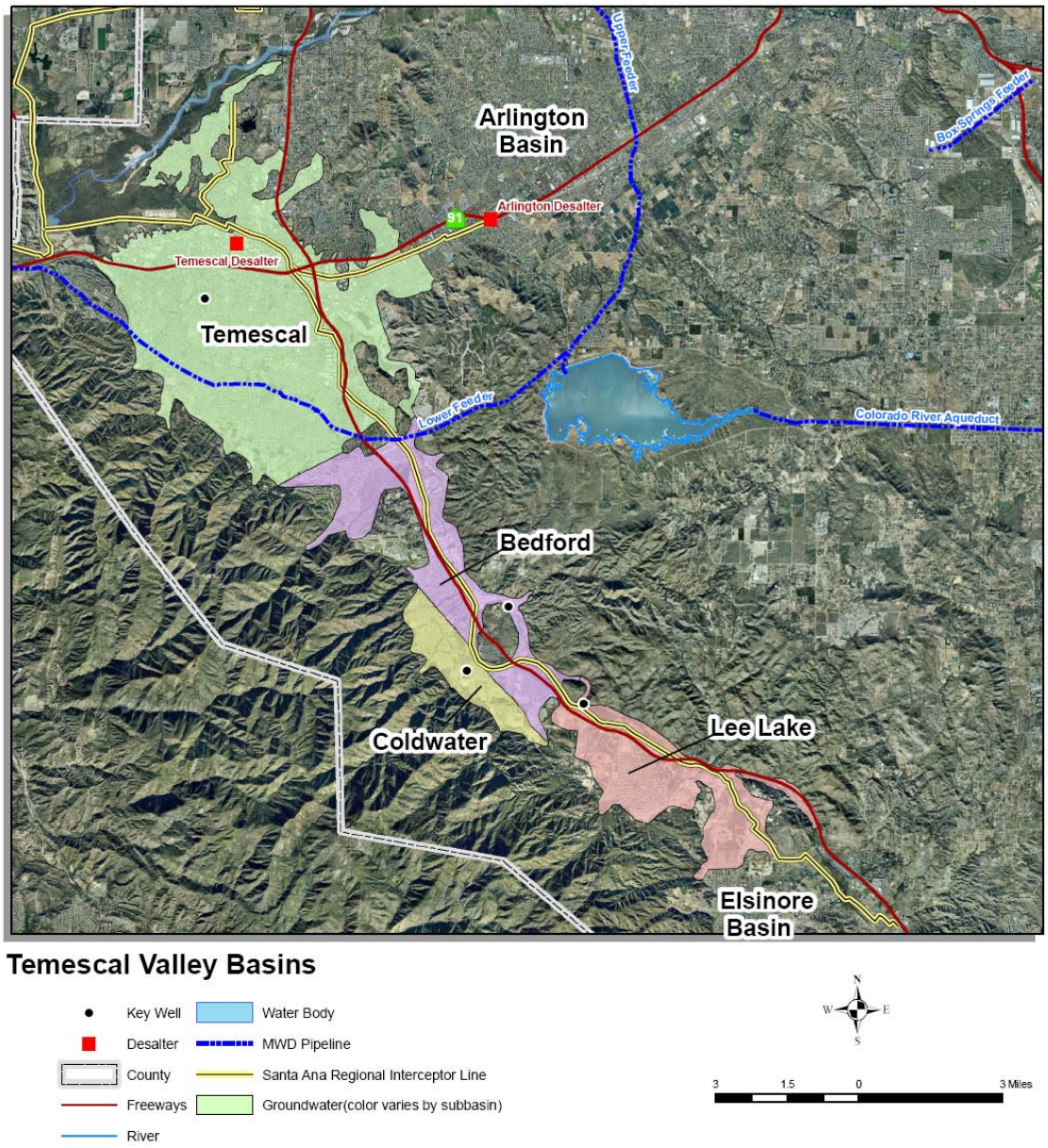
The Temescal Valley Basins include several small-unadjudicated groundwater basins in Riverside County between Prado Dam and Lake Elsinore along the Interstate 15 corridor. These include: the Bedford, Coldwater, Lee Lake, and Temescal basins. Because they are relatively small, these basins are discussed as a whole. The Temescal Valley Basins underlie the service area of Western Municipal Water District (Western MWD) and include the communities of Corona, Norco and unincorporated areas of Riverside County.

Figure 15-1
Map of the Temescal Valley Basins



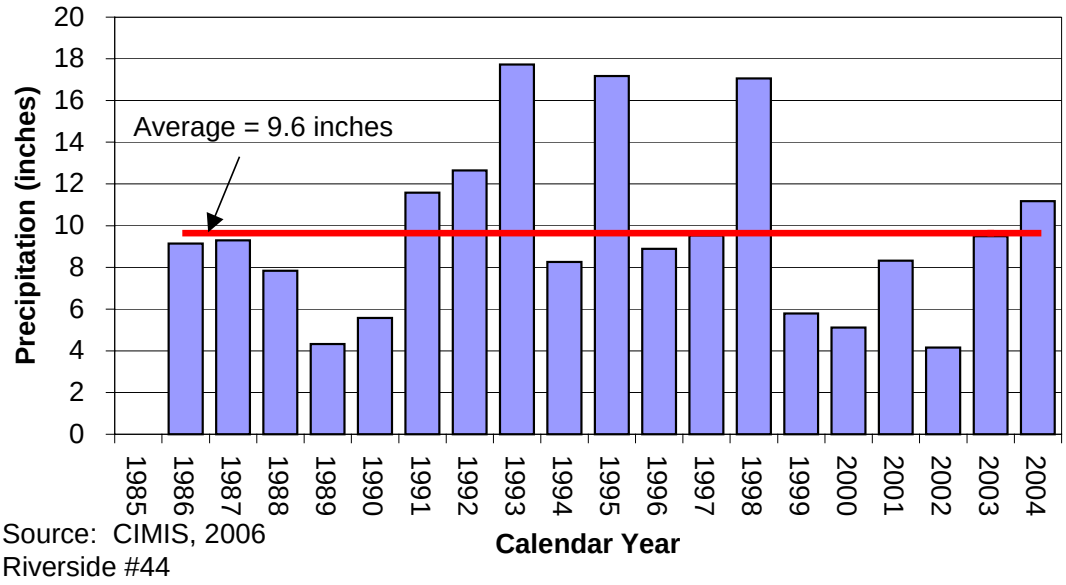
BASIN CHARACTERIZATION

The following section provides a physical description of the Temescal Valley Basins including their geographic location and hydrogeologic character.

Basin Producing Zones and Storage Capacity

The following section describes the basin structure and storage capacity for each of the Temescal Valley Basins. Each basin is generally unconfined (one continuous aquifer) and therefore each responds rapidly to changes in hydrology and recharge. **Table 15-1** summarizes the hydrogeologic parameters for each basin. As shown in **Figure 15-2**, precipitation in the vicinity of the Temescal Valley Basins near Riverside averages approximately 9.6 inches per year.

Figure 15-2
Historical Precipitation in the Temescal Valley Basins



Source: CIMIS, 2006
Riverside #44

Bedford Basin

The Bedford Basin is located south of the Temescal Basin in Temescal Canyon between the Santa Ana Mountains and the El Sobrante Hills. The basin covers an area of approximately 10 square miles with an alluvial depth ranging from 30 to 200 feet. (AKM, 2005). Groundwater within the basin tends to flow northwest into the Temescal Basin. Total storage within the basin is unknown.

Coldwater Basin

The Coldwater Basin is located southwest of the Bedford Basin and the Temescal Wash. The Basin encompasses an area of approximately 2.6 square miles and lies within the structural block between the Santa Ana Mountains to the west and the El Sobrante Hills to the east. The Coldwater Basin is bound by the North Glen Ivy Fault to the northeast. The North Glen Ivy Fault behaves as an effective barrier to groundwater flow and prevents migration of groundwater from the Coldwater Basin into the Temescal Wash and the Bedford Basin at depth. Groundwater levels throughout the basin typically respond rapidly to precipitation and recharge because of the high permeability and limited groundwater storage within this basin. Maximum depth of the basin is approximately 600 feet. Total estimated storage in the Coldwater Basin is approximately 100,000 AF (MWH, 2004).

Table 15-1
Summary of Hydrogeologic Parameters of Temescal Valley Basins

Parameter	Description
Structure	
Aquifer(s)	Unconfined to semi-confined alluvium
Depth of groundwater basin	Bedford: 30 to 200 feet Coldwater: Up to 600 feet Lee Lake: Less than 200 feet Temescal: 180 to 480 feet
Thickness of water-bearing units	
Yield and Storage	
Natural Safe Yield	Data not available
Total Storage	Approximately 100,000 AF in Coldwater Basin
Unused Storage Space	Unknown
Portion of Unused Storage Space Available for Storage	Unknown

Lee Lake Basin

The Lee Lake Basin covers an area of approximately 12 square miles and has alluvial depth of less than 200 feet. Groundwater within the basin flows toward the northwest along the course of the Temescal Wash. Primary sources of recharge include the adjacent canyon streams and seepage from Temescal Wash. Total storage within the basin is unknown.

Temescal Basin

The Temescal Basin encompasses an area of approximately 26 square miles bound by the Santa Ana River, La Sierra Hills, El Sobrante Hills and the Santa Ana Mountains. Typical depths for the City of Corona's wells in the Temescal Basin range from 180 to 480 feet (AKM, 2005). Groundwater flow is from the mountains to the center of the basin and northeast toward the Santa Ana River (DWR, 2006). Total storage within the basin is unknown.

Safe Yield/Long-Term Balance of Recharge and Discharge

Safe yield has not been determined for any of the Temescal Valley Basins.

GROUNDWATER MANAGEMENT

The following section describes how the Temescal Valley Basins are currently managed.

Basin Governance

The Temescal Valley Basins are not adjudicated. The management agencies for the Temescal Valley Basins are described in **Table 15-2**. The City of Corona is currently preparing a groundwater management plan for the Temescal Basin to be completed in 2007.

Table 15-2
Summary of Management Agencies in the Temescal Valley Basins

Agency	Role
City of Corona	Operation of Temescal Desalter Preparation of Groundwater Management Plan for Temescal Basin.
Western Municipal Water District (Western MWD)	Part of Watermaster Committee responsible for administration of 1969 Santa Ana River Judgment.
San Ana River Watermaster	Watermaster for 1969 Stipulated Judgment that defined water allocations in the Santa Ana River among lower Santa Ana River and upper Santa Ana River producers.
Santa Ana Water Project Authority (SAWPA)	Joint Powers Authority established to plan and build facilities to protect the water quality of the Santa Ana River Watershed.

Interactions with Adjoining Basins

The Temescal Valley Basins are upstream of Prado Dam. On April 17, 1969, the Orange County Superior Court entered a Stipulated Judgment in Case No. 117628 involving the Orange County Water District vs. City of City of Chino et al.

The Judgment, which became effective October 1, 1970, contained a declaration of rights of the entities in the lower Santa Ana River area (i.e. OCWD) versus those in the upper Santa Ana River area (i.e. San Bernardino Valley Municipal Water District, or SBVMWD, Chino Basin MWD, now called IEUA, and Western MWD). The Judgment is administered by the Santa Ana River Watermaster, a committee of five members (one each from SBVMWD, IEUA and Western MWD and two from OCWD). Under this Judgment, purveyors upstream of Prado Dam, have the right to use all surface and groundwater supplies originating above Prado Dam without interference from water purveyors downstream of Prado Dam, provided that the average adjusted base flow at Prado Dam is at least 42,000 AFY. Baseflows have ranged from approximately 38,000 AFY in 1970 to approximately 170,000 AFY in 2002. (Santa Ana River Watermaster, 2003). SBVMWD has an obligation to ensure an average annual adjusted base flow of 15,250 AFY at Riverside Narrows. IEUA and Western MWD have a joint obligation to ensure average annual adjusted base flow of 42,000 AFY at Prado Dam. In addition, SBVMWD, IEUA and Western MWD are prohibited from exporting water from the lower area to the upper area while OCWD is prohibited from exporting water or causing water to from the upper area to the lower area (Santa Ana River Watermaster, 2003).

Fault or bedrock barriers prevent significant groundwater flow from the Temescal Valley Basins. Except for the 1969 Judgment described above, there are no agreements with other basins.

WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Temescal Valley Basins.

Active Production Wells

There are 53 active production wells within the Temescal Valley Basins. Historical production from 1985 to 2004 is summarized in **Figure 15-3**. A summary of the average production from these wells is provided in **Table 15-3**. Production by basin is discussed below.

Bedford Basin

There are 5 identified active wells in the Bedford Basin. The primary producer in the Bedford Basin is Elsinore Valley Municipal Water District (EVMWD). Groundwater production from the Bedford Basin has decreased in recent years from a high of approximately 2,900 AFY in 1991 to less than 900 AFY in 2004. The City of Corona has plans to drill news wells in this basin for future use (AKM, 2005).

Coldwater Basin

There are 9 identified wells in the Coldwater Basin. Primary producers in the Coldwater Basin include: the City of Corona and EVMWD. Historically, the Coldwater Basin production has been used for exportation outside the basin by both the City of Corona and EVMWD. EVMWD has stopped the exportation of Coldwater Basin water since 2004 because of low water levels in its wells. EVMWD has used three wells to serve municipal demand overlying the Coldwater

Basin. The primary source of domestic supply in the Coldwater Basin is groundwater from the EVMWD wells. Because of low water levels in 2004, this supply was supplemented by imported water from Lee Lake Water District.

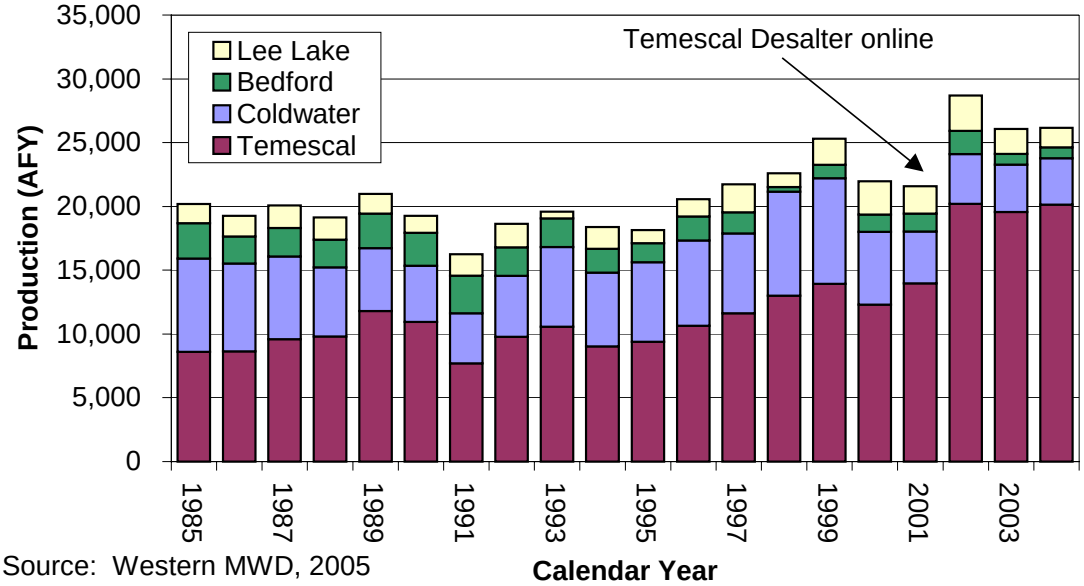
Lee Lake Basin

There are 10 identified active wells in the Lee Lake Basin. The primary producer of the Lee Lake Basin is EVMWD. This water is generally used for agricultural demand.

Temescal Basin

The City of Corona and the City of Norco are the primary pumpers from the Temescal Basin. Currently, 18 City of Corona wells with a combined annual capacity of approximately 39,000 AF extract groundwater from the Temescal Basin. In the past five years, Corona has drilled and equipped seven new wells to supply water to the Temescal Basin Desalter, which came online in 2001. The City of Corona plans to pump 29,765 AFY by year 2015 and will continue to pump that amount (AKM, 2005). The City of Norco has four wells in the Temescal Basin. The remaining wells are owned by private producers. In 1985, about 50 percent of the total production in the Temescal Basin was by the combined cities of Corona and Norco. Since the Temescal Desalter came online, more than 95 percent of the total production has come from these cities.

Figure 15-3
Historical Groundwater Production in the Temescal Valley Basins



Source: Western MWD, 2005

Table 15-3
Summary of Production Wells in the Temescal Basin

Basin	Number of Active Wells [1]	Estimated Production Capacity [2] (AFY)	Average Production 1985-2004 (AFY)	Well Operation Cost ($/AF)
Bedford	5	2,000	1,833	Not available
Coldwater	9	11,000	5,640	
Lee Lake	10	3,000	1,694	
Temescal	29	42,000	12,062	
Total	**53**	**58,000**	**21,229**	

Source: Western MWD, 2005
1. Active wells have production within past 5 years
2. Estimated production capacity is based upon maximum annual production in past 5 years or published data where available

Other Production

Major stream flows in the Coldwater and Lee Lake basins are diverted and either spread, used for irrigation or stored in Lee Lake. Between 1985 and 2004, total diversions for Coldwater and Lee Lake basins have averaged approximately 1,800 AFY and 1,500 AFY, respectively.

ASR Wells

There are no ASR wells in the Temescal Valley Basins.

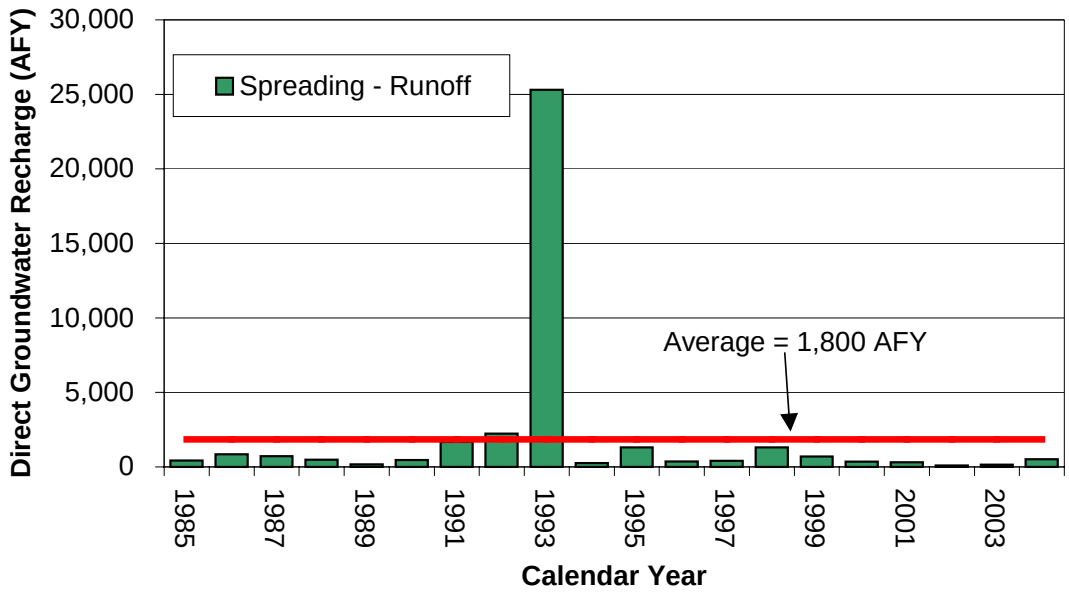
Spreading Basins

The only spreading basins in the Temescal Valley Basins are located in the Coldwater Basin. The City of Corona acquired the rights to the surface flows of Coldwater Canyon in 1964 when it purchased the assets of the Corona City Water Company. To meet California Department of Health Services requirements, the surface flow is spread in percolation ponds and extracted by the Corona's three Glen Ivy area wells in the Coldwater Basin. Historical groundwater recharge is shown in **Figure 15-4**.

There is a total spreading capacity of approximately 15 cfs. In addition, EVMWD has rights up to 1,000 AFY to divert flows from Mayhew Canyon and has spread the water in the adjacent gravel pits when not actively mined. Mining operations have limited the amount of water that can be spread in recent years. Recently, CEMEX, a gravel mining company, has constructed a concrete spillway at the north end of the basin to direct the Mayhew Canyon flow into the gravel

pit immediately downstream for stormwater runoff control. More recharge is anticipated in the future as a result of this modification. (EVMWD, 2006).

Figure 15-4
Summary of Groundwater Recharge in Temescal Valley Basins



Seawater Intrusion Barriers

There are no seawater intrusion barriers in the Temescal Valley Basins.

Desalters

The Temescal Desalter, located in the Temescal Basin, was completed in 2001. This facility utilizes approximately 6 miles of pipelines, 5 new wells, a blending station and 945 reverse osmosis membranes and has a capacity of approximately 10 million gallons per day (MGD), or about 11,000 AFY.

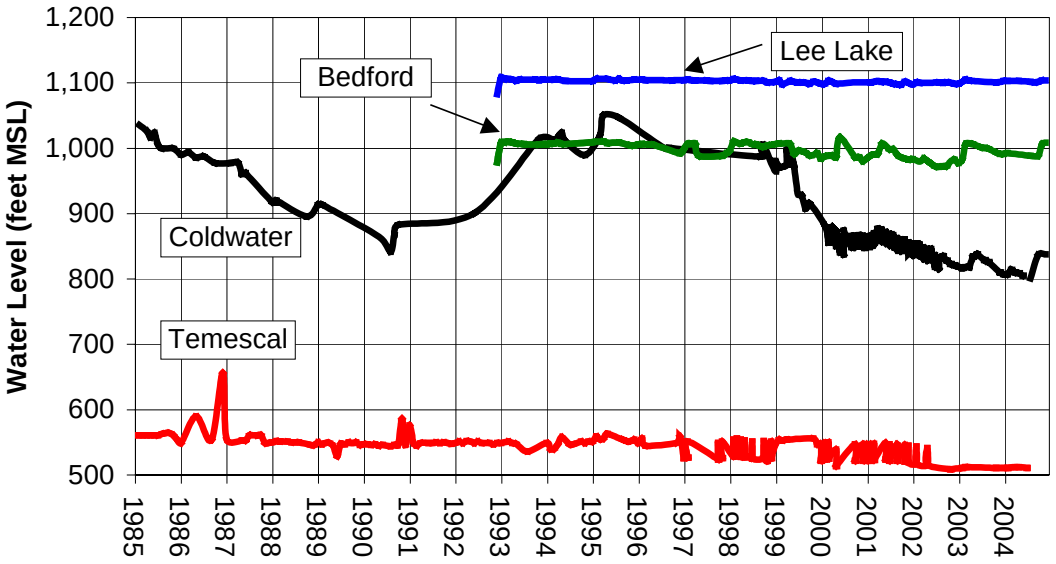
GROUNDWATER LEVELS

The following section provides a brief discussion of water level trends in the Temescal Valley. Historical groundwater levels are shown in **Figure 15-5**.

Bedford Basin

Limited water level data are available for the Bedford Basin. Depths to static groundwater are relatively shallow, ranging from less than 10 feet to about 30 feet. Therefore, there is limited storage space within this basin.

Figure 15-5
Historical Groundwater Levels in the Temescal Valley Basins



Source: SAWPA, 2006;; EVMWD, 2006

Coldwater Basin

In mid-2004, water levels in the Coldwater Basin were at a 20-year low due to lower than normal rainfall between 1999 and 2003 and decreased spreading of runoff. Groundwater levels in the Coldwater Basin track parallel with production (i.e. production is highest when water levels are highest and pumping costs are low). Production by the City of Corona wells in the Coldwater Basin has also decreased as production has increased in the Temescal Basin. Following the heavy rains of 2004/05, water levels in the Coldwater Basin had recovered nearly 40 feet by the end of 2004 and a total of 150 feet by June 2005.

Lee Lake Basin

Like the Bedford Basin, limited water level data are available. Depths to static groundwater are relatively shallow, ranging from less than 10 feet to about 30 feet. Therefore, there is limited storage space within this basin.

Temescal Basin

Groundwater levels in the Temescal Basin remained relatively stable between 1985 and 2000. Since the Temescal Desalter came online in 2001, groundwater levels have dropped as much as 40 feet. Depth to water is about 130 to 200 feet.

GROUNDWATER QUALITY

The following section describes the overall water quality considerations for the Temescal Valley Basins. The water quality of the Coldwater Basin is generally good with TDS concentrations less than about 400 mg/L while the Bedford, Lee Lake and Temescal Basins are generally poorer quality with TDS concentrations above 700 mg/L.

Groundwater Quality Monitoring

Groundwater quality samples are collected from active production wells in accordance with California DHS requirements as specified in Title 22 of the California Code of Regulations.

The Santa Ana Watershed Basin Monitoring Task Force is a collaborative effort of public and private sector agencies and interests. As part of this effort, SAWPA compiles water quality data in the Santa Ana River Watershed, including total dissolved solids (TDS) and nitrate (as N) data. SAWPA also prepares a triennial update of the ambient groundwater quality throughout all the groundwater basins in the Santa Ana River Watershed.

Groundwater Contaminants

Primary constituents of concern for the Temescal Valley Basins are total dissolved solids (TDS), nitrate, iron and manganese. In addition, the occurrence of key constituents of regional concern, volatile organic compounds (VOCs) and perchlorate, are described for reference. These constituents are summarized in **Table 15-4**.

The ambient 20-year (1984 to 2003) average TDS concentrations for the Temescal Valley Basins ranged from 400 mg/L in the Coldwater Basin to 740 mg/L in the Bedford Basin. These data are presented graphically in **Figure 15-6**. The ambient groundwater quality of the Bedford and Lee Lake Basins is generally poor and does not typically meet secondary drinking water standards for TDS. TDS concentrations within the Bedford Basin are generally greater than 600 mg/L and have historically been greater than 1,100 mg/L. The current ambient TDS concentration for the Bedford Basin is 740 mg/L (Wildermuth, 2005). As such, most of the wells are used for agricultural irrigation or are inactive. Ambient concentrations of TDS have increased about 20 mg/L in the Coldwater Basin and decreased by about 80 mg/L in the Temescal Basin compared to the 1978 to 1997 average. TDS concentrations from wells in the Lee Lake Basin have ranged from about 450 to 700 mg/L since 1985. Ambient TDS concentrations exceed secondary standards for TDS in the Bedford and Temescal Basins, which limit their potential use without treatment.

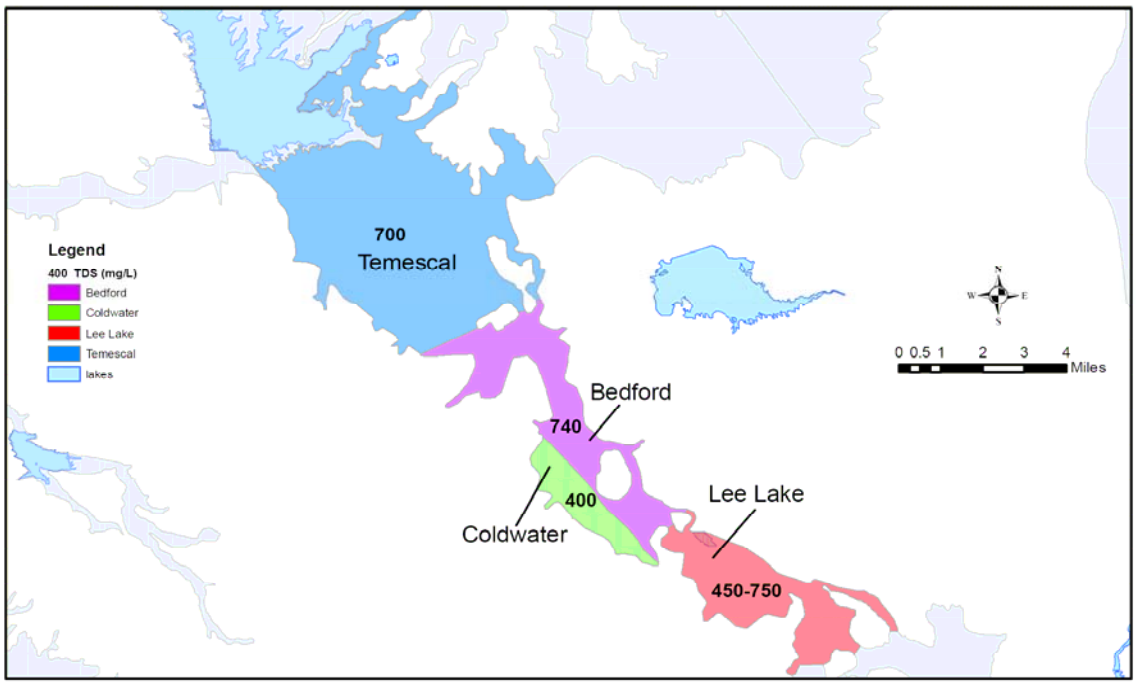
Ambient nitrate (as N) concentrations currently range from 2.4 mg/L in the Coldwater Basin to 12.8 mg/L in the Temescal Basin (Wildermuth, 2005). These data are presented graphically in **Figure 15-7**. Nitrate concentrations exceed the primary MCL of 10 mg/L in the Temescal Basin, potentially limiting its use without treatment. The ambient nitrate level in each basin dropped about 0.4 mg/L between 1997 and 2003. The current ambient nitrate concentrations in the Bedford Basin are about 2.8 mg/L as N (Wildermuth, 2005).

Table 15-4
Summary of Constituents of Concern in Temescal Valley Basins

Constituent	Units	Range	Description
TDS Secondary MCL =500	mg/L	Average: 400 to 740	Average TDS concentrations in Coldwater and Temescal Basins are about 400 mg/L and 700 mg/L, respectively. TDS concentrations within the Bedford Basin are generally greater than 600 mg/L and have historically been greater than 1,100 mg/L. TDS concentrations from wells in the Lee Lake Basin have ranged from about 450 to 700 mg/L since 1985.
Nitrate (as N) Primary MCL=10	mg/L	Average: 2.4 to 12.8	Lowest nitrate concentrations are found in the Coldwater Basin. Highest concentrations of nitrate are found in the Temescal Basin. Nitrate concentrations in the Bedford Basin have been as high as 5.8 mg/L since 1985. The current ambient nitrate concentrations are about 2.8 mg/L Nitrate concentrations in the Lee Lake Basin have been as high as 4.2 mg/L
VOCs **(TCE and PCE)** Primary MCL 5 for TCE 5 for PCE	µg/L	ND to 4.4 for TCE ND to 5 for PCE	Three known wells have had detections of TCE below the MCL in the Temescal Basin. One well has had detections of PCE in Temescal Basin. TCE and PCE were not detected in other basins.
Perchlorate Notification level = 6	µg/L	ND to 14	13 municipal production wells have had detection of perchlorate in the Temescal Basin. Perchlorate has not been detected in wells from the Bedford, Coldwater or Lee Lake Basins.
Iron and manganese Secondary MCL: 300 for iron 50 for manganese	µg/L	ND to 3,000 for iron ND to 3,000 for manganese	Four wells in Temescal Basin are currently treated for iron and manganese

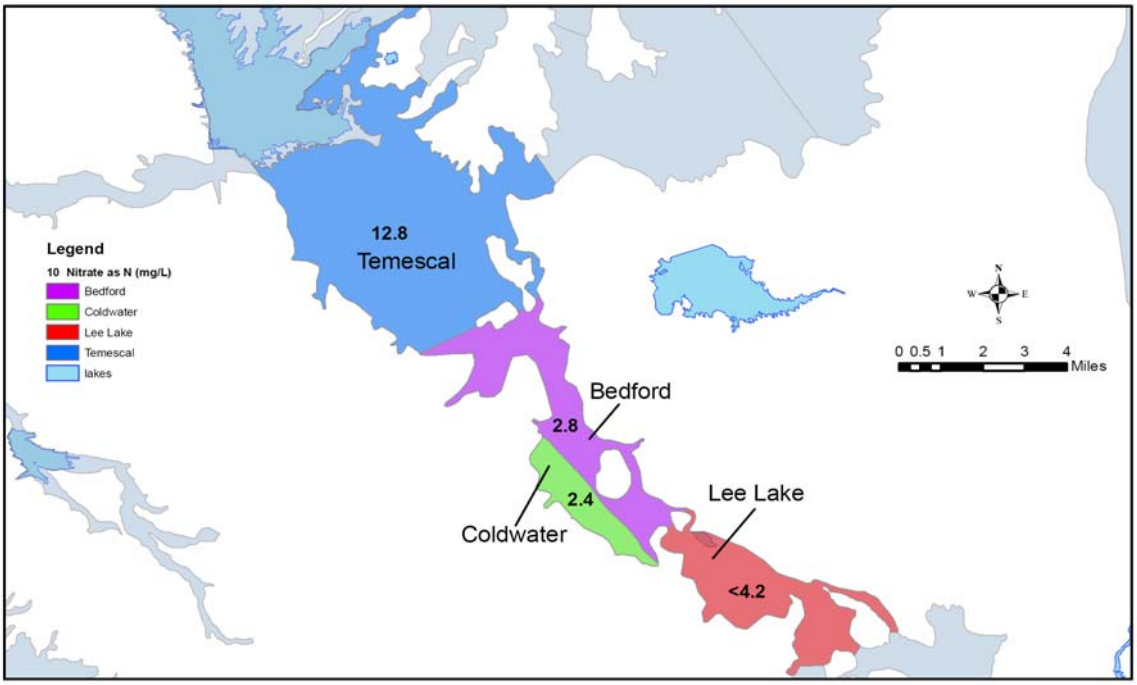
Source: Wildermuth, 2005, SAWPA, 2006 and Regional Board, 2006

Figure 15-6
Ambient TDS Concentrations (1984 to 2003)



Source: Wildermuth, 2005 and SAWPA, 2006

Figure 15-7
Ambient Nitrate Concentrations (1984 to 2003)



Source: Wildermuth, 2005 and SAWPA, 2006

Nitrate (as N) concentrations in the Bedford Basin have been as high as 5.8 mg/L since 1985 (SAWPA, 2006). Nitrate concentrations (as N) in the Lee Lake basin have been as high as 4.2 mg/L (SAWPA, 2006).

In addition to TDS and nitrate, elevated concentrations of perchlorate are encountered in the Temescal Basin. Thirteen municipal production wells in the Temescal Basin have known detections of perchlorate from 4 µg/L to 14 µg/L since 1998 (SAWPA, 2004; Regional Board, 2006). These wells are blended with other wells, imported water from Metropolitan or treated by the Temescal Desalter. Perchlorate has not been detected in wells from the Bedford, Coldwater or Lee Lake basins.

Three known wells have had detections of the VOC trichloroethylene (TCE) below the MCL in the Temescal Basin. One well has had detections of the VOC tetrachloroethylene (PCE) at or below the MCL in Temescal Basin. TCE and PCE were not detected in the other basins.

Iron and manganese are also detected above the applicable MCLs in the Temescal Basin. Concentrations range from non-detect to 3,000 µg/L.

Blending Needs

Nitrate concentrations in the Temescal Basin wells typically do not meet the EPA and DHS MCLs for nitrate (10 mg/L as N). The shallow basin groundwater typically has high levels of nitrate (0.9 to 24.4 mg/L as N) that has historically been blended to meet regulatory requirements. In 2001, the Temescal Desalter came online, eliminating the need for blending for nitrate.

In addition, perchlorate-impacted wells are blended with non-impacted sources to decrease the concentrations of perchlorate. Perchlorate-impacted water from three wells is treated by the Temescal Desalter (SAWPA, 2004).

Groundwater Treatment

The Temescal Desalter, completed in 2001, utilizes approximately 6 miles of pipelines, 5 new wells, a blending station and 945 reverse osmosis membranes. The cost to produce the water (pumping / filtering / delivering) for city residents is predicted to be $350 per AF. The capacity of the Temescal Desalter is approximately 16,803 AFY (AKM, 2005).

The City of Norco treats its wells for iron, manganese and hydrogen sulfide (City of Norco, 2005). Limited data are currently available related to this treatment.

CURRENT GROUNDWATER STORAGE PROGRAMS

There are no current groundwater storage programs in the Temescal Valley Basins. However, the City of Corona and EVMWD are evaluating a groundwater storage program in the Coldwater Basin.

BASIN MANAGEMENT CONSIDERATIONS

The following describes the basin considerations for each basin.

Bedford and Lee Lake Basins

Because the Bedford and Lee Lake Basins are shallow, there is limited storage and extraction potential in either basin. In addition, water quality concerns, specifically TDS and nitrate, limit the usability of the Bedford and Lee Lake Basins for significant storage and extraction.

Coldwater Basin

The usability of the Coldwater Basin is largely dependent upon natural recharge and gravel mining operations. When water levels are higher (less than about 200 feet below ground surface), fresher groundwater from the Coldwater Basin is lost to the open gravel pits and can spill into the Bedford Basin. Water levels are therefore maintained at a lower level. In addition, the TDS objective for the Coldwater Basin is 380 mg/L, which could potentially limit the ability to store water in this basin.

Temescal Basin

Historically, the use of the Temescal Basin has been limited because of elevated concentrations of TDS and nitrate. Upon completion of the Temescal Desalter in 2001, the potential for storage and utilization of this basin has improved. Several wells in the basin are treated for iron and manganese, which could limit its potential.

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