CHAPTER 4. EXISTING AND PLANNED WATER SUPPLY SOURCES

The City obtains its water supply from two surface water sources (Sacramento and American Rivers) and groundwater pumped from the North American and South American subbasins of the Sacramento Valley Groundwater Basin. Consequently, the City has its own water entitlements, and does not receive any water supply from another water agency. The purpose of this chapter is to discuss the City's surface water entitlements to the Sacramento and American Rivers, and the availability and management of groundwater within the two subbasins.

SURFACE WATER ENTITLEMENTS

The City has surface water entitlements, consisting of five appropriative water right permits issued by the State Water Resources Control Board, pre-1914 rights and a water rights settlement contract with the Bureau of Reclamation. Table 4-1 summarizes the City's water right permits, including application number and priority date, permit number and issuance date, rate of diversion in cfs, annual limit in af, purpose of use, period of use, place of use, and the current deadline to perfect full use. Each water right permit is discussed in more detail below. Copies of the City's Bureau of Reclamation contract and water agreements are provided in Appendix C.

Surface water is currently diverted at two locations: Off the American River downstream from the Howe Avenue Bridge, and off the Sacramento River downstream of the confluence of the American and Sacramento Rivers. The City's current authorized POU for water diverted under the Sacramento River permit includes all the land within the City Limits, while the POU for water diverted under the American River permits includes not only the City limits, but also portions of service areas of several other water purveyors. Figure 4-1 illustrates the City's POU for these permits water source.

Sacramento River Water Rights

The City has pre-1914 and post-1914 appropriative rights for water from the Sacramento River. The City has used Sacramento River water since 1854 and claims a pre-1914 appropriative right to divert 75 cubic feet per second (cfs) from the Sacramento River.

The City's post-1914 Sacramento River permit (Permit 992) authorizes the City to take water from the Sacramento River by direct diversion, and has a priority date of March 30, 1920. Permit 992 authorizes the City to divert up to 81,800 acre-feet annually (afa) with a maximum flow of 225 cfs.

Permit 992 allows the City to use water diverted from the Sacramento River within the city limits of the City of Sacramento (see Figure 4-1), as this area changes from time to time through annexations.

Table 4-1. City of Sacramento State Water Right Permits Summary

Application Permit and License No.	Priority Date	River Source	Maximum Amount Specified		Purpose of Use	Season of Diversion and Rediversion	Place of Use	Deadline to Perfect by Full Use
			cfs	acre-ft/yr				
A. 1743 P. 992	3/30/1920	Sacramento	225	81,800	Municipal	Jan 1 to Dec 31	City of Sacramento	12/31/2030
A. 12140 P. 11358	10/29/1947	American	675[a]	245,000[a]	Municipal	Nov 1 to Aug 1	79,500 acres within and adjacent to City	12/1/2030
A. 12321 P. 11359	2/13/1948	Tributaries of American			Municipal	Nov 1 to Aug 1[b]	96,000 acres within and adjacent to City	12/31/2030
A. 12622 P. 11360	7/29/1948	Tributaries of American			Municipal	Nov 1 to Aug 1[b]	96,000 acres within and adjacent to City	12/31/2030
A. 16060 P. 11361	9/22/1954	American			Municipal	Nov 1 to Aug 1	79,500 acres within and adjacent to City	12/1/2030

[a] Aggregate maximum applicable to City's diversions under all four American River permits pursuant to the City/Bureau of Reclamation water right settlement contract.

[b] Year-round period for re-diversion of water previously diverted by SMUD Upper American River Project Reservoirs. SMUD's season of diversion is Nov 1 to Aug 1.

American River Water Rights

The City has four water right permits authorizing diversions of American River water. American River Permits 11358 and 11361 authorize the City to divert water from the American River by direct diversion, with a combined maximum allowable rate of diversion of 675 cfs, with priority dates of October 29, 1947, and September 22, 1954, respectively. The POU for both permits is 79,500 acres within and adjacent to the City.

The other two American River permits (Permits 11359 and 11360) authorize re-diversion for consumptive uses of American River tributary water previously diverted by the Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP)[1]. Permits 11359 and 11360 have priority dates of February 13, 1948, and July 29, 1948, respectively, and the POU for both permits is 96,000 acres within and adjacent to the City. The combined maximum allowable diversion under these permits includes rediversion of up to 1,510 cfs of UARP direct diversion water and up to 589,000 afa of UARP stored water. The combined POU for American River water is presented on Figure 4-1.

The City's diversions of American River water to the City's Fairbairn Water Treatment Plant (FWTP) also are subject to limitations during certain time periods specified in the Water Forum Agreement, as discussed in Chapter 5.

Bureau of Reclamation Settlement Contract

The City also has a water rights settlement contract entered into in 1957 by the City and the U.S. Bureau of Reclamation (Bureau). At that time, the State Water Rights Board was deciding how to allocate water rights on the American River among numerous competing applicants, including the City and the Bureau. The City and the Bureau had protested each others' applications. This contract settled their differences and enabled both parties to drop their protests, to the benefit of both parties.

The essence of the City/Bureau settlement contract is that the City agreed to limit its combined rate of diversion under its American River water rights permits to a maximum of 675 cfs. The City's diversions under its American River water rights permits may scale up to 245,000 afa by the year 2030. The City also agreed to limit its rate of diversion under its Sacramento River water rights Permit 992 to a maximum of 225 cfs and a maximum amount of 81,800 afa. This limits the City's total diversions of Sacramento and American River water to 326,800 afa. In return, the settlement contract requires the Bureau to make available in the rivers at all times enough water to enable the agreed-upon diversions by the City. The City agreed to make an annual payment to the Bureau for Folsom Reservoir storage capacity used to meet the Bureau's obligations under the contract, beginning with payment for 8,000 acre feet of storage capacity in 1963 and building up, more or less linearly, to payment for the use of 90,000 acre feet of storage capacity in 2030. The settlement contract is permanent and not subject to deficiencies. The Bureau contract, in conjunction with the City's water rights, provides the City with a very reliable and secure water supply.[2]

Summary of Surface Water Entitlements

As discussed above, the City holds pre-1914 rights, as well as five permits to divert or redivert water from the Sacramento and American Rivers. The 1957 settlement contract with the Bureau sets forth a diversion schedule (Schedule A) that assures, as well as limits, the total diversion available to City from the Sacramento and American Rivers.

Table 4-2 presents the City's maximum allowed diversion, as specified in Schedule A, from the Sacramento and American Rivers combined, and the maximum allowed diversion from the American River by itself. The maximum allowed diversion from the Sacramento River is 81,800 afa during any year, but the total combined diversion from both rivers cannot exceed the total requirement specified in Schedule A.

Table 4-2. Maximum Annual Diversion Allowed to the Year 2030[(a)]

Year	Maximum Diversion from the Sacramento River, afa[(b)]	Maximum Diversion from the American River, afa[(c)]	Maximum Combined Diversion, afa
2005	81,800	154,000	205,000
2010	81,800	170,500	227,500
2015	81,800	189,000	252,000
2020	81,800	208,500	278,000
2025	81,800	228,000	304,000
2030	81,800	245,000	326,800

(a) Data obtained from Schedule A of the 1957 Water Rights Settlement Contract between the Bureau and the City.

(b) The City may divert up to 81,800 afa from the Sacramento River as long as the total combined diversion from both the Sacramento and American Rivers does not exceed the Maximum Combined Diversion.

(c) The City may divert up to the Maximum Diversion from the American River as long as the total combined diversion from both the Sacramento and American Rivers does not exceed the Maximum Combined Diversion.

GROUNDWATER SUPPLY

The City overlies two subbasins of the Sacramento Valley Groundwater Basin (the North American and South American subbasins). The City is one of many water purveyors that utilize groundwater from the subbasins. As previously discussed in Chapter 3, the City operates 30 municipal supply wells and 5 irrigation wells north of the American River, and operates 2 municipal supply wells and 9 irrigation wells south of the American River. Hence, the City pumps groundwater from both subbasins, although approximately 95 percent of the amount pumped by the City is pumped from the North American subbasin. As will be discussed in

Chapter 6, the City pumped 22,521 af of groundwater for potable water consumption in 2005. Figure 4-2 illustrates the location of the City's groundwater wells (both municipal and irrigation) within each subbasin.

In addition to any groundwater supplied to areas outside of the City's surface water POUs, the City's present desire is to maintain the flexibility to use surface water exclusively *or* use a combination of surface water and groundwater when desired. The City anticipates maintaining groundwater production facilities for redundancy and operational flexibility. Existing regulations do not directly limit the use or expansion of groundwater pumpage by the City. However the City's groundwater supplies may be subject to future federal and state regulations that may place restrictions on acceptable concentration levels of radon, arsenic and other water quality parameters.

A description of both groundwater subbasins follows, including discussion on the quality, water level, and management conditions.

Description of the Groundwater Subbasins

The North and South American Subbasins are located within the larger Sacramento Valley Groundwater Basin. The North American Subbasin is bounded by Bear River to the north, Feather River to the west, the Sacramento and American Rivers to the south, and a north-south line extending from the Bear River to Folsom Lake to the east.[3] The South American Subbasin is bounded by the Sierra Nevada to the east, the Sacramento River to the west, the American River to the north, and the Cosumnes and Mokelumne Rivers to the south.[4]

The various geologic formations that constitute the water-bearing deposits underlying both the North and South American subbasins are described in the 2003 Update to the DWR Bulletin 118-3. These formations include an upper, unconfined aquifer system, and a lower, semi-confined aquifer.[5] The upper aquifer system consists of the Modesto, Riverbank, Turlock Lake, Victor, Fair Oaks, and Laguna Formations, along with Arroyo Seco and South Fork Gravels; the lower aquifer consists primarily of the Mehrten Formation.[6]

It should be noted that as part of the Water Forum process, a groundwater model was developed by the Sacramento County Water Agency (SCWA). The model defined a Central Basin boundary which took into account the hydrogeologic boundaries and the political boundaries of organized water purveyors/districts, cities, and the County of Sacramento. Essentially, the Central Basin boundary overlies the DWR South American Subbasin; however, the boundaries are slightly different because the Central Basin boundary was developed from the Sacramento County groundwater model grid.[7] However, the portion of the South American subbasin underlying the City of Sacramento, is considered to be the Central Basin.

Groundwater Quality

Groundwater underlying the City's service area generally meets primary and secondary drinking water standards for municipal water use, and is described as being calcium–magnesium-bicarbonate type water, with minor fractions of sodium-magnesium-bicarbonate.[8] Due to high

concentrations of iron and manganese in the lower aquifer system, the upper aquifer system is usually the preferred source of groundwater.[9]

The lower aquifer system also contains higher concentrations of total dissolved solids (TDS) than the upper aquifer. The TDS concentration in most wells is within secondary drinking water standards, but varies quite significantly throughout the area (from 21 to 657 mg/L, with an overall average of 221 mg/L).[10] TDS concentrations exceed 2,000 milligrams per liter (mg/L) at depths of approximately 1,200 feet or greater.[11] However, most wells do not extend into this poorer quality groundwater.

Groundwater Levels

As will be discussed in subsequent sections, the Sacramento Groundwater Authority (SGA) adopted the SGA Groundwater Management Plan (SGA GWMP) on December 11, 2003, to help establish a framework for maintaining a sustainable groundwater resource in the North American Subbasin (see Appendix D). The Water Forum and SCWA have recently completed a Central Sacramento County Groundwater Management Plan in February 2006 for an area approximately the same as the South American Subbasin.

Groundwater level trends for the North American Subbasin were obtained from the SGA GWMP. Groundwater level trends in the South American Subbasin were obtained from DWR Bulletin 118Update 2003. Groundwater level trends are discussed separately for each subbasin below. Neither subbasin has been described to be in overdraft in DWR Bulletin 118, nor has Bulletin 118 projected either basin to become overdrafted with the current management of the subbasins.

Groundwater Level Trends in the North American Subbasin

A collection of municipalities, cities, water districts, agriculture, and private users overlying the subbasin have historically used groundwater from the North American Subbasin. The SGA GWMP evaluated the effect of groundwater pumping in the portion of the North American Subbasin located within Sacramento County, but north of the American River (i.e., within the SGA's planning area), by dividing the SGA's planning boundary into four separate general areas as follows:

- Western (bordered by the Sacramento River): "Long-term trends of increasing or decreasing groundwater levels are not evident in these wells, however, groundwater levels do fluctuate seasonally in each well."[12]
- North Central (bordered by the county line): "The general trend in this area is steeply declining groundwater levels until the early 1990s and then stabilized levels."[13]
- South-Central (bordered by the American River): "The general trend in this area is gently to moderately declining groundwater levels over time."[14]

- Eastern (bordered by the eastern foothills): "The general trend in this area is stable groundwater elevations near the American River and high elevations in the foothills, with declining groundwater levels away from the river and foothills."[15]

The hydrographs used in the SGA GWMP, along with the location of the wells used to develop them, are presented in Appendix D of this UWMP.

The SGA GWMP also indicated that groundwater levels in southwestern Placer County and northern Sacramento County have generally decreased, with water levels in many wells declining at a rate of about one and one-half feet per year for the last 40 years or more.[16] Water levels in wells located in Sutter and northern Placer Counties have generally remained stable; although, some wells located in southern Sutter County have declining water levels.[17] Consequently, although there is a net depletion of stored groundwater, some areas (e.g., the Western area and areas near the City) have not experienced a significant decline in water levels.

Groundwater Level Trends in the South American Subbasin

A collection of municipalities, cities, water districts, agriculture, and private users overlying the subbasin have historically pumped groundwater from the South American Subbasin. As described in Bulletin 118 Update 2003, eighteen long-term hydrographs developed by DWR indicate that groundwater elevations within the entire South American Subbasin have, in general, consistently declined by approximately 20 feet from the mid-1960's to about 1980, but recovered by about 10 feet from 1980 to 1983, where water levels remained stable until the 1987 to 1992 drought.[18] During the drought, water levels declined by about 15 feet, but recovered to levels higher than those observed prior to the drought by 2000.[19]

There are two exceptions to these trends. The first involves wells in and adjacent to the City, where water levels fluctuated by less than 10 feet since the mid-1970s.[20] The fluctuation is likely related to natural seasonal fluctuations. The other exception involves wells near Rancho Cordova, where water levels appear to have recovered less than other wells in the South American Subbasin.[21] The actual hydrographs developed by DWR were not available for review and are not included in this UWMP.

Groundwater Management

The number and type of groundwater users differs significantly between the subbasins. The North American Subbasin consists mainly of cities, water districts, and water agencies, while the South American Subbasin consists of approximately 6,000 private irrigation and residential users in addition to cities, water districts, and water agencies.[22] The management of each subbasin is discussed separately below.

Management of the North American Subbasin

The City has invested substantial time and resources to participate in the following regional planning activities affecting the management of groundwater resources in the North American Subbasin:

- Sacramento Groundwater Authority (SGA)
- Sacramento Water Forum
- American River Basin Cooperating Agencies Regional Water Master Plan (Cooperating Agencies RWMP)
- Sacramento Metropolitan Water Authority (SMWA) (currently the Regional Water Authority)
- Regional Water Authority (RWA) (successor to the SMWA)

The SGA was formed as a joint powers authority in 1998 to collectively manage Sacramento County's portion of the North American Subbasin. SGA is governed by a joint powers agreement between the City of Sacramento, Sacramento County, City of Folsom and the City of Citrus Heights, who each have police power to manage and protect the underlying groundwater basin. Appointed representatives of fourteen local water purveyors (including a City representative) and a representative from both the agricultural and private pumpers serve as the Board of Directors to the SGA. The members of the SGA collectively provide high quality, reliable water supply to over 500,000 people, in addition to irrigation supply.[23]

As discussed previously, on December 11, 2003, the SGA adopted the SGA GWMP to help establish a framework for maintaining a sustainable groundwater resource for the various purveyors overlying the groundwater basin within Sacramento County and north of the American River. The SGA GWMP also detailed specific goals, objectives, and an action plan to provide a "road map" for coordination among the fourteen overlying water purveyors.

In particular, the SGA GWMP divides the management plan into five component categories plus implementation and financing. The five components include programs for stakeholder involvement, monitoring, groundwater resource protection, groundwater sustainability, and planning integration. Sections 3 and 4 of the management plan are provided as Appendix D, which provide extensive detail on all of the SGA GWMP programs.[24]

Management of the South American Subbasin

The City has also invested substantial time and resources to participate in the following regional planning activities affecting the management of groundwater resources in the South American Subbasin:

- Sacramento Central Groundwater Authority (SCGA)
- Sacramento Water Forum
- RWA
- SMWA (currently the RWA)

The South American Subbasin consists of major water purveyors (such as Zone 40) and more than 6,000 private agricultural and residential users.[25] In 2002, the Central Sacramento County

Groundwater Forum was formed to fulfill an element of the WFA, and was aimed at developing recommendations for the management of the Central Sacramento Groundwater Basin, which is a portion of the South American Subbasin. As described above, the City overlies a portion of the Central Sacramento Groundwater Basin, although, as noted previously, the City is not a major groundwater pumper in this area.

The SCGA was formed on September 20, 2006, and is a joint powers authority, similar to the Sacramento Groundwater Authority as a form of governance. The SCGA board is planning on adopting the Central Sacramento County Groundwater Management Plan in November 2006.

As discussed previously, the Central Sacramento County Groundwater Management Plan was completed in February 2006. Sections 3 and 4 of the plan are provided in Appendix D.

Sustainable Yield of the North and South American Subbasins

As will be discussed in more detail in Chapter 5, the Water Forum, which was formed in 1993, approved the WFA in January 2000. The WFA contains a groundwater management element that estimated and recommended an average annual sustainable yield for portions of both the North American and South American Subbasins.

The WFA estimated the sustainable yield for the North American Subbasin (i.e., those areas located north of the American River) at 131,000 afa, which is approximately equal to the year 1990 pumping amount.[26] The WFA estimated the sustainable yield for the South American Subbasin (i.e., those areas located south of the American River) at 273,000 afa, which was a negotiated quantity.[27]

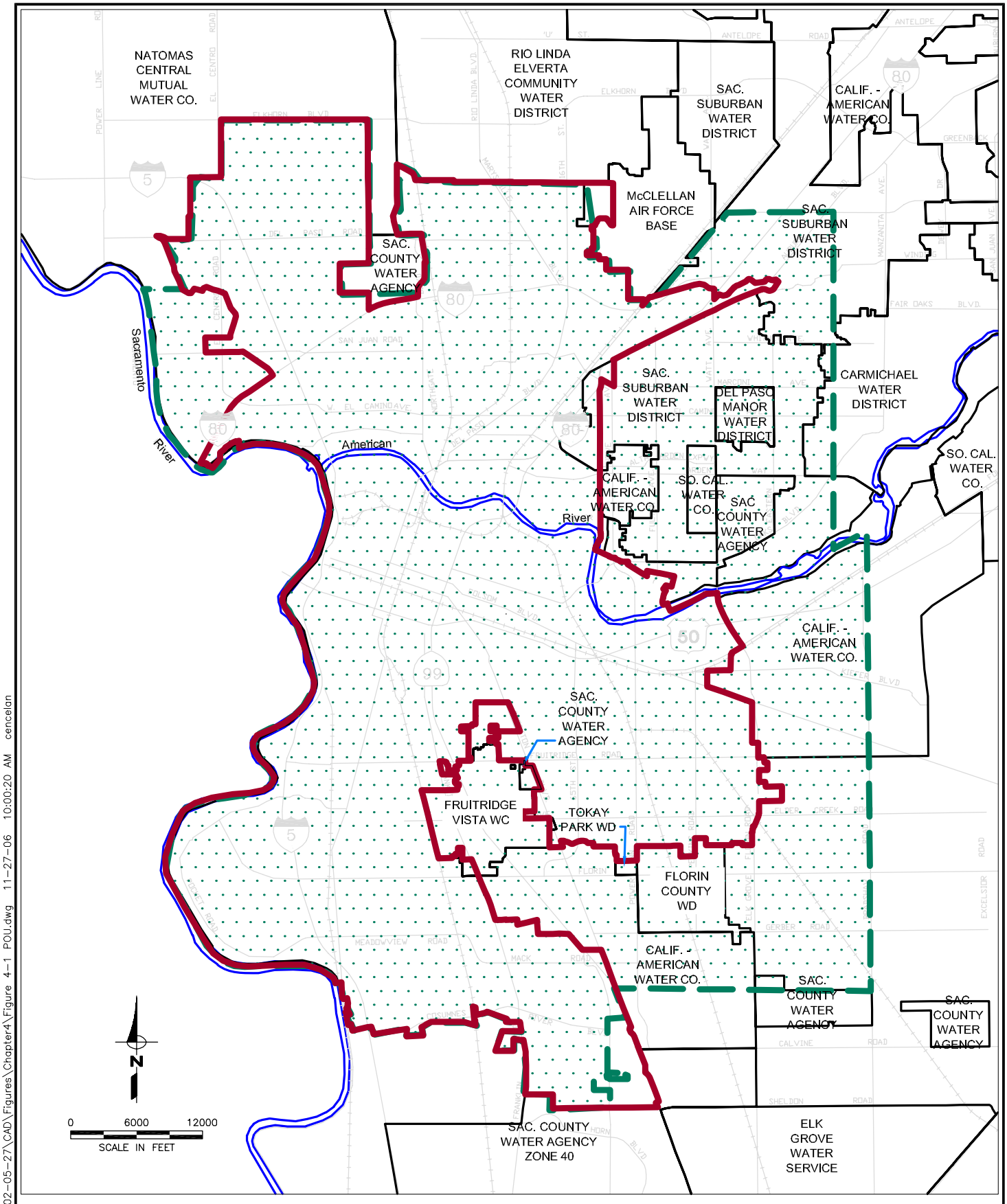
The City's actual groundwater pumpage is discussed in Chapter 6, while the City's plans for future groundwater pumping are discussed in Chapter 5.

DESALINATED WATER AND BRACKISH GROUNDWATER

The City is not considering the development or use of desalinated water or brackish groundwater; there is no source of sea water or brackish groundwater near the City.

OPPORTUNITIES FOR SHORT TERM OR LONG TERM EXCHANGES OR TRANSFERS

Although the City possesses surface water rights, as described previously, opportunities to exchange or transfer these rights are limited since the City's Bureau settlement contract entitles the Bureau to use any supply of water exceeding the amounts specified in the settlement contract and prohibits the City from encumbering its water rights in any way that would impair the parties' ability to perform the contract. In 2002, the City participated in a Bureau-approved pilot program to make surface water available to the Environmental Water Account by reducing surface water diversions, and similar opportunities may exist in the future. As noted in Chapter 3, the City also supplies water on a wholesale basis to water purveyors serving areas outside of the City, and such deliveries are expected to increase.



LEGEND

AMERICAN RIVER PLACE OF USE

CITY LIMITS AND SACRAMENTO RIVER PLACE OF USE

OTHER WATER ENTITIES

FIGURE 4-1

City of Sacramento

SACRAMENTO & AMERICAN RIVER PLACES OF USE

WEST YOST ASSOCIATES
Consulting Engineers

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REFERENCES

[1] Maddaus Water Management, *Urban Water Management Plan 2000.* December 2001.

[2] The descriptions and discussion in this UWMP of the City's water rights and water right settlement contract are provided solely for informational purposes, and nothing in this UWMP is intended to, nor shall any provision of this UWMP be interpreted, to modify or affect in any way such rights and contract.

[3] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[4] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[5] Sacramento Groundwater Authority (SGA), *Groundwater Management Plan*. December 2003.

[6] City of Sacramento, *General Plan Technical Background Report.* June 2005.

[7] A Water Forum and Sacramento County Water Agency, Central Sacramento County Groundwater Management Plan (page 2-22), February 2006.

[8] City of Sacramento, *General Plan Technical Background Report.* June 2005.

[9] City of Sacramento, *General Plan Technical Background Report.* June 2005.

[10] City of Sacramento, *General Plan Technical Background Report.* June 2005.

[11] City of Sacramento, *General Plan Technical Background Report.* June 2005.

[12] City of Sacramento, *General Plan Technical Background Report, Page 15*. June 2005.

[13] City of Sacramento, *General Plan Technical Background Report, Page 15*. June 2005.

[14] City of Sacramento, *General Plan Technical Background Report, Page 15*. June 2005.

[15] City of Sacramento, *General Plan Technical Background Report, Page 15*. June 2005.

[16] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[17] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[18] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[19] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[20] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[21] Department of Water Resources, *Bulletin 118 – Update 2003, California's Groundwater.* October 2003.

[22] Regional Water Authority Staff, *Notes from Telephone Conversation.* January 5, 2006.

[23] Sacramento Groundwater Authority, *SGA Website – ww.sgah2o.org.* January 2006.

[24] Sacramento Groundwater Authority, *SGA Website – ww.sgah2o.org.* January 2006.

[25] Larry Norton, LAR Science Conference – CSCGF Presentation. http://www.dera.saccounty.net/Zone%2040/ARC.HTM. April 22, 2005.

[26] Water Forum, *Water Forum Agreement – Section 3.* January 2000.

[27] Water Forum and Sacramento County Water Agency, Central Sacramento County Groundwater Management Plan (page 2-29), February 2006.