CIVIL ENGINEERS ▪ SURVEYORS ▪ PLANNERS

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M E M O R A N D U M

TO: Colleen Ferguson, P.E., L.S.
Public Works Director / City Engineer
City of Sonoma

FROM: Ryan Hansen, P.E., Principal
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SUBJECT: Preliminary Water Demand Analysis
20455 E. 5th Street
Sonoma, California

PURPOSE

The purpose of this memorandum is to present the water demand analysis for the proposed project at 20455 E. 5th Street in the City of Sonoma which assumes the maximum allowable density of 20 du/ac under the City's general plan. The published water demand and peaking factors outlined in the City's Water Master Plan (WMP) dated March 2011 were used for the following calculations of domestic and fire flow demands. For comparison purposes it is assumed the existing site conservatively does not contribute to the system wide demand as there is no historical information of an existing service line.

WATER DEMAND ANALYSIS

Average daily domestic water demands were calculated using the WMP land use factor as noted in table 3-1.2 (Attachment 2). As zoned under the general plan, the subject property would apply a demand factor of 3,465 gpd/acre over 2.97 acres, which is conservatively exclusive of any right of way dedications in the future. The WMP indicates that the demand factors listed in Table 3-1.2 are based on actual City billing records and were applied to each land-use designation per the City's General Plan land-use map. It is unknown if the WMP demand factors listed in table 3-1.2 include historical demand factors for separate irrigation services for each of the land use categories listed. An irrigation demand factor was not assumed for this analysis since when compared to the fire flow demand are significantly negligible. The proposed average daily demand is calculated as follows:

Proposed Ave Daily Demand: 3,465 gpd/acre x 2.97 acre= 10,291 gpd

The maximum day demand is the theoretical largest demand that occurs during any single day of the year. From the calculated average daily demand, the proposed maximum day demand is calculated based on a maximum day peaking factor of 2.0 as indicated on page 3-1 of the WMP (attachment 1) and is calculated as follows:

Proposed Maximum Day Demand: 10,291 gpd x 2.0 = 20,582 gpd

Peak hour demand is the largest demand that occurs on any one single hour during the day of maximum demand and is larger than the maximum day demand. From the calculated average daily demand, the proposed maximum peak hour demand is calculated based on the maximum peak hour factor of 3.0 as indicated on page 6-1 of the WMP (attachment 3) and is calculated as follows.

Proposed Peak Hour Demand: 10,291 gpd x 3.0 = 30,873 gpd

The fire flow demand was determined based on Appendix B of the California fire code Table B105.1 assuming a building construction type of Type V-B and a total building floor area of 18,007 sf for the largest proposed building. Per table B105.1 the minimum required fire flow demand is 3,750 gpm. However, the City of Sonoma allows a 50% reduction in the required fire flow demand when an approved fire sprinkler system is provided as long as the reduction in flow is not less than 2,000 gpm (City of Sonoma municipal code section 14.10.045). Since the 50% reduction on the fire flow demand of 3,750 gpm is less than the minimum 2,000 gpm allowed the minimum flow of 2,000 gpm governs.

Proposed Fire Demand: 2,000 gpm = 2,880,000 gpd

Given the expectation of a proposed development under the General Plan designation would likely have less than 1 acre of outdoor landscaping and given the expected fire flow demands, irrigation demands were assumed negligible for the purposes of these calculations. Should the City have any questions regarding the demand calculations or information provided, please do not hesitate to call.

Very truly yours,

Ryan T. Hansen, P.E.
Principal

SDC:cjq

Attachment 1

3.0 DEMAND ANALYSIS

The purpose of this section is to establish the potable water demand for current and future (2020) conditions. These flows are used to establish the basis for analyzing the City's potable water infrastructure.

3.1 Current Conditions

Public water system statistics for 2006, 2007 and 2008 were used to establish the current average daily demand. Since daily flow totals were not available for this study, maximum-day demands were estimated by applying a peaking factor of 2.0 to the average daily demands. This peaking factor was established in a previous study that was published in 1999, and was based on an analysis of daily flowmeter data recorded at the SCWA turnouts. A summary of the historical demand data is presented in Table 3-1.1.

TABLE 3-1.1 Summary of Historical Demands

	2006	2007	2008	totals
SCWA [acre-ft]	2253.448	2,239.534	2,270.794	6,763.776
Wells [acre-ft]	64.500	73.307	104.920	242.727
total [acre-ft]	2,317.948	2,312.841	2,375.714	7,006.503
equivalent average daily demand [mgd]	2.07	2.06	2.12	2.08
SCWA	97%	97%	96%	97%
Wells	3%	3%	4%	3%
estimated maximum-day demand [mgd]	4.14	4.13	4.24	4.17

Annual potable water consumption has not changed significantly over the last ten or more years; the average-day demand was 2.01 mgd in 1996, and 2.14 mgd in 1997[1]. The demand per capita has decreased, however. In 1997 the per capita demand was 216 gpd, and in 2008 it was 187 gpd, which is a 14% reduction[2].

Potable water demand data for 2007, 2008 and 2009 was obtained from the City's billing records.3 The zoning for each billing record was obtained by geocoding each record to the Assessor's Parcel Map using GIS software. The land-use designation for each parcel was obtained from the City's General Plan land-use map. This process allows unit-demand factors to be calculated for each land use category based on actual consumption data as summarized in Table 3-1.2 below.

[1] Water System Improvement Plan, Brelje and Race, January, 1999.
[2] Per capita demands were obtained by dividing the total water consumption, including non-residential uses, by the population.
3 A scaling factor was applied to 2009 data since 2009 was a water rationing year. The adjusted data reflects demand during the 2006-2008 period.

TABLE 3-1.2 Unit-Demand Factors for 2007 – 2009 (inside City limits)

Land Use/Zoning	Normalized Unit Flow (gpd/acre)
Agriculture	368
Commercial	3,271
Commercial-Gateway	697
Mixed Use	902
Public Facility	1,042
Park	1,301
High Density	3,465
Hillside Residential	228
Low Density Residential	1,557
Medium Density Residential	2,712
Housing Opportunity	1,961
Mobile Home Park	255
Rural Residential	401
Sonoma Residential	2,620
Wine Production	164

A map showing the spatial distribution of demand is provided in Figure 3-1, which is attached to this document.

Average daily demand for connections outside the City limits was 115,600 gallons/day for 2007, 2008 and 2009. Dividing the daily consumption by 796 people (population estimate for area outside the City limits in 2009) yields an average demand of 145 gallons per day per capita.

3.2 Potable Water Demand at Buildout (2020)

The planning horizon for this study ends at the year 2020, which corresponds to the horizon used for the City's last General Plan update. The General Plan identifies the baseline (2005) developed acreage for each land-use category within the City limits. The document also lists the 2020 build-out potential for the same categories. The differences between the 2005 and 2020 acreages were used to identify the incremental growth for each land-use category as summarized in Table 3-2.1 below.

TABLE 3-2.1 General Plan Land-Use Projections

Land-Use Category	2005 [acres]	2020 [acres]	change [acres]
hillside residential	43.7	50.3	6.60
rural residential	69.3	77.4	8.10
Sonoma residential	74.0	109.3	35.30
low-density residential	457.2	485	27.80
medium-density residential	190.9	196.6	5.70
high-density residential	6.2	6.2	-
housing opportunity	1.4	8.8	7.40
mobile home	54.8	54.8	-
commercial	106.1	107	0.90
gateway commercial	51.6	82.2	30.60
mixed use	78.9	87.1	8.20
public facility	210.5	210.5	-
park	163.4	199.5	36.10
agriculture	25.4	25.4	-
wine production	12.7	12.7	-
	1,546	1,713	167

Attachment 3

6.0 SYSTEM PERFORMANCE SUMMARY

The purpose of this section is to summarize the analyses run to evaluate the City's water system including sources of supply, storage, and distribution piping. The analyses were run to identify bottlenecks and pressure deficiencies within the City's water system. A total of four demand scenarios were analyzed using the calibrated hydraulic model:

1) Current (2008) peak hour,
2) Future (2020) peak hour,
3) Current (2008) maximum day with fire flow, and
4) Future (2020) maximum day with fire flow.

In addition to the four scenarios listed above, a desktop water age analysis was used to evaluate water quality in the City's water tanks. The results of these analyses are described in the following sections.

6.1 Peak Hour Analysis

Peak hour demands were input into the calibrated hydraulic model to assess bottlenecks and identify locations of low pressure within the distribution system. Peak hour demands were established for both current and future conditions, input into the calibrated hydraulic model and run, and results analyzed for deficient pressures caused by either high velocities within the system or elevation limitations.

A peaking factor of 3.0, as identified in Section 3.0 Demand Analysis, was applied to the estimated current average day demand of 2.01 million gallons per day (MGD), to arrive at a current peak hour demand of 6.03 MGD, or approximately 4,187 gallons per minute (gpm). Future peak hour demands were determined by incorporating the additional 52,000 gallons per day (gpd) to current average day demands and then applying the peaking factor of 3.0 to arrive at a future peak hour demand of 6.18 MGD, or 4,291 gpm.

For the peak hour hydraulic simulations, all storage tanks within the City system, including the two SCWA tanks, were assumed to contain 1 foot of storage. This conservative assumption was used to verify that the water system provides acceptable pressure independent of water levels in the tanks. All pumps were also assumed to be off during the simulation, and the pressure reducing valve (PRV) in between Zone 3 and Zone 1 was simulated as closed. This latter assumption requires all Zone 1 demands to be supplied exclusively from the SCWA tanks.

Figures 6-1.1 and 6-1.2 illustrate model results (current and future) for the peak-hour demand analyses. The figures show that the minimum pressure criteria are satisfied in most areas of the distribution system. In addition, model results indicate that there is very little difference between current and future conditions due to the fact that the City is effectively built out.

Only one junction location within the entire City water system was determined to have a pressure of less than 20 psi under the peak-hour demand scenarios. This occurred at the highest elevation of Zone 1 on Brazil Street east of 4th Street East and Well No. 4.

Several zones within the system were found to have pressures between 20 psi and 40 psi. These include:

Attachment 4

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *California Fire Code* or Section *313.3* of the *California Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	4
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *California Building Code*.

b. Measured at 20 psi residual pressure.

50% REDUCTION NOT LESS THAN 2000 gpm.

2000 gpm