Chapter 2
EXISTING SYSTEM

West Basin Municipal Water District (West Basin) is one of approximately 100 recycled water distributors in California, but the only agency to produce five different types of recycled water qualities “designer water” specifically processed to accommodate customer’s needs. Secondary effluent from the City of Los Angeles’ Hyperion Wastewater Treatment Plant (HWWTP) is further treated at four different treatment facilities to produce five types of water quality levels. These are: Title 22 (tertiary treatment), Nitrified, Barrier (West Coast Barrier), Industrial reverse osmosis (RO) (single-pass RO or low pressure boiler feed), and Industrial RO Ultra (dual-pass RO or high pressure boiler feed water). This chapter describes West Basin’s existing recycled water distribution systems and treatment facilities.

2.1 DISTRIBUTION SYSTEM

West Basin currently serves an estimated 32,200 acre-feet per year (afy) or an average of 29 million gallons per day (mgd) of recycled water to over 200 customer sites. The West Basin service area encompasses approximately 185 square miles including 17 cities serving a population of about one million. The 17 cities along with unincorporated areas served by West Basin include:

- City of El Segundo
- City of Inglewood
- City of Manhattan Beach
- City of Redondo Beach
- City of Hermosa Beach
- City of Lawndale
- City of Gardena
- City of Carson
- City of Hawthorne
- City of Compton
- City of Lomita
- City of Palos Verde Estates
- City of Rolling Hills
- City of Rancho Palos Verdes
- City of Rolling Hills Estates
- City of West Hollywood
- City of Malibu
- Unincorporated Los Angeles County

In addition, West Basin serves the Cities of Los Angeles and Torrance with recycled water, which are outside of West Basin’s service area.

Secondary effluent from the HWWTP is pumped via Hyperion Secondary Effluent Pump Station (HSEPS), which is owned and maintained by West Basin, to West Basin’s main treatment facility, the Edward C. Little Water Recycling Facility (ELWRF). The various types
of product recycled water qualities from ELWRF are conveyed through a network of nearly 100 miles of distribution pipelines ranging in diameter from 4 to 60 inches.

Figure 2.1 shows the distribution systems and illustrates the general layout of West Basin’s treatment facilities. Figure 2.2 presents a schematic of the distribution systems and illustrates the relationships of the various distribution systems to the treatment facilities.

The existing distribution system consists of ten subsystems categorized by West Basin, depending on specific industrial customer location and “designer water” conveyance system, location of the treatment system, and waste discharge system. Since the terrain of the initial area served by the recycled water system is mainly flat, the distribution system was designed as a single closed pressure zone. Therefore, the existing distribution system does not have any intermediate pumping or storage facilities, other than pumping and storage facilities at some of the treatment facilities. The various types of product recycled water are directly pumped from the treatment facilities to the customer sites. This system configuration has shown to limit West Basin’s operational strategies and can cause problems with surge and water quality throughout the distribution system.

2.1.1 Hyperion Secondary Effluent Pumping System

The Hyperion Secondary Effluent Pumping System, consisting of the HSEPS and the secondary effluent force main, conveys secondary effluent from HWWTP to ELWRF. The complete system is shown on Figure 2.3.

2.1.1.1 Hyperion Secondary Effluent Pump Station

West Basin’s HSEPS, located at the southwest corner of the HWWTP, provides the only source of water for West Basin’s recycled water system. Secondary treated effluent is pumped from the HSEPS to ELWRF via a 60-inch diameter force main. West Basin has an existing contract with the City of Los Angeles to receive recycled water through the year 2016. In 2007, West Basin received on average 32.4 mgd (36,300 afy) of secondary effluent from HWWTP. West Basin’s goal is to increase the capacity of the Hyperion SE Supply to 121 mgd (135,520 afy).

The HSEPS currently includes four existing vertical turbine pumps. The firm capacity of the HSEPS is currently 51 mgd. Table 2.1 summarizes the pumps’ characteristics.

Operating pressure on the discharge side of the pumps depends on the flow of secondary effluent being pumped, and varies between 18 psi (42 feet of head) and 33 psi (76 feet of head). During the month of October 2008, flows averaged 34.1 mgd, with an average discharge pressure of 58.4 psi at the pump station and 22.5 psi at ELWRF (WBMWD 2008m). The condition of the current pumps is described in the Condition Assessment Technical Memorandum (which can be found in Appendix F).
Figure 2.1
Existing Distribution Systems And Facilities
Figure 2.2
Existing Distribution Systems and Treatment Facilities Schematic

West Basin Municipal Water District
Capital Implementation Master Plan For Recycled Water Systems
Figure 2.3
Hyperion Secondary Effluent Pumping System

Legend

Pipeline Diameter
- 12" and smaller
- 16" through 30"
- 36" and larger

US highway
State highway
Local road
Source location
Facility location
Customer location

West Basin Municipal Water District
Capital Implementation Master Plan For Recycled Water Systems
Table 2.1  HSEPS Pump Statistics
Capital Implementation Master Plan
West Basin Municipal Water District

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Floway</td>
<td>28MKM</td>
<td>10,600</td>
<td>160</td>
<td>500 @ 1,194</td>
<td>Constant Speed</td>
</tr>
<tr>
<td>2</td>
<td>Floway</td>
<td>28FKM</td>
<td>14,000</td>
<td>180</td>
<td>800 @ 1,190</td>
<td>Variable Speed</td>
</tr>
<tr>
<td>3</td>
<td>Johnson</td>
<td>33NLC</td>
<td>14,000</td>
<td>185</td>
<td>800 @ 1,185</td>
<td>Variable Speed</td>
</tr>
<tr>
<td>4</td>
<td>Floway</td>
<td>28MKM</td>
<td>10,600</td>
<td>160</td>
<td>500 @ 1,194</td>
<td>Constant Speed</td>
</tr>
</tbody>
</table>

Firm Capacity 35,200 = 51 mgd

Note:
(1) Each pump is a two-stage vertical turbine design.

2.1.1.2 Hyperion Secondary Effluent Force Main

The 60-inch diameter polyvinyl chloride (PVC) lined reinforced concrete pressure pipe force main conveys secondary effluent from the HSEPS to ELWRF. Portions of the pipeline were constructed in 1992 and 1995. The force main is approximately 15,445 lineal feet (2.93 miles) long with a static lift of about 87 feet. Based on analysis conducted as a part of the Hyperion Secondary Effluent Pump Station Feasibility Study (CDM 2004), the force main has a capacity of 67 mgd based on all current pumps running, a Hazen-Williams roughness coefficient (C-factor) of 130, and a downstream delivery pressure of 18 psi. During the month of October 2008, average and maximum velocities of 2.7 feet per second (fps) and 3.6 fps respectively were observed (using 5-minute distributed control system [DCS] sampling intervals).

2.1.2 Title 22 Distribution System

As shown on the overall system schematic on Figure 2.2, the Title 22 Distribution System conveys recycled water from ELWRF to the Title 22 customers as well as the satellite treatment facilities – Carson Regional Water Recycling Facility (CRWRF), ExxonMobil Water Recycling Facility (EMWRF), and Chevron Nitrification Facility (CNF).

During the calendar year of 2007, ELWRF distributed an average of 16.7 mgd of recycled water through its Title 22 distribution system, with a maximum daily flow of 22.9 mgd and a minimum daily flow of 10.3 mgd.

2.1.2.1 Title 22 Product Water Storage

The Title 22 Product Water Storage Tanks, located at ELWRF, consist of two 5.0 million gallon (MG) circular storage reservoirs. The reservoirs attenuate daily peaking of customer demands.
2.1.2.2 Title 22 Product Water Pump Station

The Title 22 Product Water Pump Station at ELWRF supplies flow to the entire Title 22 distribution system. Since the distribution system does not have floating storage, the pump station also provides pressure to the entire Title 22 distribution system.

The Title 22 Product Water Pump Station consists of two separate pump stations, one at each of the storage tanks, each with two constant speed pumps and two variable speed pumps with characteristics as summarized in Table 2.2 and Table 2.3. The firm capacity, without one of the largest pumps in operation, is calculated to be 43,500 gpm (62.64 mgd).

### Table 2.2 Title 22 Tank 1 Product Pump Characteristics

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model(^{(1)})</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Impeller Dia (in)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Johnston</td>
<td>20EC</td>
<td>4,500</td>
<td>280</td>
<td>15.438</td>
<td>500 @ 1,170</td>
<td>Variable</td>
</tr>
<tr>
<td>3</td>
<td>Johnston</td>
<td>20EC</td>
<td>4,500</td>
<td>280</td>
<td>15.438</td>
<td>500 @ 1,170</td>
<td>Variable</td>
</tr>
<tr>
<td>5</td>
<td>Johnston</td>
<td>25NMC</td>
<td>8,000</td>
<td>280</td>
<td>16.188</td>
<td>700 @ 1,185</td>
<td>Constant</td>
</tr>
<tr>
<td>6</td>
<td>Johnston</td>
<td>25NMC</td>
<td>8,000</td>
<td>280</td>
<td>16.188</td>
<td>700 @ 1,185</td>
<td>Constant</td>
</tr>
</tbody>
</table>

Note:
\(^{(1)}\) Pumps 2 and 3 are of a four-stage vertical turbine design. Pump 5 and 6 are four-stage vertical turbine design.

### Table 2.3 Title 22 Tank 2 Product Pump Characteristics

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model(^{(1)})</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Impeller Dia (in)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Johnston</td>
<td>20EC</td>
<td>4,500</td>
<td>280</td>
<td>15.438</td>
<td>500 @ 1,170</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Sulzer</td>
<td>20CC</td>
<td>6,000</td>
<td>293</td>
<td>15.5</td>
<td>500 @ 1,780</td>
<td>Variable</td>
</tr>
<tr>
<td>3</td>
<td>Sulzer</td>
<td>24EC</td>
<td>8,000</td>
<td>293</td>
<td>18.375</td>
<td>700 @ 1,185</td>
<td>Constant</td>
</tr>
<tr>
<td>4</td>
<td>Johnston</td>
<td>25NMC</td>
<td>8,000</td>
<td>280</td>
<td>16.188</td>
<td>700 @ 1,185</td>
<td>Constant</td>
</tr>
</tbody>
</table>

Note:
\(^{(1)}\) Pumps 1 and Pump 4 are four-stage vertical turbine design. Pump 2 is a two-stage vertical turbine design. Pump 3 is a three-stage vertical turbine design.

Backup pumping capacity is provided by the Diversion Pump Station (PS) with a single 4,500-gpm variable speed pump and two 8,000-gpm constant speed pumps, according to the Phase IV Expansion Project Feasibility Study (CDM 2002c).
2.1.2.3 Pipelines

The Title 22 distribution system represents the majority of the pipelines within West Basin’s various distribution systems. Table 2.4 presents the Title 22 distribution system pipelines by diameter. Figure 2.4 shows the layout of the Title 22 distribution system.

Although it is believed that the use of PVC (C900) piping is more widespread in the Title 22 distribution system, Table 2.4 indicates steel as the most prevalent pipeline material. However, a significant portion of the distribution system is constructed of unknown material, due to the lack of pipeline material information on many of the record drawings for the Title 22 distribution system.

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>PVC (ft)</th>
<th>DIP (ft)</th>
<th>Steel (ft)</th>
<th>Unknown (ft)</th>
<th>Total Length (ft)</th>
<th>Total Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>750</td>
<td>0</td>
<td>0</td>
<td>3,350</td>
<td>4,100</td>
<td>0.8</td>
</tr>
<tr>
<td>6</td>
<td>100,900</td>
<td>2,550</td>
<td>3,550</td>
<td>20,300</td>
<td>127,250</td>
<td>24.1</td>
</tr>
<tr>
<td>8</td>
<td>6,950</td>
<td>1,950</td>
<td>0</td>
<td>19,000</td>
<td>27,850</td>
<td>5.3</td>
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<tr>
<td>12</td>
<td>16,450</td>
<td>4,300</td>
<td>50</td>
<td>50</td>
<td>20,700</td>
<td>3.9</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>22,100</td>
<td>0</td>
<td>50</td>
<td>22,100</td>
<td>4.2</td>
</tr>
<tr>
<td>20</td>
<td>3,000</td>
<td>11,400</td>
<td>5,500</td>
<td>0</td>
<td>19,850</td>
<td>3.8</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>22,450</td>
<td>24,500</td>
<td>1,850</td>
<td>48,750</td>
<td>9.2</td>
</tr>
<tr>
<td>30</td>
<td>2,250</td>
<td>3,700</td>
<td>5,950</td>
<td>12,150</td>
<td>24,000</td>
<td>4.5</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0</td>
<td>30,400</td>
<td>50</td>
<td>30,400</td>
<td>5.8</td>
</tr>
<tr>
<td>42</td>
<td>0</td>
<td>0</td>
<td>79,400</td>
<td>6,300</td>
<td>85,650</td>
<td>16.2</td>
</tr>
<tr>
<td>48</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,300</td>
<td>3,300</td>
<td>0.6</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>100</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>130,300</td>
<td>68,450</td>
<td>149,350</td>
<td>66,500</td>
<td>414,050</td>
<td>78.4</td>
</tr>
</tbody>
</table>

Notes:
(1) These lengths include the Imperial Avenue Lateral and the Anza Avenue Lateral, which are newly constructed or in the process of being constructed.
(2) All lengths are obtained from the hydraulic models and rounded to nearest 50 feet.

2.1.2.4 Disinfection Stations

West Basin operates two temporary disinfection stations in its Title 22 distribution system to boost chlorine residuals in laterals experiencing water quality issues. The need for additional chlorine injection is the result of the low velocities and long stagnation periods in the larger transmission pipelines installed to accommodate future potential demand. Other water quality issues are experienced by customers located further distances away from the
treatment facilities and disinfection stations, where strength of the chlorine residuals
degrade to levels well below what is required for effective application. Locations of the two
disinfection stations are shown on Figure 2.4.

The first disinfection station, known as the American Honda Lateral Disinfection Station, is
located in the City of Torrance near the intersection of Crenshaw Boulevard and Del Amo
Boulevard. For the period of June through December 2007, daily samples taken at the
disinfection station showed an average chlorine residual of 1.2 mg/L after chlorine injection.
Samples taken at customer connections at the end of laterals downstream of the
disinfection station showed an average chlorine residual of 0.7 mg/L over the same period.
(WBWMD 2007b).

A second disinfection station, known as the Inglewood Temporary Disinfection Station, is
located in the City of Inglewood near the intersection of La Brea Avenue and Regent Street.
For the period of May through July 2007, daily samples taken at the disinfection station
showed an average chlorine residual of 2.2 mg/L after chlorine injection. Samples taken at
customer connections at the end of laterals downstream of the disinfection station showed
an average chlorine residual of 0.1 mg/L over the same period, with the majority of samples
showing no residual. (WBWMD 2007b)

The disinfection stations can provide an effective means of mitigating residual losses.
However, the ability to maintain effective chlorine residual and water quality depends on
consistent usage of recycled water on a daily basis as previously planned.

2.1.3 West Coast Barrier Water System

The West Coast Seawater Intrusion Barrier consists of 153 injection wells, along with 296
observation wells, strategically located to prevent seawater intrusion into the West Coast
Groundwater Basin (LACDPW 2009). Water for the barrier is supplied at the Blend Stations,
located in the City of El Segundo as shown on Figure 2.5. The Los Angeles County
Department of Public Works (LACDPW) owns and maintains the West Coast Seawater
Intrusion Barrier, from the Blend Stations to the injection wells. West Basin supplies
stabilized RO water (Barrier Water) from ELWRF to the West Basin Blend Station, where
the Barrier Water is blended with imported potable water from Metropolitan Water District of
Southern California (MWD). West Basin currently supplies 12.5 mgd of Barrier Water, which
is approximately 75 percent of overall supply to the Seawater Intrusion Barrier.

The West Coast Barrier Water System consists of the Barrier Product Water Pump Station
at ELWRF and the West Basin Barrier Water Pipeline, conveying Barrier Water from
ELWRF to the Blend Station, which supplies recycled water to the West Coast Seawater
Intrusion Barrier. Figure 2.5 shows the West Coast Barrier System as well as the location of
the West Coast Seawater Intrusion Barrier.
Figure 2.4
Title 22 Distribution System and Treatment Facilities
West Coast Barrier Water System

Legend
- Pipeline Diameter
  - 12” and smaller
  - 16” through 30”
  - 36” and larger
- Barier Piping (Not Modeled)
- Seawater barrier
- US highway
- State highway
- Local road
- Facility location

Figure 2.5
West Coast Barrier Water System

West Basin Municipal Water District
Capital Implementation Master Plan For Recycled Water Systems
2.1.3.1 Barrier Product Water Pump Station

The Barrier Product Water Pump Station contains five constant speed pumps with a firm capacity of 10,500 gpm (15.1 mgd). Equalization is provided by a 55,000 gallon clear well with approximately 0.5 MG of additional product water storage. Table 2.5 summarizes the individual pump characteristics.

Currently, a control valve on the discharge pipe of the pump station maintains an approximate pressure of 73 psi on the downstream side of the valve. On the upstream side of the valve, the pump discharge pressure is about 87 psi.

Table 2.5 Barrier Product Water Pump Characteristics
Capital Implementation Master Plan
West Basin Municipal Water District

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Year</th>
<th>Model(1)</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Impeller Dia (in)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Tag(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Johnston</td>
<td>1995</td>
<td>16CMC</td>
<td>1,750(3)</td>
<td>220</td>
<td>11.5</td>
<td>300 @ 1,790</td>
<td>P-1713-1</td>
</tr>
<tr>
<td>2</td>
<td>Johnston</td>
<td>1995</td>
<td>16CMC</td>
<td>1,750</td>
<td>220</td>
<td>11.5</td>
<td>300 @ 1,790</td>
<td>P-1713-2</td>
</tr>
<tr>
<td>3</td>
<td>Goulds</td>
<td>1995</td>
<td>20EHC</td>
<td>4,200</td>
<td>176</td>
<td>12.5</td>
<td>300 @ 1,180</td>
<td>P-1713-3</td>
</tr>
<tr>
<td>4</td>
<td>Sulzer</td>
<td>2006</td>
<td>18CC</td>
<td>3,500</td>
<td>220</td>
<td>12.9</td>
<td>150 @ 1,790</td>
<td>P-1713-4</td>
</tr>
<tr>
<td>5</td>
<td>Sulzer</td>
<td>2006</td>
<td>18CC</td>
<td>3,500</td>
<td>220</td>
<td>12.9</td>
<td>150 @ 1,790</td>
<td>P-1713-5</td>
</tr>
</tbody>
</table>

Firm Capacity 10,500 = 15.1 mgd

Notes:
(1) Pumps 1 and 2 are of a six-stage vertical turbine design. Pump 3 is a three-stage vertical turbine design. Pumps 4, and 5 are two-stage vertical turbine design.
(2) Pump years and manufacturers in field did not correspond to pump curve tag numbers on pump tests or in feasibility study. Since further investigation did not resolve discrepancy, tags are provided for future reference.
(3) The Phase IV Feasibility Study describes this pump as a 3,500-gpm pump, while the system pump curve describes it as a 1,750-gpm pump for the same speed as Pump 2.
Source: Condition Assessment Technical Memorandum Notes, (CDM 2002f), (WBMWD 2008o)

2.1.3.2 West Basin Barrier Water Pipeline

The Barrier Water Pipeline, consisting of 4,720 lineal feet (0.89 miles) of 30-inch diameter cement mortar lined and coated (CMLC) steel transmission main, conveys the Barrier Water from ELWRF to the Blend Station, located north of the treatment facility on El Segundo Boulevard west of Nash Street in the City of El Segundo.
2.1.3.3 Blend Stations

Barrier Water from ELWRF is blended with imported water from MWD, provided at imported water connection WB-28 at about 90 psi. Currently, the blended water consists of approximately 75 percent barrier water from ELWRF and 25 percent imported water from MWD. The operation is flow based with the LACDPW requesting the flow rates.

2.1.4 ELWRF Brine Line

The ELWRF Brine Line conveys RO concentrate from ELWRF to the Hyperion Outfall located at the HWWTP. The Brine Line consists of 18-inch diameter HDPE pipe and extends about 17,880 lineal feet (3.39 miles) north and west from ELWRF to the City of Los Angeles’ HWWTP along the alignment shown on Figure 2.6. The brine flow from ELWRF discharges into a manifold located above the outfall at the HWWTP. For 2007 calendar year, ELWRF discharged an average of 2.5 mgd of brine flow to the Hyperion Outfall (WBWMD 2007c).

2.1.5 Chevron Boiler Feed and Nitrified Water Systems

The Chevron El Segundo Refinery, located adjacent to ELWRF, across Sepulveda Boulevard, receives three high purity water qualities which include Nitrified, Industrial RO and Industrial RO Ultra water. These three recycled water products are conveyed in three separate distribution systems from ELWRF and the Chevron Nitrification Facility to the refinery for boiler feed and cooling tower applications: the Chevron High Pressure Boiler Feed Water system, the Chevron Low Pressure Boiler Feed Water system, and the Chevron Nitrified Water system.

2.1.5.1 Chevron High Pressure Boiler Feed Pipeline

The Chevron High Pressure Boiler Feed pipeline consists of a 12-inch and 16-inch diameter PVC pipeline that conveys Industrial RO Ultra water from the High Pressure Boiler Feed Product Pump Station at ELWRF to the Chevron on-site High Pressure Boiler Feed Storage Tank. The pipe starts out as 12 inches in diameter at ELWRF (265 feet). It continues as a 16-inch diameter pipe from the boundary of ELWRF to the boundary of the Chevron El Segundo Refinery (8,860 feet). The pipe is again 12 inches in diameter on the refinery property (905 feet). The total pipe length is approximately 10,030 lineal feet (1.90 miles). Figure 2.7 shows the pipeline alignment from ELWRF to the Chevron on-site High Pressure Boiler Feed Storage Tank.
Figure 2.6
Edward C. Little Water Recycling Facility Brine Line

West Basin Municipal Water District
Capital Implementation Master Plan For Recycled Water Systems
2.1.5.2  *Chevron High Pressure Boiler Feed Product Pump Station*

The Chevron High Pressure Boiler Feed Product Pump Station consists of two variable speed, vertical turbine pumps. The pump station has a firm capacity of 1,800 gpm. Table 2.6 summarizes the individual pump characteristics.

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model(^{(1)})</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Impeller(^{(2)}) Dia (in)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Afton</td>
<td>GSV</td>
<td>1,800</td>
<td>152</td>
<td>14</td>
<td>100 @ 1,725</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Afton</td>
<td>GSV</td>
<td>1,800</td>
<td>152</td>
<td>14</td>
<td>100 @ 1,725</td>
<td>Variable</td>
</tr>
</tbody>
</table>

**Firm Capacity** 1,800

*Notes:*

\(^{(1)}\) Pumps are of a two-stage vertical turbine design. Pump curve is 39163 SPD.

\(^{(2)}\) The impeller is closed 14 ADCH.

2.1.5.3  *Chevron Low Pressure Boiler Feed Pipeline*

The Chevron Low Pressure Boiler Feed pipeline consists of a 10-inch and 12-inch diameter PVC pipeline that conveys Industrial RO water from the Low Pressure Boiler Feed Product Pump Station at ELWRF to the Chevron on-site low Pressure Boiler Feed Water Storage Tank. The pipe starts out as 10 inches in diameter at ELWRF (440 feet). It continues as a 12-inch diameter pipe from the boundary of ELWRF to the boundary of the Chevron El Segundo refinery (8,860 feet). The pipe is again 10 inches in diameter on the refinery property (1,100 feet). The total pipe length is approximately 10,400 lineal feet (1.97 miles). Figure 2.8 shows the pipeline alignment from ELWRF to the Chevron on-site Low Pressure Boiler Feed Storage Tank.

2.1.5.4  *Chevron Low Pressure Boiler Feed Product Pump Station*

The Chevron Low Pressure Boiler Feed Product Pump Station consists of three variable speed, vertical turbine pumps. The pump station has a firm capacity of 1,200 gpm. Table 2.7 summarizes the individual pump characteristics.
Table 2.7  Low Pressure Boiler Feed Product Pump Characteristics

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model(1)</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Impeller Dia (in)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Afton</td>
<td>GSV</td>
<td>600</td>
<td>186</td>
<td>10</td>
<td>40 @ 1,700</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Afton</td>
<td>GSV</td>
<td>600</td>
<td>186</td>
<td>10</td>
<td>40 @ 1,700</td>
<td>Variable</td>
</tr>
<tr>
<td>3</td>
<td>Afton</td>
<td>GSV</td>
<td>600</td>
<td>186</td>
<td>10</td>
<td>40 @ 1,700</td>
<td>Variable</td>
</tr>
</tbody>
</table>

Firm Capacity 1,200

Notes:
(1) Pumps are of a five-stage vertical turbine design. Pump curve is 39162 SPD.
(2) The impeller is closed 10 AJCH.

2.1.5.5 Chevron Nitrified Water System Pipeline

The Chevron Nitrified Water System Pipeline, consists of about 2,750 lineal feet (0.52 miles) of 20-inch diameter pipe that conveys Nitrified Water from the Chevron Nitrification Facility to the cooling towers located at various sites within the Chevron El Segundo Refinery. Figure 2.9 shows the pipeline alignment from the Chevron Nitrification Facility to the gate at the refinery.

The Chevron nitrified water storage tank provides suction to the High Service Pump Station. The High Service Pump Station contains three pumps that pump the water to the cooling towers.

2.1.5.6 Chevron Nitrified Water Product Pump Station

The Chevron Nitrified Water Product Pump Station, which is also referred to as the High Service Pump Station, consists of three vertical turbine pumps. Two pumps are constant speed and one pump is variable speed. The pump station has a firm capacity of 3,600 gpm. Table 2.8 summarizes the individual pump characteristics.
Figure 2.7
Chevron High Pressure Boiler Feed System
Figure 2.8
Chevron Low Pressure Boiler Feed System

West Basin Municipal Water District
Capital Implementation Master Plan For Recycled Water Systems
Table 2.8  Chevron Nitrified Water Product Pump Characteristics
Capital Implementation Master Plan
West Basin Municipal Water District

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model(^{(1)})</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ingersoll</td>
<td>15M154</td>
<td>2,100</td>
<td>200</td>
<td>150 @ 1,775</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Ingersoll</td>
<td>15M154</td>
<td>1,800</td>
<td>200</td>
<td>150 @ 1,775</td>
<td>Constant</td>
</tr>
<tr>
<td>3</td>
<td>Ingersoll</td>
<td>15M154</td>
<td>1,800</td>
<td>200</td>
<td>150 @ 1,775</td>
<td>Constant</td>
</tr>
</tbody>
</table>

Firm Capacity  3,600

Note:
(1) Pump 1 is of a three-stage vertical turbine design. Pumps 2 and 3 are of two-stage vertical turbine design.

2.1.6  bp Carson Refinery Pipelines and Pump Stations

The bp Carson Refinery, located at the southeast corner of Wilmington Ave and E. 223rd Street in the City of Carson, receives Industrial RO and Nitrified Water from CRWRF via two separate conveyance pipeline systems for boiler feed and cooling tower applications. Within the bp Carson Refinery, the Industrial RO and Nitrified water is blended after delivery to a flow-metering vault. The blended water consists of approximately 83 percent Industrial RO and 17 percent Nitrified Water. The remaining 17 percent of Industrial RO water is further treated through an additional RO treatment system located within the refinery for high-pressure boiler feed water applications.

2.1.6.1  bp Reverse Osmosis Pipeline

The bp RO pipeline consists of 2,710 lineal feet of 30-inch diameter ductile iron pipe (Class 200 and 300) and 3,270 lineal feet of 24-inch diameter ductile iron pipe (Class 250) segments. The pipeline is initially sized as 30-inch diameter from CRWRF to the intersection of Carson Street and Wilmington Avenue. Since Wilmington Avenue is heavily congested with oil pipelines, as well as other utilities, the pipeline was reduced to 24-inch diameter from Carson Street to the bp Carson Refinery. The total length of the pipeline is approximately 1.13 miles from CRWRF to the bp on-site blending station. Figure 2.10 shows the pipeline alignment from CRWRF onto the bp site.
Figure 2.10
bp Reverse Osmosis System

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2.1.6.2 *bp Reverse Osmosis Product Pump Station*

The bp Reverse Osmosis Product Pump Station consists of three variable speed, centrifugal pumps. The pump station has a firm capacity of 3,450 gpm. Table 2.9 summarizes the individual pump characteristics.

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Goulds</td>
<td>3410</td>
<td>1,725</td>
<td>320</td>
<td>250 @ 3,600</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Goulds</td>
<td>3410</td>
<td>1,725</td>
<td>320</td>
<td>250 @ 3,600</td>
<td>Variable</td>
</tr>
<tr>
<td>3</td>
<td>Goulds</td>
<td>3410</td>
<td>1,725</td>
<td>320</td>
<td>250 @ 3,600</td>
<td>Variable</td>
</tr>
</tbody>
</table>

**Firm Capacity** 3,450

*Note:* (1) Pumps are centrifugal pumps.

2.1.6.3 *bp Nitrified Water Pipeline System*

The bp Nitrified Water pipeline consists of approximately 1.17 miles of 12-inch diameter DIP (Class 350) from CRWRF to the bp on-site blending station. Figure 2.11 shows the pipeline alignment from CRWRF onto the bp site.

2.1.6.4 *bp Nitrified Water Product Pump Station*

The bp Nitrified Water Product Pump Station consists of two variable speed, centrifugal pumps. The pump station has a firm capacity of 625 gpm. Table 2.10 summarizes the individual pump characteristics.

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Design Capacity (gpm)</th>
<th>Design TDH (ft)</th>
<th>Power / Speed (HP @ RPM)</th>
<th>Variable/Constant Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Goulds</td>
<td>3410</td>
<td>625</td>
<td>345</td>
<td>100 @ 3,600</td>
<td>Variable</td>
</tr>
<tr>
<td>2</td>
<td>Goulds</td>
<td>3410</td>
<td>625</td>
<td>345</td>
<td>100 @ 3,600</td>
<td>Variable</td>
</tr>
</tbody>
</table>

**Firm Capacity** 625

*Note:* (1) Pumps are centrifugal pumps.
Figure 2.11
bp Nitrified Water System

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Figure 2.12
Carson Regional Water Recycling Facility Brine Line

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2.1.7 CRWRF Brine Line

The RO concentrate collected from CRWRF is discharged to the CRWRF Brine Line consisting of 14-inch diameter standard dimension ratio (SDR) 11 high density polyethylene (HDPE) and PVC C905 pipe. The brine line extends approximately 28,400 lineal feet (5.38 miles) south and west to Los Angeles County Sanitation District’s (LACSD) Joint Water Pollution Control Plant (JWPCP) in the City of Carson. The alignment of the Brine Line is shown on Figure 2.12.

The brine flow in the pipeline is conveyed by the discharge pressure applied at the RO trains at CRWRF. A standpipe is located at the discharge point to the JWPCP outfall to prevent backup of the brine line. A bypass allows diversion flow of brine into the Dominguez Channel midway down the Brine Line in event of an emergency (UW, B).

2.2 TREATMENT FACILITIES

West Basin owns four separate treatment facilities including the ELWRF, CRWRF, CNF, and EMWRF. ELWRF is the main treatment facility for the West Basin Recycled Water System. ELWRF is the only source of Title 22 recycled water supply to other treatment facilities, as well as other landscape irrigation sites. Relationships between each of West Basin’s facilities and distribution systems are presented in the overall system schematic shown on Figure 2.2. Information regarding the facilities’ historical production rates and capacities is provided in Chapter 4, Recycled Water Supplies.

2.2.1 Hyperion Wastewater Treatment Plant

The City of Los Angeles’ HWWTP is located in the City of Los Angeles at the southeast corner of Vista Del Mar and Imperial Highway. The HWWTP treats sewage from approximately 4 million residents, serving about two-thirds of the City of Los Angeles (CLA 2009).

According to the West Basin Municipal Water District, Hyperion Secondary Effluent Pump Station Feasibility Study, June 29, 2004 (CDM 2004), the HWWTP has the following design flow rates:

- Minimum flow rate of 160 mgd
- Maximum monthly flow rate of 550 mgd

According to flow records provided by the City of Los Angeles, secondary effluent flows from the HWWTP averaged 330 mgd for the year 2007, with a minimum monthly flow of 299 mgd and a maximum monthly flow of 471 mgd. The minimum hourly flow for the same time period was about 95,800 gpm (138 mgd).

The HWWTP treats wastewater from two separate sources, with distinctive water quality characteristics:
- Coastal sewers having higher total dissolved solids (TDS)
- Inland sewers having lower TDS

While this study (CDM 2004) did not explicitly state the ranges of TDS concentrations in each source, it did conclude that the secondary effluent with higher TDS levels could not be used as a source for treatment by West Basin.

The treatment processes at the HWWTP have been designed to maintain independent treatment of the two distinct sources between the headworks to the clarifiers. In general, the south reactors and clarifiers receive the higher quality (lower TDS) water, constituting about 75 percent of the total plant flow.

To reduce treatment costs, all water pumped into the West Basin system through the HSEPS consists of this lower TDS water. West Basin bears the costs associated with removing any excess TDS from the pumped secondary effluent (SE) required to meet the water quality needs of their customers.

### 2.2.2 Edward C. Little Water Recycling Facility

ELWRF, located in the City of El Segundo, CA, is the largest water recycling facility of its kind in the United States and was recognized by the National Water Research Institute in 2002 as one of only six National Centers for Water Treatment Technologies. ELWRF is the only treatment facility in the country that produces four different qualities of “designer” or custom-made recycled water that meets the unique needs of West Basin’s municipal, commercial, and industrial customers, and seawater intrusion barrier injection system.

The four types of designer water include:

- Tertiary Recycled Water (Title 22 Water) for a wide variety of industrial and landscape irrigation uses;
- Stabilized Reverse Osmosis Water (Barrier Water): Secondary effluent purified by microfiltration (MF), followed by RO and disinfected through ultraviolet (UV) and advanced oxidation processes (AOP), and stabilized with lime for groundwater recharge;
- Pure Reverse Osmosis Water (Industrial RO) for refinery low-pressure boiler feed water;
- Ultra-Pure Reverse Osmosis Water (Industrial RO Ultra) for refinery high-pressure boiler feed water.

The fifth type of “designer” or custom made recycled water, nitrified water for industrial cooling tower usage, is produced at CNF, located in the City of El Segundo at the corner of El Segundo Boulevard and Illinois Street, using Title 22 recycled water from ELWRF.

A treatment plant flow schematic of ELWRF is shown on Figure 2.13 and a site plan is presented on Figure 2.14.
Figure 2.13
Edward C Little Water Recycling Facility
Flow Schematic
2.2.3 Carson Regional Water Recycling Facility

CRWRF, located in the City of Carson, further treats Title 22 recycled water from ELWRF through microfiltration, reverse osmosis, and nitrification treatment processes to provide Industrial RO and Nitrified water to the bp Carson Refinery for boiler-feed and cooling tower applications.

CRWRF currently produces approximately 3.5 mgd of high quality recycled water. A treatment plan flow schematic of CRWRF is shown on Figure 2.15 and a site plan is presented on Figure 2.16.

2.2.4 Chevron Nitrification Facility

CNF, located in the City of El Segundo, produces approximately 5 mgd of Nitrified Water for the Chevron El Segundo Refinery. CNF receives the Title 22 recycled water from ELWRF and further treats it through a nitrification treatment process to remove ammonia for cooling tower applications.

A treatment plant flow schematic of the CNF is shown on Figure 2.17 and a site plan is presented on Figure 2.18.

2.2.5 ExxonMobil Water Recycling Facility

EMWRF provides Nitrified and Industrial RO water to the ExxonMobil Torrance Refinery for cooling tower and boiler feed applications. EMWRF is located within the ExxonMobil Torrance Refinery in the City of Torrance and began operation in 1998. Average production by EMWRF is over 5,500 afy (about 6 mgd). EMWRF treats Title 22 recycled water from ELWRF with microfiltration and RO to produce Industrial RO, or boiler feed water. EMWRF also uses nitrification to remove ammonia to provide Nitrified water for cooling tower applications.

A treatment plant flow schematic of EMWRF is shown on Figure 2.19 and a site plan is presented on Figure 2.20.
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Figure 2.17
Chevron Nitrification Facility
Flow Schematic
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Figure 2.19
ExxonMobil
Water Recycling Facility
Flow Schematic
Figure 2.20
ExxonMobil Water Recycling Facility Site Plan
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