Baldwin Park Zone where it is distributed as needed among the three pressure zones. Beyond the Upper Baldwin Park Zone, water moves from the Nixon and Maine Plants to the Lower Baldwin Park Zone via a series of PRVs or to the Lante Reservoir where it is pumped to the Morada Zone. There is currently no provision to move water from the Lower Baldwin Park Zone back to the Upper Baldwin Park Zone. Water may be directed from the Morada Zone back to the Upper Baldwin Park Zone, but this is not considered normal operations. The configuration just described is the basis for analysis of system adequacy.

8.2 Analysis of Existing Supply Facilities

The adequacy of the combined sources of supply is subject to redundancy and emergency preparedness. Primary supply design criteria examine the adequacy of all sources to meet normal demands with a degree of redundancy. Secondary supply design criteria examine the system’s ability to recovery from an emergency event following depletion of emergency and fire storage.
8.2.1 Application of Primary Supply Design Criteria

Primary design criteria related to supply state that there should be sufficient supply to meet MDD with the largest source out of service. Table 8.1 provides well capacity per the latest SCE pump efficiency tests and nominal interconnection capacity for imported sources.

Table 8.1 – Supply Analysis

<table>
<thead>
<tr>
<th>Source/Demand</th>
<th>Supply Capacity (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine East</td>
<td>1,791</td>
<td>11,693</td>
<td>11,693</td>
</tr>
<tr>
<td>Maine West</td>
<td>1,116</td>
<td>7,983</td>
<td>9,707</td>
</tr>
<tr>
<td>Nixon East</td>
<td>2,783</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nixon West</td>
<td>2,503</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWD</td>
<td>9,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CICo</td>
<td>3,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Supply Capacity</td>
<td>11,693</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with Largest Out</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Day Demand</td>
<td></td>
<td>7,983</td>
<td>9,707</td>
</tr>
<tr>
<td>Surplus</td>
<td></td>
<td>3,710</td>
<td>1,986</td>
</tr>
</tbody>
</table>

Note that imported water from MWD is the largest single source of supply and is therefore not considered available to meet MDD per the design criteria.

Due to the limited availability of imported water from CICo, the surpluses indicated in Table 8.1 should be revised down by 3,500 gpm (i.e. less the stated capacity of the CICo interconnection). This means there is a revised existing surplus of 210 gpm and a revised future deficit of 1,514 gpm.
8.2.2 Application of Secondary Supply Design Criteria

Secondary design criteria related to supply address refill capacity stating there should be adequate capacity to refill emergency and fire storage within two days under MDD conditions. Emergency storage is equivalent to one day of MDD and fire storage is represents the largest single fire flow requirement of 5,000 gpm for four hours. The total requirement is as follows:

\[ Q = \frac{(MDD)(24 \text{ hours}) + (5,000 \text{ gpm})(4 \text{ hours})}{48 \text{ hours}} + MDD \]

Table 8.2 provides a summary and calculation of the refill requirement.

<table>
<thead>
<tr>
<th>Period</th>
<th>Emergency Storage (MG)</th>
<th>Fire Storage (MG)</th>
<th>Total Refill Volume (MG)</th>
<th>Equivalent Refill Flow Rate (gpm)</th>
<th>MDD (gpm)</th>
<th>Total (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>11.5</td>
<td>1.2</td>
<td>12.7</td>
<td>4,408</td>
<td>7,983</td>
<td>12,392</td>
</tr>
<tr>
<td>Future</td>
<td>14.0</td>
<td>1.2</td>
<td>15.2</td>
<td>5,270</td>
<td>9,707</td>
<td>14,977</td>
</tr>
</tbody>
</table>

Table 8.3 demonstrates the application of the secondary supply criteria.

<table>
<thead>
<tr>
<th>Source/Demand</th>
<th>Supply (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine East</td>
<td>1,791</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maine West</td>
<td>1,116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nixon East</td>
<td>2,783</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nixon West</td>
<td>2,503</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWD</td>
<td>9,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CICo</td>
<td>3,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Supply</td>
<td>17,693</td>
<td>17,693</td>
<td></td>
</tr>
<tr>
<td>Maximum Day Demand</td>
<td>12,392</td>
<td>14,977</td>
<td></td>
</tr>
<tr>
<td>Surplus</td>
<td>5,301</td>
<td>2,716</td>
<td></td>
</tr>
</tbody>
</table>
Once again, due to the limited availability of imported water from CICo, the surpluses indicated in Table 8.3 should be revised down by 3,500 gpm. This means there is a revised existing surplus of 1,801 gpm and a revised future deficit of 784 gpm.

8.2.3 Supply Recommendations

Application of both primary and secondary supply design criteria indicates a slight surplus of 210 gpm under existing conditions and a deficit of 1,514 gpm under future conditions. In the near-term, VCWD can manage its supply under peak conditions through strategic deliveries from CICo and occasional deliveries from MWD whenever groundwater is partially unavailable on a temporary basis such as unscheduled well maintenance.

In the long-term, VCWD must consider ways to strengthen its supply portfolio to deal with the projected future deficit. To continue 100% reliance on groundwater, additional groundwater production capacity is required. Alternatively, renegotiating availability of imported water from CICo under emergency conditions would eliminate the future deficit.

- Construct or acquire additional groundwater production capacity equivalent to the future deficit under the primary criteria (approximately 1,500 gpm).
- Renegotiate availability of imported water from CICo for emergency purposes.
8.3 Analysis of Existing Storage Facilities

Per storage design criteria, minimum capacity is equivalent to the sum of emergency, operational and fire storage.

Emergency storage is one day of MDD.

\[
V_{Existing\ Emergency} = \left(\frac{7,983\ gallons}{minute}\right)(24\ hours)\left(\frac{60\ minutes}{hour}\right) = 11.50\ MG
\]

\[
V_{Future\ Emergency} = \left(\frac{9,707\ gallons}{minute}\right)(24\ hours)\left(\frac{60\ minutes}{hour}\right) = 13.98\ MG
\]

Operational storage is 30% of one day of MDD.

\[
V_{Existing\ Operational} = (0.3)(11.50\ MG) = 3.45\ MG
\]

\[
V_{Future\ Operational} = (0.3)(13.98\ MG) = 4.19\ MG
\]

Fire storage is the requirement for one maximum event:

\[
\left(\frac{5,000\ gallons}{minute}\right)(4\ hours)\left(\frac{60\ minutes}{hour}\right) = 1.2\ MG
\]

Table 8.4 – Existing Storage Capacity

<table>
<thead>
<tr>
<th>Reservoir Name</th>
<th>Zone Served</th>
<th>Nominal Volume (MG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lante</td>
<td>Morada</td>
<td>2.0</td>
</tr>
<tr>
<td>Morada</td>
<td>Morada</td>
<td>1.5</td>
</tr>
<tr>
<td>Maine</td>
<td>UBPZ</td>
<td>1.5</td>
</tr>
<tr>
<td>Nixon East</td>
<td>UBPZ</td>
<td>2.0</td>
</tr>
<tr>
<td>Nixon West</td>
<td>UBPZ</td>
<td>2.0</td>
</tr>
<tr>
<td>Paddy Lane</td>
<td>LBPZ</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>10.0</strong></td>
</tr>
</tbody>
</table>
8.3.1 Application of Storage Design Criteria

Table 8.5 summarizes and compares the above calculations for available and required storage.

Table 8.5 – Storage Analysis

<table>
<thead>
<tr>
<th>Period</th>
<th>Storage Requirement Type</th>
<th>Total Requirement</th>
<th>Total Available</th>
<th>Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emergency</td>
<td>Operational</td>
<td>Fire</td>
<td></td>
</tr>
<tr>
<td>Existing (MG)</td>
<td>11.50</td>
<td>3.45</td>
<td>1.20</td>
<td>16.14</td>
</tr>
<tr>
<td>Future (MG)</td>
<td>13.98</td>
<td>4.19</td>
<td>1.20</td>
<td>19.37</td>
</tr>
</tbody>
</table>

According to Table 8.5, there is an existing storage deficiency of 6.14 MG increasing to a future deficiency of 9.37 MG.

8.3.2 Storage Recommendations

Construct 6.14 MG of storage in the near term.

Construct an additional 3.23 MG of storage in the long term.

8.4 Analysis of Booster Facilities

The adequacy of the booster capacity is subject to redundancy and emergency preparedness. Booster design criteria state:

Booster pumping stations should be sized to supply maximum day demand plus fire flow or peak hour demand, 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 station capacity should be able to provide maximum day demand plus fire flow or peak hour demand, whichever is greater, with the largest of each source type out of service.

The above criteria represent the primary purpose of booster pumps and shall be referred to as primary booster design criteria.

Implicit in booster capacity analysis is emergency refill as discussed in §8.2.2 (Application of Secondary Supply Design Criteria). Application of such analysis shall be referred to as secondary booster design criteria.

The sections that follow examine booster capacity on a zone by zone basis.
8.4.1 Morada Pressure Zone Booster Capacity

There are two booster stations serving the Morada Zone: Arrow and Morada. Under normal operating conditions, supply is provided by the Arrow Booster Station. The Morada Booster Station is intended to provide industrial fire flow capacity when needed. To maintain water quality goals, the Morada Booster Station is activated twice weekly to cycle the Morada Reservoir. Such operation of the Morada Booster Station is not intended to meet peak demand; however, the station is programmed to respond to emergency demands.

According to the Water Model, the Arrow and Morada Booster Stations have the capacities shown in Table 8.6.

<table>
<thead>
<tr>
<th>Station</th>
<th>All Pumps On (gpm)</th>
<th>Largest Pump Off (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow</td>
<td>2,936</td>
<td>1,914</td>
</tr>
<tr>
<td>Morada</td>
<td>1,684</td>
<td>1,131</td>
</tr>
</tbody>
</table>

According to the demand analysis, the Morada Zone has the demand conditions indicated in Table 8.7.

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>MDD+FF (gpm)</th>
<th>PHD (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>6,022</td>
<td>2,043</td>
</tr>
<tr>
<td>Future</td>
<td>6,242</td>
<td>2,485</td>
</tr>
</tbody>
</table>
8.4.1.1 Primary Booster Design Criteria: Morada Zone

Primary design criteria related to booster capacity state that there should be sufficient capacity to meet MDD+FF with the largest source out of service. Table 8.8 compares Morada Zone booster capacity to existing and future peak hour conditions.

<table>
<thead>
<tr>
<th>Capacity/Demand</th>
<th>Booster Capacity (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrow with Largest Booster Out</td>
<td>1,914</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morada with Largest Booster Out</td>
<td>1,131</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Booster Capacity with Largest Out</td>
<td></td>
<td>3,045</td>
<td>3,045</td>
</tr>
<tr>
<td>Maximum Day Demand plus Fire Flow</td>
<td></td>
<td>6,022</td>
<td>6,242</td>
</tr>
<tr>
<td>Surplus</td>
<td></td>
<td>(2,977)</td>
<td>(3,197)</td>
</tr>
</tbody>
</table>

Table 8.8 indicates that there is insufficient capacity to meet Maximum Day Demand plus Fire Flow with the largest booster out of service at each station when both stations are utilized. The existing deficit is 2,977 gpm increasing to 3,197 gpm in the future.

8.4.1.2 Secondary Booster Design Criteria: Morada Zone

Secondary design criteria related to booster capacity address refill capacity, stating that there should be adequate capacity to refill emergency and fire storage within two days under MDD conditions. Emergency storage is equivalent to one day of MDD and fire storage represents the largest single fire flow requirement in the zone of 5,000 gpm for four hours. The total requirement is as follows:

\[
Q = \frac{(MDD_{Morada})(24 \text{ hours}) + (5,000 \text{ gpm})(4 \text{ hours})}{48 \text{ hours}} + MDD_{Morada}
\]
Table 8.9 provides a summary and calculation of the refill requirement with respect to the Morada Zone.

Table 8.9 – Morada Zone Refill Requirement

<table>
<thead>
<tr>
<th>Period</th>
<th>Emergency Storage (MG)</th>
<th>Fire Storage (MG)</th>
<th>Total Refill Volume (MG)</th>
<th>Equivalent Flow Rate (gpm)</th>
<th>MDD (gpm)</th>
<th>Total (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>1.5</td>
<td>1.2</td>
<td>2.7</td>
<td>928</td>
<td>1,022</td>
<td>1,949</td>
</tr>
<tr>
<td>Future</td>
<td>1.8</td>
<td>1.2</td>
<td>3.0</td>
<td>1,038</td>
<td>1,242</td>
<td>2,280</td>
</tr>
</tbody>
</table>

Table 8.10 provides an analysis of the emergency and fire refill booster capacity of the Morada Zone.

Table 8.10 – Morada Zone Emergency & Fire Refill Analysis

<table>
<thead>
<tr>
<th>Capacity/Demand</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Arrow Booster Capacity</td>
<td>2,937</td>
<td>2,937</td>
</tr>
<tr>
<td>Refill Requirement</td>
<td>1,949</td>
<td>2,280</td>
</tr>
<tr>
<td>Surplus</td>
<td>987</td>
<td>657</td>
</tr>
</tbody>
</table>

Table 8.10 indicates a surplus capacity to refill emergency and fire storage in the Morada Zone. Note that actual storage in the Morada Zone is limited to 1.5 MG; therefore, there is adequate booster capacity to support the addition of storage in the Morada Zone.

8.4.2 Lower Baldwin Park Zone Booster Capacity

There is one booster station directly serving the Lower Baldwin Park Zone (Paddy Lane) and four PRVs providing supply from the Upper Baldwin Park Zone. Under normal operating conditions, supply is provided from UBPZ via the PRVs. The Paddy Lane Booster Station is intended to provide supplemental capacity when needed. To maintain water quality goals, the Paddy Lane Booster Station is activated daily to cycle the Paddy Lane Reservoir.
According to the Water Model, the Paddy Lane Booster Station has the capacities shown in Table 8.11.

Table 8.11 – LBPZ Zone Booster Station Capacities

<table>
<thead>
<tr>
<th>Station</th>
<th>All Pumps On (gpm)</th>
<th>Largest Pump Off (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy Lane</td>
<td>1,653</td>
<td>705</td>
</tr>
</tbody>
</table>

According to CLA-VAL specifications, the PRVs serving the Lower Baldwin Park Zone have the capacities shown in Table 8.12.

Table 8.12 – LBPZ PRV Capacities

<table>
<thead>
<tr>
<th>Location</th>
<th>Size (inches)</th>
<th>Maximum Continuous (gpm)</th>
<th>Maximum Intermittent (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badillo-Willow</td>
<td>8</td>
<td>3,100</td>
<td>3,900</td>
</tr>
<tr>
<td>Ramona Parkway</td>
<td>6</td>
<td>1,800</td>
<td>2,250</td>
</tr>
<tr>
<td>Sterling</td>
<td>10</td>
<td>4,900</td>
<td>6,150</td>
</tr>
<tr>
<td>Bogart</td>
<td>6</td>
<td>1,800</td>
<td>2,250</td>
</tr>
</tbody>
</table>

According to the demand analysis, the Lower Baldwin Park Zone has the demand conditions indicated in Table 8.13.

Table 8.13 – LBPZ Zone Demand

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>MDD+FF (gpm)</th>
<th>PHD (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>8,532</td>
<td>7,063</td>
</tr>
<tr>
<td>Future</td>
<td>9,294</td>
<td>8,588</td>
</tr>
</tbody>
</table>
8.4.2.1 Primary Booster Design Criteria: LBPZ

Primary design criteria related to booster capacity state that there should be sufficient capacity to meet PHD or MDD+FF, whichever is higher, with the largest source out of service. In the case of the Lower Baldwin Park Zone, the PRVs have different ratings for continuous and intermittent capacity; therefore, two calculations are required: (1) PHD under continuous capacity rating, and (2) MDD+FF under the intermittent capacity rating.

Table 8.14 compares LBPZ Zone booster and PRV capacity (using the continuous rating) to existing and future peak hour demand conditions.

Table 8.14 – LBPZ Booster Analysis for PHD

<table>
<thead>
<tr>
<th>Capacity/Demand</th>
<th>Booster/PRV Capacity (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy Lane with Largest Booster Out</td>
<td>704</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badillo-Willow</td>
<td>3,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramona Parkway</td>
<td>1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterling</td>
<td>4,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bogart</td>
<td>1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Capacity with Largest PRV Out</td>
<td></td>
<td>7,404</td>
<td>7,404</td>
</tr>
<tr>
<td>Peak Hour Demand</td>
<td></td>
<td>7,063</td>
<td>8,588</td>
</tr>
<tr>
<td>Surplus/Deficit</td>
<td></td>
<td>341</td>
<td>(1,184)</td>
</tr>
</tbody>
</table>

Table 8.14 indicates that there is a deficit under future peak hour demand conditions with the largest booster out of service at the Paddy Lane Booster Station and with the largest PRV out of service.
Table 8.15 compares LBPZ booster and PRV capacity (using the intermittent rating) to existing and future MDD+FF conditions.

### Table 8.15 – LBPZ Booster Analysis for MDD+FF

<table>
<thead>
<tr>
<th>Capacity/Demand</th>
<th>Booster/PRV Capacity (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy Lane with Largest Booster Out</td>
<td>704</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badillo-Willow</td>
<td>3,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramona Parkway</td>
<td>2,250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterling</td>
<td>6,150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bogart</td>
<td>2,250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Capacity with Largest PRV Out</td>
<td></td>
<td>9,104</td>
<td>9,104</td>
</tr>
<tr>
<td>Maximum Day Demand plus Fire Flow</td>
<td></td>
<td>8,532</td>
<td>9,294</td>
</tr>
<tr>
<td>Surplus/Deficit</td>
<td></td>
<td>572</td>
<td>(190)</td>
</tr>
</tbody>
</table>

Table 8.15 indicates that there is a capacity deficit to meet MDD+FF with the largest booster out of service at the Paddy Lane station and with the largest PRV out of service under future demand conditions.

### 8.4.2.2 Secondary Booster Design Criteria: LBPZ

Secondary design criteria related to booster capacity address refill capacity, stating that there should be adequate capacity to refill emergency and fire storage within two days under MDD conditions. Emergency storage is equivalent to one day of MDD and fire storage represents the largest single fire flow requirement in the zone of 5,000 gpm for four hours. The total requirement is as follows:

\[
Q = \frac{(MDD_{LBPZ})(24 \text{ hours}) + (5,000 \text{ gpm})(4 \text{ hours})}{48 \text{ hours}} + MDD_{LBPZ}
\]
Table 8.16 provides a summary and calculation of the refill requirement with respect to the LBPZ.

**Table 8.16 – LBPZ Zone Refill Requirement**

<table>
<thead>
<tr>
<th>Period</th>
<th>Emergency Storage (MG)</th>
<th>Fire Storage (MG)</th>
<th>Total Refill Volume (MG)</th>
<th>Equivalent Flow Rate (gpm)</th>
<th>MDD (gpm)</th>
<th>Total (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>5.1</td>
<td>1.2</td>
<td>6.3</td>
<td>2,182</td>
<td>3,532</td>
<td>5,714</td>
</tr>
<tr>
<td>Future</td>
<td>6.2</td>
<td>1.2</td>
<td>7.4</td>
<td>2,564</td>
<td>4,294</td>
<td>6,858</td>
</tr>
</tbody>
</table>

Table 8.17 provides an analysis of the emergency and fire refill booster capacity of the LBPZ.

**Table 8.17 – LBPZ Zone Emergency & Fire Refill Analysis**

<table>
<thead>
<tr>
<th>Capacity/Demand</th>
<th>PRV Capacity (gpm)</th>
<th>Existing Conditions (gpm)</th>
<th>Future Conditions (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badillo-Willow</td>
<td>3,100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramona Parkway</td>
<td>1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sterling</td>
<td>4,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bogart</td>
<td>1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PRV Capacity with Largest Out Refill Requirement</td>
<td>11,600</td>
<td>11,600</td>
<td></td>
</tr>
<tr>
<td>Surplus</td>
<td>5,886</td>
<td>4,742</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.17 indicates a surplus capacity to refill emergency and fire storage in the Lower Baldwin Park Zone. Note that actual storage in the Lower Baldwin Park Zone is limited to 1.0 MG; therefore, there is adequate PRV capacity to support the addition of storage in the Lower Baldwin Park Zone, if desired.
8.4.3 Upper Baldwin Park Zone Booster Capacity

Based on the configuration of the distribution system, the Upper Baldwin Park Zone must supply the entire district. However, from an operational point of view, the Morada Pressure Zone may be temporarily isolated under peak and emergency conditions, and the Paddy Lane Booster Station may be activated under peak and emergency conditions. According to the demand analysis and assuming the above operational status, peak and emergency demand conditions in the Upper Baldwin Park Zone are as indicated in Table 8.18.

Table 8.18 – UBPZ MDD+FF Requirement

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>UBPZ MDD (gpm)</th>
<th>LBPZ MDD (gpm)</th>
<th>FF (gpm)</th>
<th>Paddy Lane (gpm)</th>
<th>Total (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>3,432</td>
<td>3,533</td>
<td>5,000</td>
<td>(705)</td>
<td>11,260</td>
</tr>
<tr>
<td>Future</td>
<td>4,173</td>
<td>4,296</td>
<td>5,000</td>
<td>(705)</td>
<td>12,765</td>
</tr>
</tbody>
</table>

Table 8.19 – UBPZ PHD Requirement

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>UBPZ MDD (gpm)</th>
<th>LBPZ MDD (gpm)</th>
<th>Paddy Lane (gpm)</th>
<th>Total (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>6,863</td>
<td>7,066</td>
<td>(705)</td>
<td>13,224</td>
</tr>
<tr>
<td>Future</td>
<td>8,345</td>
<td>8,592</td>
<td>(705)</td>
<td>16,233</td>
</tr>
</tbody>
</table>
Table 8.20 provides an analysis of the total and design supply capacities of the UBPZ. The total capacity considers all supply sources and the design capacity considers all sources less the largest booster in each station (i.e. Maine 4 and Nixon 5) and the largest single source (i.e. MWD).

Table 8.20 – UBPZ Supply Capacity

<table>
<thead>
<tr>
<th>Source</th>
<th>Total Capacity (gpm)</th>
<th>Design Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine 1</td>
<td>430</td>
<td>430</td>
</tr>
<tr>
<td>Maine 2</td>
<td>641</td>
<td>641</td>
</tr>
<tr>
<td>Maine 3</td>
<td>1,030</td>
<td>1,030</td>
</tr>
<tr>
<td>Maine 4</td>
<td>2,053</td>
<td>0</td>
</tr>
<tr>
<td>Nixon 2</td>
<td>703</td>
<td>703</td>
</tr>
<tr>
<td>Nixon 3</td>
<td>1,212</td>
<td>1,212</td>
</tr>
<tr>
<td>Nixon 4</td>
<td>1,302</td>
<td>1,302</td>
</tr>
<tr>
<td>Nixon 5</td>
<td>1,910</td>
<td>0</td>
</tr>
<tr>
<td>Nixon East Well</td>
<td>2,783</td>
<td>2,783</td>
</tr>
<tr>
<td>MWD</td>
<td>9,000</td>
<td>0</td>
</tr>
<tr>
<td>CICo</td>
<td>3,500</td>
<td>3,500</td>
</tr>
<tr>
<td></td>
<td>24,564</td>
<td>11,601</td>
</tr>
</tbody>
</table>
8.4.3.1 Primary Booster Design Criteria: UBPZ

Primary design criteria related to booster capacity state that there should be sufficient capacity to meet PHD with the largest source out of service. Table 8.21 compares UBPZ booster capacity to existing and future peak hour conditions.

<table>
<thead>
<tr>
<th>Demand Condition</th>
<th>Design Capacity (gpm)</th>
<th>Demand (gpm)</th>
<th>Surplus or Deficiency (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>11,601</td>
<td>11,260</td>
<td>341</td>
</tr>
<tr>
<td>Future</td>
<td>11,601</td>
<td>12,765</td>
<td>(1,164)</td>
</tr>
</tbody>
</table>

Table 8.21 indicates an existing surplus of 341 gpm to meet peak hour demand, but a future deficiency of 1,164 gpm.

8.4.3.2 Secondary Booster Design Criteria: UBPZ

Based on the configuration of production, storage and booster pumping facilities in the UBPZ, secondary design criteria related to booster capacity do not apply. In an emergency refill scenario, supply enters the UBPZ independently of the booster pumps serving the zone.
8.4.4 Booster Recommendations

8.4.4.1 Morada Zone

To accommodate near term and long term deficiencies, increase booster capacity in the Morada Zone by 3,200 gpm to support MDD+FF requirements. The additional capacity may be added to either or both the Arrow and Morada booster stations.

8.4.4.2 Lower Baldwin Park Zone

In the long term, add the equivalent 1,200 gpm of continuous PRV capacity to the LBPZ either by installing a new PRV or by replacing an existing PRV with a larger capacity PRV.

8.4.4.3 Upper Baldwin Park Zone

There are multiple factors to be considered in the booster recommendation for the Upper Baldwin Park Zone.

It is understood that VCWD desires sufficient capacity to supply all normal demand conditions by groundwater rather relying on capacity from MWD or CICO. To that end, additional storage and booster capacity have been independently planned for the Nixon site. The Water Model was reconfigured to represent the current plans for the Nixon site including:

- All wells discharge directly to storage
- A total of 10 MG or storage capacity
- Existing boosters are replaced with four new boosters each with a capacity of 4,200 gpm at 139 feet of head.
8.5 Analysis of Existing Distribution System

The primary function of the distribution system is to carry supply to where it is needed. In most cases, fire flow demand is the governing factor in sizing pipelines. The results of a Fire Flow plus Maximum Day Demand (FF+MDD) analysis indicated a number of hydrants (or groups of hydrants) that could not meet the allocated fire flow capacity. These deficiencies have been categorized by the magnitude of the fire flow demand related to the following land uses:

<table>
<thead>
<tr>
<th>Fire Flow Demand (gpm)</th>
<th>Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>Industrial and Institutional</td>
</tr>
<tr>
<td>3,500</td>
<td>Multi-family Residential, Commercial</td>
</tr>
<tr>
<td>1,250</td>
<td>Single Family Residential</td>
</tr>
</tbody>
</table>

Note that fire flow demands listed above are typical for the land uses indicated under the current standards provided by the Fire Marshal for new construction. Fire flow requirements for individual parcels may be higher or lower than the listed demands at the discretion of the Fire Marshal. Allowances for reduced fire flow requirements include onsite fire sprinklers, use of fire retardant construction materials and sufficient separation between structures. The need for increased fire flow requirements may include multiple stories, large floor areas, high occupancy and high density.

A fire flow analysis means that a fire flow event was simulated at every hydrant location in the Water Model under Maximum Day Demand steady state conditions. The Water Model returned static pressure, residual pressure and available flow for each hydrant. The significant result is the available flow at 20 psi residual which generally represents the performance the hydrant is capable of as a worst case scenario.

As permitted by regulation, fire flows in excess of 2,500 gpm may be met by up to two hydrants flowing simultaneously, and fire flows in excess of 3,500 gpm may be met by up to three hydrants flowing simultaneously. Any hydrant that could not individually meet the assigned fire flow requirement was retested using a multi-hydrant fire flow simulation.

Fire flow capacity is a combination of booster capacity and pipeline capacity. It is assumed that booster recommendations identified in Section 0 will be implemented, and the combination of the booster recommendations and any necessary pipeline improvements identified in the following sections will satisfy fire flow requirements for new construction.
8.5.1 Industrial Fire Flow Deficiencies

Fire flow demand for industrial land use is set at 5,000 gpm.

Table 8.22 provides a list of hydrants grouped into areas that could not meet industrial fire flow requirements, prioritized by available flow at 20 psi residual pressure with up to three hydrants flowing simultaneously.

**Table 8.22 – Industrial Fire Flow Deficiencies**

<table>
<thead>
<tr>
<th>Area Number</th>
<th>Hydrant No.</th>
<th>Static Pressure (psi)</th>
<th>Combined Available Flow at 20 psi (gpm)</th>
<th>Zone</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20-6</td>
<td>66.77</td>
<td>3,748</td>
<td>U</td>
<td>Ramona Blvd. near Puente Avenue</td>
</tr>
<tr>
<td></td>
<td>20-7</td>
<td>67.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-18A</td>
<td>69.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-9</td>
<td>68.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>IR3-9</td>
<td>87.48</td>
<td>4,217</td>
<td>M</td>
<td>Business Center Drive</td>
</tr>
<tr>
<td></td>
<td>IR3-10</td>
<td>87.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR3-5</td>
<td>86.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR3-8</td>
<td>85.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR4-8</td>
<td>84.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR3-9</td>
<td>87.48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>IR2-3</td>
<td>59.24</td>
<td>4,483</td>
<td>U</td>
<td>Arrow Highway at I-605</td>
</tr>
<tr>
<td></td>
<td>IR2-1</td>
<td>64.44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR1-1</td>
<td>72.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IR9-11</td>
<td>76.59</td>
<td>4,512</td>
<td>U</td>
<td>Cypress Street &amp; Azusa Canyon Road</td>
</tr>
<tr>
<td></td>
<td>IR9-24</td>
<td>77.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IR9-10</td>
<td>77.45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The typical reason for these is undersized and/or dead-end mains serving the area.
8.5.2 Multi-family Residential/Commercial Fire Flow Deficiencies

Fire flow demand for multi-family residential and commercial land use is set at 3,500 gpm.

Table 8.23 provides a list of hydrants grouped into areas that could not meet multi-family residential or commercial fire flow requirements, prioritized by available flow at 20 psi residual pressure with up to two hydrants flowing simultaneously.

<table>
<thead>
<tr>
<th>Area Number</th>
<th>Hydrant No.</th>
<th>Static Pressure (psi)</th>
<th>Available Flow at 20 psi (gpm)</th>
<th>Zone</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19-128C</td>
<td>77.23</td>
<td></td>
<td>U</td>
<td>Palmrose Shopping Center</td>
</tr>
<tr>
<td></td>
<td>19-128F</td>
<td>76.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-128B</td>
<td>77.19</td>
<td>2,263</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-128G</td>
<td>77.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-128E</td>
<td>75.98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-128</td>
<td>76.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>38-2</td>
<td>67.16</td>
<td>2,684</td>
<td>L</td>
<td>Feather &amp; Corak</td>
</tr>
<tr>
<td>3</td>
<td>5-28</td>
<td>68.90</td>
<td>2,855</td>
<td>U</td>
<td>Heinz &amp; Cragmont</td>
</tr>
<tr>
<td>4</td>
<td>23-68</td>
<td>62.65</td>
<td>3,168</td>
<td>L</td>
<td>Bresee &amp; Illinois</td>
</tr>
<tr>
<td></td>
<td>23-75</td>
<td>62.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>20-5</td>
<td>68.7</td>
<td>3,203</td>
<td>U</td>
<td>Los Angeles &amp; Park</td>
</tr>
</tbody>
</table>

The typical reason for these is undersized and/or dead-end mains serving the area.

8.5.3 Single Family Residential Fire Flow Deficiencies

Table 8.24 provides a list of hydrants that were unable to meet single family residential fire flow requirements, prioritized by available flow at 20 psi residual pressure.
### Table 8.24 – Single Family Residential Fire Flow Deficiencies

<table>
<thead>
<tr>
<th>Hydrant No.</th>
<th>Static Pressure (psi)</th>
<th>Available Flow at 20 psi (gpm)</th>
<th>Zone</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-20</td>
<td>57.89</td>
<td>213.19</td>
<td>L</td>
<td>Sherway</td>
</tr>
<tr>
<td>27-78</td>
<td>68.47</td>
<td>440.17</td>
<td>L</td>
<td>Rexwood</td>
</tr>
<tr>
<td>28-66</td>
<td>60.84</td>
<td>442.96</td>
<td>L</td>
<td>Paddy &amp; MacDevitt</td>
</tr>
<tr>
<td>14-84</td>
<td>73.57</td>
<td>508.83</td>
<td>U</td>
<td>Demblon &amp; Bogart</td>
</tr>
<tr>
<td>35-9</td>
<td>56.68</td>
<td>717.82</td>
<td>L</td>
<td>Mayland &amp; Dutch</td>
</tr>
<tr>
<td>35-18</td>
<td>57.57</td>
<td>721.60</td>
<td>L</td>
<td>Sherway &amp; Ardilla</td>
</tr>
<tr>
<td>34-8</td>
<td>56.69</td>
<td>734.36</td>
<td>L</td>
<td>La Vista &amp; Dutch</td>
</tr>
<tr>
<td>25-55</td>
<td>58.02</td>
<td>792.87</td>
<td>U</td>
<td>Borel &amp; Olive</td>
</tr>
<tr>
<td>10-29</td>
<td>48.90</td>
<td>855.29</td>
<td>L</td>
<td>Navilla &amp; Chetney</td>
</tr>
<tr>
<td>15-1A</td>
<td>62.49</td>
<td>889.94</td>
<td>U</td>
<td>Elizabeth</td>
</tr>
<tr>
<td>34-1A</td>
<td>66.53</td>
<td>939.03</td>
<td>U</td>
<td>Park &amp; Los Angeles</td>
</tr>
<tr>
<td>30-2</td>
<td>62.78</td>
<td>954.58</td>
<td>L</td>
<td>Stichman &amp; Cloverside</td>
</tr>
<tr>
<td>27-81</td>
<td>52.10</td>
<td>958.16</td>
<td>U</td>
<td>Jeremie &amp; Big Dalton</td>
</tr>
<tr>
<td>9-29</td>
<td>67.67</td>
<td>973.68</td>
<td>L</td>
<td>Rexwood &amp; Rall</td>
</tr>
<tr>
<td>14-88</td>
<td>78.20</td>
<td>1,000.60</td>
<td>U</td>
<td>Belgate &amp; La Rica</td>
</tr>
<tr>
<td>39-23</td>
<td>56.51</td>
<td>1,041.53</td>
<td>U</td>
<td>Masline &amp; Gayhurst</td>
</tr>
<tr>
<td>34-1B</td>
<td>63.36</td>
<td>1,068.95</td>
<td>U</td>
<td>Elizabeth</td>
</tr>
<tr>
<td>13-82</td>
<td>71.79</td>
<td>1,080.40</td>
<td>U</td>
<td>Maupin &amp; Rockenback</td>
</tr>
<tr>
<td>30-46</td>
<td>85.81</td>
<td>1,086.23</td>
<td>U</td>
<td>Demblon &amp; Bogart</td>
</tr>
<tr>
<td>27-73</td>
<td>85.42</td>
<td>1,106.50</td>
<td>U</td>
<td>Jerry &amp; Palm</td>
</tr>
<tr>
<td>30-48</td>
<td>62.89</td>
<td>1,107.17</td>
<td>L</td>
<td>Willow &amp; Ituni</td>
</tr>
<tr>
<td>5-1</td>
<td>61.91</td>
<td>1,110.46</td>
<td>L</td>
<td>Stichman &amp; Cloverside</td>
</tr>
<tr>
<td>30-1</td>
<td>51.93</td>
<td>1,121.28</td>
<td>L</td>
<td>Mayland &amp; Ardilla</td>
</tr>
<tr>
<td>33-38</td>
<td>69.37</td>
<td>1,139.27</td>
<td>L</td>
<td>Rockway &amp; Rall</td>
</tr>
<tr>
<td>25-25</td>
<td>52.37</td>
<td>1,154.52</td>
<td>L</td>
<td>Chevalier &amp; Ardilla</td>
</tr>
<tr>
<td>IR7-27</td>
<td>104.26</td>
<td>1,155.20</td>
<td>M</td>
<td>La Sena &amp; Devennah</td>
</tr>
<tr>
<td>14-66</td>
<td>52.11</td>
<td>1,162.06</td>
<td>U</td>
<td>Jeremie &amp; Big Dalton</td>
</tr>
<tr>
<td>18-38</td>
<td>65.13</td>
<td>1,170.85</td>
<td>L</td>
<td>Stichman &amp; Durness</td>
</tr>
<tr>
<td>10-31</td>
<td>48.19</td>
<td>1,182.67</td>
<td>L</td>
<td>Dexter &amp; Big Dalton</td>
</tr>
<tr>
<td>28-63</td>
<td>107.3</td>
<td>1,195.21</td>
<td>M</td>
<td>Anniston</td>
</tr>
<tr>
<td>9-30</td>
<td>62.42</td>
<td>1,226.48</td>
<td>L</td>
<td>Feather &amp; Culter</td>
</tr>
<tr>
<td>30-45</td>
<td>51.93</td>
<td>1,231.73</td>
<td>U</td>
<td>Chevalier &amp; Mayland</td>
</tr>
</tbody>
</table>
Typical reasons for these single family residential fire flow results are:

- hydrant located on a small diameter dead-end main
- hydrant located on an undersized hydraulic loop
- hydrant located on a very old pipe with limited hydraulic capacity

### 8.5.4 Assessment of School Fire Flow Capacities

Actual fire flow requirements for schools vary depending on numerous factors such as:

- installation of fire sprinklers
- use of fire retardant construction materials
- floor area of the largest structure
- number and location of temporary buildings

When in doubt, the maximum fire flow demand of 5,000 gpm is recommended.

Hydrants serving schools within the VCWD Service Area were found to have the results shown in Table 8.25.

### Table 8.25 – Fire Flow Capacity at Schools

<table>
<thead>
<tr>
<th>School</th>
<th>Fire Flow Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margaret Heath Elementary School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Baldwin Park Adult &amp; Community Education Center</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Ernest R. Geddes Elementary School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Jerry D. Holland Middle School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Vineland Elementary School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Charles D. Jones Jr. High School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Sierra Vista High School &amp; Jr. High School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Foster Elementary School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Olive Junior High School</td>
<td>&gt;5,000 gpm</td>
</tr>
<tr>
<td>Kenmore Avenue Elementary School</td>
<td>4,765 gpm</td>
</tr>
<tr>
<td>Pleasant View Elementary School</td>
<td>4,711 gpm</td>
</tr>
<tr>
<td>Central Elementary School</td>
<td>4,529 gpm</td>
</tr>
<tr>
<td>Walnut Elementary School</td>
<td>3,806 gpm</td>
</tr>
<tr>
<td>Baldwin Park High School</td>
<td>3,865 gpm</td>
</tr>
</tbody>
</table>
CHAPTER 8 – SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS

Most school sites in the VCWD Service Area have exceptional fire flow capacity. A small number of school sites were found to have capacities just below the maximum requirement of 5,000 gpm. It is recommended to assess these sites individually with the Fire Marshal prior to moving forward with improvements, as allowances for onsite fire protection may result in a reduced requirement.

8.5.5 Projects to Mitigate Fire Flow Deficiencies

Regarding recommendations to mitigate fire flow deficiencies, it should be noted that the standards applied during the fire flow analysis represent the general requirements of the Los Angeles County Fire Department for (1) land subdivision, (2) construction or (3) installation/alteration of the water system according to Regulation #8 of the County Fire Code.

If none of these three conditions exists, it is assumed that the hydrant (or group of hydrants) was subject to a lower standard at the time of installation and this lower standard has been “grandfathered in” (aka allowable nonconformity). As such, the recommendations in the following sections should be considered contingent upon (1) land subdivision, (2) construction or (3) the installation/alteration of the water system.

Pipeline projects are ranked based on the relative magnitude of the fire flow deficiency, and the diameter and installation date of the underperforming pipelines according to the following algorithm:

\[
\text{Rating} = \frac{\text{flow capacity}}{\text{flow requirement}} + \frac{\text{diameter}}{12 \text{ inches}} + \frac{75 \text{ years} - \text{age}}{75 \text{ years}}
\]

For example, Hydrant 9-29 is served by a 6-inch main in Elizabeth Street north of Olive Street installed in 1969 and was determined to have a fire flow capacity of 1,025 gpm in a single family residential area:

\[
\text{Rating} = \frac{1,025 \text{ gpm}}{1,250 \text{ gpm}} + \frac{6 \text{ inches}}{12 \text{ inches}} + \frac{75 \text{ years} - 45 \text{ years}}{75 \text{ years}} \approx 1.72
\]

A lower rating generally means the flow deficiency is greater, the pipe diameter is smaller and the installation date is earlier.

A higher rating means generally the flow deficiency is smaller, the pipe diameter is larger and the installation date is later.
The pipeline projects intended to mitigate hydraulic issues are ranked accordingly in Table 8.26.

<table>
<thead>
<tr>
<th>Pipeline Project</th>
<th>Ratio of capacity to requirement</th>
<th>Diameter in inches</th>
<th>Installation Date</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherway Street</td>
<td>0.17</td>
<td>4</td>
<td>1955</td>
<td>0.72</td>
</tr>
<tr>
<td>Paddy Lane</td>
<td>0.35</td>
<td>4</td>
<td>1954</td>
<td>0.88</td>
</tr>
<tr>
<td>Rexwood Avenue</td>
<td>0.35</td>
<td>4</td>
<td>1960</td>
<td>0.96</td>
</tr>
<tr>
<td>Demblon Street</td>
<td>0.41</td>
<td>4</td>
<td>1956</td>
<td>0.97</td>
</tr>
<tr>
<td>Dutch Street</td>
<td>0.59</td>
<td>4</td>
<td>1947</td>
<td>1.03</td>
</tr>
<tr>
<td>Navilla Place</td>
<td>0.68</td>
<td>4</td>
<td>1950</td>
<td>1.16</td>
</tr>
<tr>
<td>Borel Street</td>
<td>0.63</td>
<td>4</td>
<td>1954</td>
<td>1.17</td>
</tr>
<tr>
<td>La Rica Avenue</td>
<td>0.80</td>
<td>4</td>
<td>1949</td>
<td>1.27</td>
</tr>
<tr>
<td>Maupin Avenue</td>
<td>0.87</td>
<td>4</td>
<td>1950</td>
<td>1.34</td>
</tr>
<tr>
<td>Palmrose Street</td>
<td>0.71</td>
<td>4</td>
<td>1968</td>
<td>1.43</td>
</tr>
<tr>
<td>Jeremie Street</td>
<td>0.77</td>
<td>6</td>
<td>1952</td>
<td>1.44</td>
</tr>
<tr>
<td>Dexter Street</td>
<td>0.95</td>
<td>4</td>
<td>1954</td>
<td>1.48</td>
</tr>
<tr>
<td>Anniston Avenue</td>
<td>0.97</td>
<td>4</td>
<td>1954</td>
<td>1.50</td>
</tr>
<tr>
<td>La Sena Avenue</td>
<td>0.92</td>
<td>4</td>
<td>1958</td>
<td>1.51</td>
</tr>
<tr>
<td>Gayhurst Avenue</td>
<td>0.83</td>
<td>6</td>
<td>1954</td>
<td>1.53</td>
</tr>
<tr>
<td>Feather Avenue</td>
<td>0.77</td>
<td>6</td>
<td>1962</td>
<td>1.58</td>
</tr>
<tr>
<td>Central Avenue</td>
<td>0.91</td>
<td>4</td>
<td>1965</td>
<td>1.59</td>
</tr>
<tr>
<td>Stichman Avenue</td>
<td>0.76</td>
<td>6</td>
<td>1964</td>
<td>1.59</td>
</tr>
<tr>
<td>Elizabeth Avenue</td>
<td>0.71</td>
<td>6</td>
<td>1969</td>
<td>1.61</td>
</tr>
<tr>
<td>Puente Avenue</td>
<td>0.77</td>
<td>8</td>
<td>1955</td>
<td>1.65</td>
</tr>
<tr>
<td>Park Avenue</td>
<td>0.75</td>
<td>6</td>
<td>1969</td>
<td>1.65</td>
</tr>
<tr>
<td>Illinois Street</td>
<td>0.91</td>
<td>4</td>
<td>1970</td>
<td>1.66</td>
</tr>
<tr>
<td>Rockway Drive</td>
<td>0.91</td>
<td>6</td>
<td>1960</td>
<td>1.69</td>
</tr>
<tr>
<td>Durness Street</td>
<td>0.94</td>
<td>6</td>
<td>1958</td>
<td>1.69</td>
</tr>
<tr>
<td>Heintz Street</td>
<td>0.82</td>
<td>6</td>
<td>1968</td>
<td>1.71</td>
</tr>
<tr>
<td>Jerry Avenue</td>
<td>0.88</td>
<td>4</td>
<td>1980</td>
<td>1.76</td>
</tr>
<tr>
<td>Willow Avenue</td>
<td>0.89</td>
<td>6</td>
<td>1972</td>
<td>1.83</td>
</tr>
<tr>
<td>Kenmore Avenue</td>
<td>0.95</td>
<td>6</td>
<td>1969</td>
<td>1.85</td>
</tr>
<tr>
<td>Walnut Street</td>
<td>0.81</td>
<td>8</td>
<td>1969</td>
<td>1.88</td>
</tr>
<tr>
<td>Elton &amp; Puente (Alt. 2)</td>
<td>0.69</td>
<td>8</td>
<td>1979</td>
<td>1.89</td>
</tr>
<tr>
<td>Mayland Avenue</td>
<td>0.98</td>
<td>6</td>
<td>1972</td>
<td>1.92</td>
</tr>
<tr>
<td>Los Angeles Street</td>
<td>0.99</td>
<td>8</td>
<td>1968</td>
<td>2.04</td>
</tr>
<tr>
<td>Arrow Highway (Alt. 2)</td>
<td>0.78</td>
<td>12</td>
<td>1977</td>
<td>2.29</td>
</tr>
<tr>
<td>Business Center Drive</td>
<td>0.84</td>
<td>12</td>
<td>1984</td>
<td>2.44</td>
</tr>
</tbody>
</table>
The cost to replace each of the pipelines shown in Table 8.26 was estimated discretely and plotted against the pipeline’s length to develop a general formula for pipeline replacement costs, as shown in Figure 8.1. Included in the individual estimates were pipe length and diameter, and the number of laterals, isolation valves and hydrants to be replaced.

**Figure 8.1 – General Pipeline Cost Equation Reduction**

Following are descriptions of individual pipeline project in the order shown in Table 8.26.
8.5.5.1 Sherway Street

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Sherway Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (35-18, 35-20)

Solution

Replace 730 feet of existing 4-inch pipe in Sherway Street with new 8-inch pipe as shown in Figure 8.2

Figure 8.2 – Sherway Pipeline Map
8.5.5.2 Paddy Lane

Single Family Residential Fire Flow Mitigation

**Deficiency**

1 hydrant on Paddy Lane cannot deliver single family residential fire flow due to an undersized dead-end main (28-66)

**Solution**

Replace 560 feet of existing 4-inch pipe in Paddy Lane southwest of MacDevitt Street with new 8-inch pipe as shown in Figure 8.3

**Figure 8.3 – Paddy Lane Pipeline Map**
8.5.5.3 Rexwood Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Rexwood Avenue cannot deliver single family residential fire flow due to an undersized main (27-78, 27-81)

Solution

Replace 1,550 feet of existing 4-inch pipe in Rexwood Street northwest of Baldwin Park Blvd. with new 8-inch pipe as shown in Figure 8.4

Figure 8.4 – Rexwood Pipeline Map
8.5.5.4 Demblon Street

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Demblon Street cannot deliver single family residential fire flow due to an undersized dead-end main (14-84, 14-88)

Solution

Replace 950 feet of existing 4-inch pipe in Demblon Street west of Downing Avenue with new 8-inch pipe

Replace 550 feet of existing 6-inch pipe in Bogart Avenue between of Los Angeles Street Demblon Street with new 8-inch pipe as shown in Figure 8.5

Figure 8.5 – Demblon Pipeline Map
8.5.5.5 Dutch Street

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Dutch Street cannot deliver single family residential fire flow due to an undersized main (34-8, 35-9)

Solution

Replace 950 feet of existing 4-inch pipe in Dutch Street between Ardilla Avenue and Puente Avenue with new 8-inch pipe as shown in Figure 8.6

Figure 8.6 – Dutch Pipeline Map
8.5.5.6 Navilla Place

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Navilla Place cannot deliver single family residential fire flow due to an undersized main (25-55)

Solution

Replace 680 feet of existing 4-inch pipe in Navilla Place with new 8-inch pipe as shown in Figure 8.7

Figure 8.7 – Navilla Pipeline Map
8.5.5.7 Borel Street

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Borel Street cannot deliver single family residential fire flow due to an undersized main (10-29)

Solution

Replace 800 feet of existing 4-inch pipe in Borel Street south of Nubia Street with new 8-inch pipe as shown in Figure 8.8. Note that this solution increases fire flow capacity at Pleasant View Elementary School to more than 5,000 gpm.

Figure 8.8 – Borel Pipeline Map
8.5.5.8 La Rica Avenue

Single Family Residential Fire Flow Mitigation

**Deficiency**

1 hydrant on Belgate Street Avenue cannot deliver single family residential fire flow due to an undersized main (13-82)

**Solution**

Replace 800 feet of existing 4-inch pipe in La Rica Avenue between Rockenback Street and Los Angeles Street with new 8-inch pipe as shown in Figure 8.9

**Figure 8.9 – La Rica Pipeline Map**
8.5.5.9 Maupin Avenue

**Single Family Residential Fire Flow Mitigation**

**Deficiency**

1 hydrant on Maupin Avenue cannot deliver single family residential fire flow due to an undersized main (14-66)

**Solution**

Replace 250 feet of existing 4-inch pipe in Maupin Avenue south of Hallwood Drive with new 8-inch pipe as shown in Figure 8.10

**Figure 8.10 – Maupin Pipeline Map**
8.5.5.10 Palmrose Street

Commercial Fire Flow Mitigation

**Deficiency**

6 hydrants in the vicinity of Palmrose Street are undersized and cannot deliver commercial fire flow (19-128C, 19-128F, 19-128B, 19-128G, 19-128E, 19-128)

**Solution**

Replace two existing 4-inch mains for a total of 1,590 feet in and south of Palmrose Street with new 8-inch mains as shown in Figure 8.11

**Figure 8.11 – Palmrose Pipeline Map**
8.5.5.11 Jeremie Street

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Jeremie Street cannot deliver single family residential fire flow due to an undersized dead-end main (30-1, 30-2)

Solution

Replace 820 feet of existing 6-inch pipe in Jeremie Street southeast of Big Dalton Avenue with new 8-inch pipe as shown in Figure 8.12

Figure 8.12 – Jeremie Pipeline Map
8.5.5.12 Dexter Street

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Dexter Street cannot deliver single family residential fire flow due to an undersized main (25-25)

Solution

Replace 420 feet of existing 4-inch pipe in Dexter Street between Big Dalton Avenue and Puente Avenue with new 8-inch pipe as shown in Figure 8.13

Figure 8.13 – Dexter Pipeline Map
8.5.5.13 Anniston Avenue

Single Family Residential Fire Flow Mitigation

**Deficiency**

1 hydrant on Anniston Avenue cannot deliver single family residential fire flow due to an undersized main (IR7-27)

**Solution**

Replace 1,260 feet of existing 4-inch pipe between the intersection of La Sena Avenue and Anniston Avenue and the intersection of Nubia Street and Anniston Avenue with new 8-inch pipe as shown in Figure 8.14

**Figure 8.14 – Anniston Pipeline Map**
8.5.5.14 La Sena Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on La Sena Avenue cannot deliver single family residential fire flow due to an undersized main (5-45)

Solution

Replace 280 feet of existing 4-inch pipe in La Sena Avenue between Nubia Street and Devannah Street with new 8-inch pipe as shown in Figure 8.15

Figure 8.15 – La Sena Pipeline Map
8.5.5.15 Gayhurst Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Gayhurst Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (10-31)

Solution

Replace 350 feet of existing 6-inch pipe in Masline Street west of Fortin Street with new 8-inch pipe

Replace 250 feet of existing 6-inch pipe in Gayhurst Avenue north of Masline Street with new 8-inch pipe as shown in Figure 8.16

Figure 8.16 – Gayhurst Pipeline Map
8.5.5.16 Feather Avenue

Commercial Fire Flow Mitigation

Deficiency

1 hydrant located at the intersection of Feather Avenue and Corak Street cannot deliver commercial fire flow due to inadequately sized mains and poor connectivity (38-2)

Solution

Replace 480 feet of existing 6-inch mains in Garvey Avenue between Francisquito Avenue and Feather Avenue and in Feather Avenue between Garvey Avenue and Corak Street with new 8-inch mains as shown in Figure 8.17

Figure 8.17 – Feather Pipeline Map
8.5.5.17 Central Avenue

Institutional Fire Flow Mitigation

Deficiency

Hydrants serving Central Elementary School are slightly deficient in their ability to deliver the maximum combined fire flow requirement of 5,000 gpm due to a bottleneck in Central Avenue southeast of Vineland Avenue.

Solution

Replace 300 feet of existing 4-inch pipe in Central Avenue between Vineland Avenue and Stichman Avenue with new 8-inch pipe as shown in Figure 8.18

Figure 8.18 – Central Pipeline Map
8.5.5.18 Stichman Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

2 hydrants on Stichman Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (34-1A, 34-1B)

Solution

Replace 1,000 feet of existing 6-inch pipe in Stichman Avenue southwest of Cloverside Street with new 8-inch pipe as shown in Figure 8.19

Figure 8.19 – Stichman Pipeline Map
8.5.5.19 Elizabeth Avenue

Single Family Residential Fire Flow Mitigation

*Deficiency*

2 hydrants on Elizabeth Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (9-29, 9-30)

*Solution*

Replace 1,250 feet of existing 6-inch pipe in Elizabeth Avenue north of Olive Street with new 8-inch pipe as shown in Figure 8.20

Figure 8.20 – Elizabeth Pipeline Map
8.5.5.20 Puente Avenue

Institutional Fire Flow Mitigation

Deficiency

Public hydrants near Baldwin Park High School are slightly deficient in their ability to deliver the maximum combined fire flow requirement of 5,000 gpm due to an undersized main in Puente Avenue. Note that there are no public hydrants on the east side of Puente Avenue in front of Baldwin Park High School; as a result, fire service to the school grounds is assumed to be supplied by an on-site fire loop. Nonetheless, there is less than 5,000 gpm available flow capacity in the area.

Solution

Install 1,040 feet of parallel 8-inch pipe in Puente Avenue Badillo Street and the Baldwin Park High School double check valve and meter assembly as shown in Figure 8.21

Figure 8.21 – Puente Pipeline Map
8.5.5.21 Park Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Park Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (15-1A)

Solution

Replace 1,300 feet of existing 6-inch pipe in Park Avenue north of Los Angeles Street with new 8-inch pipe as shown in Figure 8.22

Figure 8.22 – Park Pipeline Map
8.5.5.22 Illinois Street

Commercial Fire Flow Mitigation

Deficiency

2 hydrants in the vicinity of the intersection of Illinois Street and Bresee Avenue cannot deliver commercial fire flow due to inadequately sized mains (23-68, 23-75)

Solution

Replace 700 feet of existing 4-inch main in Illinois Street between Merced Avenue and Bresee Avenue with new 8-inch pipe as shown in Figure 8.23

Figure 8.23 – Illinois Pipeline Map
8.5.5.23 Rockway Drive

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Rockway Drive cannot deliver single family residential fire flow due to an undersized dead-end main (27-73)

Solution

Replace 410 feet of existing 6-inch pipe in Rockway Drive between Rall Avenue and Hydrant 27-73 with new 8-inch pipe as shown in Figure 8.24

Figure 8.24 – Rockway Pipeline Map
8.5.5.24 Durness Street

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Stichman Avenue northeast of Durness Street cannot deliver single family residential fire flow due to an undersized dead-end main (33-38)

Solution

Replace 340 feet of existing 6-inch pipe in Durness Street between Vineland Avenue and Stichman Avenue with new 8-inch pipe as shown in Figure 8.25

Figure 8.25 – Durness Pipeline Map
8.5.5.25 Heintz Street

Commercial Fire Flow Mitigation

Deficiency

1 hydrant in Heintz Street midblock between Nubia Street and Arrow cannot deliver commercial fire flow due to an inadequately sized main (5-28)

Solution

Replace 1,320 feet of existing 6-inch main in Heintz Street between Nubia Street and Arrow Highway with new 8-inch pipe as shown in Figure 8.26. Note that this solution increases fire flow capacity at Pleasant View Elementary School to more than 5,000 gpm.

Figure 8.26 – Heintz Pipeline Map
8.5.5.26 Jerry Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Jerry Avenue cannot deliver single family residential fire flow due to an undersized main (18-38)

Solution

Replace 1,300 feet of existing 4-inch pipe in Jerry Avenue between Los Angeles Street and Palm Avenue with new 6-inch pipe as shown in Figure 8.27

Figure 8.27 – Jerry Pipeline Map
8.5.5.27 Willow Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

1 hydrant on Willow Avenue cannot deliver single family residential fire flow due to an undersized dead-end main (39-23)

Solution

Replace 790 feet of existing 6-inch pipe in Willow Avenue between Merced Avenue and Ituni Street with new 8-inch pipe as shown in Figure 8.28

Figure 8.28 – Willow Pipeline Map
8.5.5.28 Kenmore Avenue

Institutional Fire Flow Mitigation

Deficiency

Hydrants serving Kenmore Avenue Elementary School are slightly deficient in their ability to deliver the maximum combined fire flow requirement of 5,000 gpm due to undersized mains.

Solution

Replace 1,320 feet of existing 6-inch pipe in Kenmore Avenue between Ramona Blvd. and Frazier Street with new 8-inch pipe as shown Figure 8.29

Figure 8.29 – Kenmore Pipeline Map
8.5.5.29 Walnut Street

Institutional Fire Flow Mitigation

Deficiency

Hydrants serving Walnut Elementary School are slightly deficient in their ability to deliver the maximum combined fire flow requirement of 5,000 gpm due to an undersized main in Walnut Street.

Solution

Install 620 feet of parallel 8-inch pipe in Walnut Street between Olive Street and Hydrant 12-24 as shown in Figure 8.30

Figure 8.30 – Walnut Pipeline Map
8.5.5.31 Elton Avenue & Puente Avenue

Industrial Fire Flow Mitigation

Deficiency

4 hydrants in Elton Avenue and Puente Avenue north of Ramona Blvd. are undersized for industrial fire flow purposes. Dead-end mains providing fire flow should be sized at 16 inches, whereas these two mains are 8 inches. (20-6, 20-7, 20-18A, 20-9)

Solution 1

Replace 1,410 feet of existing 8-inch mains in Elton Avenue and Puente Avenue north of Ramona Blvd with new 16-inch mains as shown in Figure 8.31

Solution 2

Install an 8-inch jumper between the northern terminus of Elton Avenue and the northern terminus of Puente Avenue via private alleyways and parking lots, as shown in Figure 8.31. Note: this solution will result in fire flow capacity greater than 5,000 gpm for all hydrants except Fire Hydrant 20-6 at the northern end of Puente Avenue which will have a combined capacity of 4,331 gpm.

Figure 8.31 – Elton & Puente Pipeline Map
8.5.5.32 Mayland Avenue

Single Family Residential Fire Flow Mitigation

Deficiency

3 hydrants in the vicinity of Mayland Avenue and Chevalier Avenue cannot deliver single family residential fire flow due to an undersized main (30-45, 30-46, 30-48)

Solution

Replace 330 feet of existing 6-inch pipe in Mayland Avenue between Pacific Avenue and Chevalier Avenue with new 8-inch pipe as shown in Figure 8.32

Figure 8.32 – Mayland Pipeline Map
8.5.5.33 Los Angeles Street

Commercial Fire Flow Mitigation

Deficiency

1 hydrant in Los Angeles Street east of Park Avenue cannot deliver commercial fire flow due to an undersized dead-end main (20-5)

Solution

Replace 890 feet of existing 8-inch main in Los Angeles Street east of Park Avenue with new 12-inch pipe as shown in Figure 8.33

Figure 8.33 – Los Angeles Pipeline Map
8.5.5.34 Arrow Highway

Industrial Fire Flow Mitigation

Deficiency

3 hydrants in Arrow Highway east of the I-605 Freeway cannot deliver industrial fire flow due to insufficiency connectivity (IR1-1, IR2-1, IR2-3)

Solution

Replace 3,400 feet of existing 12-inch pipe with new 16-inch pipe in Arrow Highway between the San Gabriel River and the I-605 Freeway as shown in Figure 8.34

Or

Install 3,400 feet of new 12-inch pipe parallel to the existing 12-inch pipe in Arrow Highway between the San Gabriel River and the I-605 Freeway as shown in Figure 8.34

Figure 8.34 – Arrow Highway Pipeline Map
8.5.5.35 Business Center Drive

Industrial Fire Flow Mitigation

Deficiency

5 hydrants in or receiving flow from Business Center Drive cannot deliver industrial fire flow due to insufficiency connectivity (IR3-9, IR3-10, IR3-5, IR3-8, IR4-8)

Solution

Replace 710 feet of existing 12-inch pipe with new 16-inch pipe in Business Center Drive as shown in Figure 8.35

Or

Install 710 feet of new 12-inch pipe parallel to existing 12-inch pipe in Business Center Drive as shown in Figure 8.35
8.5.5.36 Azusa Canyon Road

Industrial Fire Flow Mitigation

Deficiency

6 hydrants in vicinity of Azusa Canyon Road and Cypress Street cannot deliver industrial fire flow due to high head loss in the 12-inch main skirting the northern and eastern side of Conrock Pit (IR9-11, IR9-24, IR9-10, IR9-23, IR7-37, IR9-5)

Solution

Install an emergency PRV between the Morada Zone and Upper Baldwin Park Zone in the vicinity Azusa Canyon Road and Olive Street. Normal pressure in the Upper Baldwin Park Zone in this area is approximately 67 psi. A discharge pressure setting of 50 psi will assure adequate fire flow capacity at the six hydrants listed above.
8.6 Evaluation Based on Age and Condition

All components of the distribution system have a finite service life. Individual components may wear out prematurely or outlive their recommended life cycle; however, for planning purposes average life cycles should be considered when budgeting replacement costs. Care should be taken to replace inefficient, worn or damaged infrastructure in a timely manner to avoid excessive repair costs and other vulnerabilities.

Table 8.27 provides a methodology for identifying and corroborating cyclical replacement. Prior to replacement (or maintenance as indicated), both criteria should be met. The Interval criterion represent the age and the Indication criterion represents condition. Any component exceeding its recommended age that also exhibits poor condition should be considered a string candidate for replacement.

<table>
<thead>
<tr>
<th>Component</th>
<th>Interval (years)</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>60</td>
<td>Frequent repair history, excessive energy losses</td>
</tr>
<tr>
<td>Pump/Motor Overhaul</td>
<td>15</td>
<td>Drop in efficiency below 65%</td>
</tr>
<tr>
<td>Pump/Motor Replacement</td>
<td>30</td>
<td>Frequent repair history, drop in efficiency</td>
</tr>
<tr>
<td>Control Valve Overhaul</td>
<td>25</td>
<td>Leaks, poor response, frequent repairs</td>
</tr>
<tr>
<td>Tank Recoating</td>
<td>15</td>
<td>Evidence of corrosion</td>
</tr>
<tr>
<td>Tank Replacement</td>
<td>80</td>
<td>Frequency/extent of repair history</td>
</tr>
<tr>
<td>Well Refurbishment/Replacement</td>
<td>50</td>
<td>Decline in effective capacity</td>
</tr>
<tr>
<td>Production meter calibration</td>
<td>5</td>
<td>Drop in accuracy</td>
</tr>
<tr>
<td>Production meter replacement</td>
<td>20</td>
<td>Drop in accuracy and reliability</td>
</tr>
</tbody>
</table>
8.6.1 Pipeline Replacement

In 2012, the American Water Works Association (AWWA) published a report on water pipeline replacement called *Buried No Longer: Confronting America’s Water Infrastructure Challenge*. The report suggests that steel pipe in the western United States has an average service life of 95 years. Statistically speaking, this means half of all steel pipes last longer than 95 years and half are replaced before that age. The bulk of the VCWD system (95.5%) is steel pipe.

This implies that once the VCWD distribution system is mature, an average of 6,620 feet of pipeline replacement should be scheduled per year (or 66,200 feet over a 10-year period):

\[
\text{length of pipe} = \frac{628,625 \text{ feet}}{95 \text{ years}} \approx 6,620 \text{ feet per year}
\]

However, the VCWD distribution system is a comparatively young system with only about 14% of its pipelines more than 60 years old and none beyond the 95 year average service life. The weighted average pipe age in the VCWD distribution system is estimated at 46.6 years.

It is estimated the VCWD distribution system will reach maturity in 25 to 30 years, at which time a regular and vigorous replacement program should be implemented. Until then, a more moderate pipeline replacement program is recommended. Consider the following:

- No pipe age and condition issues in 2014
- Distribution system maturity will occur in 30 years (i.e. 2044), at which time a replacement schedule of 6,620 feet per year is required indefinitely.
- Using a straight line projection, VCWD should consider a pipe replacement that starts at zero in 2014 and increases by 220 feet per year until 2044:

\[
\frac{6,620 \text{ feet per year}}{2044 - 2014} \approx 220 \text{ feet per year per year}
\]
Over the next ten years, this approach implies replacement of 9,900 feet of pipe, as shown in Table 8.28.

### Table 8.28 – Near Term Pipeline Replacement Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>Feet of Pipe per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>220</td>
</tr>
<tr>
<td>2016</td>
<td>440</td>
</tr>
<tr>
<td>2017</td>
<td>660</td>
</tr>
<tr>
<td>2018</td>
<td>880</td>
</tr>
<tr>
<td>2019</td>
<td>1,100</td>
</tr>
<tr>
<td>2020</td>
<td>1,320</td>
</tr>
<tr>
<td>2021</td>
<td>1,540</td>
</tr>
<tr>
<td>2022</td>
<td>1,760</td>
</tr>
<tr>
<td>2023</td>
<td>1,980</td>
</tr>
<tr>
<td>Total for Ten Years</td>
<td>9,900</td>
</tr>
</tbody>
</table>

Approximately 91,460 feet of pipe were identified as more than 60 years old, making them candidates for replacement (see Table 8.29). At this time, these pipelines should only be considered for replacement if (1) their repair history corroborates poor condition or (2) they were also identified as being hydraulically deficient. The pipeline are rated based on age and diameter according to the following algorithm:

\[
\text{Rating} = \frac{\text{diameter}}{12 \text{ inches}} + \frac{75 \text{ years} - \text{age}}{75 \text{ years}}
\]

For example, the pipeline in Benbow between Stewart and Baldwin Park is a 4-inch main that was installed in 1949:

\[
\text{Rating} = \frac{4 \text{ inches}}{12 \text{ inches}} + \frac{75 \text{ years} - 65 \text{ years}}{75 \text{ years}} \approx 0.47
\]

A lower rating generally means the pipe diameter is smaller and the installation date is earlier.

A higher rating means generally the pipe diameter is larger and the installation date is later.
Table 8.29 – Pipeline Replacement Candidates by Rating

<table>
<thead>
<tr>
<th>Year Installed</th>
<th>Alignment</th>
<th>From</th>
<th>To</th>
<th>Length (feet)</th>
<th>Dia. (in.)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>Downing</td>
<td>Los Angeles</td>
<td>Northern Terminus</td>
<td>410</td>
<td>2</td>
<td>0.31</td>
</tr>
<tr>
<td>1946</td>
<td>Ohio</td>
<td>Stewart</td>
<td>Baldwin Park</td>
<td>1,290</td>
<td>4</td>
<td>0.43</td>
</tr>
<tr>
<td>1946</td>
<td>Rockenback</td>
<td>Stewart</td>
<td>Baldwin Park</td>
<td>1,290</td>
<td>4</td>
<td>0.43</td>
</tr>
<tr>
<td>1947</td>
<td>MacDevitt</td>
<td>Puente</td>
<td>Ardilla</td>
<td>970</td>
<td>4</td>
<td>0.44</td>
</tr>
<tr>
<td>1947</td>
<td>Cedarwood</td>
<td>Puente</td>
<td>Ardilla</td>
<td>970</td>
<td>4</td>
<td>0.44</td>
</tr>
<tr>
<td>1947</td>
<td>Havenbrook</td>
<td>Puente</td>
<td>Ardilla</td>
<td>970</td>
<td>4</td>
<td>0.44</td>
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<tr>
<td>1947</td>
<td>Dutch</td>
<td>Puente</td>
<td>Ardilla</td>
<td>970</td>
<td>4</td>
<td>0.44</td>
</tr>
<tr>
<td>1947</td>
<td>La Vista</td>
<td>Dutch</td>
<td>NE Terminus</td>
<td>340</td>
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<td>0.44</td>
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<tr>
<td>1948</td>
<td>Anada</td>
<td>La Rica</td>
<td>Baldwin Park</td>
<td>430</td>
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<tr>
<td>1948</td>
<td>Masline</td>
<td>La Rica</td>
<td>Baldwin Park</td>
<td>430</td>
<td>4</td>
<td>0.45</td>
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<tr>
<td>1949</td>
<td>Benwood</td>
<td>Stewart</td>
<td>Benham</td>
<td>270</td>
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<td>0.47</td>
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<td>1949</td>
<td>Benham</td>
<td>Bellbrook</td>
<td>Benwood</td>
<td>350</td>
<td>4</td>
<td>0.47</td>
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<td>1949</td>
<td>La Rica</td>
<td>Brookport</td>
<td>Benbow</td>
<td>850</td>
<td>4</td>
<td>0.47</td>
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<td>1949</td>
<td>Edra</td>
<td>Olive</td>
<td>Benbow</td>
<td>1,220</td>
<td>4</td>
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<td>1949</td>
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<td>Benbow</td>
<td>Los Angeles</td>
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<td>4</td>
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<td>1949</td>
<td>Rockenback</td>
<td>Baldwin Park</td>
<td>Eastern Terminus</td>
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<td>0.47</td>
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<td>1949</td>
<td>Beltgate</td>
<td>Baldwin Park</td>
<td>Eastern Terminus</td>
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<td>0.47</td>
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<td>1949</td>
<td>Atalake</td>
<td>Clark</td>
<td>Northern Terminus</td>
<td>380</td>
<td>4</td>
<td>0.47</td>
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<tr>
<td>1949</td>
<td>Landis</td>
<td>Clark</td>
<td>Northern Terminus</td>
<td>260</td>
<td>4</td>
<td>0.47</td>
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<tr>
<td>1949</td>
<td>Dundry</td>
<td>Pacific</td>
<td>Jeremie</td>
<td>620</td>
<td>4</td>
<td>0.47</td>
</tr>
<tr>
<td>1950</td>
<td>Benham</td>
<td>Clark</td>
<td>Elwyn</td>
<td>1,500</td>
<td>4</td>
<td>0.48</td>
</tr>
<tr>
<td>1950</td>
<td>Palm</td>
<td>Stewart</td>
<td>La Rica</td>
<td>640</td>
<td>4</td>
<td>0.48</td>
</tr>
<tr>
<td>1950</td>
<td>Bogart</td>
<td>Hallwood</td>
<td>Rockenback</td>
<td>280</td>
<td>4</td>
<td>0.48</td>
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<tr>
<td>1950</td>
<td>Maupin</td>
<td>Hallwood</td>
<td>Rockenback</td>
<td>280</td>
<td>4</td>
<td>0.48</td>
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<tr>
<td>1950</td>
<td>Rockenback</td>
<td>Maupin</td>
<td>Bogart</td>
<td>550</td>
<td>4</td>
<td>0.48</td>
</tr>
<tr>
<td>1950</td>
<td>Downing</td>
<td>Estella</td>
<td>Northern Terminus</td>
<td>480</td>
<td>4</td>
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### CHAPTER 8 – SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS

**VALLEY COUNTY WATER DISTRICT**

<table>
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<tr>
<th>Year Installed</th>
<th>Alignment</th>
<th>From</th>
<th>To</th>
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<th>Dia. (in.)</th>
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<td>Francisquito</td>
<td>8,230</td>
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</table>
Of the pipelines listed above, four pipelines for a total of approximately 3,050 feet were identified as being hydraulically deficient making them high priority projects:

§8.5.5.2 Paddy Lane
§8.5.5.5 Dutch Street
§8.5.5.6 Navilla Place
§8.5.5.11 Jeremie Street

Over the next ten years, an additional 6,850 feet of pipe should be identified for replacement from Table 8.29 or from among the fire flow mitigation projects.

8.6.2 Pump Maintenance and Replacement

There are 4 existing well pumps and 21 existing booster pumps for a total of 25 pumps. In a 30-year cycle, a pump should be overhauled once and replaced once.

Therefore, over a typical 10-year period, there should be an allocation for 8 pump overhauls and 8 pump replacements:

\[
\left( \frac{25 \text{ pumps}}{30 \text{ year cycle}} \right) \times 10 \text{ years} \approx 8 \text{ pump per 10 year period}
\]

Based on SCE pump efficiency testing, all pumps below the 65% efficiency rating threshold should be considered for overhaul or replacement. Table 8.30 lists the current ratings of the pumps which are candidates for repair of replacement.

**Table 8.30 – Pumps According to Efficiency Rating**

<table>
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<th>Pump Name</th>
<th>Eff. (%)</th>
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<td>Morada 2</td>
<td>54.1</td>
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<tr>
<td>Lante Booster</td>
<td>55.7</td>
</tr>
<tr>
<td>Morada 1</td>
<td>55.7</td>
</tr>
<tr>
<td>Maine 3</td>
<td>59.6</td>
</tr>
<tr>
<td>Morada 3</td>
<td>59.8</td>
</tr>
<tr>
<td>Nixon 2</td>
<td>60.1</td>
</tr>
<tr>
<td>Nixon 4</td>
<td>63.9</td>
</tr>
<tr>
<td>Maine West</td>
<td>63.9</td>
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8.6.3 Control Valve Overhaul

Control valves should be scheduled for overhaul on a 25-year cycle. There are 13 existing control valves, as shown in Table 8.31.

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<th>No.</th>
<th>Location</th>
<th>Size (inches)</th>
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<td>1</td>
<td>District Office</td>
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<td>2</td>
<td>Badillo-Willow</td>
<td>8</td>
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<td>3</td>
<td>Olive Interconnection</td>
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</tr>
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<td>4</td>
<td>MWD Interconnection</td>
<td>16</td>
</tr>
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<td>Ramona Parkway</td>
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</tr>
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<td>6</td>
<td>Sterling</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Covina Interconnection</td>
<td>8</td>
</tr>
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<td>8</td>
<td>Lante Reservoir</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Arrow Bypass</td>
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</tr>
<tr>
<td>10</td>
<td>Morada Plant</td>
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</tr>
<tr>
<td>11</td>
<td>Paddy Lane Plant</td>
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</tr>
<tr>
<td>12</td>
<td>Maine Plant</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>Nixon Plant</td>
<td>8</td>
</tr>
</tbody>
</table>

\[
\left( \frac{13 \text{ control valves}}{25 \text{ year cycle}} \right) (10 \text{ years}) \approx 5 \text{ control valve per 10 year period}
\]

8.6.4 Tank Recoating

Tank interiors should be scheduled for recoating on a 15-year cycle. There are six existing tanks.

\[
\left( \frac{6 \text{ tanks}}{15 \text{ year cycle}} \right) (10 \text{ years}) \approx 4 \text{ tank recoatings per 10 year period}
\]
8.6.5 Tank Replacement

On an 80-year replacement cycle, none of the six VCWD tanks is scheduled for replacement within the next ten years.

8.6.6 Well Refurbishment or Replacement

On a 50-year refurbishment/replacement cycle, all four VCWD wells exceed or will exceed their recommended life cycle during the next ten years in terms of age. Work has recently been done of three wells (Nixon East, Nixon West, Maine West) and is scheduled for the remaining well (Maine East).

8.6.7 Meter Replacement

Meters should be scheduled for replacement on a 20-year cycle. There are approximately 12,500 existing meters.

\[
\left( \frac{12,500 \text{ meters}}{20 \text{ year cycle}} \right) (10 \text{ years}) \approx 6,250 \text{ new meters per 10 year period}
\]

8.6.8 Telemetry

VCWD maintains an existing SCADA system to assist with control and monitoring of the Arrow and Morada Plants. It is estimated that an additional 25 registered to monitor and control supply and distribution.
8.7 Capital Improvement Program

The Capital Improvement Program (CIP) is a set of projects recommended to be implemented within the next ten years. Individual projects are given relative priority based on perceived urgency. Projects have been separated as Capital Projects and Maintenance Projects to be consistent with VCWD’s budgeting allocations.

8.7.1 Cost Assumptions

Estimates for capital project are based on the cost assumptions provided in Table 8.32.

### Table 8.32 – Unit Cost Assumptions

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<th>Category</th>
<th>Item</th>
<th>Unit Cost</th>
<th>Unit</th>
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<td>Storage</td>
<td>New Storage</td>
<td>2</td>
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</tr>
<tr>
<td></td>
<td>Recoating</td>
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<td>$/sf</td>
</tr>
<tr>
<td>Pumps</td>
<td>New Pump</td>
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<td>$/pump</td>
</tr>
<tr>
<td></td>
<td>Pump Replacement</td>
<td>75,000</td>
<td>$/pump</td>
</tr>
<tr>
<td></td>
<td>Pump Refurbishment</td>
<td>15,000</td>
<td>$/pump</td>
</tr>
<tr>
<td>Control Valves</td>
<td>New Valve</td>
<td>50,000</td>
<td>$/valve</td>
</tr>
<tr>
<td></td>
<td>Valve Overhaul</td>
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<td>$/valve</td>
</tr>
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<td>8-inch pipe</td>
<td>110</td>
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<td>12-inch pipe</td>
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<tr>
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<td>$/register</td>
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</table>

The total cost of a capital project is the summation of the unit costs plus costs associated with design and administration. These are costs are 25% of construction costs for engineering and 10% of construction costs for contingencies.
8.7.2 Capital Projects

The capital projects listed in Table 8.33 consider a 10-year planning horizon. Relative priority for individual projects or groups of projects is provided. Prioritization is not meant to be rigid, rather to assist with scheduling and implementation. It is recommended to corroborate conditions in the field with operations prior to implementation.

<table>
<thead>
<tr>
<th>Category</th>
<th>Project</th>
<th>Priority</th>
<th>Justification</th>
<th>Constr.</th>
<th>Engr.</th>
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<td></td>
<td>Phase 3 Reservoir</td>
<td>High</td>
<td></td>
<td>4,584</td>
<td>802</td>
<td>458</td>
<td>5,844</td>
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<tr>
<td></td>
<td>Phase 4 Reservoir</td>
<td>High</td>
<td></td>
<td>2,100</td>
<td>368</td>
<td>210</td>
<td>2,678</td>
</tr>
<tr>
<td></td>
<td>New Well</td>
<td>Low</td>
<td>Preferred Supply</td>
<td>1,000</td>
<td>250</td>
<td>100</td>
<td>1,350</td>
</tr>
<tr>
<td></td>
<td>1 Well Replacement</td>
<td>Medium</td>
<td>Well Cyclical Maintenance</td>
<td>1,000</td>
<td>250</td>
<td>100</td>
<td>1,350</td>
</tr>
<tr>
<td>Supply</td>
<td>2 Morada Booster Pumps</td>
<td>Medium</td>
<td>Booster Hydraulics</td>
<td>300</td>
<td>75</td>
<td>30</td>
<td>405</td>
</tr>
<tr>
<td></td>
<td>New LBPZ PRV</td>
<td>Low</td>
<td>Distribution Hydraulics</td>
<td>50</td>
<td>13</td>
<td>5</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Azusa Canyon Road PRV</td>
<td>High</td>
<td>Fire Flow Hydraulics</td>
<td>50</td>
<td>13</td>
<td>5</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>4 Tank Recoatings</td>
<td>Medium</td>
<td>Tank Cyclical Maintenance</td>
<td>1,440</td>
<td>360</td>
<td>144</td>
<td>1,944</td>
</tr>
<tr>
<td>Valves</td>
<td>25 Registers</td>
<td>Medium</td>
<td>Operational Control</td>
<td>125</td>
<td>31</td>
<td>13</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>Paddy Lane</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>126</td>
<td>31</td>
<td>13</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>Dutch Street</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>172</td>
<td>43</td>
<td>17</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td>Navilla Place</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>136</td>
<td>34</td>
<td>14</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>Jeremie Street</td>
<td>High</td>
<td>Hydraulics, Age and Diameter</td>
<td>172</td>
<td>43</td>
<td>17</td>
<td>232</td>
</tr>
<tr>
<td></td>
<td>6,850 ft of Pipe Replacement</td>
<td>Medium</td>
<td>Pipeline Cyclical Replacement</td>
<td>1,760</td>
<td>440</td>
<td>176</td>
<td>2,376</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>19,873</td>
<td></td>
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</tr>
</tbody>
</table>
8.7.3 Maintenance Projects

The cyclical maintenance projects listed in Table 8.34 consider a 10-year planning horizon. Relative priority for individual projects or groups of projects is provided. Prioritization is not meant to be rigid, rather to assist with scheduling and implementation. It is recommended to corroborate conditions in the field with operations prior to implementation.

Table 8.34 – Maintenance Projects ($1,000s)

<table>
<thead>
<tr>
<th>Category</th>
<th>Project</th>
<th>Priority</th>
<th>Justification</th>
<th>Constr.</th>
<th>Engr.</th>
<th>Cont.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boosters</td>
<td>4 Pump Overhauls</td>
<td>Medium</td>
<td>Booster Cyclical Maintenance</td>
<td>60</td>
<td>0</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>4 Pump Replacements</td>
<td>Medium</td>
<td>Booster Cyclical Maintenance</td>
<td>300</td>
<td>0</td>
<td>30</td>
<td>330</td>
</tr>
<tr>
<td>Valves</td>
<td>5 Control Valve Overhauls</td>
<td>Medium</td>
<td>Valve Cyclical Maintenance</td>
<td>75</td>
<td>0</td>
<td>8</td>
<td>83</td>
</tr>
<tr>
<td>Meters</td>
<td>6,250 Meter Replacements</td>
<td>Medium</td>
<td>Meter Cyclical Replacement</td>
<td>2,740</td>
<td>0</td>
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<td>3,014</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,493</td>
</tr>
</tbody>
</table>
CHAPTER 9 – METHODS OF FINANCING

9.1 General Description

Funding plans are based on an agency’s unique set of financial conditions. This chapter identifies some of the opportunities that VCWD should consider in the development of a capital improvement financing plan. Many projects are financed by a combination of resources and funding methodologies. Some of the more common financing techniques, including common types of debt instruments applicable in this case, are reviewed herein.

9.2 Pay-As-You-Go

The accumulation of current funds for improvement projects is referred to as "pay-as-you-go" financing. This method of financing requires that an agency accumulate the total capital cost of the improvements in advance of the start of construction. Large projects may require several years to accumulate the necessary funds. This method of funding is ideally applicable to smaller projects. Pay-as-you-go financing eliminates interest costs. On the down side, current customers may pay for facilities that benefit future users. System expansion or projects to increase the capacity of existing facilities to serve new users, funded by pay-as-you-go financing, are not equitable. Projects to modernize or otherwise improve an existing system are appropriate for this method of financing. The pay-as-you-go method requires matching needed improvements to water revenues, and an adequate water rate structure to ensure proper phasing of improvements.

9.3 Pay-As-You-Use

Capital items with a long useful life can be financed over the life of the project on a “pay-as-you-use” basis using debt instruments. The term of borrowing should coincide with the estimated useful life of the improvements, if market conditions permit, and the debt obligation is within the community’s ability to pay.

9.4 State Revolving Fund (DWSRF)

The Drinking Water State Revolving Fund (DWSRF) program is an innovative method of financing for state water programs to further the goals of the SDWA. Under this program, EPA provides grants to states to set up DWSRF programs. These programs consist of federal and state matching funds placed in a revolving loan fund to finance low interest loans for construction of the eligible water projects, which address the public health and compliance priorities of SDWA. Additionally, states can set aside federal funds from each grant to be used for state water program items and/or direct assistance to water systems subject to specified maximum limits for each activity.

Provisions in the SDWA require at least 15% of the loan fund be used for the direct benefit of small systems. Other provisions allow for subsidization of loans for economically disadvantaged communities. A unique provision of the DWSRF requires that communities not receive a loan unless they can demonstrate the technical, managerial, and financial
capacity to comply with the SDWA, or they agree to make the changes necessary to come into compliance.

9.5 Contributions, Connection Fees and Access Fees

Several methods of obtaining contributions to fund improvement projects exist such as:

- Cash fees paid by developers to expedite construction of certain facilities;
- Assessment district financing by property owners for system improvements;
- Construction and dedication of facilities to VCWD by developers; and
- Connection and system access fees.

9.6 Revenue Bonds

Revenue bonds are used to finance capital infrastructure which is revenue producing. Revenue bonds are special obligations of the issuing entity with repayment solely from the revenues produced by the constructed infrastructure and from no other source of funds. Normally, revenues derived from the constructed facilities must also be sufficient to cover the cost of maintaining and operating the facility. In addition, bond covenants pledge that net revenues will be equal to an amount sufficient to meet all repayment and expense obligations plus an operating margin or coverage which typically varies from about 1.2 to 1.5 times the amount of the debt service. Coverage margins typically reflect the source of the loan as well as the financial characteristics and credit worthiness of the issuing agency. Water system facilities are typically financed with the use of revenue bonds in accordance with the Revenue Bond Law of 1941. In accordance with this Act, an election must be held with a majority of the voters at the election approving the revenue bond issue.

Since the passage of Proposition 13 limiting the allowable increases in annual property taxes, the creation of assessment districts, in existence since the early 1900s, has been a popular alternative method of financing public infrastructure. Approximately one third of privately owned property in California is included within an assessment district. Assessment districts are created in accordance with either the Improvement Act of 1911 or the Municipal Improvement Act of 1913. The former act can also be used to fund improvement maintenance. These two acts set forth the procedures for implementing an improvement project and for levying the assessment to pay for such work. Assessment bonds to fund capital improvements can be issued by assessment districts in accordance with associated assessment bond acts. The prior referenced Improvement Act of 1911 provides for authorization to levy assessments and issue related bonds. However, the Improvement Act of 1913 has no bond procedures, but improvements can be financed through a subsequent bond act known as the Improvement Bond Act of 1915 (solely a bond act). These acts may be utilized in various combinations. There may be a 1911 act assessment with a 1911 or 1915 act bond; or a 1913 act assessment with a 1911 act or 1915 act bond. However, there is no such thing as a 1913 act bond or a 1915 act assessment.
An assessment district is created by a local sponsoring governmental agency. Property owners typically initiate the assessment district creation by circulating a petition which must be signed by property owners representing 60% of the benefited land area. It is essential that properties within the assessment district, which will bear the burden of tax levies to pay for the bond financings receive a direct and special benefit (as distinguished from general benefits obtained by the community as a whole). Following the creation of the assessment district bonds can be approved by the governing board only after the preparation of an Engineer’s Report and at the conclusion of a public hearing. In accordance with Proposition 13, the property assessment cannot be based directly on the value of each property but on a mathematical formula that takes into account how much each property will benefit from the constructed infrastructure. Each parcel in the assessment district is obligated for a fixed percentage of the total district debt and will be assessed each year for that portion of the annual debt service.

9.7 State Grants (Propositions 50 and 84)

The State of California has two grant programs available to finance water infrastructure. Proposition 50 (known as the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002) authorized the legislature to appropriate funds for Integrated Regional Water Management (IRWM) projects. This grant program is jointly administered by the DWR and State Water Resources Control Board. The grant program has gone through three rounds of applications and funding that started in 2004 and ended in 2009. Funds are still in the Proposition 50 system that are unspent and may be available through the Proposition 84 program for VCWD projects.

In 2006 the voters of California approved Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act. The act was codified in Section 1, Division 43 of the Public Resource Code (PRC). Division 43, § 75029 of the PRC identifies the sum of $130 million for grant projects that meet one of the project eligibility criteria. Typically, grants are associated with water quality and system improvements associated with treatment. It is recommended VCWD monitor the Proposition 84 website for future grants and possible eligibility.

9.8 Certificates of Participation

In lieu of funding capital improvement projects on a pay-as-you-go basis or by assessment proceedings, VCWD may utilize a financing vehicle referred to as Certificates of Participation (COP). COPs were first developed in the late 1970's in response to Proposition 13, which limited an agency's ability to finance services and capital expenditures through property tax increases and general obligation debt. Proposition 13 prohibits agencies from incurring bonded indebtedness without voter approval. However, agencies can enter into long-term lease obligations in lieu of bonded debt. The COP structure is an extension of a long-term lease sold as a tax-exempt investment in the capital markets.
Agencies typically use two types of COP structures. The first, VCWD issues a COP that directly finances certain capital improvements and VCWD enters into a long-term lease purchase agreement with a nonprofit lessor. The agreement requires VCWD to lease back the improvements at an annual cost equal to the annual debt service on the COP. Upon redemption of the COP, VCWD receives title of the financed capital improvements.

The second alternative involves the mortgaging or refinancing of publicly owned land and improvements. The proceeds from the mortgage can fund projects including land acquisition, new facilities construction, capital improvements and equipment purchases. This COP structure, known as the Asset Transfer Program (ATP), enables VCWD to pledge its equity in existing real property for financing new projects. Under this method, VCWD sells an existing facility to a non-profit corporation (typically comprised of members from the governing body) and enters into a long-term lease purchase agreement at an annual cost equal to the debt service on the COP that initially financed the purchase of the facility. Upon redemption of the COP, title to the refinanced facility reverts to VCWD at no additional cost.

The primary security for repayment of a COP is VCWD's pledge to establish rates and charges that will produce revenues, on an annual basis, in an amount sufficient to support its annual lease obligation to the non-profit corporation.

The ATP can provide at least four notable advantages over more conventional forms of tax-exempt financing and direct COP:

1. By borrowing against the appreciated value of existing property and improvements, VCWD provides investors with greater security, in the form of real property and existing improvements, as compared to a simple pledge of proposed capital projects.

2. By refinancing existing facilities, VCWD eliminates the need to capitalize interest during construction, thereby reducing the total size of the issue and substantially decreasing VCWD's overall cost of borrowing.

3. By eliminating the need for a conditional or provisional rating to be assigned, the marketability of the COP improves.

4. Water enterprise funds spent on capital improvements without the availability of ATP proceeds are invested without any arbitrage restrictions.

A COP can provide an agency with a flexible, cost effective vehicle to finance capital improvements. The COP can finance capital programs or leverage existing facilities. Additionally, VCWD may choose to finance capital projects with a COP in lieu of enterprise funds, and invest a like amount of moneys without any arbitrage restrictions. Each of these structures can satisfy VCWD's goal of providing capital improvements at the lowest cost to its customers.
9.9 Recommendations

VCWD should conduct an updated water rate structure analysis and financing plan study before pursuing the construction of improvements listed herein. The rate analysis and financing plan study will assist VCWD in determining the most cost effective and feasible funding approach for construction projects. The pay-as-you-go method remains the most feasible method along with special bond financing.
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APPENDICES

Appendix A – 2009 VCWD Atlas Map
Appendix B – SCAG Land Use Codes
Appendix C – Statistical Breakdown of Parcels by Land Use Code
Appendix D – USGVMWD Indirect Reuse Plan Memorandum
Appendix E – 2011 VCWD Water Quality/Consumer Confidence Report
Appendix F – CDPH Disinfectant Byproducts Initial Statement of Reasons (DPH-09-004)
Appendix G – CDPH Groundwater Replenishment Reuse Draft Regulation
Appendix H – Los Angeles County Fire Flow and Hydrant Requirement (V7-C1-S8)
Appendix A

2009 VCWD Atlas Map
Appendix B

SCAG Land Use Codes
LAND USE CODE DESCRIPTIONS
AND KEY SIGNATURES
Level III/IV

The land use definitions and descriptions were developed by Aerial Information Systems, Inc. as a Modified Anderson Land Use Classification. This classification uses a hierarchical system, allowing easy aggregation and disaggregation of classes. Most uses in the 1990 Land Use Study of Southern California were mapped to the fourth level. The user may elect to use the second or third level, or any variation, in analyses or display. The descriptions below apply to land use characteristics in southern California, and may not apply to other geographic areas. Key signatures are described using natural color aerial photography.

1000 URBAN OR BUILT-UP
Areas of built-up land characterized by intensive land use, where most of the land is covered by man-made structures because of human activity.

1100 RESIDENTIAL
The residential category includes areas of single family residences, multi unit dwellings, and mobile homes. Also included is a mixed residential category that consists of two or more of the aforementioned groups. The units/acre listed can be used as an indicator of relative density to aid in analysis when using the land use study.

1110 SINGLE FAMILY RESIDENTIAL
These residential areas are typically made up of detached dwellings, where each structure houses a single family, located in an urban or suburban setting. (Single family residential units located in a rural setting are classified as code 1151 or code 1152 under Rural Residential.) These single family residences are usually served by all utilities, are on paved streets, and are provided with or have access to all urban facilities such as schools, parks, police, and fire stations.

Single family residential neighborhoods are normally large contiguous areas of residential lots. Some areas have subdivisions or tracts of homes with similar size or architectural design. In these areas the roofs may be similar in shape or color when viewed on the aerial photo. Typically, single family lots contain landscaped front and back yards, one driveway, and one walkway either to the sidewalk or to the driveway. The house usually contains one chimney, and one air-conditioning unit. Some lots may have swimming pools in the back yards. High or low density is determined by the size of the lot on which the residence is located. If an area is under construction, and the residential lots or pads are easily identifiable, then the unit may be coded with the appropriate density category.
1111  **High Density Single Family Residential**
This category contains single family detached residential units with a unit density of >2 units/acre. These units are typically found in modern urban and suburban subdivisions.

1112  **Low Density Single Family Residential**
This category contains single family detached residential units with a unit density of <2 units/acre. These units may include areas of urban ranch homes or estates. Also included are urban areas where single family lots have been established but houses have not been built on all of them and are not likely to be built in the near future. The homes are spaced at a density of <2 units/acre. In some situations, a low density area may be rural in appearance because it was once a rural area but is now within the urban setting or a transitional area.

1120  **MULTI-FAMILY RESIDENTIAL**
Multi-family units are attached residences, apartments, condominiums, and townhouses. Multi-family residences are usually served by all utilities, are on paved streets, and are provided with or have access to all urban facilities such as schools, parks, police and fire stations. Senior citizen apartment buildings are included in these classes. Also included are off-campus university owned housing and off-campus fraternity/sorority houses.

1121  **Mixed Multi-Family Residential**
This category is used when there is a mixture of multi-family uses (duplexes, triplexes, apartments, condominiums, and/or townhouses of any type), none of which is over 2.5 acres in size, and no one type dominates. This situation may occur in older neighborhoods.

1122  **Duplexes, Triplexes, and 2- or 3-Unit Condominiums and Townhouses**
This category is composed of duplexes, triplexes, and 2- or 3-unit condominiums and townhouses that are attached multi-family structures.

Duplex and triplex residences may occur together or mixed with single family houses in some older neighborhoods (see code 1121 and 1140). Typically the multi-unit structure is one story located on a lot approximately the same size as nearby single family residential lots. There may be minimal landscaping or yard space. On the aerial photo, one may be able to count the driveways, sidewalks, entryway overhangs, chimneys, or air conditioning units corresponding to the number of units in the structure.

Some newer duplexes and triplexes occur as 2- or 3-unit structures in complexes as condominiums and townhouses, with common grounds.
1123 **Low-Rise Apartments, Condominiums, and Townhouses**

This category includes multi-family structures of one to two stories and approximately 10 to 18 units/acre. The area consists of either a large single structure or a group of structures, of four or more units each, in a complex with associated common grounds, facilities and parking areas.

Typically low-rise apartments, condominiums, and townhouses occur together in large contiguous areas since land use is restricted to multi-family zoned areas. However, in some areas one to a few buildings may occur on individual lots in single family residential neighborhoods. In newer neighborhoods they may appear as a large complex composed of many structures of similar architecture with common grounds and facilities. Some older structures are U-shaped or O-shaped with a swimming pool in the middle. A parking level may be located underneath the living area, in which case it is not counted as a story. Parking for larger complexes may include garages or carports along the periphery of the complex. Low-rise apartments and condominiums are the most common types of multi-family structures in the study area. Also included are off-campus fraternity/sorority houses and senior citizen apartments. Residential units located above first floor commercial in buildings along a commercial strip are considered commercial use (1223, 1224). An area mapped as Low-Rise Apartments, Condominiums, and Townhouses may contain an occasional Medium-Rise building.

1124 **Medium-Rise Apartments and Condominiums**

This category includes multi-family structures of three to four stories and >18 units/acre. The area consists of a large single structure or a group of structures, of four or more units each, in a complex with associated common grounds, facilities and parking areas.

Many medium-rise apartments and condominiums occur in older areas as hotel/apartments. Several may be located next to each other in compact areas. Some may occur as large complexes, composed of many structures of similar architecture, with common grounds and facilities. Medium-rise apartments and condominiums are not as common as low-rise. Senior citizen apartments are included. If an area contains commercial use on the first floor and multi-family residential use on the upper floors, then the area is considered strip commercial (codes 1223, 1224). Some older urban core cities contain apartment and condominium buildings predominantly of three, four, or more stories. An area mapped as Medium-Rise may contain occasional Low-Rise or High-Rise buildings. Use of stereoscopic viewing of aerial photos is essential in determining relative height in relation to other structures in the area.

1125 **High-Rise Apartments and Condominiums**

This category includes multi-family structures of five stories or greater and >18 units/acre. The area consists of either a single large structure or a group of adjacent structures with common grounds, facilities
and parking areas.

Many high-rise apartments and condominiums occur as single or groups of high residential towers. Parking may be underground or in an adjacent parking structure. Smaller high-rise structures may contain only residential units with no other uses. High-rise residential structures are configured to maximize availability of window access to each individual residential unit. Thus the building may be long and narrow, or contain narrow lateral wings that provide window access. Senior citizen apartments are included. If an area contains commercial use on the first floor and multi-family residential use on the upper floors, then it is considered High-Rise Apartments and Condominiums.

1130 MOBILE HOMES AND TRAILER PARKS

These residential units are composed of mobile homes, trailers and pre-fabricated housing that are either stationary with foundations or that is on wheels and capable of being moved. Included are vacant and occupied spaces, and associated storage facilities for the complex. Mobile homes and trailer parks are usually served by all utilities, are on paved streets, and are provided with or have access to all urban facilities, such as schools, parks, police, and fire stations. This category does not include transient facilities such as recreational vehicle parks or campgrounds (see code 1880).

Mobile homes are typically long, narrow, and rectangular in shape. Most have a white signature when represented on an aerial photo, although some modern mobile homes may have a less reflective or colored roofing material. Some newer modular home or mobile home courts and subdivisions contain homes with false facades, giving the impression of an apartment or condominium complex, or single family houses.

1131 Trailer Parks and Mobile Home Courts, High Density

This category includes typical mobile home or trailer parks and pre-fabricated homes (>6 units per acre) that are in a contiguous area with trailer or mobile home spaces and associated facilities.

Trailer courts and mobile home parks normally have a high, closely spaced density of units within the lot with very limited landscaping. The mobile homes are parked side by side in parallel rows with an access drive along the front of the row. Also included are associated recreational vehicle storage lots within or next to the mobile home park.

1132 Mobile Home Courts and Subdivisions, Low Density

This category includes typical mobile and pre-fabricated homes located in lower density mobile home park or in a single family residential subdivision pattern on curbed named streets (<6 units per acre).
Individual mobile homes appear as in the description above (1131), although there may be additional architectural modification associated with it. Units are more widely spaced, with landscaping as in front and back yard areas of a normal subdivision. Each lot has its own driveway or walkway, similar to single family residential areas. Also included are associated recreational vehicle storage lots within or next to the mobile home park.

1140 MIXED RESIDENTIAL

1140 Mixed Residential
This category includes areas where there is a combination of single family detached and multi-family dwellings of any type occurring together. Each individual residential type does not meet the 2.5-acre minimum mapping resolution and neither dominates. Typically these are located in older neighborhoods, where duplexes, triplexes, and apartment buildings occur among single family houses.

1150 RURAL RESIDENTIAL
Rural Residential units include ranches, farmsteads, single mobile homes, and residences located in a rural setting. Typically these areas have limited urban services.

1151 Rural Residential High Density
This category is composed of a group of homes in a rural setting at a density of >2 units/acre. Units may contain backyard animal shelters or pens for non-commercial livestock. This class does not include commercial agricultural land, but does include backyard non-commercial agricultural activity, including field crops, groves, horse facilities, barns, and other agricultural uses. Backyard agricultural is mapped as part of the 1151 polygon.

1152 Rural Residential Low Density
This category includes homes located in a rural setting at a density of <2 units/acre. Included are backyard animal shelters or pens for non-commercial livestock. This class does not include commercial agricultural land, but does include backyard non-commercial agricultural type activity including improved pastureland, field crops, groves, horse facilities, barns, and other agricultural uses. If the back-lot agricultural use meets the MMU (2.5 acres), it will be mapped as a separate polygon and coded with the appropriate land use class.

1200 COMMERCIAL AND SERVICES
Commercial and Services includes areas used predominantly for business or the sale of products and their associated services. Also included are some non-commercial uses such as government and public service offices.
This class does not include industrial activities.

1210 GENERAL OFFICE USE

Included are areas of office buildings usually used for financial, personnel, business, medical and other professional services. The unit includes associated facilities and parking areas.

1211 Low- to Medium-Rise Major Office Use

This category includes office buildings of one to ten stories in height.

Office buildings are usually located on or adjacent to major streets, depending on the need for high visibility. Offices have parking areas either behind or around the buildings. Typically there are two styles of building structures. Normally, the low-rise office buildings (one to four stories in height) try to maximize window access, resulting in buildings that are long and narrow, containing a central courtyard, or have lateral wings. Medium-rise office buildings (five to ten stories in height) tend to be square, or rectangular in shape. Landscaping can vary from minimal to extensive, although modern larger office buildings do have considerable surrounding landscaped areas. Utility administrative offices are included in this category. Some corporate or business parks may be entirely made up of, or predominantly contain office space, although they may be similar to light industrial complexes (1311) or mixed commercial and industrial complexes (1500).

If an area contains commercial strip use on the first floor and offices on the upper floors (3 - 10 stories), then the area is considered Low- to Medium-Rise Major Office Use. A commercial strip of two-story structures containing offices on the upper floors is considered strip commercial (1223, 1224).

1212 High-Rise Major Office Use

This category includes office buildings that are eleven to forty stories in height.

The characteristics of the smaller high-rise office buildings are similar to medium-rise office buildings as described above. The taller office buildings are typically rectangular, with no particular regard for window accessibility. Older office buildings may be located side by side with retail commercial on the first floor. Modern suburban office buildings may have their own parking areas or landscaped surroundings. Many taller office buildings will have underground parking, or parking on the first few levels.

1213 Skyscrapers

This category includes office buildings greater than forty stories in height.
Skyscrapers are the tallest buildings built, normally occurring in downtown areas of larger cities, although they can also be located in business districts not associated with a downtown area. Retail commercial use usually occurs on the ground floor, with office use on the upper floors. Their relative height compared to surrounding areas is evident when the photos are viewed in stereo. Parking may be underground, on the first few levels, or in adjacent parking structures.

1220 RETAIL STORES AND COMMERCIAL SERVICES
Areas composed primarily of retail stores, restaurants, offices, and personal services, including associated facilities and parking areas.

1221 Regional Shopping Center
This category includes large retail centers composed of one or more major department stores and a full range of smaller shops, restaurants, offices and commercial services.

Most regional centers are enclosed malls, which are typically one to three stories in height, elongate in shape, with large square protrusions formed by the large department stores, the areas between being the smaller retail stores, services, and restaurants. Usually parking areas totally surround the building, some of which may be parking structures. Businesses located within the contiguous parking area are included with the regional shopping center. In urban areas, where open space may be limited, the mall building may be located over an entire block, with parking underground, and no visible surface parking. Factory outlet centers are included in this category.

1222 Retail Centers (Non-Strip with Contiguous Interconnected Off-Street Parking)
This category includes a large magnet store, with smaller retail stores, restaurants, service shops, and offices located in shopping centers with contiguous interconnected off-street parking. These centers are normally located along major highways and traffic corridors to take advantage of the increased customer exposure. Included are gasoline stations, restaurants and other stores whose parking area is contiguous with the center. Included are some grocery store, drug store, and department store shopping centers.

Retail or shopping centers contain buildings that are typically rectangular in shape with some architectural protrusions spaced at intervals when viewed on an aerial photo. The smaller stores are housed in long, narrow portions of the building, the larger stores are in the larger square portions. The building is usually situated toward the rear of the lot, with parking on the street side. There may be smaller commercial buildings within the parking area. Usually there is minimal to no landscaping.
Also included in this category are thematic commercial centers that function as a tourist attraction with specialty shops and restaurants.

1223 Modern Strip Development
This category includes retail stores, restaurants, service shops, and offices aligned along major highways and traffic corridors to take advantage of the increased customer exposure. Included are gasoline stations, auto repair shops, convenience stores, liquor stores, small bank branch offices, clothing stores, restaurants, furniture stores, discount stores, novelty stores, car dealerships or auto centers, drug stores, small corner markets, auctions, and mini-malls. In addition to on-street parking, there is easy access to off-street parking areas, that can be found in the front, on the side, as well as behind the commercial establishments. This category includes most newer style business corridors built since the 1950's.

Included are modern commercial corridors, usually containing a mixture of commercial uses along major highways. Some lots contain one building toward the back of the lot with no major store, and a small parking lot on the street side. Strip Development areas are typically located on major streets to take advantage of the high visibility. Usually there is minimal to no landscaping. Mini-malls are similar to shopping centers except they contain no large or magnet store. In two- or three-story structures, if offices or apartments are located over first floor commercial in a commercial strip, then the site is considered strip commercial also. Older style strip development areas are included in class 1224.

1224 Older Strip Development
This category includes strip development areas of little or no parking, such as the older business districts of small suburban cities. Any available parking is normally on the street, or in non-attended public parking areas. This category includes most older style business corridors built prior to the 1960's.

Older strip development areas contain storefronts and restaurants that directly abut the street or sidewalk, with very limited parking on the street or in back. Commercial units are positioned one immediately adjacent to another along the street. The strip development is composed mostly of specialty stores, offices, service shops, and restaurants. Adjacent parking areas that are less than the 2.5-acre minimum mapping resolution are included. In two- or three-story structures, if offices or apartments are located over first floor commercial in a commercial strip, then the site is considered strip commercial also. Adjacent non-attended public parking areas that are greater than 2.5 acres are mapped as class 1247.

1230 OTHER COMMERCIAL
Commercial uses other than general office, typical retail stores, and/or personal services. Included in this category are associated facilities and parking areas.
1231 Commercial Storage
This category includes public mini storage unit facilities and small commercial storage yards. This class does not include large storage warehouses (see code 1340).

Mini storage facilities are normally composed of a series of long, narrow parallel rectangular buildings, sometimes encompassed by a U-shaped or L-shaped building. Also included in this category are RV or large vehicle storage lots which, in some cases, are adjacent to mini storage unit facilities.

1232 Commercial Recreation
This category includes areas of commercial recreational use, such as sports stadiums (not associated with schools), car and horse race tracks, indoor shooting ranges, amusement parks, fairgrounds, gambling facilities (card halls and Indian bingo), and movie theaters (all drive-in and some walk-in types). Zoos are not included in this class, but are mapped as class 1850.

School sports facilities are mapped with the appropriate school category (e.g. a high school track would be called "High School"). Race tracks in this category do not include isolated or rural horse exercise or training tracks (see code 2700). Drive-in theaters are pie slice-shaped areas with concentric arcs within, as seen on aerial photos. Other examples include walk-in theaters not located in a mall or retail center, bowling alleys, ice and roller skating rinks, miniature golf courses, and small amusement facilities. Facilities such as bowling alleys and skating rinks may need to be verified and coded in the field since, on the photo, they resemble other types of land uses. Some categories, such as race tracks, some amusement parks, and fairgrounds, may already be identified on the collateral maps.

1233 Hotels and Motels
This category includes all major hotels and motels. Small or inactive motels which may be less than 2.5 acres may be classified as strip commercial. Large hotels usually contain varied commercial activity on-site (e.g. restaurant, barber/beauty salons, bar, gift shops, etc.). Motels, however, tend to be limited to an office and individual units.

Hotels, motels, suites, inns, and motor lodges tend to be located along major transportation corridors, near airports, large amusement parks, convention centers, civic centers, and/or downtown areas to take advantage of the potential market of transient overnight or extended-stay travellers. Smaller facilities normally contain a series of one- or two-story buildings with parking within the complex, or surrounding the buildings. Landscaping may be minimal. Usually there is a swimming pool toward the front or middle of the lot. Restaurants and gas stations are located in the immediate area. Large hotels tend to be
greater than three stories in height. In order to maximize window access the building configurations are long and narrow in shape, or contain narrow lateral wings. Parking may be underground, in parking structures, or in open areas around the hotel complex. Older hotels and motel may be located along what once was a major transportation corridor, but the major corridor has since been moved to a freeway in another location.

1234 Attended Pay Public Parking Facilities
This category includes stand alone public parking areas and parking structures that have an attendant-cashier present, and is not associated with another use.

Collateral data is required to map attended pay public parking areas. Parking structures will appear as a multi-story structure when the photos are viewed in stereo. Other areas appear as open ground level parking areas. Heavily commercial or downtown areas typically contain pay parking facilities, especially in the larger city core areas.

1240 PUBLIC FACILITIES
Public Facilities include government offices and other public service facilities, major health care facilities, religious facilities, and public and private educational facilities. This class also includes associated facilities and parking areas. Collateral data aids in the identification of these facilities.

1241 Government Offices
This category includes federal, state, regional, county or municipal administrative office buildings. Also included in this category are post offices, courthouses, and school district offices.

The aerial photo signature will appear similar to Commercial General Office Use (see code 1211). In the suburban areas the offices will usually be one to two stories in height, with landscaping and parking.

1242 Police and Sheriff Stations**
This category includes all municipal, county sheriff, and state highway patrol police stations. Police stations in a military installation are not included.

Collateral data is required to map these facilities. Normally these facilities are below the 2.5-acre minimum mapping resolution. As a critical land use, these facilities will be mapped at a minimum as a one acre polygon so that they can be included in this data base.

1243 Fire Stations**
This category includes all state, county and municipal fire stations. Seasonal fire stations are also included. Fire stations in a military installation are not included.

Collateral data is required to map these facilities. Normally these facilities are below the 2.5-acre minimum mapping resolution. As a critical land use, these facilities will be mapped at a minimum as a one acre polygon so that they can be included in this data base.

1244 Major Medical Health Care Facilities
This category includes public and private general medical health care facilities (hospitals) that give short-term care.

Larger hospitals are normally multi-storied, with split-level recessed/tiered upper floors that may form long and narrow lateral wings in order to maximize availability of window access for patient rooms. The area may contain other associated buildings, parking structures, parking areas, and landscaping. Smaller hospitals are one to two stories in height, with parking areas and landscaping. In both cases there may be circular drives with covered main entrances. Some facilities contain a number of buildings forming a complex. Medical offices are often located in close proximity to medical health care facilities. Some medical school facilities may be included as part of a major medical health care facility complex.

1245 Religious Facilities
This category includes churches, mosques, synagogues, temples, tabernacles, and other places of worship or religious pursuit. Religious monasteries, convents, etc. are also included in this category. Not included are schools (see 1262 through 1264), communication (see code 1420) and mass media facilities (see code 1211 and 1212) associated with a religious denomination.

Worship facilities are normally below the 2.5-acre minimum mapping resolution. They appear as one main building with landscaping and parking areas. Some facilities have a grass play area, or other smaller buildings. Monasteries and convents may appear as large office-type or apartment-type buildings in a closed compound with parking areas and substantial landscaping. Religious facilities may be identified on the topographic base maps, but that source may not be current. Small cemeteries, less than 2.5 acres, that are associated with an adjacent church are included with the church. Religious camps are mapped as code 1880. Retreat or conference centers are mapped as code 1253.

1246 Other Public Facilities
This category includes convention centers, and other public facilities, such as libraries, community centers, auditoriums, live indoor and outdoor theater facilities, observatories and museums, which are not
covered by other categories.

Convention centers may appear as very large rectangular to square building complexes with some architectural design. There is much landscaping and surface parking, parking structures, or underground parking. Convention centers are usually located in downtown civic center areas, central business districts, or near major airports.

Many public facilities in this category resemble office buildings in appearance. Outdoor theaters appear as large amphitheater areas with concentric seating pattern. Libraries, auditoriums, observatories, museums, and community centers are usually identified on collateral sources.

1247 Non-Attended Public Parking Facilities
This category includes free or metered public parking areas where no attendant-cashier is present. Only parking facilities greater than the 2.5-acre minimum mapping resolution are included. Facilities smaller than minimum mapping resolution are mapped with the adjacent use.

Most non-attended public parking facilities occur in older strip development areas (code 1224). Most of these parking facilities are located in the central business districts of suburban cities or community centers. The parking facility is usually located behind or across the street from the old commercial strip.

1250 SPECIAL USE FACILITIES
Special Use Facilities include institutional type facilities such as correctional institutions, mental health institutions, convalescent health care facilities, non-profit institutions, and fraternal organizations.

1251 Correctional Facilities
This category includes large facilities providing institutional services, such as juvenile halls, youth correctional facilities, county jailhouses, federal and state prisons, and state correctional mental hospitals (also see code 1252).

These institutions may be several acres in size, with many "office-type" or "apartment-type" buildings, landscaping, and parking areas, all confined to a closed complex. Other uses, such as agriculture, occurring within the correctional facility grounds are mapped separately.

1252 Special Care Facilities
This category includes public and private institutional care, such as convalescent and rehabilitation facilities, nursing homes, mental health facilities, sanitariums and state non-correctional mental hospitals.
Also included are reform schools, orphanages, and homes for abused, neglected, or other special needs children. This class does not include senior citizen apartments (see codes 1121, 1122, 1123, 1124, and 1125).

Larger facilities are normally multi-storied, with split level recess-tiered upper floors that may form long and narrow lateral wings in order to maximize availability of window access for patient or resident rooms. The area may contain other associated buildings, parking structures, parking areas, and landscaping. Smaller facilities are one to two stories in height, with parking areas and landscaping. In both cases there may be circular drives with covered main entrances. Residential and mental health facilities may contain "office-type" or "apartment-type" buildings, landscaping, and parking areas in a closed complex.

**1253 Other Special Use Facilities**

This category includes fraternal and other non-profit organizations, such as Salvation Army, Goodwill Industries, YMCA, youth organizations, homeless shelters, etc. Also included are retreat or conference centers.

This category includes a wide range of photo signatures. Many of the facilities in this category are similar to office buildings in appearance. Some may occur in retail commercial areas. Some fraternal organizations, however, may take on the appearance of churches or other religious facilities. YMCA and YWCA facilities may contain recreational facilities such as swimming pools, gymnasiums, baseball fields, etc. Some facilities may appear in industrial areas, such as Goodwill Industries.

**1260 EDUCATIONAL INSTITUTIONS**

All levels of public and private schools, colleges, universities, seminaries, and training centers are covered by this category. Includes buildings, open space, dormitories, and parking areas. Also included are all athletic facilities, such as ball fields, stadiums, soccer fields, swimming pools, and tennis courts.

**1261 Pre-Schools/Day Care Centers**

This category includes public and private pre-schools, nursery schools, and day care centers. Facilities associated with other educational institutions or religious facilities are not included in this category.

Most pre-schools/day care centers are below the 2.5-acre minimum mapping resolution. Typically, pre-schools and day care centers are located in commercial areas within close proximity to residential neighborhoods. The facility can appear similar to any commercial type use, however, it will usually contain playground equipment within a fenced lot.
1262  **Elementary Schools**

This category includes public and private schools, kindergarten through sixth grade, kindergarten through eighth grade, or other beginning grade levels, depending on local school board or administration policy.

Normally buildings are one or two stories in height, though some higher storied buildings may be present. The area contains landscaping and walkways. Buildings are either long and rectangular or have long narrow wings to maximize availability of window access. The play area can be a gray photo signature of asphalt, or a green signature of grass, or both. Elementary schools are usually much smaller than the other types of schools, normally less than 10 acres in size. The parking lot is very small, and may contain a bus loading curb or area. Because this class is a critical land use, any schools that are below the 2.5-acre minimum mapping resolution will be mapped at their actual size, or at a one-acre minimum. If a school serves a narrower or wider range of grade levels, then the school is assigned the class that the facility typically resembles.

1263  **Junior High Schools**

This category includes public and private schools for grades seven through eight, seven through nine, or other intermediate grade levels, depending on local school board or administration policy. Intermediate and Middle Schools may be included in this category.

Normally buildings are one or two stories in height, though some higher storied buildings may be present. The area contains landscaping and walkways. The buildings are either long and rectangular or have long narrow wings to maximize availability of window access. The athletic area may have a gray photo signature representing asphalt and a larger area of grass which is used as the soccer field/baseball diamond/track. Some schools will have a swimming pool or tennis courts. A parking lot with bus loading curb area may be visible. Junior high schools appear similar to high schools, but have smaller parking and athletic facilities. A junior high school lot is normally about 10 to 20 acres in size. Because this class is a critical land use, any schools that are below the 2.5-acre minimum mapping resolution will be mapped at their actual size or at a one acre minimum. If a school serves a narrower or wider range of grade levels, then the school is assigned the class that the facility typically resembles.

1264  **Senior High Schools**

This category includes public or private schools for grades ten through twelve, nine through twelve, or other upper grade levels, which are authorized to grant a high school diploma. Both regular, alternative, and extended day or adult education campuses are included. Seminary high schools are also included.

Normally buildings are one or two stories in height, though three- or four-story buildings may be present.
The area contains landscaping, walkways, and glades. Buildings are either long and rectangular or have long narrow wings to maximize availability of window access. The athletic area may be a gray signature of asphalt, with a larger area of grass for a soccer field. There are also separate baseball diamond/fields, football fields/stadiums, and track ovals.

Some schools will have a swimming pool and tennis courts. A parking lot with bus loading curb area may be visible. One may find a series of buses parked there. A senior high school lot is normally about 20 to 50 acres in size. However some private high schools may be below the 2.5-acre minimum mapping resolution and will be mapped as a one acre polygon at minimum in order to be included in the data base. If the school serves a narrower or wider range of grade levels, then the school is assigned the class that the facility typically resembles.

1265 Colleges and Universities

This category includes all public or private schools that offer courses at grade level 13 or higher, conferring either professional or academic degrees. Post-high school seminaries are also included.

Normally buildings are one to four stories in height, though higher storied buildings may be present. Buildings are either long and rectangular or have long narrow lateral wings to maximize availability of window access. Some buildings, such as libraries, auditoriums, and gymnasiums, may be rectangular in shape. Many buildings have architectural design in their shapes and features. Areas within the school may be well landscaped, containing walkways, glades, quads, squares, large lawn areas, greens, or malls. Athletic areas may be separate from the main school area. Asphalt areas for basketball may be present. There are also separate baseball fields, football stadiums, track ovals, tennis courts, and swimming pools. Small streets and parking areas may be located throughout the complex. Dormitories and on-campus fraternity/sorority houses are included. Off-campus university-owned housing and off-campus fraternity/sorority houses may be mapped as a multi-family or single-family residential category.

1266 Trade Schools

This category includes all schools which provide technical, vocational, occupational, or professional training (e.g. vocational schools, occupational training centers, police academies, secretarial schools, nursing academies, technical institutes, or art institutes).

These facilities are normally smaller than and may identify themselves as, a college or university. Most facilities will be smaller than a high school and without the athletic facilities normally associated with other schools. Buildings may be any size, but normally one to two stories in height, resembling office buildings. Some buildings may be long and narrow to maximize availability of window access. The
facility will have an adjacent parking area.

1270 MILITARY INSTALLATION

Areas of military installations and associated facilities administered by the United States Armed Forces or the California National Guard. Water bodies within a military installation are coded as 4400.

1271 Base (Built-Up Area)

This category includes all developed lands (except agriculture (1272), airfields (1273), and water (4400)) within a military installation. Includes bases, camps, armories, ordnance depots, and missile sites.

Built up area may contain office buildings, residential units, industrial areas, equipment storage facilities, administrative buildings, other support facilities, parking areas, landscaping, glades, walkways, and athletic facilities. Small areas of vacant land within this category are considered part of the built-up area. Some government contracted research or industrial facilities may be located within a military reserve. Collateral data is necessary to delineate the boundaries of the military reservations.

1272 Vacant Area

This category includes all large areas of undeveloped lands within a military installation.

Includes large areas of vacant land within the military installation boundary. Small areas of vacant land within the built-up base area are considered part of the base (1271). Also included in this category are agricultural areas within the military reservation. Collateral data is necessary to delineate the boundaries of the military reservations.

1273 Air Field

This category includes air fields and associated facilities within a military installation.

Includes the landing strip, tarmac, taxiways, aircraft storage areas, hangars, and repair areas. Vacant areas within the airfield complex are included. On the aerial photos the hangars appear as large square buildings, two to three stories in height with aircraft parked nearby, with direct access to the air strip and taxiways.

1274 Former Military Base (Built-Up Area)

This category includes all developed lands (except agriculture (1272), airfields (1273), and water (4400)) within a former military installation. Includes bases, camps, armories, ordnance depots, and missile sites.

Built up area may contain office buildings, residential units, industrial areas, equipment storage facilities,
administrative buildings, other support facilities, parking areas, landscaping, glades, walkways, and athletic facilities. Small areas of vacant land within this category are considered part of the built-up area. Some government contracted research or industrial facilities may be located within a military reserve. Collateral data is necessary to delineate the boundaries of the military reservations.

1275 Former Military Vacant Area
This category includes all large areas of undeveloped lands within a former military installation.

Includes large areas of vacant land within the military installation boundary. Small areas of vacant land within the built-up base area are considered part of the base (1271). Also included in this category are agricultural areas within the military reservation. Collateral data is necessary to delineate the boundaries of the military reservations.

1276 Former Military Air Field
This category includes airfields and associated facilities within a former military installation.

Includes the landing strip, tarmac, taxiways, aircraft storage areas, hangars, and repair areas. Vacant areas within the airfield complex are included. On the aerial photos the hangars appear as large square buildings, two to three stories in height with aircraft parked nearby, with direct access to the air strip and taxiways.

1300 INDUSTRIAL
Areas where manufacturing, assembly, processing, packaging, or storage of products takes place.

1310 LIGHT INDUSTRIAL
Design, assembly, finishing, packaging, and storage of products or materials which have been processed at least once. These activities are characterized as "clean", since they produce a relatively small amount of smoke or other effluents, noise, and dust. Includes associated facilities and parking.

1311 Manufacturing, Assembly, and Industrial Services
This category includes all types of light industrial activity except those associated with the motion picture industry. Associated areas used for open storage of heavy equipment are mapped as 1323.

Most light industrial manufacturing and assembly buildings appear as large square or rectangular structures, all located in an contiguous area usually zoned for such operations. Some buildings may be long and narrow; most buildings are one story and may have very high ceilings. On the aerial photo one
can note a series of evenly spaced air conditioning units or air turbines on the roof. Many newer industrial buildings will have a white roof photo signature. The buildings are usually located in the middle of the lot, though that is not an essential requirement. There will be parking areas surrounding the building for employee parking. There is also minimal to no landscaping. Some light industrial manufacturing establishments occur together in a business, corporate, or industrial park. Others may occur in an industrial or commercial park mixed with commercial uses or offices (see code 1500). Included in this category are wholesale lumber yards and lumber milling and cutting operations. Lumber operations are distinguishable on the photo by the many large stacks of wood, pallets, and trusses. Also included are breweries, wineries, and food processing facilities. Small extractive sand and gravel operations as part of a small brick making operation are included in this category unless the extractive (code 1331) area is large enough to map as a unit by itself. Metal reprocessing facilities and recycling centers are also included. Industrial facilities located within a military reserve are mapped as military (code 1271).

1312 Motion Picture and Television Studio Lots
This category includes motion picture company and television production studios as well lots or open areas used for outdoor sets. Also included are permanent remote lots used for production.

Various types of structures may appear on the lot. Offices would appear as long narrow buildings, possibly with wings. Sound stages may appear as very larger square or rectangular buildings. The buildings may appear in a series or in rows. The back lot areas may appear as non-descript open areas with various smaller structures and vegetation.

1313 Packing Houses and Grain Elevators
This category includes facilities used for the packing and storage of produce for shipment to markets or processing plants.

Packing houses and grain elevators are usually located adjacent to railway lines. They can occur in urban industrial areas, although they are normally located in rural agricultural areas. Packing houses are large, rectangular warehouse type buildings. Grain elevators consist of one to several adjacent, tall, cylindrical metallic structures. The elevators may be adjacent to associated buildings.

1314 Research and Development
This category includes industrial complexes where product, technology, or idea development and research is the primary function.
Normally research and development is part of a commercial or industrial business and is housed within structures of that primary use. However, some research and development takes place in separate areas or structures apart from or adjacent to its associated parent facility. Research and development facilities contain office buildings and laboratories. Some light industrial-type structures may also be present. Off-campus university field laboratories are included. Academic institutions, however, are not included in this class. Research and development facilities located within a military reserve are mapped as military (code 1271).

1320 HEAVY INDUSTRIAL
Industrial and manufacturing facilities of a large magnitude involving the processing of raw materials. It is considered relatively "dirty" since wastes such as smoke, slag, dust, and liquid effluent, as well as noise, are often generated. Includes associated facilities and parking areas.

1321 Manufacturing
This category includes large operations of manufacturing activities such as large brick, cement, and asphalt production facilities. This category does not include Petroleum Refining and Processing (see code 1322), Open Storage (see code 1323), Major Metal Processing (see code 1323), and Chemical Processing (see code 1325).

These facilities may appear as several large buildings or as a complex on a large lot, with parking. The layout of the complex buildings may not be orderly. The facility may have access to several spurs of a railroad system taking advantage of the transportation network. Raw materials may be stored in the open or in large silos. The area appears to be very "dirty" from the fallout of raw materials or industrial waste products.

Manufacturing plants are usually located in an area of other similar operations or with light industrial areas.

1322 Petroleum Refining and Processing
This category includes major oil refineries, as well as associated petrochemical plants.

Petroleum operation photo signatures have a "dirty" gray to black appearance over the entire facility. Large pipes, vats and storage tanks are compactly situated over the entire area. Typically there are acres of storage tanks situated in a matrix formation. Petroleum refining facilities are located adjacent to major harbor facilities, or may be located on the coast where tankers may unload their crude oil from offshore intake pipes. This category does not include oil well or exploration areas (see code
1332).

1323  **Open Storage**
This category includes wrecking yards, junk yards, storage of heavy equipment not related to maintenance, and other salvage and recycling operations. Also included are outdoor areas used for storage of light or heavy industrial products. This class does not include open storage of new cargo at harbor facilities (see code 1411).

The photo signature for wrecking and junk-yards appears as a lot containing many cars in high concentration lined up in columns or rows with dirt access "lanes" in between. Other junk-yards may appear as non-descript areas of large metallic material lying in an area in no particular order or arrangement. Open storage of light or heavy industrial products appear as large yards in an industrial area with a relatively neat organization of heavy equipment. Also included are non-commercial lots containing what appears to be abandoned equipment, usually stored in a disorderly fashion. Cargo storage areas located in railroad yards are coded as Railroad (code 1412).

1324  **Major Metal Processing**
This category includes all foundries, smelters, stamp mills, and other heavy metal manufacturing or processing plants, with the exception of recycling centers or wrecking yards.

The photo signature appears as an area, many acres in size, containing many square to rectangular or long narrow buildings, with air turbines or air conditioning units on the roofs. Situated within the area are numerous smoke stacks and pipes. The area is also tinged with a "dirty" gray color. Also included are associated "slag heaps".

1325  **Chemical Processing**
This category includes major chemical refining plants and their associated facilities.

Chemical processing plants may appear as office type buildings used for administrative purposes, with larger industrial type buildings, large pipes, and tanks for movement and storage of necessary liquids or gases.

1330  **EXTRACTION**
Areas whose use is devoted to the extraction of mineral and rock products. Includes associated mining area, facility structures, and parking areas.
1331  Mineral Extraction - Other Than Oil and Gas
This category includes surficial extraction of minerals and rock products, including sand, gravel, clay, diatomaceous earth, metals and other non-metals. Includes quarries, open pit mines, and borrow pits. Also included are surficial structures related to below ground mine activities. This class does not include oil and gas extraction (see code 1332).

Most quarries will appear as a giant hole dug in the earth, with steep-sided edges. On the top surface and down in the pit there will be little or no vegetation due to the disturbance of the ground by earth movers. Ponds of water may be located in the pit or on the upper ground surface. Tailing piles may be located nearby, adjacent to, or on the mining site. Sand and gravel operations are usually located in or near river floodplains. Sand and gravel pits may have the extracted material piled in the pit or adjacent to the pit on the upper ground surface, with storage bins and long linear conveyor belts crossing the piles. Borrow pits may appear only as small one- to 3-acre areas of graded land with little or no vegetation located near a highway or built up area. The borrow pit was extracted for fill dirt. Some short escarpments may be found at the edges of the borrow pit. Most underground mining operations have limited surface exposure. Some shaft or mining operation out-buildings may be located in a mappable cluster, with some adjacent tailings.

1332  Mineral Extraction - Oil and Gas
This category includes oil and gas extraction and associated surface storage facilities. Subsurface known or suspected reserves are not included. Offshore oil and gas extraction is not included.

Oil and gas extraction fields can be distinguished by the presence of a series of tall oil derrick towers or oil pumps. The derricks appear as a group of concentrated long shadows on the aerial photo. Some areas have only the oil pumps, without derricks, scattered within a field area. Some oil field pumps may be located in a built-up area. By itself, a pump is below mapping resolution, but when situated in a group, the area may be mappable. An oil field area appears on the aerial photo as an extensive network of roads and small clearings usually located on a hill or mountain slope. Most fields are identified on the basemap. Built-up uses take precedence over the mapping of pumps.

1340  WHOLESALING AND WAREHOUSING

1340  Wholesaling and Warehousing
This category includes storage, supply, or distribution warehousing or wholesale shipping centers other than those which are integral parts of airports, transportation centers, and harbor facilities.
The warehouse structures appear similar to light industrial manufacturing buildings in that most are large squares or rectangular in size and shape, with few or no air turbines or air conditioning units on the roof. The building is typically located near the middle of the lot, with very little employee parking. On the aerial photo one may be able to see long narrow truck trailers lining the edges at the loading docks. Other truck trailers may be parked within the lot. Usually there is little or no landscaping, and very little parking. Only large high volume operations may have larger employee parking areas. This category does not include Truck Terminals (1416). Open storage of heavy equipment is coded 1323.

1400 TRANSPORTATION, COMMUNICATION, AND UTILITIES
Major structures and facilities associated with forms of transportation, communication, and utilities.

1410 TRANSPORTATION
Areas devoted to major transportation, such as airports, freeways, roads, railways, and harbors facilities.

1411 Airports
This category includes all airports, air fields, and air strips, heliports, and their associated parking and storage facilities.

The airport area includes repair and storage hangars, aircraft parking areas, taxiways, and the vacant areas at the ends of and between runways. On the aerial photo the hangars will appear as large rectangular or square structures adjacent to the runway/taxiway and aircraft parking area. In major airports, passenger terminals and automobile parking areas are also included, as well as air freight facilities. Also included in this class are heliports and land associated with seaplane bases. Also included are car rental establishments located within the airport complex. Off-site car rental locations are mapped as modern strip development (code 1223). Vacant and agricultural areas within the airport boundary are coded 3100 and 2110 or 2120 respectively.

1412 Railroads
This category includes train terminals, stations, associated parking areas, roundhouses, repair and switching yards, and railbed rights-of-way, including spurs and sidings. Also included are cargo storage and transfer areas located within the railroad yards. The width of the rights-of-way must be at least half the width of a 2.5-acre square to be included.

Railroad beds appear on the aerial photo as a continuous dark, narrow line with an adjacent band of off-white on each side. The railroad beds appear very similar to minor roadway beds, except they are
narrower and are continuous for miles. Terminals and switching yards appear as an abrupt multi-
branching of the line, becoming polygonal areas, rather than linear. One may be able to see the
railroad cars on the photo. Spurs and sidings may be below resolution. They appear as two or three
tracks branching off side by side next to the main track or as a branch of the track veering off in
another direction. Railroad rights-of-way are normally below minimum mapping resolution, so only
those areas meeting the minimum resolution are mapped. Major railroad stations will appear as a
large facility with parking and a large building adjacent to the railroad tracks. The tracks may be
under a large covering, or have covered platforms adjacent to each track.

1413 Freeways and Major Roads
This category includes freeways, interchanges, major roadways, and their adjacent rights-of-way.
The delineations include the roadbed, landscaped areas, access routes, and associated adjacent
drainage ways. Also included are rest areas, weigh stations, and toll booths.

All freeways are to be mapped, as well as major roadways that are at least half the width of a 2.5-acre
square. Freeways appear as two to six lane roadways with adjacent landscaping and center divider,
with interchanges, overpasses, and underpasses. The freeway lane signature is gray to white. Rest
areas appear as landscaped areas with small structures (bathrooms and picnic overhangs) and parking
areas. On the photo one may be able to see cars and large trucks parked. Normally there is a rest area
located on each side of a freeway at the same location. There is an off-ramp and an on-ramp from the
freeway to each rest area. Toll booth plazas appear as a sudden widening of the roadway into many
lanes that run into a long, narrow covered area dissecting the roadway. On the other side of the
booths, the lanes converge again to form the freeway lanes. Road cuts are mapped as vacant land
(3100), not as part of the 1413.

1414 Park and Ride Lots
This category includes Cal Trans park and ride lots provided for commuter ridesharing, buspooling,
vanpooling, and carpooling purposes.

Park and ride facilities appear similar to parking lots and are located near major freeways or
highways. Some park and ride lots are located in retail center parking lots. Collateral data is
necessary to map these facilities.

1415 Bus Terminals and Yards
This category includes areas used as bus terminal facilities, including bus storage and maintenance.
Major bus terminals and storage/maintenance yards appear as large parking areas for buses. On the aerial photo one may be able to see a number of buses parked side by side or one behind the other. School bus yards are also included. School buses will appear as yellow in color, with a white roof and, in some cases, large black numbers painted on top.

1416 Truck Terminals
This category includes areas used as truck or highway freight terminals, freight transfer, or large truck stops where there is a high level of truck activity.

Truck terminals and freight transfer structures will appear as small rectangular buildings with the large truck trailers parked all around at the loading docks. Additional trailers may be parked on the lot. There is not very much employee parking. Warehousing is not included in this category (1340). Large truck stops are located adjacent to freeways and contain services such as gas stations, restaurants, motels, and truck repair. On the aerial photo one can see a large truck trailer parking area, with trucks. Small truck stops are mapped as part of modern strip development (code 1223).

1417 Harbor Facilities
This category includes port and dock facilities and associated storage areas. Includes shipyards, dry-docks, locks, waterway control structures, buildings and associated parking areas. Marinas are included in Other Open Space and Recreation (see codes 1880 and 4300). Harbor-use in the adjacent water body are included in Water (code 4200).

Major harbor facilities are located at the ocean, within close proximity to or within a large metropolitan area. Numerous wide channels and "sea lanes" are available for ships to pass in, out and through the facility. There are numerous slips and berths for loading and unloading of cargo, as well as large areas for container or cargo storage. Other facilities include ship repair and ship building areas. There may also be tanks for storage of petroleum products not associated with a refinery. Other adjacent facilities, such as heavy or light industrial are mapped into their respective categories. All water associated with the harbor facilities is included in class 4200, Harbor Water Facilities.

1418 Navigation Aids
This category includes areas occupied by facilities necessary to aid navigation, such as lighthouses.

Lighthouses will appear on the coast at prominent points where sea navigation may be hazardous. There is usually an area set aside for the light itself, keepers quarters, other navigation and
communication antennas, as well as some landscaping. When viewed in stereo one may be able to
discern the lighthouse tower. Other navigation aids such as beacons, horns, and communication
antennae, and VORTACs may be below minimum mapping resolution.

1420 COMMUNICATION FACILITIES

1420 Communication Facilities
This category includes areas used for airwave communications, including radio, radar, television,
television, telephone, and microwave facilities.

Most communication facilities are below minimum mapping resolution, unless many antennae towers
and structures are located together. These facilities are normally made up of one or more antennae or
towers, sometimes including one to a few small square or rectangular buildings. Radio towers occur
as a set of 3 tall towers on a lot, whereas TV towers occur as one large, tall tower. Microwave towers
are usually individual, shorter towers. Telephone central offices are normally enclosed in a one- or
two-story, square or rectangular building in a built-up area.

1430 UTILITY FACILITIES
Areas which are used for the production and transmission of electricity, and the treatment or transportation of
water, sewage, and fuels.

1431 Electrical Power Facilities
This category includes facilities engaged directly in the generation and distribution of electricity.
Included are power generating stations (thermal, nuclear, hydroelectric, coal, steam, wind energy
farms), substations, and transmission line rights-of-way. Transmission line rights-of-way are mapped
if the width of the corridor is at least half the width of a 2.5-acre square. This class does not include
administrative offices.

Electrical power plants appear similar to heavy industrial operations. The facility contains smoke or
steam stacks with vents, piping, tanks, towers, and racks containing transformers and other electrical
equipment. Several transmission line corridors converge at power plant sites. Substations appear as
metal racks containing the transformers and other electrical equipment. They may be as small as 1/4
acre to as large as several acres. The racks are normally located near the center of the lot, with the
ground surfaced in gravel. One to several transmission line corridors converge at the substation. The
transmission line corridor appears as a linear swath of land traversing the landscape. The corridor
may be located along the side of a street and be very narrow or located in vacant areas and be as wide
as 1/4 mile if the corridor contains several transmission line towers. On the aerial photo one may be able to see the individual tower areas as a white dot immediately surrounded by a small graded area. Leaning away from each dot one may be able to see the black shadow of the tower or power pole. One can follow these dots from tower to tower along the corridor, from substation to substation or power plant. Some corridors contain other uses such as nurseries, orchards, cropland, or pastures within the right-of-way. The other uses underlying a transmission line take precedence. If the underlying use is vacant, the electric transmission line corridor takes precedence. Only corridors that are above the minimum mapping resolution are mapped.

1432 Solid Waste Disposal Facilities
This category is used for active dumps and sanitary landfill operations, and their associated facilities.

Most landfills in southern California are located in old excavated gravel pits or in canyons. They will appear as large extents of graded area, or if located on a plain, will appear as an extensive graded mound. The pit or canyon may appear to be partially or significantly filled, with tractors or other heavy excavating equipment on its surface. These facilities are normally located away from areas of human habitation or areas of high human concentration or activity. Other uses overlying a closed, abandoned, or inactive landfill take precedence.

1433 Liquid Waste Disposal Facilities
This category includes sewage treatment and liquid waste treatment plants and associated spreading grounds, aeration fields, and water injection plants. Also included are associated facilities and parking areas.

The aerial photo signature will normally show about four circular tanks, each with a linear pipe forming a radius within the tank. Surrounding the tanks may be some small ponds, site office, and parking facilities.

1434 Water Storage Facilities
This category includes most small water reservoirs and water tanks used for domestic water supply. Included are any associated facilities and dams.

The reservoirs include all covered water storage facilities and water tanks. Open water bodies used for water storage are included if they are below 5 acres in area, otherwise they are mapped as Water (see code 4100). Water tanks appear on the photo as a small round light colored structure. Covered reservoirs may be circular, oval, or rectangular in shape. Dams associated with water storage
reservoirs are included. Dams associated with flood control are mapped as code 1437.

1435 Natural Gas and Petroleum Facilities

This category includes major natural gas and petroleum distribution systems. Included are pumping facilities, and storage facilities not associated with a refinery. Not included are underground storage facilities.

Pipeline rights-of-way at least half the width of a 2.5-acre square are mapped. Most of the facilities require collateral data in order to be mapped. Large tank farms not associate with a refinery are included.

1436 Water Transfer Facilities

This category includes major above-ground water distribution channels, aqueducts, water treatment, filtration (non-sewage), reclamation (non-sewage), and pumping facilities.

Examples of water transfer are the California Aqueduct and Coachella Canal which appear on the aerial photo as a linear open water, concrete lined canal; and the Los Angeles Aqueduct which appears as a linear, large, above-ground pipeline. Most of the facilities can be identified on the collateral data. This category does not include improved flood channels and structures (see code 1437).

1437 Improved Flood Waterways and Structures

This category includes flood control channels and dams, detention ponds, percolation basins, and debris dams.

Most improved flood control channels are channelized and/or lined with concrete. The photo signature shows a white to off-white color representing the concrete lining. Percolation basins are a series of basins adjacent to a flood control channel where flood water is allowed to recharge the groundwater. Debris dams are normally earthen, but may contain a concrete spillway. They are located at the mouth of canyons or downstream of the canyon, and contain a vegetated, though dry to intermittent back pond. Dams associated with water storage are mapped as code 1434. The improved flood waterways and structures are usually identified on the collateral data.

1438 Mixed Wind Energy Generation and Percolation Basin

This category is used where electrical power facilities such as wind energy generation farms and improved flood structures, such as percolation basins occur together in a double use fashion. The
wind energy towers are located on the levees between the basins.

1440 MAINTENANCE YARDS

1440 Maintenance Yards
This category includes maintenance facilities owned and operated by a major utility or government agency. Included are repair and storage yards.

Maintenance yards normally contain an L-shaped or long, narrow rectangular, single story building. The lot contains a number of parked company vehicles and heavy equipment or machinery. Also stored on the lot is other maintenance or replacement equipment. Construction materials may also be stored on the lot. Collateral data and field verification are required for mapping.

1450 MIXED TRANSPORTATION

1450 Mixed Transportation
This category includes areas where more than one transportation use is present and neither dominates.

This class may be used when a highway occurs adjacent to a railroad and together the width of the right-of-way is above the 2.5-acre minimum mapping resolution. Each individual right-of-way may be below resolution. Where a 1450 is crossed by a freeway (1413), the freeway takes precedence in the overlap area.

1460 MIXED TRANSPORTATION AND UTILITY

1460 Mixed Transportation and Utility
This category includes areas where a transportation and utility right-of-way occur together or side by side and neither use dominates.

This class may be used when a highway or railroad occurs adjacent to a transmission line corridor or an improved flood control channel. Together the combined right-of-way is above the 2.5-acre minimum mapping resolution. Each individual right-of-way may be below resolution.

1500 MIXED COMMERCIAL AND INDUSTRIAL

1500 Mixed Commercial and Industrial
This category includes both commercial and industrial land uses occurring together, or in close
proximity. Each individual land use unit is below the 2.5-acre minimum mapping resolution and neither use dominates.

Typically this class occurs at some "industrial", "commercial" or "business" parks that contain a mixture of light industrial use, offices, warehouse/distribution use, retailing, and personal services. These complexes usually contain one or more buildings rectangular in shape, with minimal landscaping. Each building is similar to a typical light industrial building. Buildings composed predominantly of retail businesses are coded 1223, and those composed predominantly of light industrial are coded 1311. This class is also used in areas not located in a complex, but the industrial and commercial classes do follow the definition above. Also included are areas where a combination of commercial and industrial use occur within the same building.

1600 MIXED URBAN

1600 Mixed Urban
This category includes built-up areas where there is a mixture of uses occurring within a specific area, and no one class dominates.

In these areas no one class can be mapped above the 2.5-acre minimum mapping resolution. This class typically occurs in smaller towns or villages where there are various uses in a small area. It may also occur in older areas where consistent zoning was not in force at the time of construction of structures. Also included are areas where a mixture of uses occur within the same building. For example, an older commercial strip may contain adjacent buildings where commercial use occurs on the first floor and, in all buildings, either residential or offices occur in the upper floors.

1700 UNDER CONSTRUCTION

1700 Under Construction
This category includes facilities that were under construction at the time aerial photography was taken, or at the time of field verification. Structure use and/or extent cannot be or is difficult to determine.

The aerial photo signature shows a newly graded area with no vegetation. Pad platforms or foundations may be visible. Partly constructed structures may also be visible. If the use and its extent can be determined, then the polygon is categorized with its known use.
1800 OPEN SPACE AND RECREATION

Developed open areas within urban settings, and urban and non-urban open areas developed for recreational activities.

1810 Golf Courses
This category includes public and private courses including driving ranges, greens, fairways, links, hazards, buildings, and parking areas.

Golf courses appear on the photo as areas containing long green grass areas lined with trees. The greens have hazard ponds and white sand traps adjacent to them. There can be nine or eighteen fairways/greens. Typically there is a main building serving as the clubhouse/office/restaurant. Driving ranges not associated with a golf course are mapped as Other Open Space and Recreation (code 1880). Most golf courses are identified on the collateral data. Residential areas within golf courses are mapped separately as their residential type. Water bodies that are greater than 2.5 acres are mapped as 4100.

1820 Local Parks and Recreation
This category includes neighborhood, city, town, or community parks, and sports fields, and their associated parking facilities. Beach parks are not included (see code 1870).

Local parks are typically small, up to several city blocks in size, but basically serve the immediately surrounding community. The photo signature shows a green grass area with trees scattered throughout, though trees are not a requirement of this class. The park may contain limited sports facilities. Parking is usually on the street, though there may be one or more parking lots. The sports fields are usually softball fields, basketball courts, tennis courts, or soccer fields, though some parks also contain swimming pools. Some parks also contain a recreational building or multi-purpose building, with offices and indoor sports facilities. Private parks serving a development or subdivision are included. Most parks are identified from collateral sources. In some cities, school athletic field/playground areas are also considered parks, therefore these areas were mapped as parks.

1830 Regional Parks and Recreation
This category includes developed land within parks designed to serve a regional area. All facilities within the park, such as campgrounds, marinas, or boat launching facilities, are included in this class.

Regional parks are typically large, and may include undeveloped areas. The undeveloped portions of parks are mapped as vacant (see code 3100). The photo signature shows green grass areas, as well as
tree-covered areas. The park may have one or more roads winding through it, depending on the size of the park. The park usually contains a number of sports facilities, such as basketball courts, tennis courts, softball fields, soccer fields, and swimming facilities. Water bodies within regional parks that are above mapping resolution are coded 4100. Beach parks are not included (see code 1870). Where multiple uses occur within a regional park, for example golf course, agriculture, flood control, etc., the use other than Regional Park takes precedence. Most regional parks are identified on collateral sources.

1840 Cemeteries
This category includes public and private cemeteries, memorial parks, mausoleums, and other burial grounds. Included are associated facilities and parking areas.

Cemeteries appear on the photo as green grass areas, similar to local parks. Cemeteries, however, contain roads configured as a grid network or with a center oval. The interpreter may be able to see subtle lineation representing the tombstones, plaques, and flowers at each grave. One or more buildings are found on the lot which may include a mortuary, chapel, office, or crematory. A line of cars may be seen on the photo if a funeral was in progress at the time of exposure.

1850 Wildlife Preserves and Sanctuaries
This category includes public and private facilities, and developed areas devoted to the preservation of wildlife species and habitats. This class includes such uses as zoos, wild animal parks, duck ponds, exotic animal farms, etc.

Zoos appear as large areas with many buildings and much vegetation in a confined area, with numerous walkways. A large parking lot is adjacent to the facility. Other wild animal facilities are typically located outside the urban area in canyons and are not open to the general public. Most wildlife preserves and sanctuaries will be identified on collateral data. Undeveloped areas within national and state preserves and sanctuaries are mapped as 3100.

1860 Specimen Gardens and Arboreta
This category includes botanical gardens or arboreta devoted to preserving living specimens of vegetation for scientific or cultural purposes.

These facilities are identified on collateral data. The photo signature will show a well manicured, highly vegetated area, with numerous walkways, buildings, and greenhouses, with an adjacent parking area. Arboreta associated with colleges or universities are mapped as 1860.
1870  Beach Parks
This category includes all public and private beach parks. The facilities include bathhouses, barbecue pits, parking areas, sports areas, as well as the beach area.

Beach parks are identified on the collateral data. The aerial photo signature shows a white to tan color for the sand area, and a gray signature for parking areas. Some buildings may be located adjacent to the parking lots.

1880  Other Open Space and Recreation
This category includes developed portions of public and private recreational facilities that are not described in the other open space and recreational categories above. Included are camps, campgrounds (unless within a regional park (1830)), outdoor shooting ranges, ski areas, marinas, and driving ranges not associated with a golf course. Also included are maintained grass areas not used or designated as a local park.

Most of these facilities are identified on the collateral data. Marinas are located adjacent to harbors, and contain small piers, with numerous boats. The water portion of a marina, where the boats are moored, is mapped in the Water category (see code 4300). Ski areas are typically located in mountains above 5000 feet. The area contains a series of wide linear clearings that may braid with each other. A series of towers representing the chairlift system can be seen on the aerial photo. Campgrounds appear as an area with narrow roads circling within, with offshoot segments representing each campsite area. Campgrounds are also identified on collateral sources.

1900  URBAN VACANT

1900 Urban Vacant
This category includes open undeveloped land within urban areas that are not associated with a particular facility.

Typically these areas are vacant lots. They normally contain no structures but may have such improvements as curbs and sidewalks. The land may be in a graded condition showing little or no vegetation, or may be in a successional vegetated state, with numerous shrubs and grasses, in a non-uniform, unkept condition. Not included in this class are terraced erosion control embankments (see 3100).
2000 AGRICULTURE

Agriculture includes land used primarily for the production of food, fiber, and livestock. Included in these classes are associated structures and facilities.

2100 CROPLAND AND IMPROVED PASTURE LAND

Included here are active field and row cropland areas and improved pasture lands. The croplands include cultivated, in crop, harvested, fallow or temporarily idle land. The improved pasture land may be in pasture year-around or be in the cropland seasonal rotation. Improved pasture land does not include rangeland (see code 3100).

2110 Irrigated Cropland and Improved Pasture Land

This category includes all irrigated field and row cropland areas, and irrigated improved pasture land.

The majority of row crops in southern California is irrigated. The photo signature for active cropland will show one of several signatures. If the land is in field crop, the signature will show a uniform, smooth texture area, with a green color. Land that is in row crop will appear similar to field crop, except the individual rows can be distinguished as narrow parallel lineations. Land that is being made ready for crop or has been harvested will appear as a uniform, smooth texture of off-white to tan color representing the just graded or plowed field. Fallow fields will appear similar to vacant lots or disturbed vacant land. The area will appear unkempt, with a non-uniform texture representing a mixture of shrubs and grasses in a successional state. Fallow land will occur in close proximity to in-crop areas. The improved pasture land photo signature may appear similar to the cropland signature. Most improved pasture lands are mapped as non-irrigated (2120). In many cases post-harvest field crop, row crop, or fallow area will be used for pasture of livestock. Cropland and improved pastures may occur within electrical transmission line rights-of-way.

2120 Non-Irrigated Cropland and Improved Pasture Land

This category includes all non-irrigated cropland, including dry-farmed field crops.

Most non-irrigated cropland is represented by dry-farmed field crops such as peas, beans, barley, oats, and hay. The photo signature for field crop will show a dull green to mottled brown color with smooth, uniform texture. Furrows or plow marks may also be visible. Dry farmed areas may appear very similar to natural grass vegetation. Land that is being made ready for crop or has been harvested will appear as a uniform, smooth texture of off-white to tan color representing the just graded or plowed field. Fallow fields will appear similar to vacant lots or disturbed vacant land. The area will appear unkempt, with a non-uniform texture representing a mixture of shrubs and grasses in a
successional state. Fallow land will occur in close proximity to in-crop areas.

2200 ORCHARDS AND VINEYARDS

2200 Orchards and Vineyards
This category includes commercially productive tree, bush, and vine crops.

Orchards include fruit and nut trees, and bush crops. The photo signature for citrus orchards appear as dark green, coarse textured areas, where the individual trees are distinguishable. The trees are aligned in a matrix form, with crowns appearing to abut each other. Nut and other fruit trees are similar, however, the color will be a lighter shade of green. The trees are aligned in a matrix form, with crowns abutting each other. Bush crops are similar to orchards, however, they may be configured in rows rather than a matrix, and are much shorter in height. The photo signature for vineyards will appear as dark green, coarse-textured, thin linear rows that, when measured, will be approximately five to ten feet apart. The height of vineyards is shorter than orchards. The orchard and vineyard areas will be neat and uniform. Orchard areas typically are formed as square plots of land, whereas vineyard plots typically form two sections on a similar-sized plot of land. In many cases orchards occur within electrical transmission line rights-of-way. It is important to use stereo viewing, to avoid confusing vineyards with row crops.

2300 NURSERIES

2300 Nurseries
This category includes land managed for the production of ornamental trees, plants and flowers, vegetable seedlings, seed farms, sod farms, and wholesale greenhouses.

Nurseries typically appear similar to row crops in configuration. The photo signature, however, reveals that it is an area of non-uniformity, where a few rows appear similar, then the next few rows are of a different type of plant, and so on. Trees may occur in some rows, then plants in the next section. Greenhouses or hot houses may also occur in some row areas, or in separate areas altogether. Greenhouses typically appear as long narrow structures abutting each other with steeply pitched roofs. Together the roofs give an accordion effect.

In many cases nurseries occur within electrical transmission line rights-of-way. Also included in this
category are Christmas tree farms, which appear on the photo as groves with uneven spacing, smaller crown cover, and open space between the trees. On the aerial photo, sod farms appear similar to pasture or field crop; therefore, some field verification is necessary. Abandoned greenhouse structures are mapped as 2300.

2400 DAIRY AND INTENSIVE LIVESTOCK, AND ASSOCIATED FACILITIES

2400 Dairy and Intensive Livestock, and Associated Facilities
This category includes large, specialized livestock and other specialty farms. These areas have a high concentration of animal population in a relatively small area. This class includes beef cattle feed lots, dairies, hog farms, and goat farms.

Livestock feedlots and dairies appear similar in that both contain a series of small fenced areas with a very high concentration of animals. Dairies contain simple rectangular shade structures that are evenly and widely spaced over the area. Structures for protecting stored hay bales may be present. Dairies also contain structures used for milking.

Both feedlot and dairies contain fenced areas with a very dark to black photo signature representing dung piles. Large fertilizer mounds associated with dairies are mapped as 2600. Pasture and field crop adjacent to and associated with dairies are mapped as 2110. Abandoned dairy structures are mapped as 2400.

2500 POULTRY OPERATIONS

2500 Poultry Operations
This category includes poultry operations such as chicken, turkey, and egg farms.

Poultry farms typically contain a series of long, narrow enclosed structures in a parallel, side-by-side configuration. The photo signature shows each structure as having a white pitched roof, typically with air conditioning units. Grain feed storage structures may be located at the ends of the building. One to ten structures may occur in each group. Major poultry manure spreading grounds are coded 2600.

2600 OTHER AGRICULTURE
2600 Other Agriculture

This category includes other miscellaneous agricultural facilities not described in the agricultural categories above. These facilities include storage facilities, dairy fertilizer piles, poultry manure spreading grounds, hydroponic farms, fish hatcheries, apiaries, and worm farms. Also included are backyard lots of mixed agricultural/non-agricultural use that meet the MMU.

Storage facilities can include isolated barns, or other structures located in, or adjacent to an agricultural area. Also included are small plots of land where heavy equipment or machinery is stored within the agricultural field area. Fish hatcheries may be identified on the basemap or on the collateral maps. Typically they appear as a series of small square or rectangular ponds adjacent to several small buildings. Track ovals not associated with a horse ranch are coded 2600. Backyard agriculture may include improved pastures, barns, and/or corrals. These areas are mapped as part of the residential class if the land use is less than 2.5 acres in size.

2700 HORSE RANCHES

2700 Horse Ranches

This category includes commercial and non-commercial horse ranches, stables, tracks, barns, and corral areas, and improved pastureland. The 2700 class also includes backyard horse facilities, i.e. track ovals, walking rings, stables, barns, etc., that meet the MMU. Horse racing track facilities are mapped as Commercial Recreation (code 1232).

Stables appear as one or more long, narrow buildings within a farm complex, adjacent to pastures (irrigated pastures are coded as 2110). Horse tracks are large dirt oval tracks located at the horse ranches. Track ovals not associated with a horse ranch are coded 2600. Corral areas, included horse corrals associated with residential areas, are coded 2700. Improved pasture areas are fenced, containing water troughs, and possibly shade structures or enclosures. Improved pastures differ from fenced rangeland in that pasture contains smaller fenced areas, typically with individual enclosures of less than one hundred acres. Horse ranches may also occur within electrical transmission line rights-of-way.

3000 VACANT

Vacant areas include land that has not been built-up with man-made structures, and contains no agriculture or
waterbody. The area is open, containing natural or disturbed natural vegetation. Rangeland is included in this category. Areas containing abandoned structures are mapped as their previous use.

3100 Vacant Undifferentiated
This category represents most occurrences of vacant land.

This class does not include vacant lots in urbanized areas (see code 1900), although terraced erosion control embankments are included. Also included in this category are road cuts. Undeveloped areas of parks are also included. Most vacant land is in a natural state, containing tree, brush/shrub, and/or grassland vegetation. No or few significant structures or improvements are present. Rangeland may be open land or fenced over large areas. Rangeland vegetation may be no different than open vacant land, or may contain grassland for grazing livestock. Eucalyptus groves are also included.

3200 Abandoned Orchards and Vineyards
This category includes orchards and vineyards, formerly productive, now abandoned and not in commercial production.

Abandoned orchards and vineyards may contain successional or weedy vegetation between the rows. The photo signature may show and the field check may verify an unkept condition. Many trees or vine plants may be dead, or totally removed. If a significant number of trees remain on the lot, then the polygon is coded 3200. If most trees have been removed, then the polygon is mapped as Urban Vacant (code 1900) or Vacant Undifferentiated (code 3100).

3300 Vacant With Limited Improvements
This category includes areas where streets have been laid in a subdivision pattern, but no further building or improvements have occurred over time.

Typically, the photo will show a network of streets, dirt or paved, but with no structures. The lots will be vacant, with natural vegetation.

3400 Beaches (Vacant)
This category is used for vacant coastal beach areas not associated with a national, state, county, or municipal beach park.

The photo shows a white to tan signature of the sand area. The collateral data does not show these areas to be beach parks.
4000 WATER

Water includes open water bodies which are greater than 2.5 acres in size.

4100 Water, Undifferentiated
This category includes all open water bodies greater than 2.5 acres in area not associated with water storage; and all water bodies associated with water storage that are greater than 5 acres in size. Included in this class are oceans, lakes, reservoirs, golf course ponds, rivers, estuaries, and channels. The water must occur perennially.

Water body delineations follow those depicted on the 7.5 minute U.S.G.S. topographic quadrangles, unless the configuration of the water body has changed significantly. Water bodies at low water levels are mapped at their normal levels to account for drought years. The photo signature for water is blue to dark blue.

4200 Harbor Water Facilities
This category includes the water portion of harbor facilities. These include the slips and berths where the ships load and unload, the shipping channels, and outer harbor area within the outer jetty.

4300 Marina Water Facilities
This category includes the water portion of marina facilities composed primarily of the boat mooring areas. The aerial photo will show an area of buoys or anchorages where the small pleasure boats moor or "park".

4400 Water Within a Military Installation
This category includes all water bodies within a Military Installation of 2.5 acres or larger in size.

4500 Area of Inundation (High Water)
This category includes the areas of water inundation. This occurs at the Salton Sea and includes the area from the basemap's designated shoreline to the 1990 shoreline as shown on the aerial photo. This situation also occurs at Lake Skinner where the 1990 shoreline is greater than the basemap shoreline.

9999 No Photo Coverage
Areas in which no photo coverage was available for land use mapping in the study. Lack of coverage
was usually due to air space restrictions near military reservations.
Appendix C

Statistical Breakdown of Parcels by Land Use Code
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Number of Parcels</th>
<th>Acreage of Parcels</th>
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<tr>
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<td>Baldwin Park</td>
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Appendix D

USGVMWD Indirect Reuse Plan Memorandum
DATE: November 14, 2011
TO: Water Policy Committee
FROM: General Manager
SUBJECT: Adopt the Indirect Reuse Action Plan and direct staff to perform Tasks 1-7.

Recommendation

It is recommended that the Board adopt the Indirect Reuse Action Plan (IRAP) and direct staff to perform Tasks 1 through 7 of the IRAP (attached).

Background

Upper District is following a common project life cycle process to implement a project to use highly treated recycled water for groundwater recharge. The project life cycle includes: identification of alternatives; permitting; environmental; design; financing; public outreach and construction.

A recently completed alternatives analysis concluded that the use of highly treated recycled water from the Los Angeles County Sanitation District’s San Jose Creek Wastewater Treatment Plant (Plant) is the most feasible means of using recycled water on a large scale to reduce the Main San Gabriel Basin’s (Basin) dependence on increasingly expensive imported water.

Upper District is preparing an Integrated Resources Plan (IRP) that will identify the most appropriate portfolio of reliable cost effective water supplies including: conservation; recycled water (direct and indirect reuse); transfers; storage; and imported water from the Metropolitan Water District (Metropolitan). Because the alternative analysis demonstrated that available treatment technologies for an indirect reuse project are economically feasible compared to the rising cost of imported water, it is appropriate to move forward with certain tasks while the IRP is being prepared. The Indirect Reuse Action Plan (IRAP) tasks will complement and improve the results of the IRP by reducing uncertainty regarding the delivery of highly treated recycled water for groundwater recharge.

The IRAP identifies the tasks required to fully develop a detailed understanding of how specifically to permit, construct, operate and pay for an advanced treatment facility that will produce highly treated recycled water for groundwater recharge (indirect reuse) in the Basin. The IRAP focuses on project tasks that will be undertaken in the next 18 months. The IRAP will serve as a working document that will be used to track progress and discuss alternative approaches as changed conditions warrant.
IRAP tasks and the questions they will answer include:

- Task 1: Coordinate with partner agencies.
  - Are any improvements needed to the contract for recycled water with Los Angeles County Sanitation District (LACSD)?
  - How much will LACSD charge Upper District for tertiary recycled water?
  - How much will LACSD charge Upper District for brine disposal fees?
  - How much will LACSD charge Upper District to lease land for a pump station?
  - Will the Army Corps of Engineers (ACE) provide a permit to Los Angeles County Flood Control District (LAFCD) for use of the Santa Fe Dam Spillway area and drop structures in the San Gabriel River for recharge of recycled water?
  - How will the recharge of recycled water impact Los Angeles County Flood Control District (LAFCD) recharge operations?

- Task 2: Finalize land and right of way requirements.
  - Exactly where will a treatment facility be located?
  - Where will the pipeline alignment be?
  - What arrangements need to made with the owners of land?

- Task 3: Optimize the treatment technology.
  - What specific treatment technologies will be used to ensure the most effective delivery of indirect reuse for groundwater recharge?

- Task 4: Document regulatory compliance strategy.
  - How will the combination of the selected treatment technologies and management of the Basin meet the Basin Management Plan and regulatory requirements for water quality?

- Task 5: Estimate project cost.
  - What is the capital cost of the project?
  - What are the operating costs?

- Task 6: Evaluate project economics and identify funding alternatives.
  - How does the capital and operating cost of the project compare to the future cost of imported water?
  - What alternative financing strategies can be used to pay for the project?
  - Will the groundwater producers pay for the project?

- Task 7: Prepare IRAP Report.
  - Documents the answers to all the above questions.
The IRAP tasks will be completed by July 2013 and are estimated to cost about $1 million. The tasks will be funded by revenue generated from water rates.

If the Board determines that the IRAP Report adequately answers all the above questions, then the Board can confidently invest additional ratepayer dollars into project completion work tasks including:

- Regional Water Quality Control Board (RWQCB) approval and permit
- Public outreach
- Implement funding plan
- Environmental documentation
- Obtain right-of-way
- Preliminary design
- Final design
- Construction
- Operations
DRAFT
INDIRECT REUSE
ACTION PLAN

NOVEMBER 2011
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ACTION PLAN PURPOSE

Upper District is following a common project life cycle process to implement a project to use highly treated recycled water for groundwater recharge. The project life cycle includes: identification of alternatives and selection of a preferred alternative; permitting; environmental; design; financing; public outreach and construction.

A recently completed alternatives analysis concluded that the use of highly treated recycled water from the Los Angeles County Sanitation District's San Jose Creek Wastewater Treatment Plant (Plant) is the most feasible means of using recycled water on a large scale to reduce the Main San Gabriel Basin's (Basin) dependence on increasingly expensive imported water.

Upper District is preparing an Integrated Resources Plan (IRP) that will identify the most appropriate portfolio of reliable, cost-effective water supplies including: conservation; recycled water (direct and indirect reuse); transfers; storage; and imported water from the Metropolitan Water District (Metropolitan). Because the alternative analysis demonstrated that available treatment technologies for an indirect reuse project are economically feasible compared to the rising cost of imported water, it is appropriate to move forward with certain tasks while the IRP is being prepared. The (Indirect Reuse Action Plan (IRAP) tasks will complement and improve the results of the IRP by reducing uncertainty regarding the delivery of highly treated recycled water for groundwater recharge.

The IRAP identifies the tasks required to fully develop a detailed understanding of how specifically to permit, construct, operate and pay for an advanced treatment facility that will produce highly treated recycled water for groundwater recharge (indirect reuse) in the Basin. The IRAP focuses on project tasks that will be undertaken in the next 18 months. The IRAP will serve as a working document that will be used to track progress and discuss alternative approaches as changed conditions warrant.
IRAP tasks and the questions they will answer include:

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  - How much will LACSD charge Upper District for tertiary recycled water?
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  - How will the recharge of recycled water impact Los Angeles County Flood Control District (LAFCD) recharge operations?

- **Task 2: Finalize land and right of way requirements.**
  - Exactly where will a treatment facility be located?
  - Where will the pipeline alignment be?
  - What arrangements need to be made with the owners of land?

- **Task 3: Optimize the treatment technology.**
  - What specific treatment technologies will be used to ensure the most effective delivery of indirect reuse for groundwater recharge?

- **Task 4: Document regulatory compliance strategy.**
  - How will the combination of the selected treatment technologies and management of the Basin meet the Basin Management Plan and regulatory requirements for water quality?
• Task 5: Estimate project cost.
  o What is the capital cost of the project?
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• Task 6: Evaluate project economics and identify funding alternatives.
  o How does the capital and operating cost of the project compare to the future cost of imported water?
  o What alternative financing strategies can be used to pay for the project?
  o Will the groundwater producers pay for the project?

• Task 7: Prepare IRAP Report.
  o Documents the answers to all the above questions.

The IRAP tasks will be completed by July 2013 and are estimated to cost about $1 million. The tasks will be funded by revenue generated from water rates.

If the Board determines that the IRAP Report adequately answers all the above questions, then the Board can confidently invest additional rate payer dollars into project completion work tasks including:

• Regional Water Quality Control Board (RWQCB) approval and permit
• Public outreach
  ▪ Implement funding plan
  ▪ Environmental documentation
  ▪ Obtain right-of-way
  ▪ Preliminary design
  ▪ Final design
  ▪ Construction
  ▪ Operations
PROJECT DESCRIPTION

Upper San Gabriel Valley Municipal Water District (Upper District) is identified in the Main San Gabriel Basin Judgment (Judgment) as a Responsible Agency for the delivery of supplemental water to replenish the Main San Gabriel Basin (Main Basin). Supplemental water is water that is non-tributary to the San Gabriel River watershed and includes recycled water. Management of the Main Basin is predicated on the long-term reliable supply of supplemental water. Consequently, Upper District is responsible for developing projects to reduce dependence on increasingly expensive imported water supplies including the use of recycled water to replenish the Main San Gabriel Basin.

Upper District has a contract with the LACSD for 8,000 acre-feet per year of tertiary water from LACSD’s Plant. The San Gabriel Valley Municipal Water District (SGVMWD) also has a contract with LACSD for an additional 2,000 acre-feet per year.

The application of additional treatment to the tertiary recycled water will include a combination of treatment optimization for microfiltration (MF), reverse osmosis (RO) and may include other technologies such as ozone, ultra violet light and biologically activated carbon (BAC). The preferred combination of technologies and their order (treatment train) will be developed to meet specific water quality objectives and the Basin Management Plan.

Other proposed facilities associated with the project include a 6-mile transmission pipeline along the San Gabriel River and at least one pump station. The pump station(s) will convey advanced treated recycled water to the initial replenishment area located in the San Gabriel River between Santa Fe Dam and Lower Azusa Road.
Figure 1 illustrates the general project area and outlines the general location of facilities to be constructed. Figure 1 also illustrates potential future storm water capture projects that could be used in conjunction with the Project.

Figure 1. General Project Area.

PROJECT SCHEDULE

A project schedule has been developed (see Figure 1) to identify the timeframe necessary to complete the Project. Figure 2 below summarizes the tasks in two major categories. The first category, "Immediate Work Tasks" are necessary to answer the above fundamental questions. These tasks will answer questions about permitting, construction and financing. The Immediate Work Tasks will be completed in mid 2013. "Project Completion Work Tasks" illustrate the overall schedule of bringing a project to completion. These tasks will not begin until mid 2013, once the IRAP report is
completed that identifies the specific technology train, regulatory compliance, and project objectives necessary for the completion of the full scale project design and construction. The IRAP report will further define the necessary project completion work tasks.

Figure 2. Indirect Reuse Project Schedule

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PRELIMINARY PROJECT COSTS

Preliminary estimates of the total project costs is about $100 million, or twice the direct reuse program currently underway. The immediate work tasks are estimated to cost about 10 percent, or $1 million of the total project cost.

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<tr>
<td>CDPH / RWQCB Approval</td>
<td>300,000</td>
</tr>
<tr>
<td>Obtain Right of Way</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Preliminary Design</td>
<td>1,400,000</td>
</tr>
<tr>
<td>Final Design</td>
<td>5,000,000</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Construction</td>
<td>90,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$100,890,000</strong></td>
</tr>
</tbody>
</table>

**IMMEDIATE WORK TASKS BUDGET**

Figure 4. Immediate Work Tasks Budget

<table>
<thead>
<tr>
<th>Task 1</th>
<th>Agency Coordination</th>
<th>50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 2</td>
<td>Land And Right of Way Requirements</td>
<td>40,000</td>
</tr>
<tr>
<td>Task 3</td>
<td>Regulatory Compliance (CDPH)</td>
<td>435,000</td>
</tr>
<tr>
<td>Task 4</td>
<td>Optimization of Treatment Technologies</td>
<td>450,000</td>
</tr>
<tr>
<td>Task 5</td>
<td>Project Cost Estimate</td>
<td>30,000</td>
</tr>
<tr>
<td>Task 6</td>
<td>Funding Plan</td>
<td>20,000</td>
</tr>
<tr>
<td>Task 7</td>
<td>Preliminary Project Report</td>
<td>15,000</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>$1,040,000</strong></td>
</tr>
</tbody>
</table>

**IMMEDIATE WORK TASKS DESCRIPTION**

**TASK 1  Coordinate with partner agencies.**

Upper District needs to partner and coordinate immediate activities with LACSD, Watermaster, LACDPW and USACE to support the development of the Project. This task provides funds to improve the recycled water contract with LACSD as necessary, develop cost estimates for the tertiary water and the cost of operating and maintaining the Project facilities, and the costs of brine disposal.
This task also includes funds to develop a proposed plan of operations, working closely with LACFCD and the USACE. Coordination with these entities will help facilitate the development of a blending plan to define the points of replenishment within the flood control system, and ensure that the project meets the regulatory requirements of the project. Coordination with Watermaster to ensure all planning objectives are met will also be included in this task. More specific scope of work items necessary for the completion of this task are summarized below.

**TASK 2  Finalize land and right of way requirements.**

There is a long lead time involved with land and right of way acquisition for conveyance projects of this magnitude. This task funds the identification of specific pipeline alignment easement and right of way requirements by parcel that must be obtained from property owners. Additionally, several treatment plant locations will be investigated to identify ownership and costs associated with land acquisition as necessary for the treatment footprint. This task is time sensitive and may drive the timing of the final design for the project.

**TASK 3  Optimize Treatment Technologies.**

This task will allow Upper District to partner with the water reuse industry leaders and regulatory agencies to research and demonstrate the most effective treatment train directly applicable to the source water for the Project that will minimize brine discharge while lowering capital and operational expenditures. This task will include pilot scale testing of proven and emerging technologies, teaming with regulatory agencies to develop specific regulatory goals, and developing a recommendation on the technology train for the full scale project that accommodates the regulatory objectives.
**TASK 4  Document Regulatory Compliance Strategy.**

Upper District has engaged with CDPH and the Regional Board to better understand the requirements specific to groundwater replenishment. Part of the requirements for a successful compliance strategy requires water quality data collected at key locations as dictated and required by the regulatory agencies. Additionally, an assimilative analysis must be completed to demonstrate that the Project will meet the basin management objectives. This task will fund the continued background monitoring water quality testing and develop an assimilative analysis with the data collected. A final engineering report will be completed and submitted to the regulatory agencies for consideration.

**TASK 5  Estimate Project Cost.**

As we continue to develop the Project, revised project costs will be critical to the funding plan. Currently, the Upper District is working with cost estimates compiled in recent reports. However, as the project continues to evolve with perhaps alternative treatment technologies, a revised set of costs estimates is necessary for the Board's consideration when evaluating the timing of delivering the full scale design and construction. Based on the initial results of Tasks 1-4, this task will estimate capital costs, operations costs, and maintenance costs for the project.

**TASK 6  Funding Plan**

The prior Task 5 will roll up right into this which prepares a funding plan by evaluating the project economics and alternative financing strategies. Once the project costs have been developed, we will evaluate the various funding mechanisms to deliver a project of this magnitude. This task will identify the funding opportunities via loans, grants, MWD LRP funding, Watermaster financing, producer financing, public private partnerships, or
other means to secure the appropriate level of funding resources to complete this project.

**TASK 7  Prepare IRAP Report.**

This task takes all the information gathered from all of the above tasks and compiles the findings in a detailed Indirect Reuse Action Plan Report. The report will be completed in July 2013, after several other plans including the IRP, LAIRWMP and the WUE Plan. By this time, the Board will have a complete road map and sufficient financial and technical information to determine the schedule of delivery of the final full scale project.
Appendix E

2011 VCWD Water Quality/Consumer Confidence Report
### 2011 VALLEY COUNTY WATER DISTRICT DRINKING WATER QUALITY

<table>
<thead>
<tr>
<th>Chemical/Bacteria</th>
<th>Chemical</th>
<th>MCL</th>
<th>PHG (MCLG)</th>
<th>Average Amount</th>
<th>Range of Detection</th>
<th>Number of Sites</th>
<th>AL Violation?</th>
<th>Typical Source of Contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INORGANIC CHEMICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate (ppm)</td>
<td>10</td>
<td>NA</td>
<td>11 – 21</td>
<td>No</td>
<td>2011 Runoff/leaching from natural deposits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorate (ppm)</td>
<td>2</td>
<td>NA</td>
<td>0 – 12</td>
<td>No</td>
<td>2011 Runoff/leaching from natural deposits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorite (ppm)</td>
<td>0.3</td>
<td>NA</td>
<td>0.1 – 3</td>
<td>No</td>
<td>2011 Runoff/leaching from natural deposits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*NH4⁺/NO₂⁻ (ppm)</td>
<td>40</td>
<td>40</td>
<td>32 – 48</td>
<td>NA</td>
<td>2011 Leaching from fertilizer use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*NH₃ (ppm)</td>
<td>4</td>
<td>40</td>
<td>32 – 48</td>
<td>NA</td>
<td>2011 Leaching from fertilizer use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SECONDARY DRINKING WATER STANDARDS: Aesthetic Standards, Not Health-Related</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>5</td>
<td>NA</td>
<td>10 – 20</td>
<td>No</td>
<td>2009 Runoff/leaching from natural deposits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coliform Bacteria** (% Positive)</td>
<td>5 (MCLG = 0)</td>
<td>No</td>
<td>Naturally present in the environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Trihalomethanes (ppb)*</td>
<td>80</td>
<td>No</td>
<td>Byproduct of chlorine disinfection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Haloacetic Acids (ppb)</em></td>
<td>60</td>
<td>No</td>
<td>Byproduct of chlorine disinfection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### LEAD AND COPPER CONCENTRATIONS AT RESIDENTIAL TAPS

<table>
<thead>
<tr>
<th>Site</th>
<th>Lead ppm</th>
<th>Copper ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>0.29</td>
<td>3.9</td>
</tr>
<tr>
<td>Site 2</td>
<td>0.20</td>
<td>3.9</td>
</tr>
<tr>
<td>Site 3</td>
<td>0.33</td>
<td>3.9</td>
</tr>
</tbody>
</table>

### SECONDARY MCLs

Secondary MCLs are set to protect the aesthetic, taste, and appearance of drinking water.

### DISTRIBUTION SYSTEM WATER QUALITY

<table>
<thead>
<tr>
<th>Chemical/Bacteria</th>
<th>Chemical/Bacterium (MRDL/MRL/DL)</th>
<th>Results</th>
<th>Range of Detection</th>
<th>Number of Sites</th>
<th>AL Violation?</th>
<th>Typical Source of Contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pathogens</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. coli (E. coli)</td>
<td>E. coli (E. coli)</td>
<td>99%</td>
<td>1 – 10,000</td>
<td>No</td>
<td>2011 No bacterial growth in water</td>
<td></td>
</tr>
<tr>
<td><em>H. pylori (Bacillus cereus)</em></td>
<td><em>H. pylori (Bacillus cereus)</em></td>
<td>50%</td>
<td>0.5 – 0.3</td>
<td>No</td>
<td>2011 No bacterial growth in water</td>
<td></td>
</tr>
<tr>
<td>Chlorine Residual (ppm)</td>
<td>Chlorine Residual (ppm)</td>
<td>0.2 – 0.6</td>
<td>No</td>
<td>2011 Chlorine disinfection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DISTRIBUTION SYSTEM WATER QUALITY

<table>
<thead>
<tr>
<th>Chemical/Bacteria</th>
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<th>Results</th>
<th>Range of Detection</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Pathogens</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. coli (E. coli)</td>
<td>E. coli (E. coli)</td>
<td>99%</td>
<td>1 – 10,000</td>
<td>No</td>
<td>2011 No bacterial growth in water</td>
<td></td>
</tr>
<tr>
<td><em>H. pylori (Bacillus cereus)</em></td>
<td><em>H. pylori (Bacillus cereus)</em></td>
<td>50%</td>
<td>0.5 – 0.3</td>
<td>No</td>
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<tr>
<td>Chlorine Residual (ppm)</td>
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<td>0.2 – 0.6</td>
<td>No</td>
<td>2011 Chlorine disinfection</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Water utilities in California have provided an annual report to their customers since 1901, which summarizes the prior year’s water quality and explains important issues regarding their drinking water. In 1995, the United States Congress reauthorized the Safe Drinking Water Act (SDWA), which was originally passed in 1974 and later amended in 1986. The 1993 amendments called for the enhancement of nation-wide drinking-water regulations to ensure public health and safety, as well as to provide for the better protection and public information. This yearly water quality report covers water quality testing from calendar year 2011 and has been prepared in compliance with the consumer right-to-know regulations required by the SDWA 1993 amendments.

The United States Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH) are the public agencies responsible for drafting and implementing regulations that ensure your tap water is safe to drink. USEPA and CDPH establish drinking water standards that limit the amount of contaminants in water provided to the public. CDPH also establishes water quality standards for bottled water that provide for the same protection of health.

**Source of Supply**

Valley County Water District’s water supply comes from groundwater wells located in the Main San Gabriel Groundwater Basin. However, as a result of historic industrial discharges, several of Valley County Water District’s groundwater wells are contaminated and have been taken out of service. Water treatment facilities have been constructed at Valley County Water District to clean up groundwater contamination.

**Drinking Water Source Assessment**

In accordance with the federal Safe Drinking Water Act, an assessment of the drinking water sources for Valley County Water District was completed in December 2002. The purpose of the drinking water source assessment is to provide source water protection by identifying types of activities in the proximity of the drinking water sources that may come in contact with the water. The outcomes of the assessment that Valley County Water District’s sources are considered most vulnerable to the following activities or facilities associated with contaminants detected in the water supply: gas/oil/other/chemical production and storage, automobile repair shops, wastewater treatment plants, landfills, and mining activities.

In addition, the sources are considered most vulnerable to other contaminants that may come from sewage treatment plants, septic systems, cattle grazing, agriculture, terrestrial and aquatic runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.

Contaminants that may be present in source water include:

- **Microbial contaminants**, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
- **Inorganic contaminants**, such as salts and metals, that can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, and agricultural activities.
- **Pesticides and herbicides**, that may come from a variety of sources such as agriculture, urban stormwater runoff, and residential use.
- **Reductive contaminants**, that can be naturally-occurring or can be the result of oil and gas production and mining activities.

Organic chemical contaminants, including synthetic and volatile organic chemicals, that are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, agricultural application and septic systems.

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 water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA’s Safe Drinking Water Hotline (1-800-426-4711) or visit USEPA’s Office of Ground Water and Drinking Water at www.epa.gov/safewater/ or visit the CDPH website at www.cdph.ca.gov/DrinkingWater.

**Immuno-compromised people**

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

**Nitrates**

Nitrates in your tap water may have exceeded one-half the NCL in 2011, but it was never greater than the MCL. Nitrates in drinking water at levels above the MCL of 45 parts-per-million (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 levels above 45 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 health care provider.

**About Lead in Tap Water**

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Level in drinking water is primarily from materials and components associated with service lines and home plumbing. Valley County Water District 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 to 2 seconds 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 what to do if the level is high can be obtained from Safe Drinking Water Hotline or at www.epa.gov/safewater/lead.

**Water Quality Standards**

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

**Drinking water standards established by USEPA and CDPH set limits for substances that may affect consumer health or aesthetic qualities of drinking water.** The chart in this report shows the following five 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 to protect the consumer health aesthetic qualities of drinking water. The chart in this report shows the following five types of water quality standards.
- **Maximum Contaminant Level Goal (MCLG):** The value of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by USEPA.
- **Maximum Residual Disinfectant Level (MRDL):** This value is a level of a disinfectant in drinking water that is necessary for control of microbiological contaminants. It may also be set to protect the odor, taste, and appearance of drinking water.
- **Radioactive Contaminants:** This value is a level of a disinfectant in drinking water that is necessary for control of microbiological contaminants. It may also be set to protect the odor, taste, and appearance of drinking water.
Appendix F

CDPH Disinfectant Byproducts Initial Statement of Reasons  
(DPH-09-004)
Initial Statement of Reasons
Disinfectant Residuals, Disinfection Byproducts, and Disinfection Byproduct Precursors
Title 22, California Code of Regulations

All suppliers of domestic water to the public are subject to regulations adopted by the U.S. Environmental Protection Agency (EPA) under the Safe Drinking Water Act of 1974, as amended (42 U.S.C. § 300f et seq.), as well as by the California Department of Public Health (Department) under the California Safe Drinking Water Act (Health & Saf. Code, div. 104, pt. 12, ch. 4, § 116270 et seq). California has been granted primary enforcement responsibility, (“primacy”) by U.S. EPA for public water systems in California. California has no authority to enforce federal regulations, but only state regulations. Federal law and regulations require that California, in order to receive and maintain primacy, promulgate regulations that are no less stringent than the federal regulations. Pursuant to Health and Safety Code sections 116350, 116375, 131052, and 131200, the California Department of Public Health (Department) has authority to adopt the subject regulations.

On January 4, 2006, the U.S. EPA promulgated the Stage 2 Disinfectants and Disinfection Byproducts Rule (S2DDBPR) (71 Fed. Reg. 388; amended Jan. 27, 2006, 71 Fed. Reg. 4644, June 29, 2006, 71 Fed. Reg. 37168, and June 29, 2009, 74 Fed. Reg. 30953), as required by the Safe Drinking Water Act Amendments of 1996 (SDWAA), which provides increased public health protection by reducing the potential risk of adverse health effects associated with Total Trihalomethanes (TTHM) and five Haloacetic Acids (HAA5) throughout the distribution system. The S2DDBPR applies to community water systems and nontransient noncommunity water systems using a primary or residual disinfectant other than ultraviolet light or delivering water that has been treated with a primary or residual disinfectant other than ultraviolet light.

This rule builds on the Stage 1 Disinfectants and Disinfection Byproducts Rule (S1DDBPR) by focusing on monitoring for and reducing concentrations of TTHM and HAA5 in drinking water. The S2DDBPR requires some systems to complete an Initial Distribution System Evaluation (IDSE) to characterize TTHM and HAA5 levels in their distribution system and identify locations to monitor TTHM and HAA5 for S2DDBPR compliance. The S2DDBPR bases TTHM and HAA5 compliance on a locational running annual average (LRAA) calculated at each monitoring location.

In 2003, California Assembly Bill 1757 was chaptered, which repealed the Permit Reform Act (PRA) of 1981, which consisted of sections 15374 – 15378 of the Government Code. The PRA of 1981 required the Department to adopt regulations that include procedures for considering and issuing permits, most notably including (1) setting of time from receipt of permit application to notification Department that application was complete, (2) setting of time from completion of an application for Department to make a decision on the permit, and (3) listing of minimum, median, and maximum processing times for permits. With the PRA requirements no longer in place, the current proposed rulemaking will repeal regulations adopted in conformance with the PRA of 1981.
On June 17, 2006, and September 1, 2006, the Department’s regulations concerning Disinfectants/Disinfection Byproducts in Drinking Water (R-62-00) and Public Notification of Drinking Water Violations (R-59-01) became effective, respectively. As both regulations were in the rulemaking process concurrently, not all of the federal Public Notification Rule (65 Fed. Reg. 25982 (May 4, 2000)) requirements could be included in the Department’s public notification regulations. The proposed rulemaking will include the remaining public notification and consumer confidence report requirements from the federal Public Notification Rule that relate to the federal S1DDBPR. The proposed rulemaking will also include, for clarity, a provision from the federal S1DDBPR on monitoring violations.

California currently requires community water systems and nontransient noncommunity water systems to monitor for TTHM and HAA5 in the distribution system, if the water systems (1) treat their water with a chemical disinfectant in any part of the treatment process or (2) provide water containing a chemical disinfectant. (Cal. Code Regs., tit. 22, div. 4, ch. 15.5, § 64530 et. seq).

Pursuant to federal primacy requirements and sections 116350, 116375, 131052, and 131200 of the Health and Safety Code, the Department proposes the below noted changes to title 22. In addition to these changes, the Department proposes a number of non-substantive changes, which are not described in detail below due to their minor nature. The non-substantive changes are to correct capitalization, grammar, punctuation, spacing, and use of acronyms, plurals, and italics; redesignate subsections and paragraphs; update reference to the outdated phrase “California Administrative Code”; and update or delete reference to outdated division, part, chapter, group, article, section, and table numbers.

**Chapter 1, Article 1**
- Amend section 60001 (Department) to provide an alternate spelling of “Department” used in new and revised regulations and update the name of the state regulating agency.
- Amend section 60003 (Director) to update the name of the state regulating agency.

**Chapter 1, Article 2**
- Adopt article 2 (Monitoring and Reporting Requirements – Scope) and section 60098 (Monitoring and Reporting Requirements) to clarify what regulatory requirements are included in section 116275(c)(3) as monitoring and reporting violations.

**Chapter 4, Article 3**
- Repeal section 60430 (Processing Time) to conform to the repeal of the PRA of 1981.
Chapter 13, Article 3
- Amend section 63790 (Examination Scheduling and Application Processing) to conform to the repeal of the PRA of 1981 and provide a title that is more descriptive and appropriate for the section.
- Amend section 63835 (Certification and Renewal Application Processing) to conform to the repeal of the PRA of 1981, clarify existing language, and provide a title that is more descriptive and appropriate for the section.

Chapter 14, Article 1
- Amend section 64001 (Water Permit Application) to conform to the repeal of the PRA of 1981 and establish permit submittal requirement for a permit or amended permit.
- Repeal section 64002 (Processing Time) to conform to the repeal of the PRA of 1981 and delete obsolete language.

Chapter 14, Article 3
- Amend section 64211 (Permit Requirement) to conform to the repeal of the PRA of 1981.
- Amend section 64213 (Chemical Quality Monitoring) to update a reference to approved analytical methods for volatile organic chemical analysis.

Chapter 14, Article 4
- Amend section 64252 (Primacy Delegation Application) to (1) require Local Primacy Agencies (LPAs) to include in their application (a) the compliance status of water systems with chapter 15.5 and (b) an annual workplan, (2) delete obsolete language, and (3) conform to the repeal of the PRA of 1981.
- Amend section 64254 (Permits) to require LPAs to include compliance with chapter 15.5 during permit issuance.
- Amend section 64256 (Sampling and Monitoring) to ensure LPAs require water systems to comply with monitoring requirements of chapter 15.5.
- Amend section 64257 (Reporting) to require LPAs to report compliance of water systems with chapter 15.5.
- Amend section 64258 (Enforcement) to require LPAs to enforce chapter 15.5.

Chapter 15, Article 1
- Adopt sections 64400.05 (Combined Distribution System), 64400.29 (Consecutive System), 64400.36 (Dual Sample Set), 64400.41 (Finished Water), 64400.66 (Locational Running Annual Average or LRAA), 64400.90 (Operational Evaluation Levels or OEL), 64402.30 (Wholesale System) to add necessary definitions.
- Amend section 64400.45 (GAC10) to revise the definition of GAC10 and clarify the monitoring frequency.
- Adopt 64400.46 (GAC20) to add a necessary definition and clarify the monitoring frequency.
Chapter 15, Article 2
- Amend section 64415 (Laboratory and Personnel) to clarify who may perform required analyses, sample collection, and field tests; allow the use of methods for unique California-only regulated contaminants; and provide needed flexibility in the event the Department determines a U.S. EPA approved method is unacceptable.

Chapter 15, Article 4.5
- Repeal section 64439 (Trihalomethanes Requirements) to eliminate obsolete requirements; TTHM is now regulated under chapter 15.5.

Chapter 15, Article 18
- Amend section 64463.1 (Tier 1 Public Notice) to include notification of chlorite maximum contaminant level (MCL) and chlorine dioxide maximum residual disinfectant level (MRDL) violations. The U.S. EPA currently requires Tier 1 and Tier 2 public notification for violation of the chlorine dioxide MRDL and Tier 2 public notification for violation of the chlorite MCL. Chlorite is a degradation product of chlorine dioxide. The federal maximum residual disinfectant level goal for chlorine dioxide is 0.8 mg/L, the same as the maximum contaminant level goal for chlorite. The listed endpoints of concern for both are the neurodevelopmental effects associated with short-term exposures. As chlorine dioxide and chlorite have the same acute health effects, the Department believes that the response to excess chlorite in drinking water should not be less stringent than that for chlorine dioxide.
- Amend section 64463.4 (Tier 2 Public Notice) to include notification of MRDL violations and chapter 15.5 monitoring and testing procedure violations.
- Repeal section 64468.5 (Health Effects Language – Disinfectants and Disinfection Byproducts) to delete obsolete language; health effects language for disinfectants and disinfection byproducts is now regulated in appendix 64465-G.

Chapter 15, Article 19
- Amend section 64470 (Record Maintenance) to use the term “microbiological” in lieu of “bacteriological” and require recordkeeping for turbidity analyses and monitoring plans.

Chapter 15, Article 20
- Amend section 64481 (Content of the Consumer Confidence Report) to (1) revise the definition of primary drinking water standard; add definitions for MRDL and MRDL goal; require reporting of chapter 15.5 detected contaminants; revise the type of information to be reported in the table of detected contaminants; clarify reporting of recycled provisions violations; use the phrase “California Department of Public Health” in lieu of “State Department of Health Services”; and delete references to obsolete federal requirements, (2) appendix 64481-A (Typical Origins of Contaminants with Primary MCLs) – provide a title that is more descriptive and appropriate for the appendix; adopt health effects language for surface water treatment, disinfection byproducts, disinfection byproduct precursors, and disinfectant residuals; and delete the obsolete TTHM health
effects language, and (3) appendix 64481-B (Typical Original of Contaminants with Secondary MCLs) – adopt health effects language for copper and delete the obsolete corrosivity health effects language.

Chapter 15.5, Article 1
- Amend section 64530 (Applicability of this Chapter) to specify applicability and schedules for water systems to (1) comply with IDSE requirements (incorporated federal rule by reference) and (2) conduct TTHM and HAA5 compliance monitoring and compliance calculations.

Chapter 15.5, Article 2
- Amend section 64533 (Maximum Contaminant Levels for Disinfection Byproducts) to revise detection limits for purposes of reporting disinfection byproducts and establish additional best available technologies for TTHM and HAA5 in table 64533-B (Best Available Technology Disinfection Byproducts).

Chapter 15.5, Article 3
- Amend section 64534 (General Monitoring Requirements) to clarify who may perform required analyses, sample collection, and field tests; provide needed flexibility in the event the Department determines a U.S. EPA approved method is unacceptable; update federal rule citations relating to the proposed rulemaking; allow the use of U.S. EPA approved alternative testing methods; clarify that sample collection and field tests are to be performed by persons trained to perform such sample collections and/or tests; clarify the applicability of subsection (d); delete an outdated reference to the federal Information Collection Rule (ICR), because the ICR only remained in effect until December 30, 2000 (61 Fed. Reg. 24354 (May 14, 1996)); and clarify what constitutes monitoring violations and actions to be taken.
- Amend section 64534.2 (Disinfection Byproducts Monitoring) to establish additional criteria to resume routine TTHM/HAA5 monitoring based on source water TOC results; clarify when to analyze chlorite samples collected daily at the entrance to the distribution system; establish when to analyze chlorite samples collected in the distribution system [paragraph (b)(1)] and establish criteria for chlorite confirmation sampling and analysis for samples collected in the distribution system [paragraph (b)(4)] (it is constructed similarly to the determination for perchlorate; since chlorite poses a relatively acute risk of adverse effects, it is important to move quickly and take actions in response to the initial result); establish new criteria to reduce or remain on reduced bromate monitoring; require Department notification within 30 days if a system elects to reduce bromate monitoring or is required to resume routine bromate monitoring; establish criteria to resume routine bromate monitoring; establish routine, reduced, and increased monitoring requirements for TTHM and HAA5, when MCL compliance is determined on a LRAA basis at each monitoring location; establish requirements for undisinfected systems that begin using a disinfectant other than UV light after the IDSE compliance dates; require an operational evaluation when an operation evaluation level (OEL) is exceeded for TTHM or HAA5; when a system is able to identify the cause of the OEL exceedance, the
request to limit the scope of the operational evaluation must be in writing; specify the time period associated with monitoring violations; and cite the sections that provide the detailed requirements for public notification and Department reporting.

- Amend section 64534.6 (Disinfection Byproduct Precursors (DBPP) Monitoring) to establish source water TOC monitoring requirements for systems that use an approved surface water, do not use conventional filtration to treat the water (i.e., a system uses direct filtration, diatomaceous earth filtration, or an alternative filtration technology, or meets the filtration avoidance criteria), and are seeking to qualify for reduced TTHM and HAA5 monitoring.

- Amend section 64534.8 (Monitoring Plans) to establish monitoring plan requirements for TTHM and HAA5 compliance monitoring locations, when MCL compliance is determined on a LRAA basis at each monitoring location.

Chapter 15.5, Article 4

- Amend section 64535.2 (Determining Disinfection Byproducts Compliance) to clarify TTHM and HAA5 compliance determination requirements during the first year of monitoring, when MCL compliance is determined on a statewide basis and on a LRAA basis at each monitoring location; replace “at the end of the quarter” with “immediately” to clarify when the violation has occurred and for consistency with public notification requirements, which requires a water system to issue a notice when it learns of the violation; delete chlorite compliance determination requirements where non-compliance with the chlorite MCL would trigger Tier 2 public notification based on the arithmetic average of each three sample-set taken in the distribution system; establish chlorite compliance determination requirements where non-compliance with the chlorite MCL would trigger (1) Tier 1 and Tier 2 public notification based on samples taken at the entrance to the distribution system and in the distribution system, respectively (note: subsections(d)(1) and (d)(3) are constructed similarly to the determination for chlorine dioxide) and (2) Tier 1 public notification base on initial and confirmation samples taken in the distribution system (note: compliance based on a locational average is more stringent than a compliance based on a system average that includes the confirmation samples); establish TTHM and HAA5 compliance determination requirements after the first year of monitoring when MCL compliance is determined on a LRAA basis at each monitoring location; clarify how TTHM and HAA5 MCL compliance is determined if system is on increased monitoring; specify the time period associated with MCL violations when MCL compliance is determined on a LRAA basis at each monitoring location; and cite the sections that provide the detailed requirements for public notification and Department reporting.

Chapter 15.5, Article 6

- Amend section 64537 (General Reporting Requirements) to provide a more appropriate title for the section; clarify the reporting deadline for systems that sample less frequently than quarterly; establish water system and Department notification requirements for a chlorite MCL or chlorine dioxide MRDL.
insure operational evaluation reporting requirements; and establish monitoring plan and chemical analysis recordkeeping requirements.

- Amend section 64537.2 (Disinfection Byproducts Reporting) to clarify applicability of reporting under table 64537.2-A; delete a chlorite reporting requirement that will be obsolete with the revisions made to section 64535.2(d); establish a chlorite reporting requirement, when a confirmation sample is taken pursuant to section 64634.2(b)(4); and establish TTHM and HAA5 reporting requirements when MCL compliance is determined on a LRAA basis at each monitoring location, under table 64537.2-B.

The net effect is that:

- Community water systems (CWS), and nontransient noncommunity water systems (NTNCWS) serving at least 10,000 persons, using a primary or residual disinfectant other than ultraviolet light or delivering water that has been treated with a primary or residual disinfectant other than ultraviolet light would be required to conduct an IDSE to characterize locations with high TTHM and HAA5 concentrations.

- CWS and NTNCWS using a primary or residual disinfectant other than ultraviolet light or delivering water that has been treated with a primary or residual disinfectant other than ultraviolet light would be required to:
  - Report TTHM and HAA5 results with respect to revised detection limits for purposes of reporting.
  - Comply with new routine, reduced, and increased monitoring requirements for TTHM and HAA5.
  - Comply with TTHM and HAA5 MCLs on a LRAA basis at each monitoring location.
  - If the operational evaluation level for TTHM or HAA5 is exceeded, conduct an operational evaluation and submit a report to the Department.
  - Update and submit to the Department monitoring plans to specify TTHM and HAA5 monitoring locations, where MCL compliance is determined on a LRAA basis at each monitoring location.
  - Report to the Department information on TTHM and HAA5 monitoring and MCL compliance, where MCL compliance is determined on a LRAA basis at each monitoring location.

- CWS and NTNCWS that treat their water with a chemical disinfectant in any part of the treatment process or provide water containing a chemical disinfectant would be required to:
  - If using chlorine or chloramines as a disinfectant:
    o Comply with additional criteria to resume routine TTHM and HAA5 monitoring (compliance on a system-wide basis).
  - If using chlorine dioxide as a disinfectant:
    o Report chlorite results with respect to a revised detection limit for purposes of reporting.
    o Comply with time frames for analyzing chlorite samples collected at the entrance to the distribution system and collected in the distribution system.
Conduct confirmation sampling for chlorite in the distribution system when applicable.

Comply with chlorite MCL and chlorine dioxide MRDLs, where non-compliance results in Tier 1 or Tier 2 public notification.

Comply with laboratory notification requirements of the water system and Department when a sample exceeds a chlorite MCL or chlorine dioxide MRDL.

Report to the Department information on chlorite monitoring and MCL compliance.

- If using ozone as a disinfectant:
  - Report bromate results with respect to a revised detection limit for purposes of reporting.
  - Comply with new criteria to reduce or remain on reduced bromate monitoring.
  - Notify the Department if going on reduced bromate monitoring or resuming routine bromate monitoring.
  - Comply with criteria to resume routine bromate monitoring.

- If using an approved surface water, not using conventional filtration, and seeking to qualify for reduced TTHM and HAA5 monitoring:
  - Conduct source water TOC monitoring.

- Update and submit to the Department monitoring plans if applicable.

- Undisinfected CWS and NTNCWS that begin using a disinfectant other than UV light after the IDSE compliance dates would be required to consult with the Department, establish monitoring locations, and prepare a monitoring plan.

- LPAs would be granted the responsibility and authority to implement and enforce chapter 15.5.

- CWS and NTNCWS would be required to conduct:
  - Tier 1 public notification for acute violation of the chlorite MCL or chlorine dioxide MRDL.
  - Tier 2 public notification for:
    - non-acute violation of the chlorite MCL or chlorine dioxide MRDL or,
    - if the Department determines a Tier 2 rather than a Tier 3 public notice is required, violation of other monitoring and testing procedure requirements of chapter 15 (i.e., public notification and consumer confidence report requirements) or chapter 15.5.

- Public water systems would be required to maintain records for microbiological (in lieu of bacteriological) analyses, turbidity analyses, and monitoring plans.

- Public water systems would be required to include in their Consumer Confidence Report, if applicable, detections and violations of chapter 15.5 contaminants, violations of regulatory action levels and recycled provisions, and health effects language for surface water treatment, chapter 15.5 contaminants, and copper.

- Public water systems would be allowed to use U.S. EPA approved alternative test methods for analysis of chapter 15.5 contaminants.

- The Department would no longer be required to regulate its activities when considering and issuing permits.
None of the proposed amendments would affect California's primacy status, because the net effect of these amendments is that the state's regulation would be at least as stringent as the federal regulation.

The following table summarizes the proposed amendments with respect to the Federal citation references:

- 2009 FR are to 40 Code of Federal Regulations part 141 (74 Fed. Reg 30953 (June 29, 2009)), “National Primary Drinking Water Regulations: Minor Correction to Stage 2 Disinfectants and Disinfection Byproducts Rule and Changes in References to Analytical Methods”.
- 6/2006 FR are to 40 Code of Federal Regulations part 141 (71 Fed. Reg. 37168 (June 29, 2006)), “Stage 2 Disinfectants and Disinfection Byproducts Rule, Correction”.

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<tr>
<td>64534.2(c)(2)</td>
<td>2006 FR; 141.132(b)(3)(ii)(B)</td>
<td>Added language to require CDPH notification of a change in monitoring frequency. The notification is necessary to inform CDPH that monitoring is reduced as the system qualified for reduced monitoring and is not a result of a monitoring failure.</td>
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<td>64534.2(c)(3)</td>
<td>2006 FR; 141.132(b)(3)(ii)(B)</td>
<td>Added language to require CDPH notification of a change in monitoring frequency. The notification is necessary to inform CDPH that monitoring is reduced as the system qualified for reduced monitoring and is not a result of a monitoring failure.</td>
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<td>64534.2(d)(1), Table 64534.2-C</td>
<td>2009 FR; 141.621(a)(2), Footnote 2 2006 FR; 141.620(c)(6) &amp; 141.621(a)(2)</td>
<td>For clarity, reorganized column order, column headings, and footnote numbering.</td>
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<tr>
<td>64534.2(d)(2)</td>
<td>2006 FR; 141.621(a)(3)</td>
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<td>64534.2(d)(3)</td>
<td>2006 FR; 141.623(a)</td>
<td>For consistency with existing state regulation [section 64534.2(a)(1)], added language to (1) require the system to apply to the Department for reduce monitoring and (2) specify what information must be included in the application for the Department to make a determination. An application to reduce monitoring is necessary to ensure that all criteria are met before a system reduces monitoring.</td>
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<tr>
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<td>64534.2(d)(3), Table 64534.2-D</td>
<td>2006 FR; 141.623(a)</td>
<td>For clarity, reorganized column order and column headings. For systems using only groundwater not under direct influence of surface water and serving &lt;500 population, the number of distribution system monitoring locations is revised to read “1 dual sample set every third year” instead of “1 dual sample set per year” to agree with “every third year” in the monitoring period column. The monitoring frequency disagreement and the language that was intended are discussed on page 30955 in 2009 FR.</td>
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<td>64534.2(d)(4)</td>
<td>2006 FR; 141.623(c)</td>
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<td>64534.2(d)(6)</td>
<td>2006 FR; 141.626(a) &amp; (b)</td>
<td>Added language to clarify that system request to limit the scope of the operational evaluation must be in writing.</td>
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<td>64534.2(d)(7)</td>
<td>2006 FR; 141.627</td>
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<td>64534.6(c)</td>
<td>2006 FR; 141.132(b)(1)(iii)</td>
<td>Does not include reference to “April 1, 2008” since that date has passed.</td>
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<tr>
<td>64534.6(c)(1)</td>
<td>2006 FR; 141.132(b)(1)(iii)</td>
<td>Added language to clarify when a system on reduced source water TOC monitoring would need to return to routine source water TOC monitoring. Revised “at the end of the quarter” to read “immediately” to clarify when the violation has occurred and for consistency with public notification requirements, which requires a water system to issue a notice when it learns of the violation.</td>
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<tr>
<td>64534.6(c)(2)</td>
<td>2006 FR; 141.132(b)(1)(iii)</td>
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<td>64534.8(a)</td>
<td>2006 FR; 141.622(a)(1), (b), &amp; (c)</td>
<td>Retained existing state language for consistency to (1) require all systems to submit plans to the Department for review and approval prior to implementation (2) make plans available to the public available no later than 30 days following the applicable compliance date. The federal language requires systems serving more than 3300 persons to submit plans prior to monitoring, if the systems did not include the information in their IDSE report. The Department believes it is necessary to review and approve all plans before monitoring begins to verify that the proposed monitoring locations and frequencies are appropriate.</td>
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<td>64534.8(b)</td>
<td>2006 FR; 141.622(a)(1)</td>
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<td>64535.2(e)(2)</td>
<td>2006 FR; 141.620(d)(2)</td>
<td>Added language to clarify how MCL compliance is determined if system is on increased monitoring.</td>
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<td>2006 FR; 141.620(d)(1)</td>
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</table>
Documents Incorporated by Reference

The following documents are incorporated by reference in the regulations as it would be too cumbersome, unduly expensive, or impractical to publish these documents into regulation.

1) 40 Code of Federal Regulations parts 141.131, 141.605, and 141.621 (74 Fed. Reg 30953 (June 29, 2009)), “National Primary Drinking Water Regulations: Minor Correction to Stage 2 Disinfectants and Disinfection Byproducts Rule and Changes in References to Analytical Methods”.

2) 40 Code of Federal Regulations, parts 141.600, 141.601, 141.602, 141.603, 141.604, and 141.605 (71 Fed. Reg. 388 (January 4, 2006)), “Stage 2 Disinfectants and Disinfection Byproducts Rule”.

3) 40 Code of Federal Regulations part 141.131 (71 Fed. Reg. 37168 (June 29, 2006)), “Stage 2 Disinfectants and Disinfection Byproducts Rule, Correction”.


5) 40 Code of Federal Regulations parts 141.701(a)(4) and (a)(6) (71 Fed. Reg. 654 (January 5, 2006)), “Long Term 2 Enhanced Surface Water Treatment Rule”.

6) 40 Code of Federal Regulations part 141.131 (66 Fed. Reg. 3770 (January 16, 2001)), “Revisions to the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1DBPR), and Revisions to the State Primacy Requirements to Implement the Safe Drinking Water Act (SDWA) Amendments”.

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<td>64537.2, Table 64537-B</td>
<td>2006 FR; 141.629(a)(1) – (a)(2)(v)</td>
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</table>
Statements of Determination

Alternatives Considered

The Department has determined that no reasonable alternative considered or otherwise identified and brought to its attention would be more effective in carrying out the purpose for which this action is proposed, or would be as effective as and less burdensome to affected private persons than the proposed action.

Local Mandate Determination

The Department has determined that the proposed regulations would not impose a mandate on local agencies or school districts that require state reimbursement because the proposed regulation implements a federal mandate for which the regulated community must comply, regardless of the adoption of this regulation, or imposes no significant quantifiable costs. As a result, local agencies or school districts should not incur costs resulting from the adoption of this regulation.

Local agencies/school districts currently incur costs in their operation of public water systems. These costs are not the result of a “new program or higher level of service” within the meaning of Article XIIIB, Section 6 of the California Constitution because they apply generally to all individuals and entities that operate public water systems in California and do not impose unique requirements on local governments. Therefore, no state reimbursement of these costs is required.

Local regulatory agencies also may incur costs for their responsibility to enforce federal regulations related to small public water systems (under 200 service connections) that they regulate. However, local agencies are authorized to assess fees to pay reasonable expenses incurred in enforcing statutes and regulations related to small public water systems (Health and Safety Code Section 101325). Therefore, no reimbursement of any incidental costs to local agencies in enforcing this regulation would be required, Government Code Section 17556(d).

Business Impact

The Department is promulgating regulations substantially identical to federally mandated regulations. There are no significant differences related to fiscal impact between the proposed S2DDBPR regulations and the federal S2DDBPR regulations. Regardless of whether California adopts a regulation that parallels the federal S2DDBPR regulation, applicable water systems are required to comply with the federal S2DDBPR and will incur the associated costs. The adoption of the S2DDBPR portions of this regulation merely provide California’s regulatory agencies with the authority to enforce the regulation, which would otherwise be enforced by the U.S. EPA. Additionally, the portions of the proposed regulation unrelated to the federal S2DDBPR have no fiscal impact on the regulated community.
Economic Impact Statement

The Department has made an initial determination that the proposed regulations would not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states. The Department has determined that the proposed regulations would not significantly affect the following:

1. The creation or elimination of jobs within the State of California. The requirements summarized above should not have any affect in this area in that there would not be any significant change in water system or regulatory personnel needed for compliance with the new requirements.

2. The creation of new businesses or the elimination of existing businesses within the State of California. The nature of the water industry is such that the adoption of this proposed regulation would not result in the creation or elimination of water systems. The impact of the proposed regulations would be insignificant.

3. The expansion of businesses currently doing business within the State of California. Since water system size is basically a function of the number of service connections (consumers) served, the proposed regulations should not have any affect on expansion.

Effect on Small Business

The Department has determined that the proposed regulations would not affect small business because Government Code chapter 3.5, article 2, section 11342.610 excludes drinking water utilities from the definition of small business.

Reporting Requirements

The Department has determined that the proposed regulations require reports from businesses, and it is necessary for the health, safety, or welfare of the people of California that the proposed regulations apply to businesses.
This draft regulation reflects the California Department of Public Health’s (CDPH’s) Drinking Water Program’s current thinking on the regulation for replenishing groundwater with recycled municipal wastewater. To assist readability, this draft does not include some information and formatting required by the Administrative Procedures Act.

Any comments you have on this draft can be emailed to Mike McKibben at Michael.McKibben@cdph.ca.gov and Randy Barnard at Randy.Barnard@cdph.ca.gov.
ARTICLE 5.2. INDIRECT POTABLE REUSE: GROUNDWATER REPLENISHMENT - SUBSURFACE APPLICATION

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Section 60301.050. 24-hour Composite Sample.
“24-hour composite sample” means an aggregate sample derived from no fewer than eight discrete samples collected at equal time intervals or collected proportional to the flow rate over the compositing period. The aggregate sample shall reflect the average source water quality covering the composite of sample period.

Section 60301.080. Added Tracer.
“Added Tracer” means a non-reactive substance, either foreign to the receiving groundwater or at concentrations at least three orders of magnitude greater than the receiving groundwater, intentionally added to the water applied at a GRRP such that the first two percent of the tracer can be identified in the groundwater downgradient of the GRRP to determine the underground retention time of the water.

Section 60301.180. Department.
“Department” means the California Department of Public Health.

Section 60301.190. Diluent Water.
“Diluent water” means water, meeting the diluent requirements of this Chapter, used for reducing the recycled municipal wastewater contribution over time.

Section 60301.370. Groundwater.
“Groundwater” means water below the land surface in a saturated zone.

Section 60301.390. Groundwater Replenishment Reuse Project (GRRP).
"Groundwater Replenishment Reuse Project (GRRP)" means a project involving the planned use of recycled municipal wastewater that is operated for the purpose of replenishing a groundwater basin designated in the Water Quality Control Plan [as defined in Water Code section 13050(j)] for use as a source of municipal and domestic water supply, or a project determined as a GRRP by the RWQCB based on a project’s existing or projected replenishment of the affected groundwater basin.
Section 60301.450. Indicator Compound.

“Indicator Compound” means an individual chemical in a GRRP’s municipal wastewater that represents the physical, chemical, and biodegradable characteristics of a specific family of trace organic chemicals; is present in concentrations that provide information relative to the environmental fate and transport of those chemicals; is used to monitor the efficiency of trace organic compounds removal by treatment processes; and provides an indication of treatment process failure.

Section 60301.455. Intrinsic Tracer.

“Intrinsic Tracer” means a substance present in the recharge water at concentrations greater than the receiving groundwater such that the substance in the water applied at the GRRP can be readily detected at low concentrations in the groundwater downgradient of the GRRP and can be used to determine the underground retention time of the water.

Section 60301.575. Maximum Contaminant Level or MCL.

“MCL” means the maximum permissible concentration of a contaminant, as defined by the section 116275(c) and (d) of the Health and Safety Code or established by the U.S. Environmental Protection Agency.

Section 60301.625. Notification Level or NL.

“NL” means the concentration of a contaminant established by the Department pursuant to section 116455 of the Health and Safety Code.

Section 60301.670. Project Sponsor.

“Project sponsor” means an entity subject to water recycling requirements for a GRRP from a RWQCB and is, in whole or part, responsible for complying with the requirements of this Chapter.

Section 60301.680. Public Water System.

“Public Water System” has the same meaning as defined in section 116275(h) of the Health and Safety Code.

Section 60301.685. Recharge Water.

“Recharge Water” means recycled municipal wastewater or the combination of recycled municipal wastewater and diluent water that is applied at a GRRP facility.
Section 60301.690. Recycled Municipal Wastewater.

“Recycled Municipal Wastewater” means recycled water that is the effluent from the treatment of a wastewater of municipal origin.

Section 60301.705. Recycled Municipal Wastewater Contribution (RWC).

“Recycled Municipal Wastewater Contribution (RWC)” means the fraction equivalent to the quantity of recycled municipal wastewater applied at the GRRP divided by the sum of the quantity of recycled municipal wastewater and credited diluent water applied at the GRRP.

Section 60301.770. RWQCB.

“RWQCB” means Regional Water Quality Control Board.

Section 60301.780. Saturated Zone.

“Saturated zone” means an underground region or regions in which all interstices in, between, and below natural geologic materials are filled with water, with the uppermost surface of the saturated zone being the water table.

Section 60301.810. Spreading Area.

“Spreading area” means a natural or constructed impoundment with a depth equal to or less than its widest surface dimension used by a GRRP to replenish a groundwater basin with recharge water infiltrating and percolating through a zone that, in the absence of a GRRP, would be an unsaturated zone.

Section 60301.840. Subsurface Application.

"Subsurface Application" means the controlled application of recharge water to a groundwater basin(s) by a means other than surface application.

Section 60301.850. Surface Application.

"Surface Application" means the controlled application of recharge water to a spreading area.

Section 60301.855. Surrogate Parameter.

“Surrogate parameter” means a measurable physical or chemical property that has been demonstrated to provide a direct correlation with the concentration of an indicator compound, is used to monitor the efficiency of trace organic compounds removal by a treatment process, and/or provides an indication of a treatment process failure.
Section 60301.860. Total Nitrogen.
"Total nitrogen" means the sum of concentrations of nitrogen in ammonia, nitrite, nitrate, and organic nitrogen-containing compounds, expressed as nitrogen.

Section 60301.870. Total Organic Carbon (TOC).
"Total organic carbon (TOC)" means the concentration of organic carbon present in water.

Section 60301.910. Unsaturated Zone.
"Unsaturated Zone" means the volume between the land surface and the uppermost saturated zone.
ARTICLE 5.1. INDIRECT POTABLE REUSE: GROUNDWATER REPLENISHMENT - SURFACE APPLICATION WITHOUT FULL ADVANCED TREATMENT

Section 60320. Groundwater Recharge.
(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services’ recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.

(b) The State Department of Health Services’ recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.

(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.


Section 60320.100. General Requirements.
(a) A Groundwater Replenishment Reuse Project (GRRP) project sponsor utilizing surface application without continuous full advanced treatment of the entire recycled municipal wastewater stream prior to application shall meet the requirements of this Article. For the purpose of this Article, advanced treatment means treatment meeting the reverse osmosis and advanced oxidation process criteria in section 60320.201 of Article 5.2.

(b) Prior to operation of a new GRRP, or prior to permit renewal for an existing GRRP, the GRRP’s project sponsor shall have a Department-approved plan describing the steps the project sponsor will take to provide an alternative source of potable water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism the project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP’s operation, as determined by the Department:
   (1) violates a California or federal drinking water standard;
   (2) has been degraded to the degree that it is no longer a safe source of drinking water; or
   (3) receives water that fails to meet section 60320.108.

(c) Prior to operating a new GRRP, the project sponsor shall collect at least two samples from each monitoring well approved pursuant to section 60320.126.
The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics in sections 60320.110, 60320.112, 60320.118 and 60320.120.

(d) A GRRP’s recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to section 60320.108 and 60320.124. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.116.

(e) A GRRP’s project sponsor shall provide the Department, RWQCB, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates:

(1) the location and boundaries of the GRRP;

(2) the boundary representing the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to section 60320.108 and section 60320.124; and

(3) the location of all monitoring wells established pursuant to section 60320.126, and drinking water supply wells within two years of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a new GRRP, the project sponsor shall demonstrate to the Department and RWQCB that the project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a new GRRP’s project sponsor shall demonstrate that all treatment processes have been installed and can be operated by the project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, the project sponsor for a new GRRP shall include a hydrogeological assessment of the proposed GRRP’s setting. The assessment shall include the following:

(1) the qualifications of the individual(s) preparing the assessment;

(2) a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;

(3) a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and

(4) based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts;
(A) the existing hydrogeology and the hydrogeology anticipated as a result of the presence of the GRRP, and
(B) maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

Section 60320.102. Public Hearing.
(a) A public hearing for a GRRP shall be held by the project sponsor prior to the Department’s submittal of its recommendations to the RWQCB for the GRRP’s initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing, the project sponsor shall provide the Department, for review and approval, the information the project sponsor intends to present at the hearing. The information shall also be provided on the Internet. Following the Department’s approval of the information, the project sponsor shall place the information on the Internet and in a repository that provides at least thirty days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, the project sponsor shall:
   (1) Notify the public of the following;
       (A) the location and hours of operation of the repository,
       (B) the Internet address where the information may be viewed,
       (C) the purpose of the repository and public hearing,
       (D) the manner in which the public can provide comments, and
       (E) the date, time, and location of the public hearing; and
   (2) At a minimum, notify the first downgradient potable water well owner and well owners whose drinking water source is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to (b)(1) shall be by one or more of the following methods delivered in a manner to reach persons whose source of drinking water may be impacted by the GRRP:
   (1) local newspaper(s) publication;
   (2) mailed or direct delivery of a newsletter;
   (3) conspicuously placed statement in water bills; or
   (4) television and/or radio.

Section 60320.104. Lab Analyses.
(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.
(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP’s Operations Plan prepared pursuant to section 60320.122.

Section 60320.106. Wastewater Source Control.
A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:
(a) administers an industrial pretreatment and pollutant source control program;
(b) implements and maintains a source control program that includes, at a minimum;
   (1) an assessment of the fate of Department-specified and RWQCB-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,
   (2) chemical and contaminant source investigations and monitoring that focuses on Department-specified chemicals and contaminants,
   (3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency’s service area that flows into the water reclamation facility subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and
   (4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system; and
(c) is compliant with the effluent limits established in the RWQCB permit for the GRRP.

Section 60320.108. Pathogenic Microorganism Control.
(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, and Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction and shall achieve at least 1-log reduction.

(b) Except for those portions treated with advanced treatment meeting the requirements of section 60320.201, the wastewater used as recycled municipal wastewater shall receive treatment to meet:
(1) the definition of filtered wastewater, pursuant to section 60301.320; and
(2) the definition of disinfected tertiary recycled water, pursuant to section 60301.230.

(c) For each month retained underground as demonstrated in subsection (f), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction. A GRRP meeting subsection (b)(1) and (2) or providing advanced treatment complying with section 60320.201, that also demonstrates at least six months retention underground pursuant to subsection (f), will be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction.

(d) With the exception of log reduction through retention time underground, the project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department’s review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process’s log reduction. The report and/or challenge test shall be prepared by engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground and a soil treatment process, the project sponsor shall propose and include in its Operations Plan prepared pursuant to section 60320.122, on-going monitoring that verifies the performance of each treatment process’s ability to achieve its credited log reduction.

(e) The project sponsor of a GRRP whose permit was issued prior to [insert effective date] shall demonstrate compliance with subsection (d) prior to the renewal of the GRRP’s permit. The project sponsor of a new GRRP shall demonstrate compliance with subsection (d) prior to being issued a permit.

(f) To demonstrate the retention time underground in subsection (c), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when water is applied at the GRRP to when the first two percent (2%) of such water arrives at the downgradient endpoint. The project sponsor for a new GRRP shall initiate the tracer study prior to the end of the third month of operation. The project sponsor for existing GRRP that hasn’t already performed such a tracer study shall complete a tracer study demonstrating retention time underground prior to the renewal of the GRRP’s permit.

(g) For the purpose of siting a GRRP location during project planning and until a GRRP’s project sponsor has met the requirements of subsection (f), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.108.
Table 60320.108

<table>
<thead>
<tr>
<th>Method used to estimate the retention time to the nearest downgradient drinking water well</th>
<th>Virus Log Reduction Credit per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracer study utilizing an intrinsic tracer, based on T₁₀ (i.e. The time representing the difference from when water is applied at the GRRP to when the first ten percent arrives at the downgradient endpoint.)</td>
<td>0.67 logs</td>
</tr>
<tr>
<td>Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.</td>
<td>0.50 logs</td>
</tr>
<tr>
<td>Analytical modeling using existing academically-accepted equations such as Darcy’s Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.</td>
<td>0.25 logs</td>
</tr>
</tbody>
</table>

(h) The protocol(s) used to establish the retention times in subsections (f) and (g) shall be approved by the Department.

(i) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP’s project sponsor to demonstrate that the underground retention times required in this section are being met.

(j) If the pathogen reduction in subsection (a) is not met based on the ongoing monitoring required pursuant to subsection (d), within 24 hours of being aware the project sponsor shall immediately investigate the cause and initiate corrective actions. For failing to meet the pathogen reduction criteria longer than 4 consecutive hours or more than a total of 8 hours during any 7-day period, the Department and RWQCB shall be immediately notified. Failures of shorter duration shall be reported to the RWQCB no later than 10 days after the month in which the failure occurred.

(k) If the effectiveness of a treatment train’s ability to reduce enteric virus is less than 9-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, the project sponsor shall immediately notify the Department and RWQCB, and discontinue application of recycled municipal wastewater at the GRRP.
Section 60320.110. Nitrogen Compounds Control.

(a) To demonstrate control of the nitrogen compounds, the project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP’s Operations Plan, collect at least two samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied throughout the spreading area. Samples may be collected before or after surface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by the project sponsor to complete each analysis within 72 hours and have the result reported to the project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;

(A) notify the Department and the RWQCB within 48 hours of being notified of the exceedance by the laboratory,

(B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations such that continued and future exceedances don’t occur, and

(C) initiate additional monitoring for nitrogen compounds as described in the GRRP’s Operations Plan, including locations in the groundwater basin and spreading area, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the surface application of recycled municipal wastewater. Surface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) Based on a GRRP’s operation, including but not limited to the time the spreading area is out of service and utilization of a denitrification process, the project sponsor shall initiate additional monitoring for nitrogen compounds to identify elevated concentrations in the groundwater and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL.

(c) The GRRP’s project sponsor may apply for reduced monitoring frequencies for total nitrogen, nitrate, or nitrite if, for the most recent 24 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen or one-half the nitrate, nitrite, and nitrate plus nitrite MCLs; and

(2) a result did not exceed 10 mg/L total nitrogen or 80 percent of the nitrate, nitrite, and nitrate plus nitrite MCLs.
(d) If the results of reduced monitoring conducted pursuant to subsection (c) exceed the total nitrogen, nitrate, nitrite, and nitrate plus nitrite concentrations in paragraph (c), the project sponsor shall revert to the GRRP’s monitoring frequencies for total nitrogen, nitrate, and nitrite prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (c) are met.

Section 60320.112. Regulated Contaminants and Physical Characteristics Control.

(a) Each calendar quarter, as specified in the GRRP’s Operations Plan, the GRRP’s project sponsor shall collect grab samples representative of the applied recycled municipal wastewater and have the samples analyzed for:
   (1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;
   (2) the radionuclide chemicals in Tables 64442 and 64443;
   (3) the organic chemicals in Table 64444-A;
   (4) the disinfection byproducts in Table 64533-A; and
   (5) lead and copper.

(b) Recharge water may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in paragraph (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction for the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction applied for the quarter, the reported value shall be amended to account for any dilution.

(c) Each year, the GRRP’s project sponsor shall collect at least one representative grab sample of the recycled municipal wastewater and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant’s MCL or action level (for lead and copper), within 72 hours of notification of the result the project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation.

   (1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant’s MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP’s project sponsor shall notify the Department and RWQCB within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant’s MCL or action level. If the running four-week average exceeds the contaminant’s MCL or action level, the GRRP’s project sponsor shall notify the
Department and RWQCB within 24 hours and, if directed by the Department or RWQCB, suspend application of the recycled municipal wastewater.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant’s MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant’s MCL.

(A) If the running four-week average exceeds the contaminant’s MCL, the project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in the next quarterly report submitted to RWQCB pursuant to section 60321, with a copy provided to the Department.

(B) If the running four-week average exceeds the contaminant’s MCL for sixteen weeks, the project sponsor shall notify the Department and RWQCB within 48 hours and, if directed by the Department or RWQCB, suspend application of the recycled municipal wastewater.

(e) With the exception of color, if an annual result of the monitoring performed pursuant to (c) exceeds a contaminant’s secondary MCL in Table 64449-A or the upper limit in Table 64449-B, the project sponsor shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly results exceeds a contaminant’s secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken in the next quarterly report submitted to RWQCB pursuant to section 60321, with a copy provided to the Department. The annual monitoring in (c) may resume if the running annual average of quarterly results does not exceed a contaminant’s secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

Section 60320.114. Diluent Water Requirements.
To be credited with diluent water used in calculating an RWC pursuant to section 60320.116, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP’s project sponsor is exempt from subsections (a) and (b). The GRRP’s project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding an MCL, collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the RWQCB within 48 hours of receiving the confirmation sample result,
(2) investigate the cause(s) and implement corrective actions, and
(3) each week, collect and analyze two grab samples at least three days
apart as specified in an Operations Plan. If the average of the results for a two-
week period exceeds the MCL, surface application of the diluent water shall not
be used in the calculation of RWC until corrective actions are made. Quarterly
monitoring may resume if four consecutive results are below the MCL.

(b) Conduct a source water evaluation per California-Nevada Section of
American Water Works Association watershed sanitary survey handbook, or
other Department approved evaluation, of the diluent water for Department
review and approval that includes, but is not limited to:
(1) a description of the source of the diluent water;
(2) delineation of the origin and extent of the diluent water;
(3) the susceptibility of the diluent water to contamination;
(4) the identification of known or potential contaminants; and
(5) an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed primary MCLs or notification levels
and implements a Department-approved water quality monitoring plan for
Department-specified contaminants to demonstrate compliance with the primary
MCLs and notification levels. The plan shall also include:
(1) monitoring of any chemicals or contaminants in section 60320.120,
based on the source water evaluation performed in (b); and
(2) actions to be taken in the event of non-compliance with a primary MCL
or exceedance of a notification level.

(d) Develop a method for determining the volume of diluent water to be
credited and demonstrate that the diluent water will be introduced in a manner
such that the diluent water volume will not result in the GRRP’s 120-month
running monthly average RWC exceeding its maximum RWC at or beyond the
boundary established pursuant to 60320.100(e)(2). The method shall be
submitted to the Department for review and approval, and be conducted at a
frequency specified in the engineering report prepared pursuant to section
60323. The method shall address all conditions that influence how and when the
recycled municipal wastewater and diluent water arrive at all points along the
boundary. The conditions must include, but are not limited to, temporal variability
in the diluent water supply and regional groundwater gradients, the difference in
the distribution of the recycled municipal wastewater and diluent water between
individual aquifers where more than one aquifer is replenished, and the
difference in travel-time when recycled municipal wastewater and diluent water
are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120
months:
(1) demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, notification levels, and the water quality requirements in section 60320.112;

(2) provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and

(3) conduct a source water evaluation of the diluent water pursuant to subsection (c).

(f) In the Operations Plan prepared pursuant to 60320.122, include a description of:

(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and

(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

Section 60320.116. Recycled Municipal Wastewater Contribution (RWC) Requirements.

(a) Each month, for each surface application facility used for replenishing a groundwater basin, the GRRP’s project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 calendar months. For GRRPs in operation less than 120 months, calculation of the RMA RWC shall commence after 30 months of recycled water application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP’s RMA RWC, as determined in (a), shall not exceed the maximum RWC specified by the Department.

(c) The initial maximum RWC, based on the Department’s review of the engineering report and information obtained as a result of the public hearing, shall not exceed 0.20.

(d) A GRRP may increase its maximum RWC, provided that:

(1) the increase has been approved by the Department and RWQCB;

(2) for the previous 52 weeks, the TOC 20-week running average, as monitored pursuant to section 62320.118, has not exceeded 0.5 mg/L divided by the proposed maximum RWC; and

(3) the GRRP has received a permit from the RWQCB that allows operation of the GRRP at the increased maximum RWC.

(e) In addition to the requirements in subsection (d), prior to operating a GRRP at an RWC greater than 0.50 or 0.75, which must be achieved sequentially, the project sponsor shall:
(1) provide a proposal to the Department prepared and signed by an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply;
(2) submit an updated engineering report and Operations Plan; and
(3) provide evidence of compliance with section 60320.126(a).

(f) If the RMA RWC exceeds its maximum RWC, the GRRP’s project sponsor shall:
(1) notify the Department and RWQCB in writing within 7 days of exceedance; and
(2) within 60 days, implement corrective action(s) and submit a report to the Department and RWQCB describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

Section 60320.118. Total Organic Carbon and Soil Treatment Process Requirements.
(a) For each surface application facility used for replenishing a groundwater basin, the GRRP’s project sponsor shall monitor TOC as follows:
(1) For recycled municipal wastewater, at least one 24-hour composite sample each week prior to application; or
(2) At least one sample each week in a manner yielding TOC values representative of the recycled municipal wastewater TOC concentrations after infiltration and percolation, and not influenced by diluent water, native groundwater, or other source of dilution as determined by;
   (A) measuring undiluted percolating recycled municipal wastewater,
   (B) measuring diluted percolating recycled municipal wastewater and adjusting the value for the diluent water effect, or
   (C) using replenishment demonstration studies to develop a soil treatment factor that can be applied weekly to recycled municipal wastewater measurements leaving the treatment plant.

(b) Grab samples may be taken in lieu of the 24-hour composite samples required in subsection (a) if:
(1) the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period; or
(2) the entire recycled municipal wastewater stream has been treated by reverse osmosis meeting the criteria in section 60320.201(a) and (b).

(c) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L divided by the RMA RWC based on:
(1) the 20-week running average of all TOC results; and
(2) the average of the last four TOC results.
(d) If the GRRP exceeds the limit in (c)(1), or its approved increased TOC limit obtained pursuant to section 60320.130(c), based on a 20-week running average, the GRRP’s project sponsor shall:

1. immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, 3 days apart, are less than the limit;
2. notify the Department and RWQCB within 7 days of suspension; and
3. within 60 days, submit a report to the Department and RWQCB describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include;
   A. a reduction of RWC sufficient to comply with the limit, and/or
   B. additional treatment demonstrated to the Department to remove TOC and chemicals or contaminants of concern to public health.

(e) If the GRRP exceeds the limit in (c)(2) or its approved increased TOC limit obtained pursuant to section 60320.130(c) based on the last four results, the GRRP shall, within 60 days, submit a report to the Department and RWQCB describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(f) Quarterly, a project sponsor shall monitor the GRRP’s recycled municipal wastewater or recharge water prior to the soil treatment process and the water after the soil treatment process, but at a point no farther than 30 days downgradient of the treatment process. The monitoring shall include at least three indicator compounds based on the results of an occurrence study approved by the Department. If the monitoring results do not indicate a reduction of at least 90 percent in the concentration of indicator compounds by the soil treatment process, excluding the effects of dilution from diluent water that may be present, the project sponsor shall investigate the reason for the low reduction and report the indicator compound and investigative results within 90 days of receipt of the analytical results.

(g) If the result of the investigation in subsection (f) concludes that the 90 percent reduction could not be demonstrated because the concentration of indicator compounds prior to the soil treatment process wasn’t sufficient, the project sponsor shall consult with the Department and comply with an alternative monitoring plan approved by the Department.

(h) To use one or more wastewater chemicals in lieu of TOC, approval from the Department shall be obtained. At a minimum, the chemical(s) used in lieu of TOC shall:

1. be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and
2. have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.
Section 60320.120. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP’s project sponsor shall sample and analyze the recycled municipal wastewater and the downgradient monitoring wells specified by the Department for the following:


2. Chemicals with notification levels that the Department has specified, based on a review of the GRRP’s engineering report and the affected groundwater basin(s); and

3. Chemicals that the Department has specified, based on a review of the GRRP’s engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to subparagraph 60320.106(a)(2)(A).

(b) The project sponsor may reduce monitoring for the chemicals in subsection (a) to once each year following Department approval based on the Department’s review of the most recent two years of results of the monitoring performed pursuant to subsection (a).

(c) Annually, the project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and RWQCB based on the following:

1. a review of the GRRP’s engineering report;

2. the inventory developed pursuant to section 60320.106(a)(2)(D);

3. the affected groundwater basin(s);

4. an indicator compound’s ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

5. the availability of a test method for a chemical.

(d) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and RWQCB no later than the quarter following the quarter in which the results are received by the GRRP’s project sponsor. If a detection of a contaminant is from a monitoring well and exceeds a state notification level, the project sponsor shall monitor the well for the contaminant within 7 days of receipt of the initial result. If the average of the initial and the confirmation results exceed the notification level, as soon as possible but no later than 30 days after receipt of the confirmation result, the project sponsor shall notify the Department and RWQCB. Following notification, the Department may require the project sponsor to notify local agencies overseeing private drinking water wells and each public water system immediately downgradient of the GRRP of the notification level exceedance.
Section 60320.122. Operation Optimization and Plan.

(a) Prior to operation, a new GRRP shall have an Operations Plan submitted to and approved by the Department. An existing GRRP shall maintain, and make available to the Department or RWQCB for review upon request, an Operations Plan. At a minimum, the Operations Plan shall identify the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and RWQCB. The project sponsor shall be responsible for ensuring that the Operations Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP.

(b) During the first year of operation for a new GRRP, or during the first year of operation after [insert effective date] for an existing GRRP, and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:
   (1) microbial contaminants;
   (2) regulated contaminants identified in section 60320.112 and the nitrogen compounds in section 60320.110; and
   (3) nonregulated chemicals identified in section 60320.120.

(c) Within six months of optimizing treatment processes pursuant to (b) and anytime thereafter operations are optimized that result in a change in operation, each GRRP shall update their operations plan to include such changes in operational procedures and submit the operations plan to the Department for review.

Section 60320.124. Response Retention Time.

(a) The recycled municipal wastewater used by a GRRP shall be retained underground for a period of time sufficient to allow the GRRP’s project sponsor ample response time to identify treatment failures and implement actions, including those required pursuant to section 60320.100(b), necessary for the protection of public health from inadequately treated recycled municipal wastewater or recharge water.

(b) The response time required in subsection (a) shall be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. Regardless of the minimum response time identified in subsection (a), the retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response time in subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, the project sponsor shall receive no more than 0.67
months credit. The retention time shall be the time representing the difference from when water is applied at the GRRP to when the first ten percent (10%) of such water arrives at the downgradient endpoint. A project sponsor for new GRRP shall initiate the tracer study prior to the end of the third month of operation. The project sponsor for existing GRRP that hasn’t already performed a tracer study shall initiate a tracer study prior to the renewal of the GRRP’s permit.

(d) For the purpose of siting a GRRP location during project planning and until a GRRP’s project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.124.

<table>
<thead>
<tr>
<th>Method used to estimate the retention time</th>
<th>Response Time Credit per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracer study utilizing an intrinsic tracer, based on T_{10} (i.e. the time for ten percent (10%) of tracer concentration to reach the endpoint).</td>
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<td>0.25 months</td>
</tr>
</tbody>
</table>

(e) The protocol(s) used to establish the retention times in subsections (c) and (d) shall be approved by the Department.

(f) The Department may require the GRRP to demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.
Section 60320.126. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells such that:

(1) at least one monitoring well is located;
   (A) no less than two weeks, but no more than six months of travel through the saturated zone of the GRRP, and
   (B) at least 30 days upgradient of the nearest drinking water source;

(2) in addition to the well(s) paragraph (1), at least one monitoring well is located between the GRRP and the nearest downgradient domestic water supply well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;
   (A) obtained independently from each aquifer, initially receiving the water used as a source of potable water supply, that will receive the GRRP’s recharge water, and
   (B) validated as receiving recharge water from the GRRP.

(b) From each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), the project sponsor shall collect two samples prior to GRRP operation (for a new GRRP) and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department and RWQCB based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds a nitrate, nitrite, or nitrate plus nitrite MCL, the project sponsor shall, within 24 hours, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant’s MCL, the project sponsor shall:

   (1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and RWQCB; and
   (2) discontinue surface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and RWQCB that the contamination was not a result of the GRRP.

(d) For chemical analyses completed in a calendar month, the project sponsor shall ensure the laboratory submits results no later than the end of the following month using the Electronic Deliverable Format as defined in the Electronic Deliverable Format (EDF) Version 1.2i Guidelines & Restrictions dated April 2001 and Data Dictionary dated April 2001.

(e) The GRRP’s project sponsor may reduce monitoring for the chemicals and contaminants in subsection (b) to once each year following Department approval based on the Department’s review of the most recent two years of results.
Section 60320.128. Reporting.

(a) Annually, the project sponsor shall provide a report to the RWQCB and the Department. Public water systems having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

1. A summary of the GRRP’s compliance status with the applicable monitoring requirements and criteria of this Article during the previous calendar year;
2. For any violations of this Article during the previous calendar year:
   A. the date, duration, and nature of the violation,
   B. a summary of any corrective actions and/or suspensions of surface application of recycled municipal wastewater resulting from a violation, and
   C. if uncorrected, a schedule for and summary of all remedial actions;
3. Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;
4. Information pertaining to the vertical and horizontal migration of the recharge water plume;
5. A description of any changes in the operation of any unit processes or facilities;
6. A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;
7. The estimated quantity and quality of the recycled municipal wastewater and diluent water to be utilized for the next twelve months; and
8. A summary of the measures taken to comply with section 60320.106 and the effectiveness of the implementation of the measures.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, the project sponsor shall update the report to address any project changes and submit the report to the RWQCB and the Department. The update shall include, but not be limited to:

1. anticipated RWC increases, a description of how the RWC requirements in section 60320.116 will be met, and the expected impact the increase will have on the GRRP’s ability to meet the requirements of this Article;
2. evidence that the requirements associated with retention time in section 60320.108, if applicable, and section 60320.124 have been met; and
3. a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.
Section 60320.130. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP’s project sponsor has:

1. demonstrated to the Department that the proposed alternative would assure at least the same level of protection to public health;
2. received written approval from the Department prior to implementation of the alternative; and
3. if required by the Department or RWQCB for the purpose of conducting a public hearing regarding the proposed alternative, disseminated information to the public, and received public comments, pursuant to subsections 60320.102(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in paragraph (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

(c) The TOC limit specified in section 60320.118(c) may be increased if:

1. The increased TOC limit is approved by the Department and RWQCB;
2. The GRRP has been in operation for the most recent ten consecutive years;
3. The project sponsor submits a proposal to the Department prepared and signed by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The proposal shall include the following, based on the most recent ten consecutive years of operation;
   A. GRRP operations, monitoring, and compliance data,
   B. Evidence that the GRRP has a history of compliance with the requirements of their RWQCB permit,
   C. Evidence that the water collected at all downgradient drinking water wells and monitoring wells impacted by the GRRP has met the primary drinking water standards specified pursuant to section 60320.126(b),
   D. Analytical or treatment studies requested by the Department to make the determination in subparagraph (C),
   E. Validation of appropriate construction and siting of monitoring wells pursuant to section 60320.126, and
   F. A study defining the water quality changes, including organic carbon characterization, as a result of the impact of the GRRP;
4. The project sponsor has performed a health effects evaluation that assesses the health risks to consumers of water impacted by the GRRP, including any anticipated water quality changes resulting from the proposed increased TOC limit. The evaluation shall include the following:
   A. An exposure assessment that characterizes the quality of the water consumed and the quantity of contaminants and chemicals consumed,
(B) All available human epidemiologic studies of the population that has consumed water impacted by the GRRP,

(C) The results of laboratory animal studies and health risk assessments available in peer-reviewed literature pertaining to water impacted by the GRRP and anticipated water quality changes resulting from the proposed increased TOC, including studies or assessments where extrapolation of data may be relevant,

(D) A health risk assessment of the potential individual and cumulative effects of the regulated contaminants described in section 62320.112, and the chemicals or contaminants monitored pursuant to subsections 60320.120(a) and (c), that includes;
   1. lifetime risks of cancer, and
   2. risks of non-cancer effects, and

(E) A report detailing comments, questions, concerns, and conclusions of a review by an independent scientific peer review advisory panel that includes, as a minimum, a toxicologist, an epidemiologist, an engineering geologist or hydrogeologist registered in California, an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply, a microbiologist, and a chemist.
ARTICLE 5.2. INDIRECT POTABLE REUSE: GROUNDWATER
REPLENISHMENT - SUBSURFACE APPLICATION

Section 60320.200. General Requirements.
(a) A Groundwater Replenishment Reuse Project (GRRP) project sponsor utilizing subsurface application shall meet the requirements of this Article and continuously treat, with full advanced treatment meeting the criteria in section 60320.201, the entire recycled municipal wastewater stream prior to application.

(b) Prior to operation of a new GRRP, or prior to permit renewal for an existing GRRP, the GRRP’s project sponsor shall have a Department-approved plan describing the steps the project sponsor will take to provide an alternative source of potable water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism the project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP’s operation, as determined by the Department:
   (1) violates a California or federal drinking water standard;
   (2) has been degraded to the degree that it is no longer a safe source of drinking water; or
   (3) receives water that fails to meet section 60320.208.

(c) Prior to operating a new GRRP, the project sponsor shall collect at least two samples from each monitoring well approved pursuant to section 60320.226. The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics in sections 60320.210, 60320.212, 60320.218 and 60320.220.

(d) A GRRP’s recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to section 60320.208 and 60320.224. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.216.

(e) A GRRP’s project sponsor shall provide the Department, RWQCB, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates:
   (1) the location and boundaries of the GRRP;
   (2) the boundary representing the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to section 60320.208 and section 60320.224; and
   (3) the location of all monitoring wells established pursuant to section 60320.226 and drinking water supply wells within two years of the GRRP based
on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a new GRRP, the project sponsor shall demonstrate to the Department and RWQCB that the project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a new GRRP’s project sponsor shall demonstrate that all treatment processes have been installed and can be operated by the project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, the project sponsor for a new GRRP shall include a hydrogeological assessment of the proposed GRRP’s setting. The assessment shall include the following:

1. the qualifications of the individual(s) preparing the assessment;
2. a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;
3. a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and
4. based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts:
   A. the existing hydrogeology and the hydrogeology anticipated as a result of the presence of the GRRP, and
   B. maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

Section 60320.201. Advanced Treatment Criteria.
Full advanced treatment is the treatment of an oxidized wastewater, as defined in section 60301.650, using a reverse osmosis and an oxidation treatment process that, at a minimum, meets the criteria of this section.

(a) A project sponsor shall select for use a reverse osmosis membrane that:
1. has been determined, utilizing ASTM method D4194-03 (2008), that it achieves an average rejection of sodium chloride greater than or equal to 99.5 percent, with a 15 percent recovery; and
2. through bench-scale testing, initially produces a permeate having TOC concentrations of 0.25 mg/L or less when using reverse osmosis influent consistent with the GRRP’s expected influent.

(b) For the reverse osmosis treatment process, a project sponsor shall propose, for Department review and approval, on-going performance monitoring (e.g. conductivity or TOC) that indicates when the integrity of the process has been compromised. The proposal shall include at least one form of continuous
monitoring, as well as the associated surrogate and/or operational parameter limits and alarm settings that indicate when the integrity has been compromised.

(c) To demonstrate a sufficient oxidation process has been designed for implementation, a project sponsor shall:

1. Perform an occurrence study on the project’s municipal wastewater to identify indicator compounds and select a total of at least nine indicator compounds, with at least one from each of the functional groups in subparagraphs (A) through (I) below. The project sponsor shall submit an occurrence study protocol, as well as the subsequent results and chosen indicator compounds, to the Department for review and approval.
   
   (A) Hydroxy Aromatic
   (B) Amino/Acylamino Aromatic
   (C) Nonaromatic with carbon double bonds
   (D) Deprotonated Amine
   (E) Alkoxy Polyaromatic
   (F) Alkoxy Aromatic
   (G) Alkyl Aromatic
   (H) Saturated Aliphatic
   (I) Nitro Aromatic

2. Utilize an oxidation process that achieves optimal removal of the indicator compounds selected in paragraph (1) such that removal is no less than:
   
   (A) 0.5-log (69 percent) for each indicator compound representing the functional groups in paragraph (1)(A) through (1)(G), and
   (B) 0.3-log (50 percent) for each indicator compound representing the functional groups in paragraph (1)(H) and (1)(I).

3. Establish at least one surrogate or operational parameter that reflects the removal of at least five of the nine indicator compounds selected pursuant to paragraph (1) such that:
   
   (A) at least one of the five indicator compounds represents at least one functional group in paragraph (1)(A) through (1)(G),
   (B) at least one of the five indicator compounds represents at least one functional group in paragraph (1)(H) or (1)(I),
   (C) at least one surrogate or operational parameter is capable of being monitored continuously, recorded, and have associated alarms, and
   (D) a surrogate or operational parameter, including the parameter in (C), is identified that indicates when the process may no longer meet the criteria established in paragraph (2).

4. Conduct pilot testing that includes confirmation the findings of the occurrence study in paragraph (1) and provides evidence that the requirements of paragraphs (2) and (3) can be met with a full-scale oxidation process. The pilot testing shall include challenge or spiking tests conducted to determine the removal differential under normal operating conditions utilizing, at minimum, the nine indicator compounds identified in paragraph (1). The project sponsor shall submit a pilot testing protocol, as well as the subsequent results, to the Department for review and approval.
(d) In lieu of demonstrating that a sufficient oxidation process has been designed for implementation pursuant to subsection (c), a project sponsor may conduct pilot testing demonstrating that the oxidation process will provide a 0.5-log (69 percent) reduction of 1,4-dioxane.

(1) The project sponsor shall submit a pilot testing protocol, as well as the subsequent results, to the Department for review and approval. The pilot testing shall include challenge or spiking tests, using 1,4-dioxane, to demonstrate the proposed oxidation process has been designed and will achieve the 0.5-log reduction under normal operation of the oxidation process.

(2) The project sponsor shall establish surrogate and/or operational parameters that reflect whether the 0.5-log 1,4-dioxane design criteria is being met. At least one surrogate or operational parameter shall be capable of being monitored continuously, recorded, and have associated alarms that indicate when the process no longer operates as designed.

(e) During the full-scale operation of the oxidation process designed pursuant to subsections (c) or (d), the project sponsor shall continuously monitor the surrogate and/or operational parameters established pursuant to (c)(3)(C) or (d)(2), as applicable. The project sponsor shall implement, in full-scale operation, the oxidation process as designed pursuant to subsections (c) or (d).

(f) Within 60 days after completing the initial 12-months of monitoring pursuant to subsection (e), the project sponsor shall submit a report to the Department and RWQCB that includes:

(1) the results of the monitoring performed in subsection (e);

(2) the removal differential of the indicator compounds;

(3) a description of the efficacy of the surrogate and/or operational parameters to reflect the removal differential of the indicator compounds; and

(4) a description of actions taken, or those that would be taken, if the indicator compound removal didn’t meet the associated design criteria in (c) or (d), the continuous surrogate and/or operational parameter monitoring in (c)(3)(C) or (d)(2) failed to correspond to the differential indicator compound removal, or the surrogate and/or operational parameter established in (c)(3)(D) or (d)(2) was not met.

(g) Within 60 days after completing 12 months of operation of the reverse osmosis process, the project sponsor shall submit a report to the Department and RWQCB describing the effectiveness of the treatment, process failures, and actions taken in the event the on-going monitoring in subsection (b) indicated that process integrity was compromised.

(h) Each quarter, the project sponsor shall tabulate the percent of the quarter’s monitoring, conducted pursuant to subsection (b) and (e), that did not meet the surrogate and/or operational parameter limits established to assure proper on-going performance of the reverse osmosis and oxidation processes. If
the value is more than ten percent, within 30 days after the end of the quarter the project sponsor shall:

(1) submit a report to the Department and RWQCB describing the corrective actions planned or taken to reduce the percent to ten percent or less; and

(2) consult with the Department and, if required, comply with an alternative monitoring plan approved by the Department.

(i) Each month the project sponsor shall collect grab samples representative of the effluent of the advanced treatment process and have the samples analyzed for contaminants having MCLs and notification levels. After 12 consecutive months with no results exceeding an MCL or notification level, the project sponsor may apply for reduced monitoring frequency. The reduced monitoring frequency shall be no less than quarterly. Monitoring conducted pursuant to this subsection may be used in lieu of the monitoring (for the same contaminants) required pursuant to section 60320.212. The effluent of the advanced treatment process shall not exceed an MCL or notification level.


(a) A public hearing for a GRRP shall be held by the project sponsor prior to the Department’s submittal of its recommendations to the RWQCB for the GRRP’s initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing, the project sponsor shall provide the Department, for review and approval, the information the project sponsor intends to present at the hearing. The information shall also be provided on the Internet. Following the Department’s approval of the information, the project sponsor shall place the information on the Internet and in a repository that provides at least thirty days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, the project sponsor shall:

(1) Notify the public of the following;
(A) the location and hours of operation of the repository,
(B) the Internet address where the information may be viewed,
(C) the purpose of the repository and public hearing,
(D) the manner in which the public can provide comments, and
(E) the date, time, and location of the public hearing; and

(2) At a minimum, notify the first downgradient potable water well owner and well owners whose drinking water source is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to (b)(1) shall be by one or more of the following methods delivered in a
manner to reach persons whose source of drinking water may be impacted by the GRRP:

(1) local newspaper(s) publication;
(2) mailed or direct delivery of a newsletter;
(3) conspicuously placed statement in water bills; or
(4) television and/or radio.

Section 60320.204. Lab Analyses.
(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP’s Operations Plan prepared pursuant to section 60320.222.

Section 60320.206. Wastewater Source Control.
A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:

(a) administers an industrial pretreatment and pollutant source control program;
(b) implements and maintains a source control program that includes, at a minimum;
   (1) an assessment of the fate of Department-specified and RWQCB-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,
   (2) chemical and contaminant source investigations and monitoring that focuses on Department-specified chemicals and contaminants,
   (3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency’s service area that flows into the water reclamation facility subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and
   (4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system; and
(c) is compliant with the effluent limits established in the RWQCB permit for the GRRP.

Section 60320.208. Pathogenic Microorganism Control.
(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment
that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, and Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction and shall achieve at least 1-log reduction.

(b) For each month retained underground as demonstrated in subsection (e), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction.

(c) With the exception of log reduction through retention time underground, the project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department’s review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process’s log reduction. The report and/or challenge test shall be prepared by engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground, the project sponsor shall propose and include in its Operations Plan prepared pursuant to section 60320.222, on-going monitoring that verifies the performance of each treatment process’s ability to achieve its credited log reduction.

(d) The project sponsor of a GRRP whose permit was issued prior to [insert effective date] shall demonstrate compliance with subsection (c) prior to the renewal of the GRRP’s permit. The project sponsor of a new GRRP shall demonstrate compliance with subsection (c) prior to being issued a permit.

(e) To demonstrate the retention time underground in subsection (b) a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when water is applied at the GRRP to when the first two percent (2%) of such water arrives at the downgradient endpoint. The project sponsor for new GRRP shall initiate the tracer study prior to the end of the third month of operation. The project sponsor for existing GRRP that hasn’t already performed such a tracer study shall complete a tracer study demonstrating retention time underground prior to the renewal of the GRRP’s permit.

(f) For the purpose of siting a GRRP location during project planning and until a GRRP’s project sponsor has met the requirements of subsection (e), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.208.
Table 60320.208

<table>
<thead>
<tr>
<th>Method used to estimate the retention time to the nearest downgradient drinking water well</th>
<th>Virus Log Reduction Credit per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracer study utilizing an intrinsic tracer, based on $T_{10}$ (i.e. The time representing the difference from when water is applied at the GRRP to when the first ten percent arrives at the downgradient endpoint.)</td>
<td>0.67 logs</td>
</tr>
<tr>
<td>Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.</td>
<td>0.50 logs</td>
</tr>
<tr>
<td>Analytical modeling using existing academically-accepted equations such as Darcy’s Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.</td>
<td>0.25 logs</td>
</tr>
</tbody>
</table>

(g) The protocol(s) used to establish the retention times in subsections (e) and (f) shall be approved by the Department.

(h) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP’s project sponsor to demonstrate that the underground retention times required in this section are being met.

(i) If the pathogen reduction in subsection (a) is not met based on the ongoing monitoring required pursuant to subsection (c), within 24 hours of being aware the project sponsor shall immediately investigate the cause and initiate corrective actions. For failing to meet the pathogen reduction criteria longer than 4 consecutive hours or more than a total of 8 hours during any 7-day period, the Department and RWQCB shall be immediately notified. Failures of shorter duration shall be reported to the RWQCB no later than 10 days after the month in which the failure occurred.

(j) If the effectiveness of a treatment train’s ability to reduce enteric virus is less than 9-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, the project sponsor shall immediately notify the Department and RWQCB, and discontinue application of recycled municipal wastewater at the GRRP.

(a) To demonstrate control of the nitrogen compounds, the project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP’s Operations Plan, collect at least two samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied. Samples may be collected before or after subsurface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by the project sponsor to complete each analysis within 72 hours and have the result reported to the project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;
   (A) notify the Department and the RWQCB within 48 hours of being notified of the exceedance by the laboratory,
   (B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations such that continued and future exceedances don’t occur, and
   (C) initiate additional monitoring for nitrogen compounds as described in the GRRP’s Operations Plan, including locations in the groundwater basin, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the subsurface application of recycled municipal wastewater. Subsurface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) The GRRP’s project sponsor may apply for reduced monitoring frequencies for total nitrogen, nitrate, or nitrite if, for the most recent 12 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen or one-half the nitrate, nitrite, and nitrate plus nitrite MCLs; and

(2) a result did not exceed 10 mg/L total nitrogen or 80 percent of the nitrate, nitrite, and nitrate plus nitrite MCLs.

(c) If the results of reduced monitoring conducted pursuant to subsection (b) exceed the total nitrogen, nitrate, nitrite, and nitrate plus nitrite concentrations in paragraph (b), the project sponsor shall revert to the GRRP’s monitoring frequencies for total nitrogen, nitrate, and nitrite prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (b) are met.
Section 60320.212. Regulated Contaminants and Physical Characteristics Control.

(a) Each calendar quarter, as specified in the GRRP’s Operations Plan, the GRRP’s project sponsor shall collect grab samples representative of the applied recycled municipal wastewater and have the samples analyzed for:
   (1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;
   (2) the radionuclide chemicals in Tables 64442 and 64443;
   (3) the organic chemicals in Table 64444-A;
   (4) the disinfection byproducts in Table 64533-A; and
   (5) lead and copper.

(b) Recharge water may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in paragraph (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction for the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction applied for the quarter, the reported value shall be amended to account for any dilution.

(c) Each year, the GRRP’s project sponsor shall collect at least one representative grab sample of the recycled municipal wastewater and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant’s MCL or action level (for lead and copper), within 72 hours of notification of the result the project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation.
   (1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant’s MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP’s project sponsor shall notify the Department and RWQCB within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant’s MCL or action level. If the running four-week average exceeds the contaminant’s MCL or action level, the GRRP’s project sponsor shall notify the Department and RWQCB within 24 hours and, if directed by the Department or RWQCB, suspend application of the recycled municipal wastewater.
   (2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant’s MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant’s MCL.
(A) If the running four-week average exceeds the contaminant’s MCL, the project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in the next quarterly report submitted to RWQCB pursuant to section 60321, with a copy provided to the Department.

(B) If the running four-week average exceeds the contaminant’s MCL for sixteen weeks, the project sponsor shall notify the Department and RWQCB within 48 hours and, if directed by the Department or RWQCB, suspend application of the recycled municipal wastewater.

(e) With the exception of color, if an annual result of the monitoring performed pursuant to (c) exceeds a contaminant’s secondary MCL in Table 64449-A or the upper limit in Table 64449-B, the project sponsor shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly results exceeds a contaminant’s secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken in the next quarterly report submitted to RWQCB pursuant to section 60321, with a copy provided to the Department. The annual monitoring in (c) may resume if the running annual average of quarterly results does not exceed a contaminant’s secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

Section 60320.214. Diluent Water Requirements.
To be credited with diluent water used in calculating an RWC pursuant to section 60320.216, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP’s project sponsor is exempt from subsections (a) and (b). The GRRP’s project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding an MCL, collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the RWQCB within 48 hours of receiving the confirmation sample result,

(2) investigate the cause(s) and implement corrective actions, and

(3) each week, collect and analyze two grab samples at least three days apart as specified in an Operations Plan. If the average of the results for a two-week period exceeds the MCL, subsurface application of the diluent water shall not be used in the calculation of RWC until corrective actions are made. Quarterly monitoring may resume if four consecutive results are below the MCL.
(b) Conduct a source water evaluation per California-Nevada Section of American Water Works Association watershed sanitary survey handbook, or other Department approved evaluation, of the diluent water for Department review and approval that includes, but is not limited to:

1. a description of the source of the diluent water;
2. delineation of the origin and extent of the diluent water;
3. the susceptibility of the diluent water to contamination;
4. the identification of known or potential contaminants; and
5. an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed primary MCLs or notification levels and implements a Department-approved water quality monitoring plan for Department-specified contaminants to demonstrate compliance with the primary MCLs and notification levels. The plan shall also include:

1. monitoring of any chemicals or contaminants in section 60320.220, based on the source water evaluation performed in (b); and
2. actions to be taken in the event of non-compliance with a primary MCL or exceedance of a notification level.

(d) Develop a method for determining the volume of diluent water to be credited and demonstrate that the diluent water will be introduced in a manner such that the diluent water volume will not result in the GRRP’s 120-month running monthly average RWC exceeding its maximum RWC at or beyond the boundary established pursuant to 60320.200(e)(2). The method shall be submitted to the Department for review and approval, and be conducted at a frequency specified in the engineering report prepared pursuant to section 60323. The method shall address all conditions that influence how and when the recycled municipal wastewater and diluent water arrive at all points along the boundary. The conditions must include, but are not limited to, temporal variability in the diluent water supply and regional groundwater gradients, the difference in the distribution of the recycled municipal wastewater and diluent water between individual aquifers where more than one aquifer is replenished, and the difference in travel-time when recycled municipal wastewater and diluent water are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120 months:

1. demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, notification levels, and the water quality requirements in section 60320.212;
2. provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and
3. conduct a source water evaluation of the diluent water pursuant to subsection (c).
(f) In the Operations Plan prepared pursuant to 60320.222, include a description of:
(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and
(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

Section 60320.216. Recycled Municipal Wastewater Contribution (RWC) Requirements.
(a) Each month, for each subsurface application facility used for replenishing a groundwater basin, the GRRP’s project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 calendar months. For GRRPs in operation less than 120 months, calculation of the RMA RWC shall commence after 30 months of recycled water application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP’s RMA RWC, as determined in (a), shall not exceed the maximum RWC specified by the Department.

(c) The initial maximum RWC will be based on the Department’s review of the engineering report and information obtained as a result of the public hearing.

(d) A GRRP may increase its maximum RWC, provided that:
(1) the increase has been approved by the Department and RWQCB;
(2) for the previous 52 weeks the TOC 20-week running average, as monitored pursuant to section 62320.218, has not exceeded 0.5 mg/L; and
(3) the GRRP has received a permit from the RWQCB that allows operation of the GRRP at the increased maximum RWC.

(e) If the RMA RWC exceeds its maximum RWC, the GRRP’s project sponsor shall:
(1) notify the Department and RWQCB in writing within 7 days of exceedance; and
(2) within 60 days, implement corrective action(s) and submit a report to the Department and RWQCB describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

Section 60320.218. Total Organic Carbon Requirements.
(a) For each subsurface application facility used for replenishing a groundwater basin, the GRRP’s project sponsor shall monitor the applied recycled municipal wastewater for TOC as follows:
(1) Prior to replenishment, at least one 24-hour composite sample each week.

(2) Grab samples may be taken in lieu of the 24-hour composite samples required in paragraph (1) if the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period.

(b) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L based on:

(1) the 20-week running average of all TOC results; and

(2) the average of the last four TOC results.

(c) If the GRRP exceeds the limit in (b)(1), or its approved increased TOC limit obtained pursuant to section 60320.230(c), based on a 20-week running average, the GRRP’s project sponsor shall:

(1) immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, 3 days apart, are less than the limit;

(2) notify the Department and RWQCB within 7 days of suspension; and

(3) within 60 days, submit a report to the Department and RWQCB describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include a reduction of RWC sufficient to comply with the limit.

(d) If the GRRP exceeds the limit in (b)(2), or its approved increased TOC limit obtained pursuant to section 60320.230, based on the last four results, the GRRP shall, within 60 days, submit a report to the Department and RWQCB describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(e) To use one or more wastewater chemicals in lieu of TOC, approval from the Department shall be obtained. At a minimum, the chemical(s) used in lieu of TOC shall:

(1) be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and

(2) have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.

Section 60320.220. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP’s project sponsor shall sample and analyze the recycled municipal wastewater and the downgradient monitoring wells specified by the Department for the following:

(1) Priority Toxic Pollutants [chemicals listed in the Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, and 40 CFR Part 131, Federal Register 65(97), May 18, 2000, p. 31682] specified by the Department, based on the Department’s review of the GRRP’s engineering report;
(2) Chemicals with notification levels that the Department has specified, based on a review of the GRRP’s engineering report and the affected groundwater basin(s); and
(3) Chemicals that the Department has specified, based on a review of the GRRP’s engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to subparagraph 60320.206(a)(2)(A).

(b) The project sponsor may reduce monitoring for the chemicals in subsection (a) to once each year following Department approval based on the Department’s review of the most recent two years of results of the monitoring performed pursuant to subsection (a).

(c) Annually, the project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and RWQCB based on the following:
   (1) a review of the GRRP’s engineering report;
   (2) the inventory developed pursuant to section 60320.206(a)(2)(D);
   (3) the affected groundwater basin(s);
   (4) an indicator compound’s ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and
   (5) the availability of a test method for a chemical.

(d) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and RWQCB no later than the quarter following the quarter in which the results are received by the GRRP’s project sponsor. If a detection of a contaminant is from a monitoring well and exceeds a state notification level, the project sponsor shall monitor the well for the contaminant within 7 days of receipt of the initial result. If the average of the initial and the confirmation results exceed the notification level, as soon as possible but no later than 30 days after receipt of the confirmation result, the project sponsor shall notify the Department and RWQCB. Following notification, the Department may require the project sponsor to notify local agencies overseeing private drinking water wells and each public water system immediately downgradient of the GRRP of the notification level exceedance.

Section 60320.222. Operation Optimization and Plan.
(a) Prior to operation, a new GRRP shall have an Operations Plan submitted to and approved by the Department. An existing GRRP shall maintain, and make available to the Department or RWQCB for review upon request, an Operations Plan. At a minimum, the Operations Plan shall identify the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and RWQCB. The project sponsor shall be responsible for ensuring
that the Operations Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP.

(b) During the first year of operation for a new GRRP, or during the first year of operation after [insert effective date] for an existing GRRP, and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

1. microbial contaminants;
2. regulated contaminants identified in section 60320.212 and the nitrogen compounds in section 60320.210; and
3. nonregulated chemicals identified in section 60320.220.

(c) Within six months of optimizing treatment processes pursuant to (b) and anytime thereafter operations are optimized that result in a change in operation, each GRRP shall update their operations plan to include such changes in operational procedures and submit the operations plan to the Department for review.

Section 60320.224. Response Retention Time.

(a) The recycled municipal wastewater used by a GRRP shall be retained underground for a period of time sufficient to allow the GRRP’s project sponsor ample response time to identify treatment failures and implement actions, including those required pursuant to section 60320.100(b), necessary for the protection of public health from inadequately treated recycled municipal wastewater or recharge water.

(b) The response time required in subsection (a) shall be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. Regardless of the minimum response time identified in subsection (a), the retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response time in subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, the project sponsor shall receive no more than 0.67 months credit. The retention time shall be the time representing the difference from when water is applied at the GRRP to when the first ten percent (10%) of such water arrives at the downgradient endpoint. A project sponsor for new GRRP shall initiate the tracer study prior to the end of the third month of operation. The project sponsor for existing GRRP that hasn’t already performed a tracer study shall initiate a tracer study prior to the renewal of the GRRP’s permit.
(d) For the purpose of siting a GRRP location during project planning and until a GRRP’s project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.224.

Table 60320.224

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method used to estimate the retention time</strong></td>
<td><strong>Response Time Credit per Month</strong></td>
</tr>
<tr>
<td>Tracer study utilizing an intrinsic tracer, based on $T_{10}$ (i.e. the time for ten percent (10%) of tracer concentration to reach the endpoint).</td>
<td>0.67 months</td>
</tr>
<tr>
<td>Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.</td>
<td>0.50 months</td>
</tr>
<tr>
<td>Analytical modeling using existing academically-accepted equations such as Darcy’s Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.</td>
<td>0.25 months</td>
</tr>
</tbody>
</table>

(e) The protocol(s) used to establish the retention times in subsections (c) and (d) shall be approved by the Department.

(f) The Department may require the GRRP to demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.

Section 60320.226. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells such that:

1. at least one monitoring well is located;
2. (A) no less than two weeks, but no more than six months of travel time from the GRRP, and
3. (B) at least 30 days upgradient of the nearest drinking water source;
(2) in addition to the well(s) paragraph (1), at least one monitoring well is located between the GRRP and the nearest downgradient domestic water supply well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;
(A) obtained independently from each aquifer initially receiving the water used as a source of potable water supply that will receive the GRRP’s recharge water, and
(B) validated as receiving recharge water from the GRRP.

(b) From each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), the project sponsor shall collect two samples prior to GRRP operation (for a new GRRP) and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department and RWQCB based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds a nitrate, nitrite, or nitrate plus nitrite MCL, the project sponsor shall, within 24 hours, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant’s MCL, the project sponsor shall:
(1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and RWQCB; and
(2) discontinue surface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and RWQCB that the contamination was not a result of the GRRP.

(d) For chemical analyses completed in a calendar month, the project sponsor shall ensure the laboratory submits results no later than the end of the following month using the Electronic Deliverable Format as defined in the Electronic Deliverable Format (EDF) Version 1.2i Guidelines & Restrictions dated April 2001 and Data Dictionary dated April 2001.

(e) The GRRP’s project sponsor may discontinue monitoring for the chemicals and contaminants in subsection (b) following Department approval based on the Department’s review of the most recent two years of results.

Section 60320.228. Reporting.
(a) Annually, the project sponsor shall provide a report to the RWQCB and the Department. Public water systems having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California
and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the GRRP’s compliance status with the applicable monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;
   (A) the date, duration, and nature of the violation,
   (B) a summary of any corrective actions and/or suspensions of subsurface application of recycled municipal wastewater resulting from a violation, and
   (C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;

(4) Information pertaining to the vertical and horizontal migration of the recharge water plume;

(5) A description of any changes in the operation of any unit processes or facilities;

(6) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(7) The estimated quantity and quality of the recycled municipal wastewater and diluent water to be utilized for the next twelve months; and

(8) A summary of the measures taken to comply with section 60320.106 and the effectiveness of the implementation of the measures.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, the project sponsor shall update the report to address any project changes and submit the report to the RWQCB and the Department. The update shall include, but not be limited to:

(1) anticipated RWC increases, a description of how the RWC requirements in section 60320.216 will be met, and the expected impact the increase will have on the GRRP’s ability to meet the requirements of this Article;

(2) evidence that the requirements associated with retention time in section 60320.208, if applicable, and section 60320.224 have been met; and

(3) a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.

Section 60320.230. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP’s project sponsor has:

(1) demonstrated to the Department that the proposed alternative would assure at least the same level of protection to public health;

(2) received written approval from the Department prior to implementation of the alternative; and
(3) if required by the Department or RWQCB for the purpose of conducting a public hearing regarding the proposed alternative, disseminated information to the public, and received public comments, pursuant to subsections 60320.202(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in paragraph (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.
ARTICLE 5.3. INDIRECT POTABLE REUSE: GROUNDWATER REPLENISHMENT - SURFACE APPLICATION WITH FULL ADVANCED TREATMENT

A Groundwater Replenishment Reuse Project (GRRP) project sponsor utilizing surface application with continuous advanced treatment of the entire recycled municipal wastewater stream prior to application shall meet the requirements of Article 5.2, except that after one year of operation, the project sponsor may apply for a reduced monitoring frequency for any monitoring requirement.
ARTICLE 7. ENGINEERING REPORT AND OPERATIONAL REQUIREMENTS

Section 60323. Engineering Report

(a) No person shall produce or supply reclaimed water for direct reuse from a proposed water reclamation plant unless he files an approved engineering report.

(b) The report shall be prepared by a properly qualified engineer licensed in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately treated wastewater will be delivered to the use area.

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1 Section 60320 is an existing section. The text reflects the proposed amendments.
Appendix H

Los Angeles County Fire Flow and Hydrant Requirement (V7-C1-S8)
I. INTRODUCTION

A. Purpose: To provide Department standards for fire flow, hydrant spacing and specifications.

B. Scope: Informational to the general public and instructional to all individuals, companies, or corporations involved in the subdivision of land, construction of buildings, or alterations and/or installation of fire protection water systems and hydrants.

C. Author: The Deputy Chief of the Prevention Services Bureau through the Assistant Fire Chief (Fire Marshal) of the Fire Prevention Division is responsible for the origin and maintenance of this regulation.

D. Definitions:
   1. GPM – gallons per minute
   2. psi – pounds per square inch
   3. Detached condominiums – single detached dwelling units on land owned in common
   4. Multiple family dwellings – three or more dwelling units attached

II. RESPONSIBILITY

A. Land Development Unit

   1. The Department’s Land Development Unit shall review all subdivisions of land and apply fire flow and hydrant spacing requirements in accordance with this regulation and the present zoning of the subdivision or allowed land use as approved by the County’s Regional Planning Commission or city planning department.

B. Fire Prevention Engineering Section

   1. The Department’s Fire Prevention Engineering Section shall review building plans and apply fire flow and hydrant spacing requirements in accordance with this regulation.
### III. POLICY

A. The procedures, standards, and policies contained herein are provided to ensure the adequacy of, and access to, fire protection water and shall be enforced by all Department personnel.

### IV. PROCEDURES

A. Land development: fire flow, duration of flow, and hydrant spacing

The following requirements apply to land development issues such as: tract and parcel maps, conditional use permits, zone changes, lot line adjustments, planned unit developments, etc.

<table>
<thead>
<tr>
<th>Fire Flow</th>
<th>Duration of Flow</th>
<th>Public Hydrant Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Flow</td>
<td>Duration of Flow</td>
<td>Public Hydrant Spacing</td>
</tr>
</tbody>
</table>

1. Residential
   Fire Zones 3
   Very High Fire Hazard Severity Zone (VHFHSZ)

   - a. Single family dwelling and detached condominiums (1 – 4 Units) (Under 5,000 square feet)
     1,250 GPM 2 hrs. 600 ft.
   - b. Detached condominium (5 or more units) (Under 5,000 square feet)
     1,500 GPM 2 hrs. 300 ft.
   - c. Two family dwellings (Duplexes)
     1,500 GPM 2 hrs. 600 ft.

   **NOTE:** FOR SINGLE FAMILY DWELLINGS OVER 5,000 SQUARE FEET. SEE, TABLE 1 FOR FIRE FLOW REQUIREMENTS PER BUILDING SIZE.
2. Multiple family dwellings, hotels, high rise, commercial, industrial, etc.
   a. Due to the undetermined building designs for new land development projects (*undeveloped land*), the required fire flow shall be: 5,000 GPM 5 hrs. 300 ft.

   NOTE: REDUCTION IN FIRE FLOW IN ACCORDANCE WITH TABLE 1.

   b. Land development projects consisting of lots having existing structures shall be in compliance with Table 1 (fire flow per building size). This standard applies to multiple family dwellings, hotels, high rise, commercial, industrial, etc.

   NOTE: FIRE FLOWS PRECEDING ARE MEASURED AT 20 POUNDS PER SQUARE INCH RESIDUAL PRESSURE.

B. Building plans

The Department's Fire Prevention Engineering Section shall review building plans and apply fire flow requirements and hydrant spacing in accordance with the following:

1. Residential

<table>
<thead>
<tr>
<th>Building Occupancy Classification</th>
<th>Fire Flow</th>
<th>Duration of Flow</th>
<th>Public Hydrant Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Single family dwellings - Fire Zone 3 (Less than 5000 square feet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On a lot of one acre or more</td>
<td>750 GPM</td>
<td>2 hrs.</td>
<td>600 ft.</td>
</tr>
<tr>
<td>On a lot less than one acre</td>
<td>1,250 GPM</td>
<td>2 hrs.</td>
<td>600 ft.</td>
</tr>
<tr>
<td>b. Single family dwellings - VHFHSZ (Less than 5,000 square feet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On a lot of one acre or more</td>
<td>1,000 GPM</td>
<td>2 hrs.</td>
<td>600 ft.</td>
</tr>
<tr>
<td>On lots less than one acre</td>
<td>1,250 GPM</td>
<td>2 hrs.</td>
<td>600 ft.</td>
</tr>
</tbody>
</table>
NOTE: FOR SINGLE FAMILY DWELLINGS GREATER THAN 5,000 SQUARE FEET IN AREA SEE TABLE

c. Two-family dwelling units

Duplexes 1,500 GPM 2 hrs. 600 ft.

2. Mobile home park

a. Recreation bldg. Refer to Table 1 for fire flow according to building size

b. Mobile home park 1,250 GPM 2 hrs. 600 ft.

3. Multiple residential, apartments, single family residences (greater than 5,000 square feet), private schools, hotels, high rise, commercial, industrial, etc. (R-1, E, B, A, I, H, F, M, S) (see Table 1).

C. Public fire hydrant requirements

1. Fire hydrants shall be required at intersections and along access ways as spacing requirements dictate.

2. Spacing

a. Cul-de-sac

When cul-de-sac depth exceeds 450' (residential) or 200’ (commercial), hydrants shall be required at mid-block. Additional hydrants will be required if hydrant spacing exceeds specified distances.

b. Single family dwellings

Fire hydrant spacing of 600 feet

NOTE: The following guidelines shall be used in meeting single family dwellings hydrant spacing requirements:

(1) Urban properties (more than one unit per acre):
No portion of lot frontage should be more than 450' via vehicular access from a public hydrant.
(2) Non-Urban Properties (less than one unit per acre):
No portion of a structure should be placed on a lot where it exceeds 750' via vehicular access from a properly spaced public hydrant that meets the required fire flow.

c. All occupancies

Other than single family dwellings, such as commercial, industrial, multi-family dwellings, private schools, institutions, detached condominiums (five or more units), etc.

Fire hydrant spacing shall be 300 feet.

NOTE: The following guidelines shall be used in meeting the hydrant spacing requirements.

(1) No portion of lot frontage shall be more than 200 feet via vehicular access from a public hydrant.

(2) No portion of a building should exceed 400 feet via vehicular access from a properly spaced public hydrant.

d. Supplemental fire protection

When a structure cannot meet the required public hydrant spacing distances, supplemental fire protection shall be required.

NOTE: Supplemental fire protection is not limited to the installation of on-site fire hydrants; it may include automatic extinguishing systems.

3. Hydrant location requirements - both sides of a street

Hydrants shall be required on both sides of the street whenever:

a. Streets having raised median center dividers that make access to hydrants difficult, causes time delay, and/or creates undue hazard.

b. For situations other than those listed in “a” above, the Department’s inspector’s judgment shall be used. The following items shall be considered when determining hydrant locations:

   (1) Excessive traffic loads, major arterial route, in which traffic would be difficult to detour.
(2) Lack of adjacent parallel public streets in which traffic could be redirected (e.g., Pacific Coast Highway).

(3) Past practices in the area.

(4) Possibility of future development in the area.

(5) Type of development (i.e., flag-lot units, large apartment or condo complex, etc.).

(6) Accessibility to existing hydrants

(7) Possibility of the existing street having a raised median center divider in the near future.

D. On-site hydrant requirements

1. When any portion of a proposed structure exceeds (via vehicular access) the allowable distances from a public hydrant and on-site hydrants are required, the following spacing requirements shall be met:

   a. Spacing distance between on-site hydrants shall be 300 to 600 feet.

      (1) Design features shall assist in allowing distance modifications.

   b. Factors considered when allowing distance modifications.

      (1) Only sprinklered buildings qualify for the maximum spacing of 600 feet.

      (2) For non-sprinklered buildings, consideration should be given to fire protection, access doors, outside storage, etc. Distance between hydrants should not exceed 400 feet.

2. Fire flow

   a. All on-site fire hydrants shall flow a minimum of 1,250 gallons per minute at 20 psi for a duration of two hours. If more than one on-site fire hydrant is required, the on-site fire flow shall be at least 2,500 gallons per minute at 20 psi, flowing from two hydrants simultaneously. On site flow may be greater depending upon the size of the structure and the distance from public hydrants.
NOTE: ONE OF THE TWO HYDRANTS TESTED SHALL BE THE FARthest FROM THE PUBLIC WATER SOURCE.

3. Distance from structures

All on-site hydrants shall be installed a minimum of 25 feet from a structure or protected by a two-hour firewall.

4. Shut-off valves

All on-site hydrants shall be equipped with a shut-off (gate) valve, which shall be located as follows:

a. Minimum distance to the hydrant 10 feet
b. Maximum distance from the hydrant 25 feet

5. Inspection of new installations

All new on-site hydrants and underground installations are subject to inspection of the following items by a representative of the Department:

a. Piping materials and the bracing and support thereof.
b. A hydrostatic test of 200 psi for two hours.
c. Adequate flushing of the installation.
d. Flow test to satisfy required fire flow.

(1) Hydrants shall be painted with two coats of red primer and one coat of red paint, with the exception of the stem and threads, prior to flow test and acceptance of the system.

6. Maintenance

It shall be the responsibility of the property management company, the homeowners association, or the property owner to maintain on-site hydrants.

a. Hydrants shall be painted with two coats of red primer and one coat of red, with the exception of the stem and threads, prior to flow test and acceptance of the system.
b. No barricades, walls, fences, landscaping, etc., shall be installed or planted within three feet of a fire hydrant.
E. Public hydrant flow procedure

The minimum acceptable flow from any existing public hydrant shall be 1,000 GPM unless the required fire flow is less. Hydrants used to satisfy fire flow requirements will be determined by the following items:

1. Only hydrants that meet spacing requirements are acceptable for meeting fire flow requirements.

2. In order to meet the required fire flow:
   a. Flow closest hydrant and calculate to determine flow at 20 pounds per square inch residual pressure. If the calculated flow does not meet the fire flow requirement, the next closest hydrant shall be flowed simultaneously with the first hydrant, providing it meets the spacing requirement, etc.
   b. If more than one hydrant is to be flowed in order to meet the required fire flow, the number of hydrants shall be flowed as follows:

      | Hydrants | GPM |
      |----------|-----|
      | One hydrant | 1,250 GPM and below |
      | Two hydrants | 1,251– 3,500 GPM flowing simultaneously |
      | Three hydrants | 3,501– 5,000 GPM flowing simultaneously |

F. Hydrant upgrade policy

1. Existing single outlet 2 1/2" inch hydrants shall be upgraded to a double outlet 6" x 4" x 2 1/2" hydrant when the required fire flow exceeds 1,250 GPM.

2. An upgrade of the fire hydrant will not be required if the required fire flow is between the minimum requirement of 750 gallons per minute, up to and including 1,250 gallons per minute, and the existing public water system will provide the required fire flow through an existing wharf fire hydrant.

3. All new required fire hydrant installations shall be approved 6" x 4" x 2 1/2" fire hydrants.

4. When water main improvements are required to meet GPM flow, and the existing water main has single outlet 2 1/2" fire hydrant(s), then a hydrant(s) upgrade will be required. This upgrade shall apply regardless of flow requirements.
G. Hydrant specifications

All required public and on-site fire hydrants shall be installed to the following specifications prior to flow test and acceptance of the system.

1. Hydrants shall be:
   a. Installed so that the center line of the lowest outlet is between 14 and 24 inches above finished grade
   b. Installed so that the front of the riser is between 12 and 24 inches behind the curb face
   c. Installed with outlets facing the curb at a 45-degree angle to the curb line if there are double outlet hydrants
   d. Similar to the type of construction which conforms to current A.W.W.A. Standards
   e. Provided with three-foot unobstructed clearance on all sides
   f. Provided with approved plastic caps
   g. Painted with two coats of red primer and one coat of traffic signal yellow for public hydrants and one coat of red for on-site hydrants, with the exception of the stems and threads

2. Underground shut-off valves are to be located:
   a. A minimum distance of 10 feet from the hydrant
   b. A maximum distance of 25 feet from the hydrant

   Exception: Location can be less than 10 feet when the water main is already installed and the 10-foot minimum distance cannot be satisfied.

3. All new water mains, laterals, gate valves, buries, and riser shall be a minimum of six inches inside diameter.

4. When sidewalks are contiguous with a curb and are five feet wide or less, fire hydrants shall be placed immediately behind the sidewalk. Under no circumstances shall hydrants be more than six feet from a curb line.
5. The owner-developer shall be responsible for making the necessary arrangements with the local water purveyor for the installation of all public facilities.

6. Approved fire hydrant barricades shall be installed if curbs are not provided (see Figures 1, 2, and 3 following on pages 11 and 12).
Barricade/Clearance Details

Figure 1

Figure 2

CONCRETE CAP
6" BARRICADE POST
CONCRETE FILLED
MIN. 4" DIA. SCHEDULE 40
STEEL. SEE NOTE #1

CONCRETE
3'

4' MIN.

15'

BARRICADE

6"x4" x 2 1/2"
HYDRANT

36'

OUTLETS

PLAN
FIRE HYDRANT BARRICADES
(TYPICAL)
Notes:

1. Constructed of steel not less than four inches in diameter, six inches if heavy truck traffic is anticipated, schedule 40 steel and concrete filled.

2. Posts shall be set not less than three feet deep in a concrete footing of not less than 15 inches in diameter, with the top of the posts not less than three feet above ground and not less than three feet from the hydrant.

3. Posts, fences, vehicles, growth, trash storage and other materials or things shall not be placed or kept near fire hydrants in a manner that would prevent fire hydrants from being immediately discernable.

4. If hydrant is to be barricaded, no barricade shall be constructed in front of the hydrant outlets (Figure 2, shaded area).

5. The exact location of barricades may be changed by the field inspector during a field inspection.

6. The steel pipe above ground shall be painted a minimum of two field coats of primer.

7. Two finish coats of “traffic signal yellow” shall be used for fire hydrant barricades.

8. Figure 3 shows hydrant hook up during fireground operations. Notice apparatus (hydra-assist-valve) connected to hydrant and the required area. Figure 3 shows the importance of not constructing barricades or other obstructions in front of hydrant outlets.
H. Private fire protection systems for rural commercial and industrial development

Where the standards of this regulation cannot be met for industrial and commercial developments in rural areas, alternate proposals which meet NFPA Standard 1142 may be submitted to the Fire Marshal for review. Such proposals shall also be subject to the following:

1. The structure is beyond 3,000 feet of any existing, adequately-sized water system.
   a. Structures within 3,000 feet of an existing, adequately-sized water system, but beyond a water purveyor service area, will be reviewed on an individual basis.

2. The structure is in an area designated by the County of Los Angeles’ General Plan as rural non-urban.

I. Blue reflective hydrant markers replacement policy

1. Purpose: To provide information regarding the replacement of blue reflective hydrant markers, following street construction or repair work.
   a. Fire station personnel shall inform Department of Public Works Road Construction Inspectors of the importance of the blue reflective hydrant markers, and encourage them to enforce their Department permit requirement, that streets and roads be returned to their original condition, following construction or repair work.
   b. When street construction or repair work occurs within this Department's jurisdiction, the nearest Department of Public Works Permit Office shall be contacted. The location can be found by searching for the jurisdiction office in the "County of Los Angeles Telephone Directory" under "Department of Public Works Road Maintenance Division." The importance of the blue reflective hydrant markers should be explained, and the requirement encouraged that the street be returned to its original condition, by replacing the hydrant markers.
### TABLE 1 *

<table>
<thead>
<tr>
<th>BUILDING SIZE (First floor area)</th>
<th>Fire Flow *(1) (2)</th>
<th>Duration</th>
<th>Hydrant Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 3,000 sq. ft.</td>
<td>1,000 GPM</td>
<td>2 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>3,000 to 4,999 sq. ft.</td>
<td>1,250 GPM</td>
<td>2 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>5,000 to 7,999 sq. ft.</td>
<td>1,500 GPM</td>
<td>2 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>8,000 to 9,999 sq. ft.</td>
<td>2,000 GPM</td>
<td>2 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>10,000 to 14,999 sq. ft.</td>
<td>2,500 GPM</td>
<td>2 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>15,000 to 19,999 sq. ft.</td>
<td>3,000 GPM</td>
<td>3 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>20,000 to 24,999 sq. ft.</td>
<td>3,500 GPM</td>
<td>3 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>25,000 to 29,999 sq. ft.</td>
<td>4,000 GPM</td>
<td>4 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>30,000 to 34,999 sq. ft.</td>
<td>4,500 GPM</td>
<td>4 hrs.</td>
<td>300 ft.</td>
</tr>
<tr>
<td>35,000 or more sq. ft.</td>
<td>5,000 GPM</td>
<td>5 hrs.</td>
<td>300 ft.</td>
</tr>
</tbody>
</table>

* See applicable footnotes below:

(FIRE FLOWS MEASURED AT 20 POUNDS PER SQUARE INCH RESIDUAL PRESSURE)

(1) Conditions requiring additional fire flow.

a. Each story above ground level - add 500 GPM per story.

b. Any exposure within 50 feet - add a total of 500 GPM.

c. Any high-rise building (as determined by the jurisdictional building code) the fire flow shall be a minimum of 3,500 GPM for 3 hours at 20 psi.

d. Any flow may be increased up to 1,000 GPM for a hazardous occupancy.
(2) Reductions in fire flow shall be cumulative for type of construction and a fully sprinklered building. The following allowances and/or additions may be made to standard fire flow requirements:

a. A 25% reduction shall be granted for the following types of construction: Type I-F.R, Type II-F.R., Type II one-hour, Type II-N, Type III one-hour, Type III-N, Type IV, Type IV one-hour, and Type V one-hour. This reduction shall be automatic and credited on all projects using these types of construction. Credit will not be given for Type V-N structures (to a minimum of 2,000 GPM available fire flow).

b. A 25% reduction shall be granted for fully sprinklered buildings (to a minimum of 2,000 GPM available fire flow).

c. When determining required fire flows for structures that total 70,000 square feet or greater, such flows shall not be reduced below 3,500 GPM at 20 psi for three hours.