H. WATER SUPPLY TECHNICAL MEMO AND WATER SUPPLY ANALYSIS

Agenda Item No. 6D
April 24, 2012

TO: Honorable Mayor and City Council
Attention: Laura C. Kuhn, City Manager

FROM: Rod Moresco, Interim Director of Utilities

SUBJECT: RESOLUTION ACCEPTING AND DIRECTING FILING OF THE CITY OF VACAVILLE SB 610 WATER SUPPLY ASSESSMENT REPORT FOR BRIGHTON LANDING

DISCUSSION:

As an urban water supplier to over 26,000 customers, the City of Vacaville is required to prepare and file an Urban Water Management Plan (UWMP) with the Department of Water Resources (DWR) every 5 years, in accordance with Assembly Bill 797. The primary objective of the document is to support long-term resource planning and ensure adequate water supplies to meet existing and future water demands. The 2010 UWMP Update was finalized and submitted in July 2011 to the DWR.

Additionally, on January 1, 2002, Senate Bill 610 became effective with the objective of ensuring that communities have adequate water supplies to support proposed development projects. Water suppliers must evaluate the impacts of certain large development projects as they are proposed. These proposed project impacts are then incorporated into the UWMP as it is updated for a true and complete assessment of a community's water supply and demand projections.

SB 610 consists of two primary components:

1. Preparation of a Water Supply Assessment Report (WSAR) for any proposed development project which is subject to the California Environmental Quality Act (CEQA) and which meets the definition of "project" in Water Code Section 10912 (i.e., residential development projects of more than 500 dwelling units or other types of development projects using a comparable amount of water). The WSAR must cover a 20-year planning horizon.

2. If groundwater is identified as a source of water available to the supplier, groundwater information must be provided which includes a copy of any adopted groundwater management plan.

The proposed Brighton Landing residential development project (Project) falls under the WSAR requirement and consists of 769 dwelling units bounded by Leisure Town Road on the west, Elmira Road on the north, Pacific Gas and Electric towers to the east, and the Batch property to the south. The land uses proposed for the Project include residential dwellings in varying densities, public facilities, a park, an option for commercial development, and two schools (public and private). The Project area lies entirely within the City limits and the Solano Irrigation District (SID) currently serves the Project area, therefore, Brighton Landing must de-annex from SID and be subject to the City's Annexation Water Supply Fee at the time of development.

The WSAR, completed by Nolte and Associates in conjunction with City staff, compares projected water demand and available supplies for the Project 20 years into the future, and includes scenarios for normal, single dry, and multiple dry years. Under normal water conditions, the completed Project has an estimated water demand of 660 acre-feet per year. Based on total water demand projections and water supply analysis for the entire City, as presented in the WSAR, it is determined that Vacaville has sufficient water supply to meet projected water demands through the year 2035, including impacts from the proposed Project (see Table 26 from the WSAR below).

TABLE 26
CITY OF VACAVILLE
SUMMARY OF PROJECTED WATER DEMAND VERSUS AVAILABLE SUPPLY
DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS
(AC-FT/YR)

	Normal Year		Single Dry Year		Multiple Dry Year	
Year	Projected Demand	Available Supply	Projected Demand	Available Supply	Projected Demand	Available Supply
2015	18,547	30,853	16,692	31,974	14,838	28,424
2020	19,408	32,723	17,467	33,834	15,527	30,194
2025	20,269	34,508	18,242	35,704	16,215	31,929
2030	21,004	36,393	18,904	36,148	16,803	33,642
2035	21,320	38,278	19,188	38,118	17,056	35,477

FISCAL IMPACTS:

There is no fiscal impact to the City for preparation of the WSAR as the cost for preparation and publication (approximately $16,400) will be paid by the Project developer.

RECOMMENDATION:

By simple motion, that the City Council of the City of Vacaville adopt the subject resolution.

RESOLUTION NO._____

RESOLUTION ACCEPTING AND DIRECTING FILING OF THE CITY OF VACAVILLE SB 610 WATER SUPPLY ASSESSMENT REPORT FOR BRIGHTON LANDING

WHEREAS, the California Legislature enacted Assembly Bill 797 during the 1983-1984 Regular Session of the California Legislature (Water Code Section 10610 et. seq.) known as the Urban Water Management Planning Act, which mandates that every urban supplier of water providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre feet of water annually, prepare and Urban Water Management Plan (UWMP), the primary objective of which is to plan for the conservation and efficient use of water; and

WHEREAS, the City of Vacaville is an urban water supplier to over 26,000 customers and therefore, prepared and filed a 2010 UWMP Update in July 2011 with the Department of Water Resources (DWR), and

WHEREAS, on October 9, 2001, the Governor signed into law Senate Bill 610 (Costa), effective January 1, 2002, which requires certain water suppliers, including the City of Vacaville, to add additional information to its UWMP consisting of two primary components which include a Water Supply Assessment Report (WSAR) for any proposed development project which is subject to the California Environmental Quality Act (CEQA) and which meets the definition of "project" in Water Code Section 10912, and additional groundwater information to be included in the WSAR for water suppliers who identify groundwater as an available supply source; and

WHEREAS, the City of Vacaville has prepared a WSAR for a development project titled Brighton Landing Subdivision Annexation, which is subject to CEQA and meets the project definition in Water Code Section 10912, and find the estimated water demand of the Brighton Landing project to be approximately 660 acre-feet per year; and

WHEREAS, based on the City of Vacaville's total water demand projections and water supply analysis as presented in the WSAR, the City has sufficient water supply to meet projected water demands through the year 2035 including impacts from the proposed project.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Vacaville that the SB 610 Water Supply Assessment Report for Brighton Landing is hereby adopted and will be submitted as part of the Brighton Landing Project Environmental Impact Report for future City Council consideration.

I HEREBY CERTIFY that the forgoing resolution was introduced and passed at a regular meeting of the City Council of the City of Vacaville, held on the 24th day of April 2012, by the following vote:

AYES:

NOES:

ABSENT:

ATTEST:

_____
Michelle A. Thornbrugh, City Clerk

CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR BRIGHTON LANDING

APRIL 2012

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CITY OF VACAVILLE

SB 610 WATER SUPPLY ASSESSMENT REPORT FOR BRIGHTON LANDING

APRIL 2012

Submitted to:

City of Vacaville – Utilities Department
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SB 610 WATER SUPPLY ASSESSMENT REPORT FOR BRIGHTON LANDING

APRIL 2012

Cities and counties with large development projects are required by SB 610 (Part 2.10, Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment Report (WSAR). The purpose of this legislation is to ensure that adequate water is, or will be, available to accommodate a proposed large development. While an Urban Water Management Plan (UWMP) evaluates water demand at a programmatic level for the entire service area of an urban water supplier, a WSAR evaluates the specific water needs of a proposed project in relation to existing, present, and future water demand and supply within a service area. This WSAR will evaluate the projected water needs for existing and currently planned developments including the proposed Brighton Landing Subdivision project. Figure 1 is a schematic of the City of Vacaville (City) depicting the location of the currently planned developments as well as the proposed Brighton Landing Subdivision project. The WSAR includes a review of entitlements, water rights, and delivery contracts as well as incorporates information presented previously in the 2010 City of Vacaville UWMP [1]. This WSAR is intended to be included in the CEQA documents for the Brighton Landing development project. A copy of the Resolution approving this WSAR is included in Appendix A.

1.0 INTRODUCTION

The City, founded in 1850, is nestled at the base of the Vaca Mountains. The City is located centrally between Sacramento and San Francisco on Interstate 80 (I-80). The City limits encompass over 29 square miles with a population of approximately 97,000, which makes Vacaville the third largest city in Solano County. Additional information concerning the City population, climate/precipitation, and mechanism for financing water system infrastructure are provided below.

1.1 Current/Projected City Population

The population of Vacaville increased by 63 percent from 1980 to 1990 and increased an additional 24 percent from 1990 to 2000. The growth rate from 2000 to 2010 was approximately 10 percent. It is anticipated that the population will grow by an additional 14 percent from 2011 to 2035. This population projection is based on slower growth than previous population projections, due to decreasing population growth trends caused by the economic downturn observed recently. Table 1 is a summary of the population projections for the City.

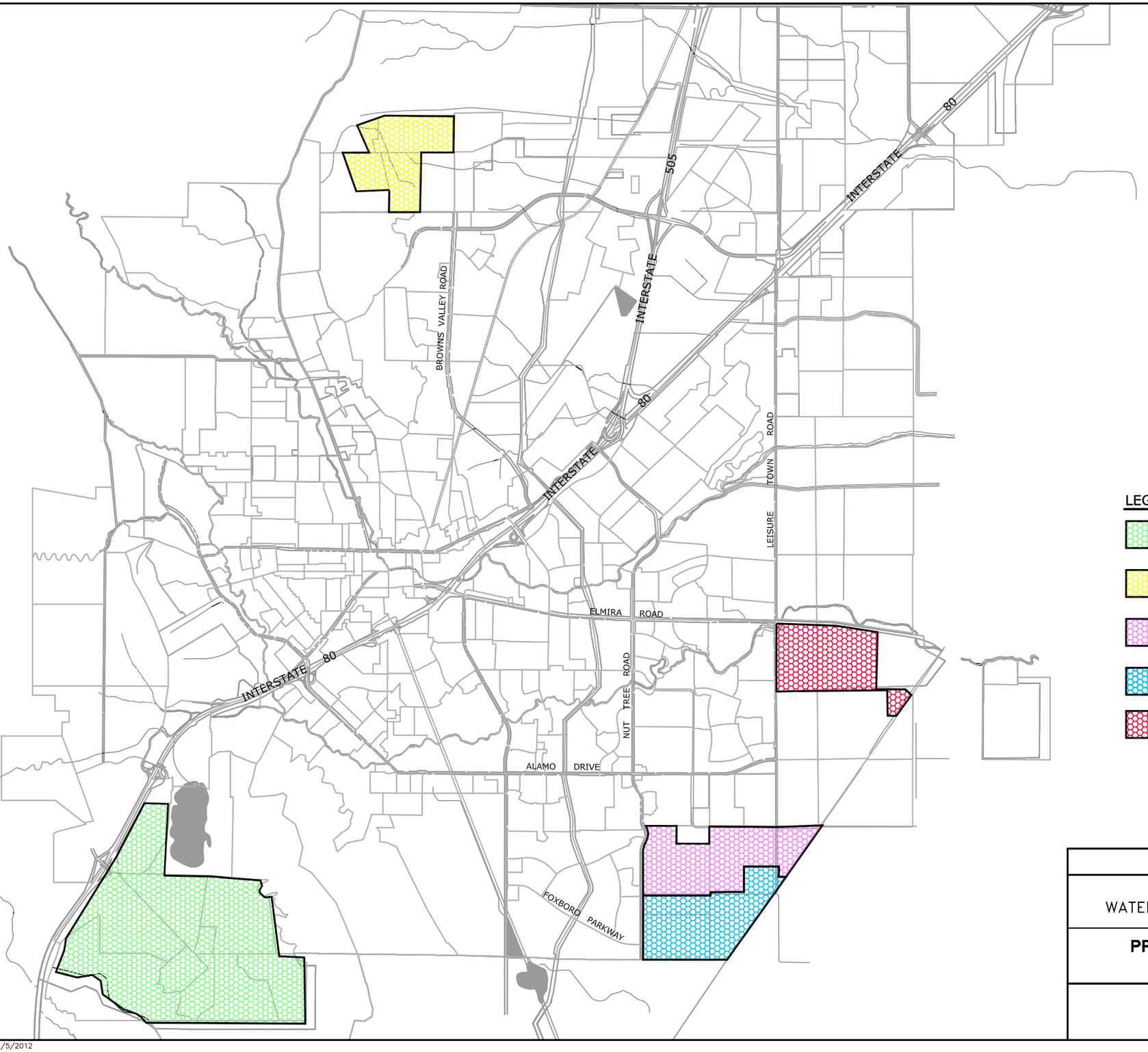

FIGURE 1

BRIGHTON LANDING SB610
WATER SUPPLY ASSESSMENT REPORT

PROPOSED DEVELOPMENTS LOCATION MAP

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N:\SAB042204\CADD\FIG-1_LOCATION MAP.DWG SEB 4/5/2012

TABLE 1
CITY OF VACAVILLE POPULATION PROJECTIONS 2010 – 2035 [1]

Year	2010[a]	2015[b]	2020[b]	2025[b]	2030[b]	2035[b]
Population	97,300	102,600	105,000	107,300	109,400	111,100

[a] 2010 population from California Department of Finance.
[b] Population projections for 2015 to 2035 provided by Association of Bay Area Government's 2009 Projections and Priorities.

1.2 Climate/Precipitation

The climate in Vacaville is characterized by mild winters and hot summers. The average annual precipitation is 25 inches, 85% of which occurs from December through March. Temperatures during the winter usually drop into the forties at night and occasionally fall below the freezing point. Snow is rare. In the summer, temperatures occasionally rise above 100 degrees. The days are typically hottest between 4 and 5 p.m., and temperatures cool off noticeably in the evenings.

The climate has significant influence on water demands in the City. Winters are characterized by relatively low water demands, while the summers have substantially higher demands. Landscape irrigation in the summer is a major contributor to the higher summer demands.

1.3 Development Impact Fee (DIF) for Water System Infrastructure

The goal of the Development Impact Fee (DIF) for water is to provide adequate financing for water facilities required to implement the City's General Plan. The fees are used to finance the planning, design, construction, and inspection of water supply and distribution system projects.

The fee programs are based on a market rate of growth constrained by the limits of the General Plan. Fee programs are adjusted annually to reflect inflation and other changes in the cost estimates, and are subject to a major revision every five years or every time a major change that would impact the fees occurs.

Water system impact fees are assessed on water meter size and average citywide consumption for each meter size. The charges are based on equivalent dwelling unit (EDU) factors, and assessed relative to a single-family home which is one EDU. Table 2 is a summary of the City water connection impact fees as of January 1, 2010. It is anticipated that water system infrastructure improvements required to support the proposed Brighton Landing project will be funded through the proposed development project and existing DIF funds.

An additional annexation water supply and delivery cost is assessed to projects as a condition for annexation. Because a project's boundaries require annexation into the City limits, water supplies and infrastructure costs for these projects were not part of the City's General Plan and are not fully covered in the development impact fees. Therefore, an additional fee is assessed per EDU to cover acquisition and delivery costs of water purchased to meet the increased annexation demands. According to a City memorandum titled *Annexation Water Supply Costs – Revised 2008* dated September 26, 2008, the 2008 annexation water supply costs are $2,139 per EDU or $3,753 per acre-foot. For current costs, the fees should be updated with ENR adjustments. Brighton Landing lies entirely within the City limits and the Solano Irrigation District (SID) currently serves the Brighton Landing Project area. Brighton Landing must de-annex from SID and be subject to the City's Annexation Water Supply Fee at the time of development.

TABLE 2
CITY OF VACAVILLE
WATER CONNECTION FEE [2]

Land Use Type	EDU[a]	Meter Size, inch	Fee, $[b]
Single-Family	1.0	¾	7,643
	1.0	1	7,643
	2.5	1	19,108
	5.0	1-½	38,215
	8.0	2	61,144
Multiple-Family	2.0	¾	15,286
	2.6	1	19,872
	7.0	1-½	53,501
	13.4	2	102,416
	23.2	3	177,318
	37.4	4	285,848
Commercial / Industrial	2.0	¾	15,286
	2.6	1	19,872
	7.0	1-½	53,501
	13.4	2	102,416
	23.2	3	177,318
	37.4	4	285,848

[a] Equivalent Dwelling Unit
[b] As of January 1, 2010.

2.0 EXISTING AND PLANNED WATER SOURCES

This section contains a description of the existing and planned groundwater, surface water, and water conveyance facilities. The water utility system is a self-supporting City enterprise. The water utility is responsible for operation, maintenance, and repair of the City's water treatment and distribution system, as well as water quality and recycled water distribution. Vacaville's water utility system was purchased from Pacific Gas and Electric (PG&E) Company in 1959 by issuing voter-approved water revenue bonds. Since purchasing the system, the City has systematically improved and upgraded this infrastructure.

2.1 Description of Existing Facilities

The Vacaville water system consists of surface water treatment facilities, wells, pumping facilities, distribution and transmission pipelines, and storage reservoirs. The system receives water from several sources, including Solano Project water from the Lake Berryessa reservoir, State Water Project water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local city wells. Within Vacaville's water entitlements, the percentage of water used from each supply source varies due to conjunctive use. If any one source has limited water availability or poor water quality, use from other sources can increase. Likewise, if unscheduled water becomes available it can be utilized to the City's advantage.

Surface water from Lake Berryessa is provided by contract between the U.S. Bureau of Reclamation (BuRec) and the Solano County Water Agency (SCWA) and delivered by the Solano Irrigation District (SID). This water is treated at either the North Bay Regional plant (NBR plant) or at the City’s 10 million gallons per day (mgd) diatomaceous earth filter treatment

plant (DE plant), in which the treated water discharges into a ground-level chlorine contact basin. Wells 1, 6, and 13 also supply water directly to the DE Plant clearwell. From the clearwell, a booster pump station pumps the water into the distribution system. Water from the remaining wells (2, 3, 5, 8, 9, 14, 15, 16, and De Mello) is treated at the wellhead and pumped directly to the distribution system. Well 7 is currently out of service due to a damaged casing. The City is evaluating whether the well will be repaired or abandoned. The De Mello Well is currently being used as a standby well. The City is currently planning for the construction of a new supply well, Well 17. Figure 2 is a schematic of the City depicting the locations of the existing City wells and DE plant.

The NBR plant provides a capacity of 13.3 mgd for Vacaville and supplies water directly to the City's distribution system. The NBR plant draws water from the Sacramento River Delta via the NBA, as well as Solano Project water from the Putah South Canal. Figure 3 is a schematic of regional water supply facilities and includes the location of the NBA and Putah South Canal.

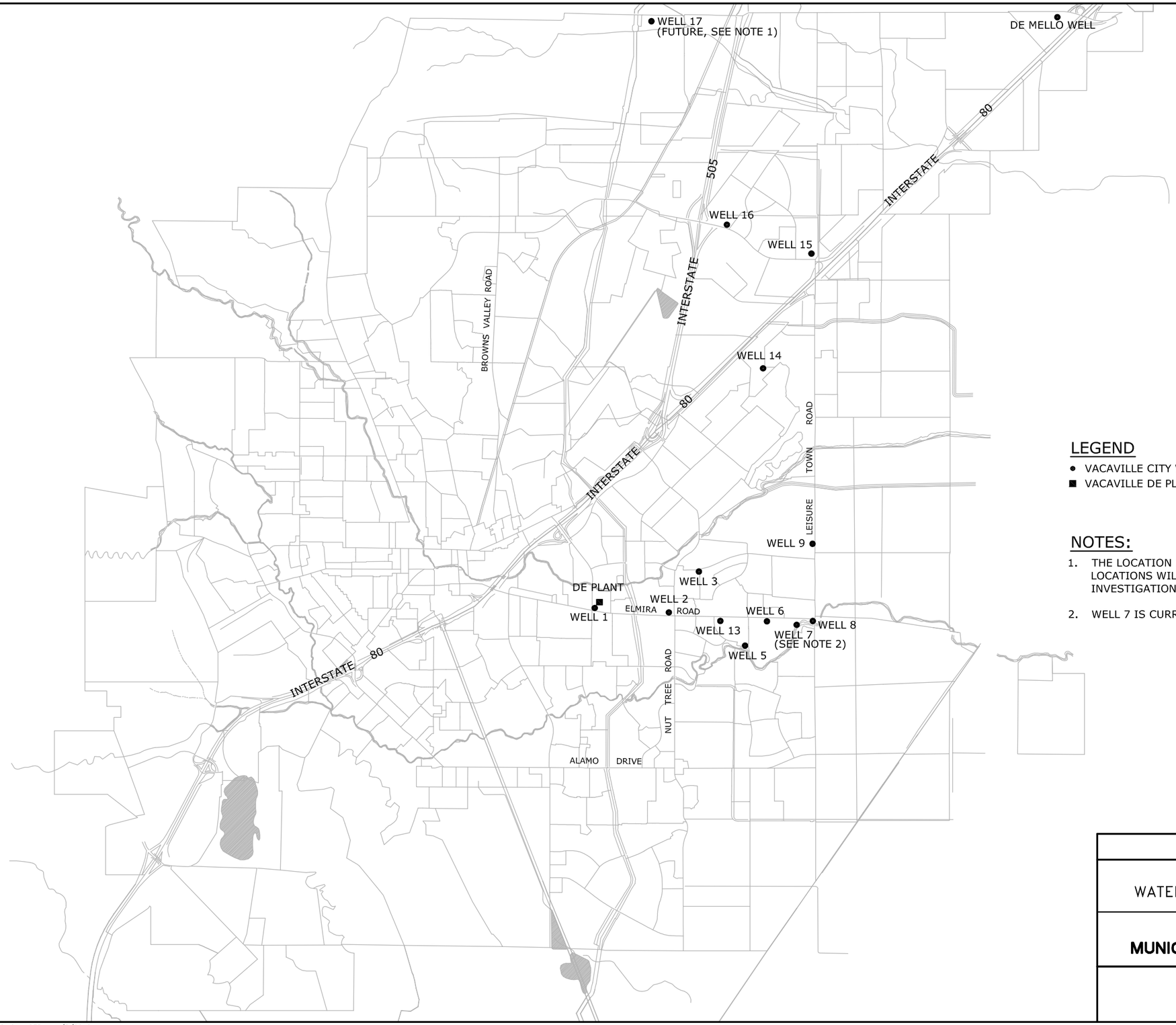
2.2 Groundwater

As noted earlier, one source of supply for the City is groundwater. Currently, groundwater is provided through 11 operational wells, 10 of which withdraw water from the deep aquifer in the basal zone of the Tehama Formation. Most City wells are located in the Elmira well field. However, new wells are being sited further north, near I-80. Currently, approximately 5,000 acre-feet per year (ac-ft/yr) of groundwater are withdrawn. Vacaville continues to explore well field expansion as a means of maintaining adequate water supply. A regional program is being implemented to monitor groundwater data as a means of insuring against overdraft or contamination. This program is described in Appendix B along with an investigation of groundwater pumping impacts [3]. A discussion of the groundwater basin and historic groundwater pumping follows. The locations of planned future wells, including a well in the proposed Brighton Landing development are shown in Figure 4. The locations of the wells shown in Figure 4 are preliminary and final locations will be determined based on field investigations.

Boundaries, Soils, Storage Capacity

The City pumps groundwater primarily from the basal zone of the Tehama Formation in the Solano Sub-basin, located east of the English Hills Fault. Well 1 is the only well currently in operation that extracts water from a different formation, Markley Formation, located west of the English Hills Fault. Tehama formation consists of moderately to highly consolidated fluvial, alluvial, and lacustrine deposits. Lithology present within the Tehama Formation includes inter-layered sand, silt, clay, and gravel, a stiff blue lacustrine clay located near the upper portions of the formation, and other continuous clay layers that divide the formation into upper, middle, and basal zones. The basal zone of the formation also includes gravel and cobble deposits, layers of detrital tuff, and calcium carbonate cemented conglomerate [4].

The primary source of groundwater supply for municipal use is the basal zone of the Tehama formation, which is a highly confined aquifer. The overlying Quaternary alluvial deposits and upper and middle zones of the Tehama formation are not suitable for high production municipal water supply. However, they are used for some domestic and agricultural purposes in



LEGEND

- ● VACAVILLE CITY WELL
- ■ VACAVILLE DE PLANT

NOTES:

1. THE LOCATION OF FUTURE WELLS IS PRELIMINARY. LOCATIONS WILL BE DETERMINED BASED ON FIELD INVESTIGATIONS.
2. WELL 7 IS CURRENTLY OUT OF SERVICE.

FIGURE 2

BRIGHTON LANDING SB610
WATER SUPPLY ASSESSMENT REPORT

CITY OF VACAVILLE
MUNICIPAL WELLS AND DE PLANT

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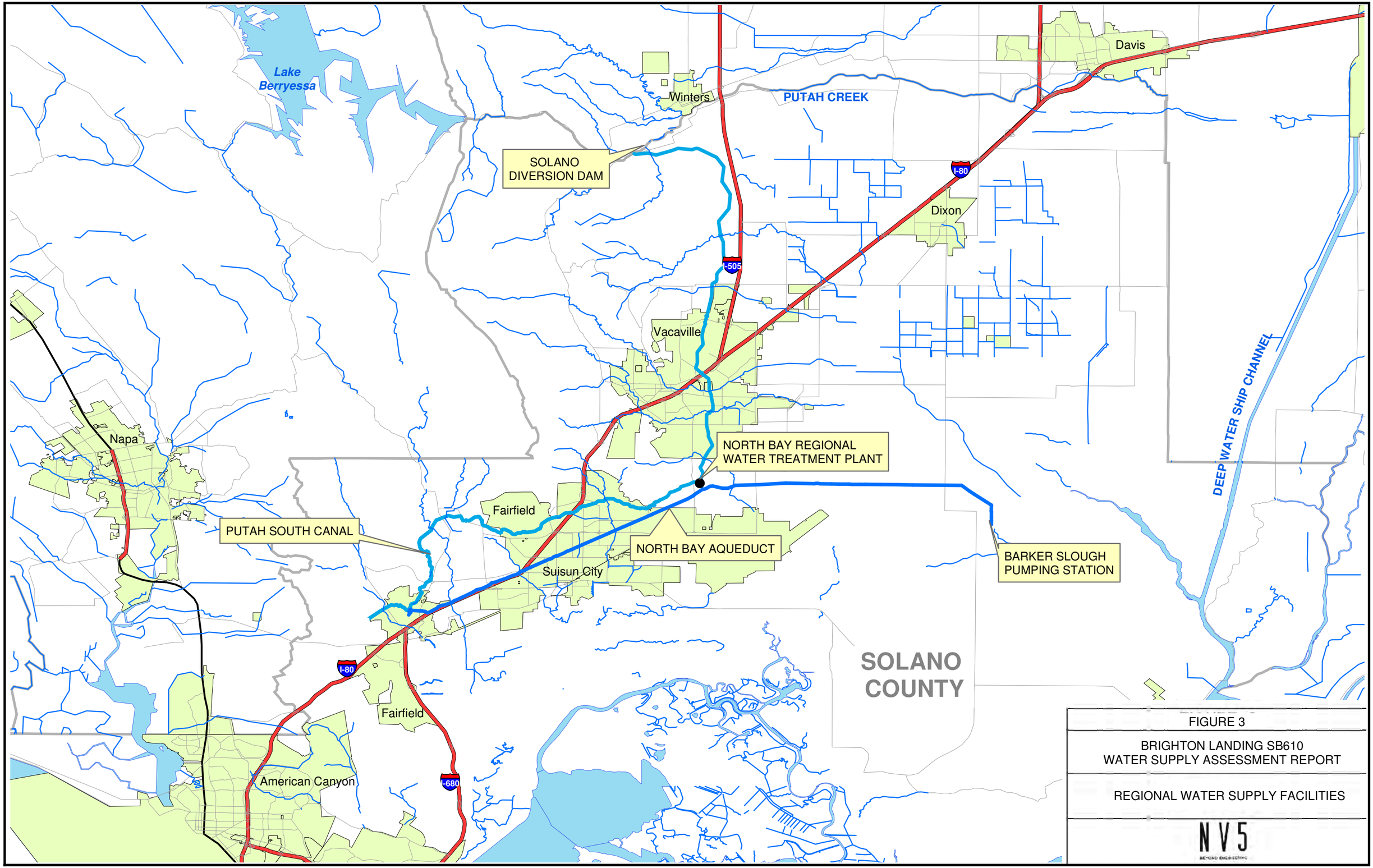

FIGURE 3

BRIGHTON LANDING SB610
WATER SUPPLY ASSESSMENT REPORT

REGIONAL WATER SUPPLY FACILITIES

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WELL 17
WELL 18
WELL 19
WELL 24
WELL 23
WELL 22
WELL 21
WELL 20
DE PLANT
REYNOLD'S RANCH BPS
REYNOLD'S RANCH RES
RES 8
RES 7
RES 6
N. ORCHARD RES
N. ORCHARD BPS
LLV ZONE 2 BPS
LLV ZONE 3 BPS
LLV ZONE 2 RES
LLV ZONE 3 RES
(18")
(24")
(30")
(12")
INTERSTATE 80
HIGHWAY 505
VACA VALLEY PKWY
BROWNS VALLEY PARKWAY
ORANGE DR
NUT TREE RD
LEISURE TOWN RD
ELMIRA RD
ALAMO DR
PEABODY RD
ALLISON DR
MERCHANT ST
ULATIS DR
E MONTE VISTA AV
N. ALAMO DR

N
4000 0 4000
SCALE: 1"=4000'

LEGEND:

- WATER LINES
- WELLS/PLANTS
- RESERVOIRS
- BOOSTER PUMP STATIONS
- WATER LINES (LOCAL)
- RESERVOIRS (LOCAL)
- BOOSTER PUMP STATIONS (LOCAL)

FIGURE 4

BRIGHTON LANDING SB610
WATER SUPPLY ASSESSMENT REPORT

PROPOSED WATER PROJECT LOCATION MAP

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unincorporated areas of Vacaville. East of the Vacaville area, these aquifers are utilized by SID to supplement surface water supplies and for shallow groundwater pumping for drainage purposes.

The Solano Sub-basin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Sub-basin boundaries are as follows: (1) Putah Creek on the north; (2) Sacramento River on the east (from Sacramento to Walnut Grove); (3) North Mokelumne River on the southeast (from Walnut Grove to San Joaquin River); (4) San Joaquin River on the south (from the North Mokelumne River to Sacramento River); and, (5) boundary between the San Francisco bay and Sacramento River hydrologic study areas as described in California Department of Water Resource (DWR) bulletin 118 on the west.

Historic Groundwater Pumping

The City is the primary groundwater user within the Vacaville area. Unmeasured agricultural and domestic groundwater extractions in unincorporated areas of the Vacaville area, Rural North Vacaville Water District (RNVWD) production wells, and SID are the other groundwater users. Since 1968, the City's annual groundwater pumping has varied from a low of 2,862 ac-ft in year 1968 to a high of 8,024 ac-ft in year 1983. Annual groundwater production, including all wells, is summarized in Table 3 from year 1968 to year 2010. The majority of groundwater production in the past was obtained from wells located at the Elmira Road well field. The newer northeast sector well field located near I-80 also contributes to the groundwater production. In the future, groundwater pumping will be more widely distributed in the study area rather than concentrated in the Elmira Road well field.

TABLE 3
CITY OF VACAVILLE
HISTORICAL GROUNDWATER PUMPING[1]

Year	ac-ft/yr	Year	ac-ft/yr	Year	ac-ft/yr
1968	2,862	1983	8,024	1997	3,386
1969	3,046	1984	6,089	1998	3,905
1970	2,871	1985	5,853	1999	4,096
1971	3,198	1986	5,824	2000	5,141
1972	3,255	1987	6,236	2001	6,214
1973	3,125	1988	5,421	2002	6,638
1974	3,316	1989	6,045	2003	6,628
1975	3,970	1990	5,625	2004	6,622
1976	4,965	1991	5,447	2005	6,680
1977	5,093	1992	5,531	2006	6,635
1978	5,020	1993	4,395	2007	6,612
1979	6,185	1994	3,893	2008	5,784
1980	6,990	1995	3,886	2009	4,647
1981	7,740	1996	3,230	2010	5,068
1982	7,683				

2.3 Surface Water

The City has three separate sources for surface water. Each source has a different level of reliability. This section describes the City's surface water sources. Appendix C contains information regarding specific contracts between the City and various water supply agencies.

Solano Project (Vacaville Supply, SID Agreement)

The Solano Project was constructed by the BuRec in 1958. The water rights permits for the Solano Project are held by the BuRec in trust for the Solano water users. The water rights permits further state that when the permits are converted to a license, the license will be issued in the name of Solano water users. Unlike most federal water projects, the water rights to the Solano Project "belong" to the Solano water users. The main feature of the Solano Project is Monticello Dam, which provides for storage of 1.6 million ac-ft of water in Lake Berryessa (Lake). Water from the Lake is diverted through the Putah Diversion Dam to the 32-mile Putah South Canal, which transports water to the eight SCWA-member unit contractors for Solano Project water.

SCWA has entered into agreements with cities, districts, and state agencies to provide water from the Solano Project. The Solano Project contracting agencies are: Fairfield, Suisun City, Vacaville, Vallejo, SID, Maine Prairie Water District, University of California at Davis, and California State Prison - Solano. Table 4 summarizes the annual entitlement to each agency.

TABLE 4
SUMMARY OF SOLANO PROJECT WATER CONTRACTS (AC-FT/YR)[1]

Agency	Annual Entitlement
Fairfield	9,200
Suisun City	1,600
Vacaville	5,750
Vallejo	14,600
SID	141,000
Maine Prairie Water District	15,000
UC Davis	4,000
California State Prison – Solano	1,200
Project Operating Loss (average estimated)	15,000
Total	**207,350**[a]

[a] Value approximates a firm yield during the driest hydrologic period on record (1916-1934).

The contracts with the public entities that use Solano Project water provide for the sale and distribution of water made available by the BuRec each year. The BuRec is contractually committed to delivering the full contract amount of water supply from the Solano Project unless the water supply does not physically exist (e.g. an empty reservoir). All Solano Project water

contractors, whether they are municipal or agricultural, are impacted by water supply reductions on an equal basis.

In addition to its entitlement from SCWA, Vacaville entered into a 1995 Master Water Agreement (Agreement) with SID. A second amendment to the Agreement, adopted in June 2010, updated the water purchase schedule. Pursuant to the second amendment, Vacaville receives an increasing supply from SID through the year 2040 and a consistent supply thereafter until the year 2050. The second amendment allows Vacaville to request additional water if needed to support growth. The agreement provides for changes in the delivery schedule, making the maximum entitlement of 10,050 ac-ft/yr available earlier than the year 2040 if desired by the City. The annual water schedule for SID water available to Vacaville is contained in Table 5.

TABLE 5
ANNUAL WATER SCHEDULE FOR THE SID WATER AGREEMENT (AC-FT/YR) [5]

Year	Annual Entitlement	Year	Annual Entitlement
2010	2,500	2026	5,925
2011	2,625	2027	6,225
2012	2,750	2028	6,525
2013	2,875	2029	6,825
2014	3,000	2030	7,125
2015	3,125	2031	7,425
2016	3,325	2032	7,725
2017	3,525	2033	8,025
2018	3,725	2034	8,325
2019	3,925	2035	8,625
2020	4,125	2036	8,925
2021	4,425	2037	9,225
2022	4,725	2038	9,525
2023	5,025	2039	9,825
2024	5,325	2040 through 2050	10,050
2025	5,625		

State Water Project (North Bay Aqueduct)

Vacaville receives water allocations from the State Water Project through the SCWA (termed Table A water) and water from a Year 2000 purchase agreement from Kern County Water Agency (KCWA). Surface water received pursuant to these agreements is delivered through the NBA, a State Water Project facility. The City supply from the State Water Project is 6,100 ac-ft/yr, while KCWA Agreement water totals 2,878 ac-ft/yr. The Solano County branch of the NBA was completed in 1988. The North Bay Aqueduct is 28 miles long starting from Barker Slough in the Delta and ending in Napa County. The location of the NBA can be seen in Figure 3. The California Department of Water Resource (DWR) is the owner and operator of the NBA.

The water supply for the NBA is less reliable than the Solano Project. Supply from the NBA comes from the State Water Project which provides water to a total of 29 contractors. A list of these contractors and their respective allocations is shown in Table 6. Because the NBA is part of the entire State Water Project, any shortages occurring in the State Water Project impact the NBA.

Within Solano County there are currently seven agencies with NBA water allocations. These include Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. Table 7 summarizes the annual increase in SCWA's contract. Member units using the NBA and their allocations are described in Table 8. Shortages during dry years are proportional to their share of the overall contract with DWR.

TABLE 6
STATE WATER PROJECT 2010 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Upper Feather River Area	
City of Yuba City	9,600
County of Butte	27,500
Plumas County Flood Control and Water Conservation District	2,160
Subtotal	39,260
North Bay Area	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency	47,506
Subtotal	76,531
South Bay Area	
Alameda County Flood Control and Water Conservation District	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	222,619
San Joaquin Valley Area	
County of Kings	9,305
Dudley Ridge Water District	50,343
Empire West Side Irrigation District	3,000
Kern County Water Agency	982,730
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	88,922
Subtotal	1,140,000

Continued on Next Page

TABLE 6 (CONTINUED)
STATE WATER PROJECT 2010 WATER ALLOCATIONS (AC-FT/YR) [1]

Agency	Maximum Allocations
Central Coastal Area	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	70,486
Southern California Area	
Antelope Valley-East Kern Water Agency	141,400
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline-Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	82,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Flood Control District	20,000
Subtotal	2,623,100
Total	**4,171,996**

TABLE 7
SUMMARY OF STATE WATER PROJECT ALLOCATIONS TO THE SOLANO COUNTY WATER AGENCY THROUGH THE NORTH BAY AQUEDUCT (AC-FT/YR) [1]

Year	Annual Allocations	Year	Annual Allocations
2001	45,836	2009	47,456
2002	46,296	2010	47,506
2003	46,756	2011	47,556
2004	47,206	2012	47,606
2005	47,256	2013	47,656
2006	47,306	2014	47,706
2007	47,356	2015[a]	47,756
2008	47,406		

[a] Each year thereafter will have an annual allocation of 47,756 ac-ft/yr.

TABLE 8
STATE WATER PROJECT
ALLOCATION TO SOLANO COUNTY CITIES SERVED
BY THE NORTH BAY AQUEDUCT (AC-FT/YR) IN YEAR 2035[1]

City	Annual Allocations
Benicia	17,200
Dixon	0[a]
Fairfield	14,678
Rio Vista	0[a]
Suisun City	1,300
Vacaville	8,978[b]
Vallejo	5,600
Total	**47,756**

[a] Dixon and Rio Vista currently do not use their individual allocation of 1,500 ac-ft/yr. If Dixon and/or Rio Vista decide to use the NBA water supply, supplies to Benicia, Fairfield and Vallejo are reduced commensurately.
[b] Vacaville allocations from State Water Project (including KCWA Agreement).

Settlement Water (DWR Agreement)

Settlement Water consists of surface water from the Sacramento River and Sacramento-San Joaquin Delta Estuary. Settlement Water is diverted under water rights held by DWR, but is not considered State Water Project water. The water is made available by DWR in settlement of area-of-origin water right applications by the cities of Fairfield, Benicia, and Vacaville. The City currently uses only 25 to 30 percent of the Settlement Water, and experiences water quality and delivery challenges. The City is working with SCWA to construct a new intake on the Sacramento River to resolve these challenges. The Agreement provides an allocation to each of the three cities as shown in Table 9.

TABLE 9
SUMMARY OF SETTLEMENT WATER FOR THE CITIES OF
FAIRFIELD, BENICIA, AND VACAVILLE (AC-FT/YR) [1]

Agency	Annual Allocations
Fairfield	11,800
Benicia	10,500
Vacaville	9,320
Total	**31,620**

2.4 Recycled Water

A preliminary planning study performed in 2003 evaluated the potential for recycled water delivery and use citywide. Potential customers were identified that may accept tertiary treated recycled water generated at the Easterly Wastewater Treatment Plant (EWWTP) in the future. Several considerations were also identified: (1) I-80 splits Vacaville into south and north

segments with the EWWTP located in the farthest southeast section of the City. Distribution piping does not currently exist and the planning and coordination to construct a system reaching north of I-80 would be expensive and challenging; and (2) SID has a non-potable water conveyance system established throughout Vacaville and has the potential to deliver to all areas of the City at a lesser cost than the City could provide recycled water [6]. Additionally, the 1995 Master Water Agreement between the City and SID includes a non-compete clause prohibiting the City from selling non-potable water within the SID service area.

Evaluation of these considerations has focused the City's current planning on future delivery to customers south of I-80 and near the EWWTP. Delivery estimates for 2020 currently total 1,175 ac-ft/yr; however, this drought-proof resource will require user contracts and possible retrofit costs on the user's behalf. Therefore, for planning purposes, only 75 percent of the total delivery estimate, or 880 ac-ft/yr, is assumed to be available beginning in 2020.

In addition, the City of Vacaville has been working with a power generation plant developer for a possible power plant located on property adjacent to the wastewater treatment plant. The close proximity to the wastewater treatment plant allowed the City to establish a reasonable rate for recycled water. This incentive provided continuing interest in Vacaville as a project site and, if the project moves forward, could result in as much as 5 MGD of recycled water sales. While this will not directly offset City potable water use, which is not available in the Elmira area, it could offset groundwater or non-potable SID water use. The power ventures developer is currently holding a lease on the property pending acceptance of their project by PG&E. The City has not offered incentives to other potential customers at this time. The possible power plant is not within the SID service area.

2.5 Summary of Water Supply Sources

The total water supply available to the City in 2035 from groundwater, surface water, and recycled water will be approximately 41,653 ac-ft/yr. A summary of the respective supply sources previously discussed is presented in Table 10.

TABLE 10
CITY OF VACAVILLE
TOTAL WATER SUPPLY IN YEAR 2035 [1]

Sources of Supply	Allocations (ac-ft/yr)
Solano Project	
Vacaville Entitlement[a]	5,750
SID Agreement[b]	8,625
State Water Project	
Vacaville Table A	6,100
KCWA Agreement	2,878
Settlement Water[c]	9,320
Groundwater Pumping[d]	8,100
Recycled Water	880
Total	**41,653**

[a] See Table 4
[b] See Table 5
[c] See Table 9
[d] See Appendix B

3.0 PROJECTED WATER DEMANDS

Presented in this section are land use summaries and projected water demands for the proposed Brighton Landing project. The water demand factors that serve as the basis for the demand projections are also described below.

3.1 Water Demand Factors

The City currently uses two sets of water demand factors (existing and growth) for planning and analysis of water supply and distribution systems. Table 11 is a summary of the current water demand factors. Most of these factors were approved as part of the *Water Demand Factors Summary Technical Memorandum* [7]. Future growth factors for RLMD, RLD, RE, and CH were determined based on actual meter readings. The difference between the two sets of demand factors (existing versus growth) includes a contingency to reflect uncertainties in projecting future land use. It also includes increases in the water demand for new development versus existing within a given land use category.

3.2 Projected Water Demands for Brighton Landing

Table 12 includes the land use summary and resulting water demands for the proposed Brighton Landing project. The *Brighton Landing Specific Plan* [8] presents the proposed land use and corresponding dwelling units or acreage by sub-area. In addition to residential units of various densities, future school(s), a park, and trails are planned for the Brighton Landing project. The *Brighton Landing Specific Plan* [8] proposes three options for Sub-Area "O". The first alternative, neighborhood commercial development, has the highest water demand (conservative), and is used in the water demand calculation presented in Table 12. This WSAR assumes that the Brighton Landing project will be constructed by 2015.

TABLE 11
SUMMARY OF CURRENT WATER DEMAND FACTORS
USED FOR MASTER PLANNING PURPOSES
CITY OF VACAVILLE

Land Use Description	Land Use Designation	Unit	Water Demand Factors, gpd/unit			
			Existing Land Use		Growth Land Use	
			Potable	Irrigation	Potable	Irrigation
Residential						
Residential Low Medium Density[a]	RLMD	du	340	0	420	0
Residential Low Density[a]	RLD	du	380	0	520	0
Residential Estates[a]	RE	du	680	0	600	0
Residential Rural	RR	du	850	0	1,000	0
Residential Medium Density	RMD	du	300	0	350	0
Residential High Density	RHD	du	260	0	300	0
Residential Urban High Density	RUHD	du	210	0	250	0
Manufactured Homes	MH	du	260	0	300	0
Retirement Residential	RetRes	du	300	0	350	0
Commercial						
Office	O	ac	1,000	500	1,600	450
Business Park	BP	ac	1,000	400	1,600	450
Retail Sales	RS	ac	1,000	400	1,600	450
Downtown	D	ac	3,900	100	3,900	100
Commercial Highway[a]	CH	ac	1,700	400	4,750	450
Commercial Service	CS	ac	1,000	400	1,600	450
Industrial						
Industrial	IND	ac	1,200	400	2,000	450
Public						
Public	P	ac	1,000	400	1,600	450
Elementary School	ESC	stu or ac	25/stu	900/ac	30/stu	1,500/ac
High School	HSC	stu or ac	30/stu	900/ac	40/stu	1,500/ac
Hospital	HOS	ac	1,400	500	2,300	450
Open Space						
Park	PK	ac	0	1,300	0	2,100
Park Recreational	PR	ac	100	1,500	170	2,500
Agricultural	AG	ac	0	2,100	0	3,440

[a] Future growth demand factor determined from actual metering information obtained from the City of Vacaville, August 2003.

TABLE 12
BRIGHTON LANDING PROJECT
LAND USE AND DEMAND SUMMARY AT YEAR 2015[a]

					Demand Factors		Estimated Water Demand			
Sub-Area[b]	**Land Use[b]**	**Designation**	**Quantity[b]**	**Unit**	**Potable gpd/unit**	**Irrigation[c] gpd/unit**	**Potable gpd**	**Irrigation gpd**	**Total gpd**	**Annual ac-ft/yr**
A	Private High School	SCH	50.14	ac	0	1,500	--	75,210	123,210	138.0
		HS	1,200	stu	40	0	48,000	--		
B	Residential Low Medium Density	RLMD	68	du	420	0	28,560	0	28,560	32.0
C	Residential Low Medium Density	RLMD	84	du	420	0	35,280	0	35,280	39.5
D	Residential Low Medium Density	RLMD	70	du	420	0	29,400	0	29,400	32.9
E	Residential Low Medium Density	RLMD	50	du	420	0	21,000	0	21,000	23.5
F	Residential Low Medium Density	RLMD	57	du	420	0	23,940	0	23,940	26.8
G	Residential Low Medium Density	RLMD	106	du	420	0	44,520	0	44,520	49.9
H	Residential Low Medium Density	RLMD	190	du	420	0	79,800	0	79,800	89.4
I	Residential Low Medium Density	RLMD	64	du	420	0	26,880	0	26,880	30.1
J	Residential Low Density	RLD	80	du	520	0	41,600	0	41,600	46.6
K	Park	PK	6.0	ac	0	2,100	0	12,600	12,600	14.1
L	Public School, Elementary	SCH	11.03	ac	0	1,500	--	16,550	55,050	61.7
		ES	1,100	stu	35	0	38,500	--		
M	Linear Park/Agricultural Bufferd[d]	PR	3.61	ac	170	2,500	600	9,025	9,625	10.8
N	Trails and Landscaping[d]	PR	15.14	ac	170	2,500	2,600	37,850	40,450	45.3
O	Commercial Neighborhood[e]	CS	4.78	ac	1,650	450	7,900	2,151	10,051	11.3
P	Trails and Landscaping (adjacent to Sub-Area "O")	PR	1.51	ac	0	2,500	0	3,775	3,775	4.2
Q	Detention Basin	PL	17.6	ac	0	0	0	0	0	0
Total Demand – Brighton Landing Project							428,580	157,161	585,741	660

[a] Assumes Brighton Landing Project built out by year 2015.
[b] Sub-area, land use and quantities from *Brighton Landing Specific Plan* [8].
[c] Domestic irrigation demand (for residential land uses) will be met with potable water, and therefore is included in potable demand factor.
[d] Potable demand is assumed to provide potential bathroom facilities, although not detailed in *Brighton Landing Specific Plan* [8].
[e] Three potential development options are included in the *Brighton Landing Specific Plan* for Sub-Area O. To be conservative, the option with the neighborhood commercial land use is assumed.

3.3 Summary of Projected Water Demands

Projected water demands in five year increments for the City and future development in the City are presented in Table 13. Baseline City demand is based on 2010 monthly water production as reported by the City of Vacaville. Water demands for the year 2035 were based on the growth projected in the most recent land use database prepared by the City's Community Development Department and population projects by the Association of Bay Area Governments (ABAG). The five-year incremental demands were estimated using linear interpolation between 2015 and 2035.

As summarized in Table 13, total average annual demand for the existing City, proposed developments, Brighton Landing, and other future developments will reach 21,320 ac-ft/yr in the Year 2035. This value will be compared to available water supply in the subsequent report section. The Brighton Landing demand includes both potable and irrigation demands.

TABLE 13
CITY OF VACAVILLE
SUMMARY OF NORMAL YEAR ANNUAL WATER DEMAND (AC-FT/YR)
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035
Existing City (2010) [a]	16,329	16,329	16,329	16,329	16,329
Proposed Developments [b]	1,432	2,167	2,902	3,510	3,510
Brighton Landing [c]	660	660	660	660	660
Other Future Development in City [d]	126	252	378	505	821
Total Demand	**18,547**	**19,408**	**20,269**	**21,004**	**21,320**

[a] Existing City demand based on actual water supply data for January through December 2010 [1].
[b] Proposed developments include Lower Lagoon Valley, Southtown, Rice McMurtry, and Vanden Meadows.
[c] See Table 12.
[d] Other future development water demands from the 2010 UWMP. Demands for North Village is included in this category.

3.4 Summary of Demand Management Practices

Under drought conditions the City has an ability to reduce water demand. The primary mechanism for demand management is through public awareness and enforcement of water conservation ordinances. Specifically, the City's Urban Water Shortage Contingency Plan includes Ordinance No. 1431 *An Urgency Ordinance of the City of Vacaville Establishing Water Conservation Requirements and Water Rate Structures to Address Normal, Drought, and Emergency Conditions* [9]. As drought or emergency conditions are declared by the City Council, additional rate tiers are added to the existing rate structure to promote conservation. A target water use amount is determined for all residential customers and based on past usage patterns for commercial, industrial, and landscape customers. Customers using water above their target amount pay increasingly higher rates for that water.

The City is also committed to implementing water conservation programs. To achieve short term and long term conservation the City has implemented, is planning to implement, or is studying

the following Demand Management Measures (DMMs), as described in the *2010 Urban Water Management Plan Update* [1]:

DMM 1 - Water survey programs for single-family residential and multi-family residential customers
DMM 2 - Residential plumbing retrofit
DMM 3 - System water audits, leak detection and repair
DMM 4 - Metering with commodity rates for all new connections and retrofit of existing connections
DMM 5 - Large landscape conservation programs and incentives
DMM 6 - High-efficiency washing machine rebate programs
DMM 7 - Public information programs
DMM 8 - School education programs
DMM 9 - Conservation programs for commercial, industrial, and institutional accounts
DMM 10 - Wholesale agency assistance programs
DMM 11 - Conservation pricing
DMM 12 - Conservation coordinator
DMM 13 - Water waste prohibition
DMM 14 - Residential ultra low flow toilet (ULFT) replacement

In past drought years demand management practices have been effective in reducing water demand. As shown in Table 14, during the 1991 - 1993 drought, the per capita demand was reduced from 177 gpd/person to 139 gpd/person, a reduction of 21 percent. Historically, the City has had the ability to lower demand by 10 percent during a single dry year and by 20 percent during multiple dry years.

Single and multiple dry year demand projections with respective 10% and 20% reductions are shown in Tables 15 and 16. Based on our projected per capita demand of 166 gpd/person by 2035, which reflects a 20% reduction in accordance with SBx7-7, the City is positioned to have sufficient water available in the event of normal, single dry, or multiple dry years through 2035.

TABLE 14
CITY OF VACAVILLE
CHANGE IN WATER PRODUCTION (DEMAND) DURING DROUGHT YEARS (1990 - 1995)

		Water Production		Per Capita Demand	Demand
Year	Population[a]	ac-ft/yr	mgd	gpd/person	Change[b]
1990	70,496	13,991	12.5	177	0%
1991	75,103	11,672	10.4	139	-21%
1992	77,504	12,036	10.7	139	-21%
1993	79,956	12,764	11.4	142	-20%
1994	81,592	14,189	12.7	155	-12%
1995	81,361	14,695	13.1	161	-9%

[a] State of California, Department of Finance, Demographic Research Unit [10]
[b] Reduction in per capita demand as compared to 1990 demand.

TABLE 15
CITY OF VACAVILLE
SUMMARY OF SINGLE DRY YEAR[a] ANNUAL WATER DEMAND (AC-FT/YR)
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035
Existing City (2010)	14,696	14,696	14,696	14,696	14,696
Proposed Development	1,289	1,950	2,612	3,159	3,159
Brighton Landing	594	594	594	594	594
Other Future Development in City	113	227	340	455	739
Total Demand	**16,692**	**17,467**	**18,242**	**18,904**	**19,188**

[a] Historically, the City has been able to reduce demand by ten percent during a single dry year based on existing conditions at that time.

TABLE 16
CITY OF VACAVILLE
SUMMARY OF MULTIPLE DRY YEAR[a] ANNUAL WATER DEMAND (AC-FT/YR)
IN FIVE YEAR INCREMENTS

Demand	2015	2020	2025	2030	2035
Existing City (2010)	13,063	13,063	13,063	13,063	13,063
Proposed Development	1,146	1,734	2,322	2,808	2,808
Brighton Landing	528	528	528	528	528
Other Future Development in City	101	202	302	404	657
Total Demand	**14,838**	**15,527**	**16,215**	**16,803**	**17,056**

[a] Historically, the City has been able to reduce demand by 20 percent during multiple dry years based on existing conditions at that time.

4.0 ANALYSIS OF WATER SUPPLY RELIABILITY

In this section, the City's groundwater and surface water supplies previously identified are analyzed. The sources are identified for their availability during normal, single, and multiple dry years as determined by the Department of Water Resources' Sacramento Valley Water Hydrologic Classifications. The three separate hydrologic conditions considered are described as follows:

Normal year: This is a year when average rainfall has been received. During a normal year, the water availability from some sources may be less than the allocated amount.

Single dry year: This is a solitary dry or critical dry year and may be the first year of a multiple year drought.

Multiple dry years: This is a series of three consecutive dry and/or critical dry years.

4.1 Groundwater

A groundwater source sufficiency report was prepared in 2011 by Ludhorff and Scalmanini Consulting Engineers to describe the use and sufficiency of groundwater supplies beneath the City (see Appendix B). As part of the groundwater source sufficiency report, an analytical groundwater flow model was used to provide a preliminary assessment of water level impacts from future increases in groundwater pumping by the City to meet future water demands. The modeling effort included simulations of ten future pumping scenarios in which pumping would be increased and/or redistributed within the study area. The recommended maximum pumping is summarized in Table 17. Details regarding the model simulations and suggested pumping practices are found in Appendix B.

TABLE 17
CITY OF VACAVILLE
PROJECTED GROUNDWATER PUMPING (AC-FT/YR)
DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS [3]

Year	Normal Year	Single Dry Year	Multiple Dry Year
2015	7,000	8,300	8,300
2020	7,000	8,300	8,300
2025	7,300	8,700	8,700
2030	7,700	9,200	9,200
2035	8,100	9,700	9,700

4.2 Surface Water

The following contains a description of the availability of the City's surface water sources during normal, single and multiple dry years.

Solano Project (Vacaville Supply, SID Agreement)

The Solano Project has an annual water supply of 207,350 ac-ft/yr. As shown in Table 10, Vacaville is entitled to 14,375 ac-ft/yr (sum of Vacaville entitlement and SID agreement) of this annual yield in the year 2035. The Solano Project differs from other reservoir projects in California due to the reservoir storage size relative to the watershed yield. This means it may take a relatively long time to deplete the reservoir, but, in turn, it takes a relatively long time to fill the reservoir. Due to the size of the reservoir as a function of its yield, the long-term reliability for the Solano project is excellent.

Because of the high degree of reliability and historical records, the City anticipates receiving 99 percent of the entitlement (and SID agreement water) during normal years, 98 percent of the entitlement during single dry years and 89 percent of the entitlement during multiple dry years. Solano Project availability percentages for the City are derived using Sacramento Valley Water Year Hydrologic Classifications and historical records and are included in Appendix D, *Solano Project Water Supply Availability,* dated August 10, 2010.

State Water Project (North Bay Aqueduct)

Supply from the NBA originates from the State Water Project and has a similar level of priority as all the other 28 contractors to the project. As a result, this source is subject to significant cutbacks during dry years. Specifically, the City anticipates 64 percent for normal years, 63 percent availability during a single dry year, and 33 percent availability during multiple dry years for this source. State Water Project availability percentages for the City are derived from CALSIM II Model Studies for State Water Project Delivery Capability and provided by SCWA. The State Water Project availability is included in Appendix E, State Water Project Water Supply Availability, dated August 10, 2010.

The 2029 model includes pumping restrictions in the South Delta based on the Biological Opinions for Delta Smelt and Salmon, which has resulted in lower reliability than those used prior to the 2010 UWMP update. In addition, the 2029 scenario includes climate change impacts that further reduce reliability. These lower reliabilities are used in the 2030 and 2035 water supply estimates.

Settlement Water (DWR Agreement)

In lieu of an Area of Origin Water Rights filing by the City, DWR and the City entered into a settlement agreement for water. Appendix F is a copy of an analysis performed by CH2MHill which addresses the expected reliability of the water to be provided to the City in accordance with the settlement agreement. As a result, the City anticipates receiving 100 percent of the allocation during normal, single dry, and multiple dry years.

Recycled Water

Preliminary planning estimates indicate that recycled water will be available for delivery in 2020. Recycled water is a 100 percent reliable source of non-potable water and is completely independent of hydrologic conditions. Therefore, the City anticipates that this source will be 100 percent available during normal, single dry, and multiple dry years.

4.3 Summary of Water Supply Availability

This section contains a determination of the water supply availability. As previously described, the amount of water entitled to the City is increasing until the maximum entitlement is reached by year 2040. Furthermore, each source has a different availability under normal, single dry, and multiple dry years. Information on supply entitlement and availability is shown in Tables 18 through 22 for normal, single dry, and multiple dry years in five-year increments between 2015 and 2035. The water supply availability is summarized in Tables 23, 24, and 25.

TABLE 18
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2015

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99%	5,693	98%	5,635	89%	5,118
SID Agreement	3,125	99%	3,094	98%	3,063	89%	2,781
State Water Project							
Vacaville Table A	6,100	64%	3,904	63%	3,843	33%	2,013
KCWA Agreement	2,878	64%	1,842	63%	1,813	31%	892
Settlement Water[a]	9,320	100%	9,320	100%	9,320	100%	9,320
Groundwater[b]	7,000	100%	7,000	120%	8,300	120%	8,300
Total	**34,173**		**30,853**		**31,974**		**28,424**

[a] The City is currently utilizing 25 to 30 percent of Settlement Water due to seasonal availability of the entitlement and turbid water conditions making treatment difficult.

[b] Recommended maximum groundwater pumping.

TABLE 19
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2020

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99%	5,693	98%	5,635	89%	5,118
SID Agreement	4,125	99%	4,084	98%	4,043	89%	3,671
State Water Project							
Vacaville Table A	6,100	64%	3,904	63%	3,843	33%	2,013
KCWA Agreement	2,878	64%	1,842	63%	1,813	31%	892
Settlement Water[a]	9,320	100%	9,320	100%	9,320	100%	9,320
Groundwater[b]	7,000	100%	7,000	120%	8,300	120%	8,300
Recycled Water	880	100%	880	100%	880	100%	880
Total	**36,053**		**32,723**		**33,834**		**30,194**

[a] The City is currently utilizing 25 to 30 percent of Settlement Water due to seasonal availability of the entitlement and turbid water conditions making treatment difficult.
[b] Recommended maximum groundwater pumping.

TABLE 20
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2025

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99%	5,693	98%	5,635	89%	5,118
SID Agreement	5,625	99%	5,569	98%	5,513	89%	5,006
State Water Project							
Vacaville Table A	6,100	64%	3,904	63%	3,843	33%	2,013
KCWA Agreement	2,878	64%	1,842	63%	1,813	31%	892
Settlement Water[a]	9,320	100%	9,320	100%	9,320	100%	9,320
Groundwater[b]	7,300	100%	7,300	120%	8,700	120%	8,700
Recycled Water	880	100%	880	100%	880	100%	880
Total	**37,853**		**34,508**		**35,704**		**31,929**

[a] The City is currently utilizing 25 to 30 percent of Settlement Water due to seasonal availability of the entitlement and turbid water conditions making treatment difficult.

[b] Recommended maximum groundwater pumping.

TABLE 21
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2030

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville							
Entitlement	5,750	99%	5,693	98%	5,635	89%	5,118
SID Agreement	7,125	99%	7,054	98%	6,983	89%	6,341
State Water Project							
Vacaville Table A	6,100	64%	3,904	46%	2,806	31%	1,891
KCWA Agreement	2,878	64%	1,842	46%	1,324	31%	892
Settlement Water[a]	9,320	100%	9,320	100%	9,320	100%	9,320
Groundwater[b]	7,700	100%	7,700	120%	9,200	120%	9,200
Recycled Water	880	100%	880	100%	880	100%	880
Total	**39,753**		**36,393**		**36,148**		**33,642**

[a] The City is currently utilizing 25 to 30 percent of Settlement Water due to seasonal availability of the entitlement and turbid water conditions making treatment difficult.

[b] Recommended maximum groundwater pumping.

TABLE 22
CITY OF VACAVILLE
WATER SUPPLY IN YEAR 2035

		Normal Year		Single Dry Year		Multiple Dry Year	
Sources of Supply	**Entitlement**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**	**% Available**	**ac-ft/yr**
Solano Project							
Vacaville Entitlement	5,750	99%	5,693	98%	5,635	89%	5,118
SID Agreement	8,625	99%	8,539	98%	8,453	89%	7,676
State Water Project							
Vacaville Table A	6,100	64%	3,904	46%	2,806	31%	1,891
KCWA Agreement	2,878	64%	1,842	46%	1,324	31%	892
Settlement Water[a]	9,320	100%	9,320	100%	9,320	100%	9,320
Groundwater[b]	8,100	100%	8,100	120%	9,700	120%	9,700
Recycled Water	880	100%	880	100%	880	100%	880
Total	**41,653**		**38,278**		**38,118**		**35,477**

[a] The City is currently utilizing 25 to 30 percent of Settlement Water due to seasonal availability of the entitlement and turbid water conditions making treatment difficult.

[b] Recommended maximum groundwater pumping.

TABLE 23
CITY OF VACAVILLE
WATER SUPPLY DURING NORMAL YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2015**	**2020**	**2025**	**2030**	**2035**
Solano Project					
Vacaville Entitlement	5,693	5,693	5,693	5,693	5,693
SID Agreement	3,094	4,084	5,569	7,054	8,539
State Water Project					
Vacaville Table A	3,904	3,904	3,904	3,904	3,904
KCWA Agreement	1,842	1,842	1,842	1,842	1,842
Settlement Water	9,320	9,320	9,320	9,320	9,320
Groundwater	7,000	7,000	7,300	7,700	8,100
Recycled Water	0	880	880	880	880
Total	**30,853**	**32,723**	**34,508**	**36,393**	**38,278**

TABLE 24
CITY OF VACAVILLE
WATER SUPPLY DURING SINGLE DRY YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2015**	**2020**	**2025**	**2030**	**2035**
Solano Project					
Vacaville Entitlement	5,635	5,635	5,635	5,635	5,635
SID Agreement	3,063	4,043	5,513	6,983	8,453
State Water Project					
Vacaville Table A	3,843	3,843	3,843	2,806	2,806
KCWA Agreement	1,813	1,813	1,813	1,324	1,324
Settlement Water	9,320	9,320	9,320	9,320	9,320
Groundwater	8,300	8,300	8,700	9,200	9,700
Recycled Water	0	880	880	880	880
Total	**31,974**	**33,834**	**35,704**	**36,148**	**38,118**

TABLE 25
CITY OF VACAVILLE
WATER SUPPLY DURING MULTIPLE DRY YEAR (AC-FT/YR)

	Year				
Sources of Supply	**2015**	**2020**	**2025**	**2030**	**2035**
Solano Project					
Vacaville Entitlement	5,118	5,118	5,118	5,118	5,118
SID Agreement	2,781	3,671	5,006	6,341	7,676
State Water Project					
Vacaville Table A	2,013	2,013	2,013	1,891	1,891
KCWA Agreement	892	892	892	892	892
Settlement Water	9,320	9,320	9,320	9,320	9,320
Groundwater	8,300	8,300	8,700	9,200	9,700
Recycled Water	0	880	880	880	880
Total	**28,424**	**30,194**	**31,929**	**33,642**	**35,477**

5.0 COMPARISON AND DETERMINATION OF SUFFICIENT SUPPLY

This section compares projected water demand to available water supply during normal, single, and multiple dry years. As shown in Table 26, Vacaville has sufficient water to meet its customers' needs through 2035, including the proposed Brighton Landing development project. This is based on continued application of the water conservation ordinance and on-going conjunctive use of water supply sources.

Groundwater and surface water supplies are projected to meet or exceed projected water demands even during extended drought conditions. This was demonstrated during a previous drought that lasted for seven years. In view of this demonstrated reliability of the City's

conjunctive water supply strategy, future water supply will be adequate to offset future water demands during normal, single, and multiple dry years.

TABLE 26
CITY OF VACAVILLE
SUMMARY OF PROJECTED WATER DEMAND VERSUS AVAILABLE SUPPLY DURING NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS (AC-FT/YR)

	Normal Year		Single Dry Year		Multiple Dry Year	
Year	Projected Demand	Available Supply	Projected Demand	Available Supply	Projected Demand	Available Supply
2015	18,547	30,853	16,692	31,974	14,838	28,424
2020	19,408	32,723	17,467	33,834	15,527	30,194
2025	20,269	34,508	18,242	35,704	16,215	31,929
2030	21,004	36,393	18,904	36,148	16,803	33,642
2035	21,320	38,278	19,188	38,118	17,056	35,477

6.0 REFERENCES

[1] City of Vacaville, *2010 Urban Water Management Plan Update*, July 2011.

[2] City of Vacaville, *Connection and Development Fees*, January 2010.

[3] Luhdorff and Scalmanini, Consulting Engineers, *Groundwater Supply Sufficiency, May 2011*.

[4] Luhdorff and Scalmanini, Consulting Engineers, *Conceptualization of the Aquifer System for the City of Vacaville*, March 2003.

[5] *Second Amendment to Master Water Agreement Between Solano Irrigation District and City of Vacaville*, Approved June 8, 2010.

[6] Carollo Engineers, *City of Vacaville Recycled Water Master Plan (Draft)*, July 2003.

[7] Nolte Associates, *City of Vacaville Water Demand Factors Summary Technical Memorandum*, June 2005.

[8] Phillippi Engineering, *Brighton Landing Specific Plan*, November 2011.

[9] City of Vacaville Ordinance 1431, *An Urgency Ordinance of the City of Vacaville Establishing Water Conservation Requirements and Water Rate Structures to Address Normal, Drought, and Emergency Conditions*, adopted March 12, 1991.

[10] Population data from State of California Department of Finance, Demographic Research Unit.

APPENDIX A

Council Resolution to be added once available.

APPENDIX B

GROUNDWATER SUPPLY SUFFICIENCY

TECHNICAL MEMORANDUM Date: June 1, 2012

FROM: Victor M. Alaniz, P.E.
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Sacramento, CA 95833

TO: Nicola Swinburne
Design, Community & Environment
1625 Shattuck Avenue, Suite 300
Berkeley, CA 94709

SUBJECT: BRIGHTON LANDING EIR WATER MODELING STUDY – **FINAL**

BACKGROUND

This memorandum is intended to provide a summary of the water modeling tasks completed by Nolte as they pertain to the Brighton Landing Specific Plan Development Project (Project) as well as a brief description of water storage requirements for the Project. Water system modeling and analysis was conducted to assess the impact of the Project on the existing water distribution system for the City of Vacaville (City).

WATER DEMAND SUMMARY

Phillippi Engineering, Inc. (PEI) prepared the *Brighton Landing Specific Plan* (Specific Plan), dated November 18, 2011. The Specific Plan includes a summary of the proposed land uses and corresponding quantities. The Project is subdivided into 17 sub-areas that comprise an area of approximately 235 acres. Figure 1 is a schematic representation of the Project subareas and land use summary. Table 1 is a summary of the total Project water demand to be provided by the City.

The Specific Plan presents three land use alternatives for Sub-Area O, the 4.8 acre area in the northwest corner of the Project. The first alternative is for neighborhood commercial, the second alternative is for low density residential, and the third alternative is for the sub-area to be incorporated as part of the private school to be constructed in Sub-Area A. The first alternative, neighborhood commercial, has the highest water demand (conservative), and is used in the water demand calculation presented in Table 1.

The irrigation demand for the proposed schools (approximately 91,760 gpd) is assumed to be provided by the City. Furthermore, the irrigation demand for the proposed park, neighborhood commercial, agricultural buffer, and trails landscaping (approximately 65,401 gpd) is conservatively assumed to be supplied by the City with the understanding that the Solano Irrigation District (SID) may provide this demand with non-potable water in the future. The total City supplied water demand for the Project is approximately 585,741 gpd.

TABLE 1
BRIGHTON LANDING PROJECT
LAND USE AND DEMAND SUMMARY

Sub-Area[a]	Land Use[a]	Designation	Quantity[a]	Unit	Demand Factors		Estimated Water Demand		
					Potable	Irrigation	Potable	Irrigation	Total
					gpd/unit	gpd/unit	gpd	gpd	gpd
A	Private High School[b]	SCH	50.14	ac	0	1,500	48,000	75,210	123,210
		HS	1,200	stu	40	0			
B	Residential Low Medium Density	RLMD	68	du	420	0	28,560	0	28,560
C	Residential Low Medium Density	RLMD	84	du	420	0	35,280	0	35,280
D	Residential Low Medium Density	RLMD	70	du	420	0	29,400	0	29,400
E	Residential Low Medium Density	RLMD	50	du	420	0	21,000	0	21,000
F	Residential Low Medium Density	RLMD	57	du	420	0	23,940	0	23,940
G	Residential Low Medium Density	RLMD	106	du	420	0	44,520	0	44,520
H	Residential Low Medium Density	RLMD	190	du	420	0	79,800	0	79,800
I	Residential Low Medium Density	RLMD	64	du	420	0	26,880	0	26,880
J	Residential Low Density	RLD	80	du	520	0	41,600	0	41,600
K	Park[c]	PK	6.0	ac	0	2,100	0	12,600	12,600
L	Public School, Elementary[b]	SCH	11.03	ac	0	1,500	38,500	16,550	55,050
		ES	1,100	stu	35	0			
M	Linear Park/Agricultural Buffer[c,d]	PR	3.61	ac	170	2,500	600	9,625	9,625
N	Trails and Landscaping[c,d]	PR	15.14	ac	170	2,500	2,600	37,850	40,450
O	Commercial Neighborhood[e]	CS	4.78	ac	1,650	450	7,900	2,151	10,051
P	Trails and Landscaping[c] (adjacent to Sub-Area "O")	PR	1.51	ac	0	2,500	0	3,775	3,775
Q	Detention Basin	PL	17.6	ac	0	0	0	0	0
	Total Demand - Brighton Landing Project						428,580	157,161	585,741

[a] Sub-areas and corresponding land use quantities from Brighton Landing Specific Plan by Phillipi Engineering Inc., dated November 18, 2011.
[b] Irrigation demand for School land use is assumed to be supplied by the City.
[c] Irrigation demand for Park, Trails and Landscaping assumed to be supplied by the City.
[d] Potable demand for Linear Park and Trails includes a potential restroom.
[e] Three potential development options are included in the Specific Plan for Subarea O. To be conservative, the option with the neighborhood commercial land use is assumed in this analysis.

WATER MODELING ASSUMPTIONS

The existing city-wide water distribution system hydraulic computer model was updated to include the Brighton Landing subdivision including the proposed water mains as suggested in the Specific Plan. The water demand of 585,741 gpd including irrigation demand of 157,161gpd (from Table 1) was distributed among junction nodes for the proposed water system.

Figure 2 is a schematic representation of the proposed water distribution system for the Brighton Landing Project based on Figure 7.1 of the Specific Plan. Figure 7.1 of the Specific Plan does not include a proposed water main on the street that splits Sub-Areas B and C. This analysis assumes an 8-inch water main is intended for this street connected to the 8-inch water main on the south boundary of the project and the 12-inch water main on the south boundary of Sub-Area A.

The City's Water Master Plan fire flow requirement for RLD land use is 1,500 gpm. For RLMD land use, the fire flow requirement is 3,000 gpm. However, this requirement is reduced to 1,500 gpm if dwelling units are constructed with a minimum eave to eave separation of six feet. The Specific Plan does not specify the eave to eave separation of the proposed RLMD land use units. The fire flow requirement for RLMD is therefore assumed to be 3,000 gpm. For the RMD and SCH land uses, the fire flow requirement is 3,000 gpm. The fire flow requirement for CS land use is 4,500 gpm.

WATER MODELING RESULTS

The following simulations were executed using the City's water distribution system model (including the Brighton Landing Project):

- Maximum Day Demand
- Maximum Day Demand and 3,000 gpm fire flow at J-BL27 (Public School)
- Maximum Day Demand and 3,000 gpm fire flow at J-BL60 (Private School)
- Maximum Day Demand and 3,000 gpm fire flow at J-BL05 (Residential)
- Maximum Day Demand and 4,500 gpm fire flow at J-BL73 (Commercial)
- Peak Hour Demand

The locations of junction nodes referenced in this analysis are shown on Figure 2.

Junction node J-BL27 was selected as the fire flow simulation near the Private School (Sub-Area A). Junction node J-BL60 was selected as the fire flow simulation near the Public School (Sub-Area L). Junction node J-BL05, located at the end of the middle cul-de-sac in Sub-Area B, was selected as the representative residential fire flow because it is a dead-end main furthest from a proposed 12-inch main.

For Maximum Day Demand, the model predicts acceptable results for residual pressures and pipe flow velocities. Pressures within the Project area range from 95 psi to 99 psi. In addition, all pipe flow velocities are anticipated to be less than 10 feet/second (ft/s) in accordance with the City's Water Master Plan.

For the Maximum Day Demand and 3,000 gpm fire flow at J-BL27 simulation, the model predicts residual pressures in the Project area ranging from 88 psi to 90 psi. In addition, the maximum pipe flow velocity was 5.4 ft/s. These results are within the level of service required by the City.

For the Maximum Day Demand and 3,000 gpm fire flow at J-BL60 simulation, the model predicts residual pressures in the Project area ranging from 86 psi to 90 psi. In addition, the maximum pipe flow velocity was 5.7 ft/s. These results are within the level of service required by the City.

A 3,000-gpm fire flow was modeled at node J-BL05, which is in the proposed RLMD land use in Sub-Area B. For Maximum Day Demand and 3,000 gpm fire flow at J-BL05, the model predicts residual pressures in the Project area ranging from 65 psi to 77 psi. However, the pipe flow velocity is observed to be 19.1 ft/s in the dead-end water main in the cul-de-sac modeled by node J-BL05. The maximum allowed pipe flow velocity is 10 ft/sec. Similar velocities are anticipated in the dead-end mains serving the Sub-Area B cul-de-sacs when fire flows are modeled at those locations. These preliminary results are conditioned on the land use category of RLMD.

The following options are acceptable to mitigate this deficiency:

1. Confirm proposed RLMD units will be constructed with a minimum six-foot eave to eave separation. This will require a fire flow of 1,500 gpm and the model confirms acceptable results for that fire flow requirement.
2. Upsize cul-de-sac mains to 12-inch
3. Loop 8-inch dead-end mains to 12-inch main in Leisure Town Road

For purposes of this analysis, it is assumed that the RLMD units will be constructed with a minimum six-foot eave to eave separation. Additional modeling will be required if the Project does not meet this requirement.

For the Maximum Day Demand and 4,500 gpm fire flow at J-BL73 simulation, the model predicts residual pressures in the Project are ranging from 84 psi to 92 psi. In addition, the maximum pipe flow velocity was 10 ft/s. These results are within the level of service required by the City.

For Peak Hour Demand, the model predicts acceptable results for residual pressures and pipe flow velocities. Pressures in the Project area ranged from 85 psi to 88 psi with maximum pipe flow velocity at 6.3 ft/s.

The proposed water distribution system presented in Figure 7.1 of the Specific Plan does not include a connection at the most southwest corner of the Project. The proposed street layout suggest this street should include an 8-inch water main to completely loop the system and serve some anticipated residential units.

WATER STORAGE REQUIREMENTS

The water storage requirements for the main zone include three components: operational, emergency, and fire storage.

- Operational storage is equal to 25 percent of the maximum day demand
- Fire storage is equal to the most critical combination of flow rate and duration in the pressure zone
- Emergency storage is equal to 12 hours of maximum day demand, equivalent to 50 percent of maximum day demand, less the production of water from DE Plant and Well 8 (these facilities have standby power that can supply water)

The average day demand for the main zone is approximately 16.9 million gallons per day (mgd). The maximum day demand is twice the average day demand, or 33.8 mgd. The main zone water storage requirements are:

- Operational Storage: 0.25 x 33.8 mgd = 8.5 million gallons (MG)
- Fire Storage: 4,500 gpm x 4 hours = 1.1 MG
- Emergency Storage: 0.50 x 33.8 mgd = 16.9 MG, this is reduced by 3.6 MG (production from DE Plant and Well 8), actual emergency storage required = 13.3
- Total Storage: 22.9 MG

The City currently has five main zone reservoirs with a combined storage capacity of 18.1 MG. The current deficit in total storage for the City's main zone is approximately 4.8 MG.

The Project has an average day demand of 0.59 mgd and a maximum day demand of 1.18 mgd.

The additional storage required in the main zone for this Project is:

Operational (25% of Maximum Day Demand):	0.30 MG
Emergency Storage (50% of Maximum Day Demand):	0.59 MG
Total:	0.89 MG

The Project increases the current main zone storage deficit to 5.6 MG. The City is currently investigating sites for three additional main zone reservoirs with a combined capacity of 12 MG. Because storage requirements for the Project will be provided by the additional reservoirs, a reservoir is not required to be constructed as part of the Project. The financial contribution for the additional storage associated with the Project will be satisfied by collection fees for the Project.

WATER SUPPLY ASSESSMETN REPORT (SB610)

Cities and counties with proposed development projects are required by SB610 (Part 2.10 Division6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment Report (WSAR). An SB610 Water Supply Assessment Report has not been prepared for the Project.

FINDINGS AND RECOMMENDATIONS

The following is a summary of the findings and recommendations concluded from this modeling study:

- Only the complete buildout of the Project was analyzed in this Technical Memorandum. Any phasing plan proposed for the Project will require a modeling analysis to confirm it can be served by the City's water distribution system.
- An 8-inch water main is anticipated and recommended to connect proposed mains in the southwest-most intersection of the development to the existing 12-inch main located in Leisure Town Road.
- An 8-inch water main is assumed on the street separating Sub-Area B and Sub-Area C. This water main is not shown in Figure 7.1 of the Specific Plan.
- The RLMD land uses areas are assumed to have dwelling units with a minimum eave to eave separation of 6 ft to qualify for the reduced fire flow requirement of 1,500 gpm. If the eave to eave separation cannot be achieved, additional studies are necessary to confirm the impact of the proposed water system at the 3,000 gpm fire flow requirement.
- The Project storage requirement is 0.89 MG.
- A SB610 Water Supply Assessment Report is required for the Project.

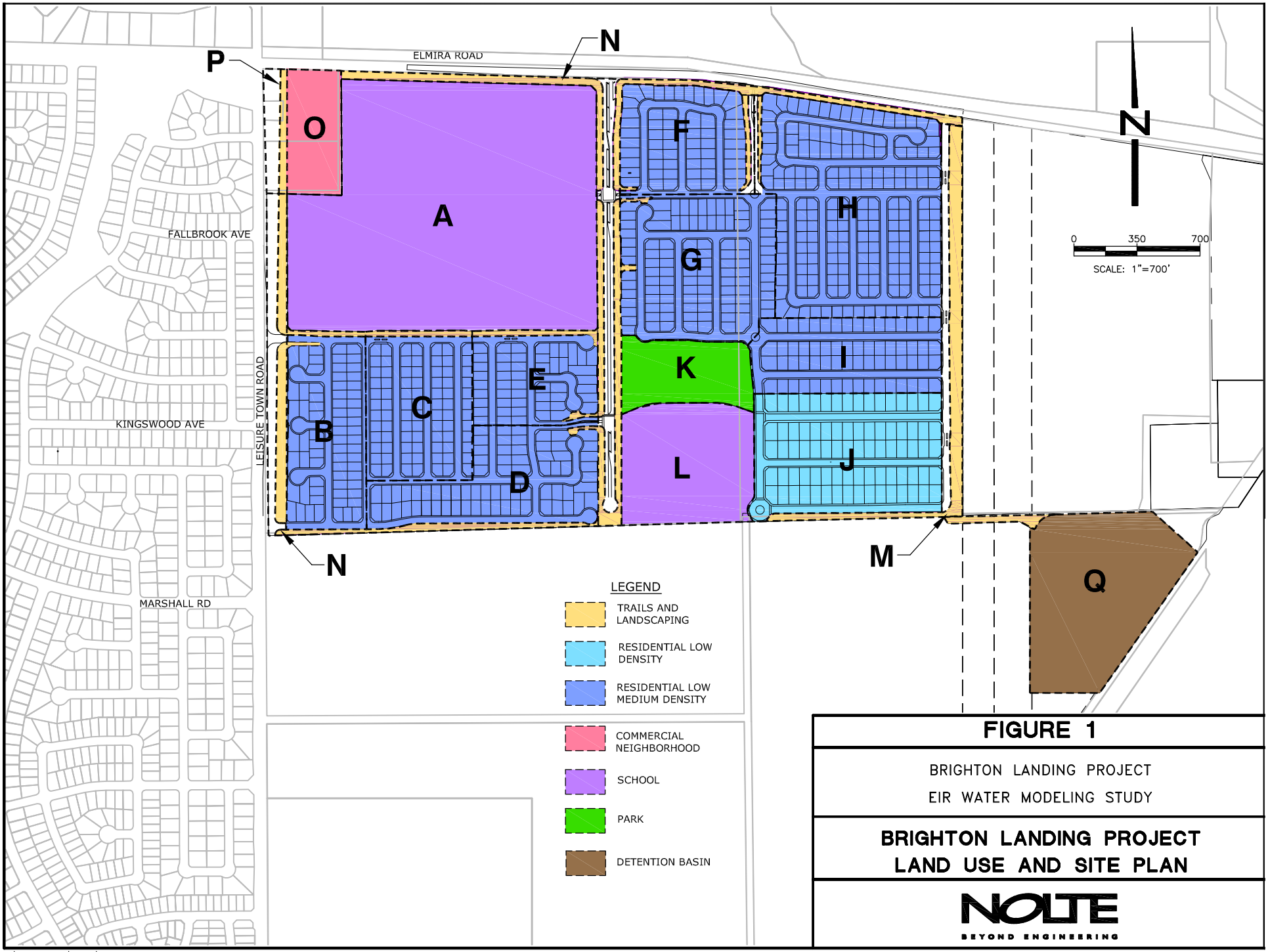

FIGURE 1

BRIGHTON LANDING PROJECT

EIR WATER MODELING STUDY

BRIGHTON LANDING PROJECT LAND USE AND SITE PLAN

NOLTE

BEYOND ENGINEERING

N:\SAB042203\CADD\FIG1.DWG JSH January 20, 2012

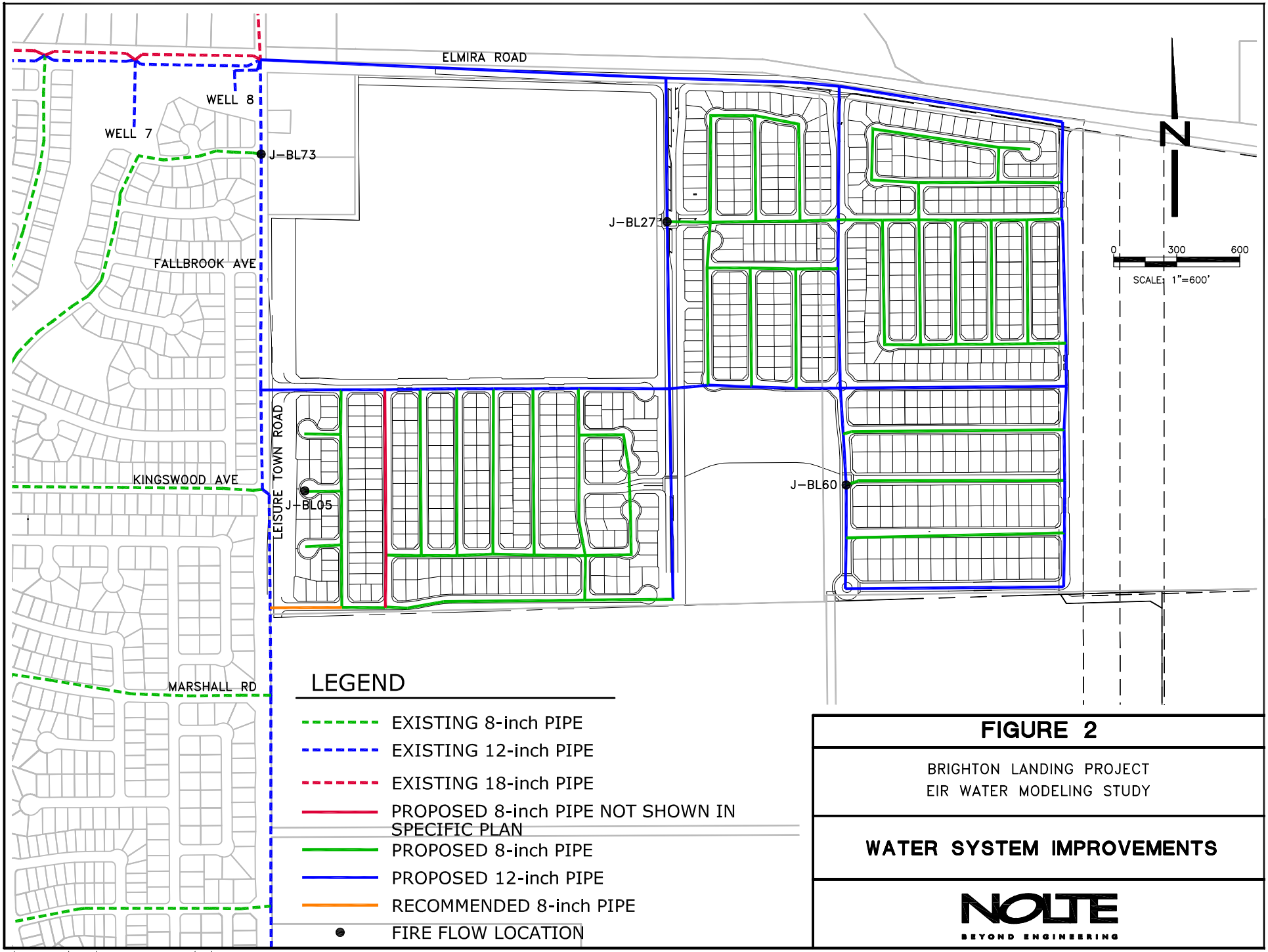

FIGURE 2

BRIGHTON LANDING PROJECT
EIR WATER MODELING STUDY

WATER SYSTEM IMPROVEMENTS

NOLTE
BEYOND ENGINEERING

N:\SAB042203\CADD\FIG2.DWG JSH 1/24/2012