



TECHNICAL MEMORANDUM NO. 2

DATE: October 19, 2005 Project No.: 423-02-03-01
TO: Don Ridenhour, Project Manager CC: WATRTAC Members
FROM: Gerry Nakano, Project Manager
Jim Connell, Project Engineer
SUBJECT: 2050 Napa Valley Water Resources Study
Napa County Municipal and Industrial Demands, Incorporated Areas

The purpose of this Technical Memorandum (TM) is to describe the historical municipal and industrial (M&I) water demands for the Napa County incorporated municipal areas, to project those demands to the year 2050 (based on currently available information and adopted General Plans), and compare these projected demands to the demands previously projected in the 1991 Water Resources Study for the Napa County Region (1991 Study). The areas involved are:

- The City of Napa (Napa),
- The City of American Canyon (American Canyon),
- The Town of Yountville (Yountville),
- The City of St. Helena (St. Helena),
- The City of Calistoga (Calistoga).

Wherever possible, data for future land-use and population projections were based on each entity's General Plan. For many of the entities, "build-out" of the developable areas as specified in the approved and adopted General Plans are anticipated to occur prior to the year 2050 (end of the evaluation period for this TM). Because of the possibility that the currently adopted General Plan boundaries may be expanded upon in the future, or that additional densification of urban areas (and corresponding increased water demand) may occur, during the latter years of the study period being evaluated in this TM, a nominal growth in population was anticipated following build-out of each municipality's General Plan (with the exception of the Town of Yountville, which was held at buildout).

This TM was based on data received from the various agencies and other sources. Because data are continually being generated and developed, these M&I demand projections should be repeated on a regular basis. The recommended period between revisiting demand projections is approximately every five years. This period would allow a balance between the collection and evaluation of new data to identify possible water-use trend changes, but being often enough to respond to changing water use patterns and plan for future water projects.

COMPARISON OF PROJECTED DEMANDS

The total projected M&I demands in Year 2020 from the 2050 Study are compared with the 1991 Study projections in Table 1 and on Figure 1. As shown, in year 2020, demands are estimated to be approximately 4,060 afa greater (16 percent) than previously projected in the 1991 Study. Figure 1 provides a more detailed comparison of the incorporated municipal area demand estimates of the two studies over time. The following sections and the appendices provide a more detailed discussion of the revised projections, and the criteria used to develop them.

Table 1. Summary of Projected Demands

Municipality	1991 Study	2050 Study		
	Year 2020, afa ^(a)	Year 2020, afa	Year 2050, afa	Annual Percent Increase 2020-2050
City of Napa	18,195	18,798 ^(b)	21,643	0.47
American Canyon	2,316	6,459 ^(c)	7,500	0.50
Yountville	625	679 ^(d)	679	0.00
St Helena	2,690	2,179 ^(e)	2,458	0.40
Calistoga	1,515	1,285 ^(f)	1,560	0.65
Total	25,341	29,400	33,840	0.47

^(a) afa = acre-feet annually.

^(b) GP 2020 Buildout (See Appendix A).

^(c) From Draft 2003 Water Master Plan Update.

^(d) Uses Unit Water Demands from WYA 2004 Water Supply Plan Update, dated August 2004.

^(e) Based on St. Helena's Year 2020 demand estimate referenced in the City's 2003 Urban Water Management Plan (UWMP), plus 6 percent unaccounted-for water.

^(f) Based on Draft 2003 General Plan and August 2000 Water Facilities Plan.

As described in TM 1, M&I water demands in the 1991 Study were determined from an analysis of water production records and metered water sales data. Average per capita water uses (Residential/Commercial/Public) for 1985 through 1989 were calculated for each municipality, and then used with Association of Bay Area Governments (ABAG) and California Department of Finance (CDOF) population projections to develop future M&I water demands.

The 2050 Study used a combination of population projections and land-use projections to estimate the future water demands. A summary of the methodology used for each municipality is shown in Table 2.

Table 2. Water Demand Projection Methodology

Agency	Projection Method Used ^(a)	Reason
Napa	Per Capita	Slightly more conservative than land use projection.
American Canyon	Land Use	Considered more reliable than per capita projections, reliable population projections not available.
Yountville	Land Use	Considered more reliable than per capita projections, reliable population projections not available.
St Helena	Per Capita	Land use unit demand data were not available.
Calistoga	Per Capita	General Plan land uses are superseded by bylaws that restrict commercial growth. Therefore, land use projection would overestimate the projected commercial water demand.

^(a) Per Capita Methodology – Used historical data to determine a per capita water demand, and then projected demands based on population projections.

Land Use Methodology – Used historical data to determine unit demands based on land use types, and then projected demands based on land-use projections.

The impact of water conservation and recycling practices also varied from agency to agency. The water conservation assumptions for each agency are summarized in Table 3.

Figure 1. 2050 Study M&I Demand Projections

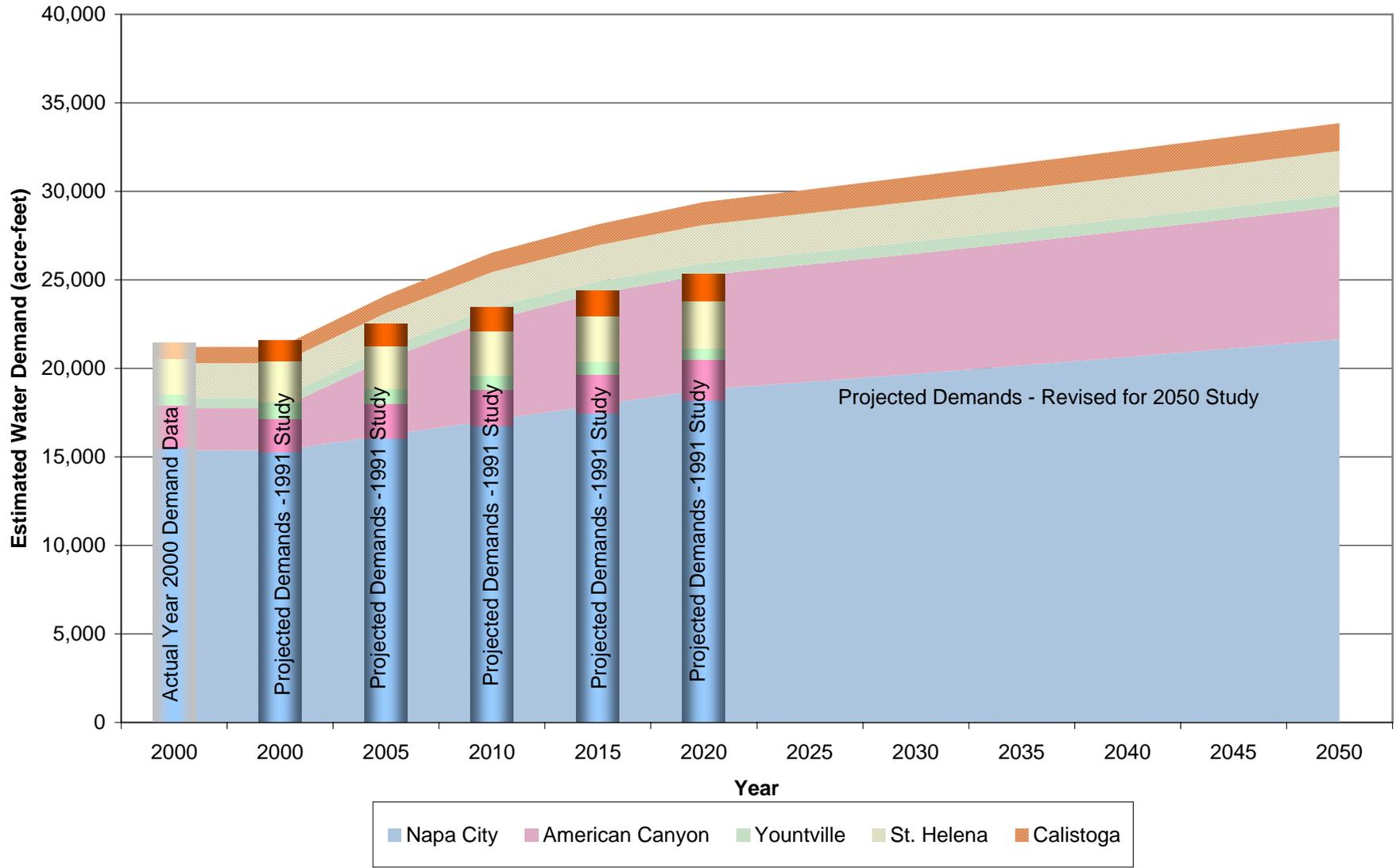


Table 3. Water Conservation and Recycling Assumptions

Agency	Assumptions
Napa	According to City staff, water conservation practices will reduce total water demands by 10 percent by the year 2020. Four percent has been saved to date with an additional six percent to be saved prior to 2020. The use of highly treated recycled water for non-potable landscape irrigation, to offset existing potable use, was also incorporated into these projections.
American Canyon	From the 2003 Water Master Plan, total projected water demand is 10 percent less than the demand based on land use. It is assumed this reduction is due to reduction of unaccounted-for water and increased water conservation practices.
Yountville	The Yountville water Conservation Ordinance generally prohibits the wasting of water and provides for demand management measures during dry years. No specific normal year reduction goals have been stated.
St. Helena	St. Helena has implemented several water demand management measures to reduce the potable water demands and is expected to continue implementing water demand management measures. The effectiveness of the demand measures is represented in the per capita water demands. The proposed Water Recycling Project is expected to produce recycled water to replace potable and non-potable water use.
Calistoga	The Water Facilities Plan (Plan), dated August 2000, by Summit Engineering Inc., did not project the impacts of water conservation or recycled water use on the total potable water demand. The Plan indicated that between 31 afa and 78 afa could be saved by partial implementation of water conservation practices.

The historical population growth for the five municipalities from 1993 to 2002 is shown in Table 4.

Table 4. Historical Population Growth, 1993-2002

Municipality	Estimated Population 1993	Estimated Population 2002	Average Annual Growth, percent
Napa ^(a)	71,840	80,661	1.3
American Canyon	8,517	11,280	2.8
Yountville ^(b)	1,909	2,087	1.0
St. Helena ^(c)	6,020	6,720	1.2
Calistoga	4,550	5,190	1.3
Total	92,836	105,938	1.5

- (a) Total population served.
- (b) Estimated based on 1990 and 2000 census data.
- (c) Total population served. Includes 720 persons outside City limits.

For the purpose of this TM, the assumed rates of growth following buildout for the five municipalities are shown in Table 5.

The per capita water demands and projected populations for the five municipalities in the County are also summarized in Table 5. The 1991 Study projected per capita demands based on the years 1985 through 1989 for all municipal demands such as residential, commercial and public. Industrial demands were projected separately, except in the cases of Yountville and American Canyon where industrial demands were considered insignificant at that time. The 1991 Study then multiplied the calculated per capita water demand by the projected population, which was based on Napa County, ABAG, and CDOF estimates. The 1991 Study did not report the projected population, so the population estimates shown in the 1991 Study population column of Table 5 were back calculated by dividing the projected municipal demand by the per capita water demand.

The per capita water demands were calculated for the 1991 Study using all water uses except industrial, whereas the 2050 Study water demand estimates were based on total water delivered. For the 1991 Study, industrial demands were considered negligible in American Canyon and Yountville. The revised water demand estimates would therefore be expected to be somewhat greater than the 1991 Study demand estimates for Napa, St. Helena, and Calistoga. This expectation was confirmed in Calistoga and St. Helena. In Napa, the 1991 Study adjusted the total demand by five percent to account for industrial demands,

therefore, the per capita water demand difference between the 1991 Study and the 2050 Study revised estimates is considered insignificant.

Table 5. Per Capita Water Demands and Projected Populations

Municipality	1991 Study		Revised Estimates – 2050 Study			
	Per Capita Water Demand, gpcd	Projected Population in Year 2020 ^(a)	Per Capita Water Demand, gpcd	Projected Population at Buildout (Year)	Assumed Annual Rate of Growth Post-Buildout, percent	Projected Population in Year 2050
Napa	179	86,142	180 ^(b)	93,000 ^(e) (2020)	0.5	108,010
American Canyon	164	11,151	200 ^(b)	27,800 ^(f) (2015)	0.5	33,100
Yountville	223	2,500	225 ^(b)	2,511 ^(f) (2010)	0.0	2,511
St. Helena	233	8,614	228/413 ^(c)	8,170 ^(g) (2050)	NA ⁽ⁱ⁾	8,170
Calistoga	151	7,326	169 ^(d)	6,726 ^(h) (2038)	0.25	7,000
Total	—	115,700 ⁽ⁱ⁾	—	—	—	158,800 ⁽ⁱ⁾

- ^(a) Calculated by dividing the 1991 Study projected municipal demand by the 1991 Study projected per capita consumption.
- ^(b) Calculated by WYA based on historical data provided by municipalities, see appendices.
- ^(c) Inside City/Outside City from UWMP May 2003, total per capita water demand is approximately 260 gpcd.
- ^(d) Water Facilities Plan, Summit Engineering, May 2000.
- ^(e) Projected population within the City's Rural Urban Limit.
- ^(f) Based on Water Supply Plan Update, dated August 2004.
- ^(g) UWMP May 2003/ABAG Projection. Includes 720 persons outside City Limits.
- ^(h) Draft 2003 General Plan.
- ⁽ⁱ⁾ St. Helena is projected to reach buildout in the Year 2050.
- ⁽ⁱ⁾ Values rounded

The following paragraphs generally summarize the differences between the 1991 Study and the 2050 Study projections for each municipality. More detailed information regarding the municipal and industrial demands for each municipality is included in the appendices.

Napa

The 2050 Study estimated a per capita water demand that is very similar to the demand estimated in the 1991 Study. The 2050 Study projected population within Napa's water service area, which

includes Napa's Rural Urban Limit (RUL) and water service to some unincorporated areas. Standard census data for Napa generally excludes the unincorporated islands, thus the population of these areas was estimated based on census block data received from Napa for the census years of 1990 and 2000. It is not clear if the city limits, the RUL, or the water service area was used in the 1991 Study for demand projections. Because the 1991 Study used USGS topographic maps showing urbanized areas, it is possible the population projections included areas lying outside the City limits.

The 2050 Study demand estimate is based on a per capita water use methodology, based on the population within Napa's RUL, with projected demands outside the RUL added in, plus the Yountville Veteran's Home and Napa State Hospital. Deliveries to American Canyon, St. Helena, Calistoga and Yountville are not included in Napa totals because these demands are accounted for elsewhere.

Buildout is expected by the year 2020. Beyond buildout, growth in population and water demand was projected at a nominal rate of 0.5 percent per year.

Further information regarding the historical and projected demands is included in Appendix A.

American Canyon

The dramatic increase in American Canyon's water demand, as projected in the 2050 Study, is due to the accelerated growth rate experienced in the American Canyon area. The 1991 Study assumed a 1.5 percent growth rate for all municipalities in Napa County. Since 1991, American Canyon has actually grown by almost three percent per year, with a growth rate of almost 12 percent in year 2001. In year 2000, the population of American Canyon was reportedly 9,375, compared to the 1991 Study projected population of approximately 8,400.

According to American Canyon's 2003 Water Master Plan prepared by Hydrosience, buildout of American Canyon is expected to take place shortly after the year 2006, with growth rates exceeding ten percent per year for the next several years, as large undeveloped areas are developed. The 2050 Study projected demands are based on land use multiplied by a water demand factor. Dividing the ultimate projected demand of 6,233 afa by the estimated per capita water demand (200 gpcd), results in a projected population of 27,800 persons. Officially, the current General Plan has designated 6,300 afa as the buildout water demand. Therefore, for the purposes of this analysis, the current General Plan projected demand of 6,300 afa will be used for the buildout condition. Beyond buildout, growth in population and water demand was projected at a nominal rate of 0.5 percent per year.

Further information regarding the historical and projected demands is included in Appendix B.

Yountville

The 2050 Study water demand for Yountville at buildout was estimated to be 679 afa. This demand is based on the Water Supply Plan Update, dated August 2004, by West Yost & Associates. The Water Supply Plan Updated based the projections on recent (2003) land-use

data and projected land use at buildout of the General Plan. The recent total per capita water demand has been approximately 225 gpcd.

The 1991 Study assumed the ratio between residential and commercial land-use types would remain constant. The 2050 Study calculated the total demand based on land-use, and then estimated the equivalent population based on historical per capita water demands. The difference between buildout population projections is most likely due to the 2050 Study's land-use methodology that did not hold the ratio of residential to commercial uses constant.

There are only seven undeveloped areas in Yountville. Development proposals have been received for three of them. The development proposals alter the General Plan land uses and must be approved. Buildout in Yountville is expected to occur by the year 2010. Due to growth restrictions, growth in population and water demand was not projected to increase beyond the maximum density buildout.

Further information regarding the historical and projected demands is included in Appendix C.

St. Helena

The 2050 Study's water demand projection for St. Helena in the year 2050 is approximately 2,458 afa. This is approximately 10 percent less than estimated in the 1991 Study for the year 2020 (2,690 afa). This decrease in projected future demand is primarily due to reduced population projections. The 1991 Study projected a population of approximately 8,614 (1.5 percent per year) persons by the year 2020. More recent estimates project the service area population (including water service areas outside of the City Limits) to be approximately 7,120 persons by the year 2020 (current population is approximately 6,720), and 8,170 persons by buildout of the General Plan land uses by the year 2050 (includes approximately 720 persons outside City Limits).

The St. Helena currently does not use recycled water, although untreated supplies from the Lower Reservoir are currently used for turf irrigation and construction water purposes. St. Helena is proposing a Recycled Water Project that will involve an upgrade and expansion of the existing wastewater treatment facilities to provide recycled water meeting tertiary, unrestricted Title 22 reuse standards by the year 2025. This recycled water would be used to offset the use of potable water for irrigation of school grounds, parks, and other city properties, and other, non-potable water uses. The potential quantity of recycled water to be produced is currently being estimated.

Buildout of the maximum carrying capacity identified in the General Plan is expected to occur by the year 2050.

Further information regarding the historical and projected demands is included in Appendix D.

Calistoga

According to the City of Calistoga's Water Facilities Plan, dated May 2000, by Summit Engineers, the projected water demand for Calistoga, based on a projected population at buildout of 8,043, will be approximately 1,517 afa. The same report projected a water demand based on land-use of approximately 2,600 afa. The difference between these two water demand

methodologies is caused by the large projected growth of commercial areas in the land-use based methodology, compared to the projected population increase. Typically, the land use projection is considered more reliable. The Draft 2003 General Plan, however, limits commercial development to maintain the current ratio between residential to commercial use. Currently this ratio is 60 percent residential to 40 percent commercial, which limits the residential growth rate to 1.35 percent per year. According to the recent studies conducted during preparation of the Draft 2003 General Plan, total buildout is expected to be completed near the Year 2038. Beyond buildout, growth in population and water demand was projected at a nominal rate of 0.25 percent per year. For the 2050 Study, the 1,517 afa water demand estimate for buildout will be used.

Further information regarding the historical and projected demands is included in Appendix E.

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APPENDIX A

City of Napa Municipal and Industrial Demands

APPENDIX A. CITY OF NAPA MUNICIPAL AND INDUSTRIAL DEMANDS

INTRODUCTION

To prepare a current estimate of the City of Napa's (Napa) projected water demands, the following data were analyzed:

- Historical Annual Production by Source
- Historical Monthly Production By Source
- Historical Annual Water Use by Land-Use Type
- Historical and Projected Total Annual Water Consumption
- Historical Per Capita Water Demand

HISTORICAL ANNUAL PRODUCTION BY SOURCE

The total annual production by source is shown in Figure A-1 for the years 1980 through 2002.

Napa provides supplemental water or emergency supply to various entities such as the cities of Calistoga, St. Helena, and American Canyon, and the Town of Yountville. These entities are not retail customers of Napa. Napa treats the North Bay Aqueduct (NBA) water for each municipality at the Jameson WTP and wheels the treated water through the Conn transmission main.

The production volumes shown in Figure A-1 include water delivered to American Canyon, Yountville, St. Helena, Calistoga and other outside entities.

HISTORICAL MONTHLY PRODUCTION BY SOURCE

Water use in Napa rises in summer months to meet landscape irrigation and other exterior water demands, and declines in winter months, as shown on Figure A-2. Water supply and distribution facilities must be planned with sufficient capacity to meet the high demands occurring in summer months.

HISTORICAL ANNUAL WATER USE BY LAND-USE TYPE

The water deliveries to the City's retail customers and other major users are shown on Figure A-3.

An estimation of the City's use is shown in Table A-1 and Figure A-4. The unaccounted-for water was calculated by subtracting, the total of all accounted-for water uses from the production volume delivered to City Retail Customers.

The unaccounted-for water ranges from 2 percent to 14 percent of the water delivered for City Retail Customer use. Reportedly, unaccounted-for water is expected to range from 8 percent to 12 percent for the City distribution system. Also shown in Figure A-4 is potable water that is used for agricultural and landscape irrigation.

HISTORICAL AND PROJECTED TOTAL ANNUAL WATER CONSUMPTION

The projected water demands for the year 2020 are shown in Table A-2. The projected year 2020 “Total City System Demand” of 18,798 af in Table A-2 assumes water conservation measures will reduce the water demand by an additional 6 percent by the year 2020. Landscape irrigation demands have been reduced in the projection presented in Table A-2 due to the City’s use of highly treated recycled water from the Napa Sanitary District to partially offset these non-potable water demands.

It is significant to point out that the City is assumed to have reached total buildout by 2020. Beyond buildout, population growth was projected at a nominal rate of 0.5 percent per year to account for possible densification and/or slight changes to the General Plan boundaries. The historical and projected growth in demand is shown in Figure A-5.

HISTORICAL PER CAPITA WATER DEMAND

Historical per capita water demand for Napa’s entire water service area is shown in Figure A-6. As this figure shows, per capita water use trended slightly upward from 1980 through 1987. There is then a severe downward trend in per capita water use from 1987 to a low in 1991. Since then, per capita demand has been slowly increasing.

The per capita demands for each year from 1980 to 2002 are presented in Table A-3. The average over the entire period is 170 gallons per capita per day (gpcd). The average over the 8-year predrought period is 178 gpcd. The per capita water demand for the drought and immediate post-drought years was 155 gpcd, with a low of 125 gpcd in 1991. Per capita demand has risen since the early 1990’s, and in some years, has met or exceeded that experienced in the predrought years. As is evident from Table A-3 and Figure A-6, the drought response actions implemented by the City of Napa significantly reduced the per capita demand during the drought years and years immediately following the drought. Per capita water demands, however, have increased since that time, as customers may not be as conscious of conservation activities.

To project water demands, a per capita demand factor of 180 gpcd was used. This per capita demand factor reflects a normal supply year (full-service delivery), and thus does not include demand management that would be implemented by the City of Napa during a drought, but does reflect a 4 percent savings compared to the mid 1980’s. Projected water demand based on per capita water use and projected population for Napa within the service area is shown in Table A-4. With the City’s additional water conservation efforts, the water demand for the City’s retail customers within the RUL is projected to increase to 17,626 af by the year 2020. Water demand projections were then continued beyond 2020 at a nominal 0.5 percent growth rate, as described above.

Table A-1. Profile of Water Use for the City of Napa and Vicinity^(a)

Water Service Categories	1991 afa	1992 afa	1993 afa	1994 afa	1995 afa	1996 afa	1997 afa	1998 afa	1999 afa	2000 afa	2001 afa	2002 afa
Residential												
Single Family Residential	4,789	5,348	5,711	6,145	6,472	6,513	7,033	6,249	7,005	7,161	7,493	7,561
Multi-Family Residential	1,645	1,800	1,801	2,202	2,021	2,033	2,153	1,993	2,021	2,017	2,090	1,975
Subtotal	6,434	7,148	7,513	8,347	8,493	8,546	9,186	8,242	9,026	9,177	9,584	9,536
Commercial	1,494	1,518	1,550	1,762	1,775	2,149	1,916	1,936	2,011	2,027	2,034	2,016
Institutional	520	404	195	295	505	446	445	340	434	462	469	416
Government ^(b)	128	145	157	215	203	228	247	231	236	251	268	259
Agricultural and Landscape Irrigation ^(c)	271	271	614	394	416	521	680	558	727	727	728	832
Contract Accounts (e.g. State Hospital)	584	606	589	568	456	473	714	551	664	717	827	772
Veterans Home	—	—	406	0	2	0	459	0	87	103	6	90
Subtotal	2,997	2,944	3,511	3,234	3,356	3,816	4,461	3,617	4,159	4,287	4,332	4,384
Other Known Water Uses (estimated)												
Main Flushing Program	—	—	92	0	—	15	9	—	—	44	—	27
Eastside Reservoir Draining	77	77	153	37	—	18	—	—	—	—	—	—
Hennessey WTP Backwashing	51	284	305	236	100	—	—	—	—	—	—	—
Hennessey WTP De-Sludging	45	45	45	45	45	45	45	45	45	45	45	45
Water Main Break	—	9	31	0	—	—	18	—	—	—	21	31
Subtotal	173	415	626	318	145	79	73	45	45	89	66	102
Total Accounted-for Water	9,604	10,507	11,649	11,899	11,994	12,441	13,720	11,904	13,230	13,552	13,981	14,023
Unaccounted-for-Water	213	620	418	311	1,068	1,133	1,646	2,005	1,833	1,817	1,919	2,096
Total City Use	9,817	11,127	12,067	12,210	13,062	13,574	15,366	13,909	15,063	15,369	15,900	16,119

Source: City of Napa: Water System Optimization & Master Plan updated August 1997 [Chapter 3] with revised data by City of Napa August 2003.

^(a) Includes all City retail customers inside and outside the RUL.

^(b) Governmental consumption estimated at 1.3 percent of annual production from 1989 to 1992 based on 1993 record information.

^(c) Agricultural contracts and landscape irrigation are included in this number.

Table A-2. Projected Water Demand of Entire Service Area, afa

Service Area	1997 Master Plan (af) Year 2020	Revised Projected Water Demand (af) Year 2020	Revised Projected Water Demand (af) Year 2050
City of Napa within RUL	15,574 ^(a)	17,046 ^(b)	19,797 ^(h)
County Areas Served Outside of RUL ^(c)	900	900	900
Napa State Hospital ^(d)	400	300	300
Napa Municipal Golf Course ^(e)	—	(161)	(161)
John F. Kennedy Memorial Park ^(f)	—	(5)	(5)
Yountville Veterans Home ^(g)	460	100	100
Subtotal of Municipal Demands	17,334	18,180	20,931
Conservation (6%)	(1,040)	(1,090)	(1,256)
Adjusted Municipal Demands	16,294	17,089	19,675
System Losses (10%) ⁽ⁱ⁾	1,629	1,709	1,968
Total City System Demand	17,923	18,798	21,643

- (a) This number is based on land use methodology in the 1997 Master Plan, Table 3-13, Total Demand within the RUL. The 1997 Master Plan estimated the land use water factors for six land use classes: Single Family Residential, Multi-Family Residential, Commercial/Industrial, Elementary Schools, High Schools and Napa College, and Parks & Sport Complexes. The water factors were based on customer meters readings for 1992, increased by 26 percent to adjust for water conservation practices that may have been in effect during that drought year. Therefore, the water demand estimates do not include the effects of conservation or system losses.
- (b) Based on a per capita water demand of 180 gpcd (assumes 4 percent conservation has been accomplished) multiplied by the projected 2020 RUL population of 93,000 persons. This total is 18,751 afa (93,000 persons times 180 gpcd times 365 days per year divided by 325,851 cubic feet per acre-foot = 18,751 afa), and would include system losses. With 10 percent system losses removed, the actual demand is estimated to be 17,046 (18,751 divided by 1.1). Therefore, this number does not include system losses or future water conservation savings.
- (c) Based on data in the 1997 Master Plan.
- (d) Assumes use of recycled water from the Napa Sanitation District to meet non-potable water demands. Non-potable water demand assumed to be 25 percent of previous total water demand of 400 af.
- (e) The current total includes non-potable water demands that will be met with recycled water at build out; consequently, the non-potable portion of the golf course demands were removed as follows: 998 gpd/acre (see Table 8) x 160 acres (2020 Lot Size) x 0.9 (% Turf at Build Out) = 143,712 gpd or 161 af.
- (f) The current total includes non-potable water demands that will be met with recycled water at build out; consequently, the non-potable portion of the Kennedy Park demands were removed as follows: 134 gpd/acre (see Table 8) x 180 acres (2020 Lot Size) x 0.2 (% Turf at Build Out) = 4,824 gpd or 5.4 af.
- (g) Data provided by the City.
- (h) 17,046 afa from 2020 increased by 0.5 percent per year.
- (i) 1997 Master Plan used 6 percent; however, new data indicated a higher percentage of lost water (9-12 percent), so a value of 10 percent was used for the revised projected water demand.

Table A-3. Historical Per Capita Water Demand Factors

Year	Average Annual Water Production for City Use ^(a) , mgd	Estimated Population Served ^(b)	Total Water Demand Factor, gpcd	Average Annual Water for Residential Use ^(a) , mgd	Residential Water Demand Factor, gpcd
1980	10.22	59,919	171	No Data	No Data
1981	10.85	60,898	178	No Data	No Data
1982	10.39	61,878	168	No Data	No Data
1983	10.80	62,857	172	No Data	No Data
1984	11.51	63,837	180	No Data	No Data
1985	12.13	64,816	187	No Data	No Data
1986	11.49	65,776	175	No Data	No Data
1987	12.86	66,736	193	No Data	No Data
Pre-Drought Average (1980-1987)			178		
1988	11.56	67,696	171	No Data	No Data
1989	11.66	68,656	170	6.85	100
1990	11.56	69,616	166	7.24	104
1991	8.76	70,357	125	5.74	82
1992	9.93	71,099	140	6.38	90
1993	10.77	71,840	150	6.70	93
1994	10.90	72,390	151	7.45	103
1995	11.66	74,867	156	7.58	101
1996	12.12	73,480	165	7.62	104
Drought and Post-Drought Average (1988-1996)			155		97
1997	13.40	74,843	179	8.19	109
1998	12.39	76,027	163	7.35	97
1999	13.45	76,516	176	8.05	105
2000	13.72	78,959	174	8.19	104
2001	14.19	80,478	176	8.55	106
2002	14.39	80,661	178	8.51	105
Recent Years (Wet) Average (1997-2002)			174		104

^(a) Excludes deliveries to American Canyon, Calistoga, Yountville, and St. Helena.

^(b) Includes population within the RUL, and estimated population served in the County areas outside the RUL.

Table A-4. Present and Projected Water Demand within the RUL Based on Per Capita Projection Method^(a)

Year	Population ^(a)	Water Demand with 4% Water Conservation (mgd) ^(b)	Water Demand with 4% Water Conservation (MG/year) ^(b)	Water Demand with 4% Water Conservation (afa) ^(b)	Projected Annual Water Demand with an Additional 6% (afa) ^(c)
1992	68,409	12.0	4,390	13,490	—
2002	77,471	14.5	5,299	16,263	—
2005	81,200	14.6	5,335	16,372	16,372
2010	86,000	15.5	5,650	17,340	16,646
2020	93,000	16.7	6,110	18,751	17,626
2030	97,756	17.6	6,427	19,725	18,541
2040	102,755	18.5	6,756	20,734	19,490
2050	108,010	19.4	7,096	21,779	20,471

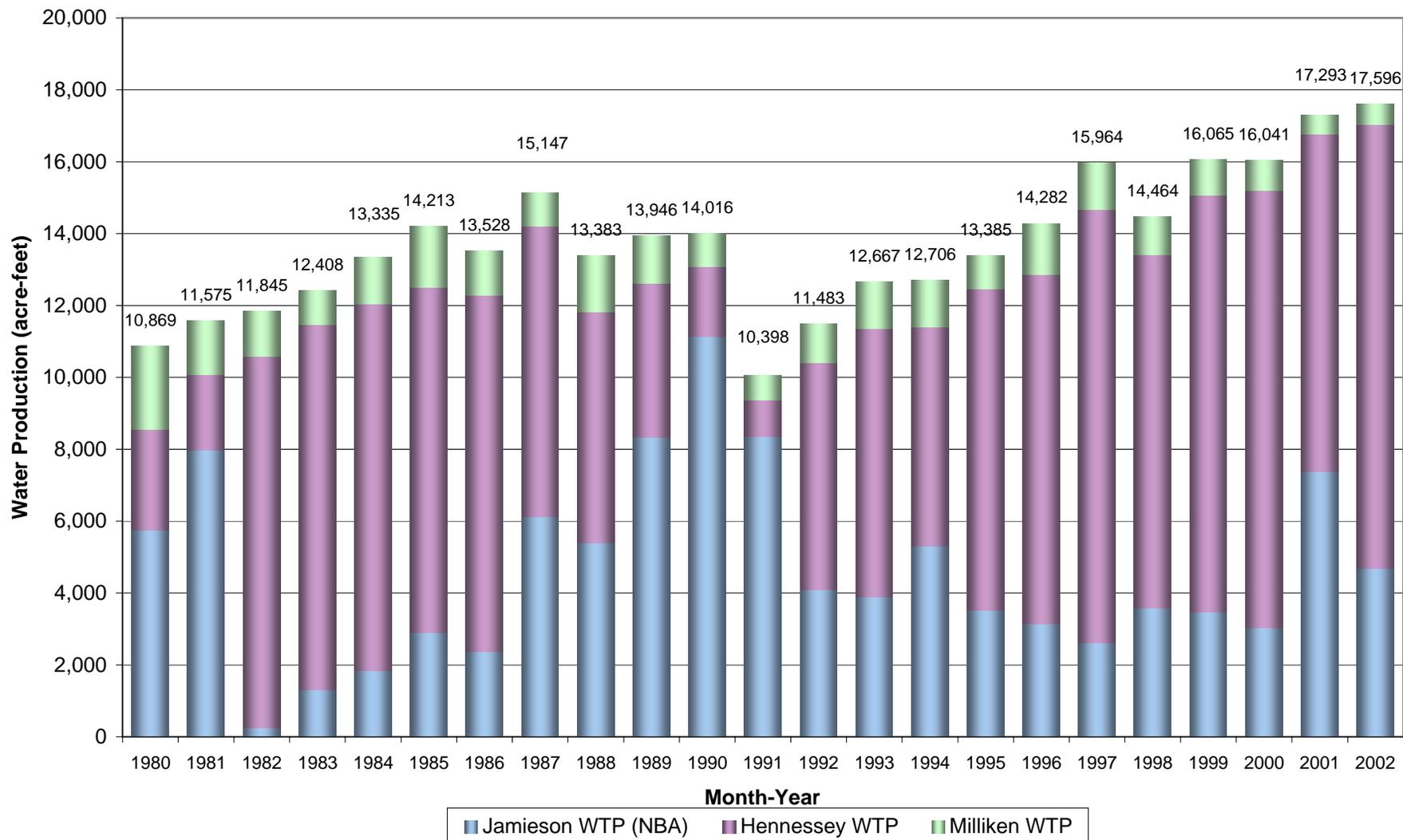
^(a) Population within RUL.

^(b) Based on per capita water demand factor of 180 gpcd, which already includes a 4 percent savings due to water conservation, compared to the mid-1980's.

^(c) Water conservation programs have already saved an estimated 4 percent, with increased conservation efforts being planned by the city, and are estimated to save an additional 4 percent from 2006 to 2010, and up to an additional 2 percent by 2020. This would bring the total savings to 10 percent.

^(d) Based on an assumed growth rate of 0.5 percent following buildout.

Figure A-1. City of Napa Historical Annual Water Production by Source (1980-2002)



Includes all City retail customers, water wheeled to Calistoga and Yountville, and water provided to St. Helena and American Canyon.

Figure A-2. City of Napa Historical Monthly Water Production by Source

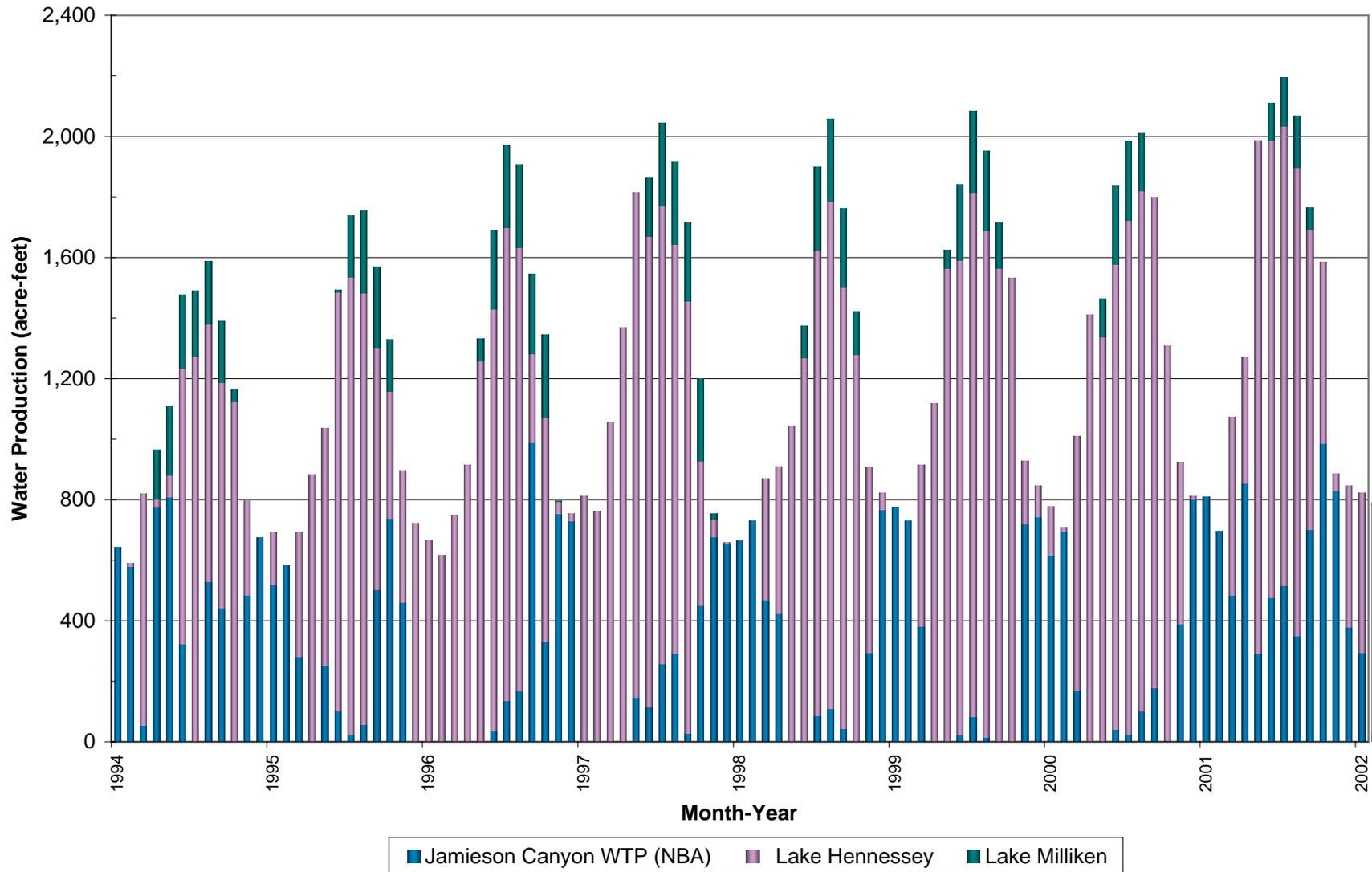
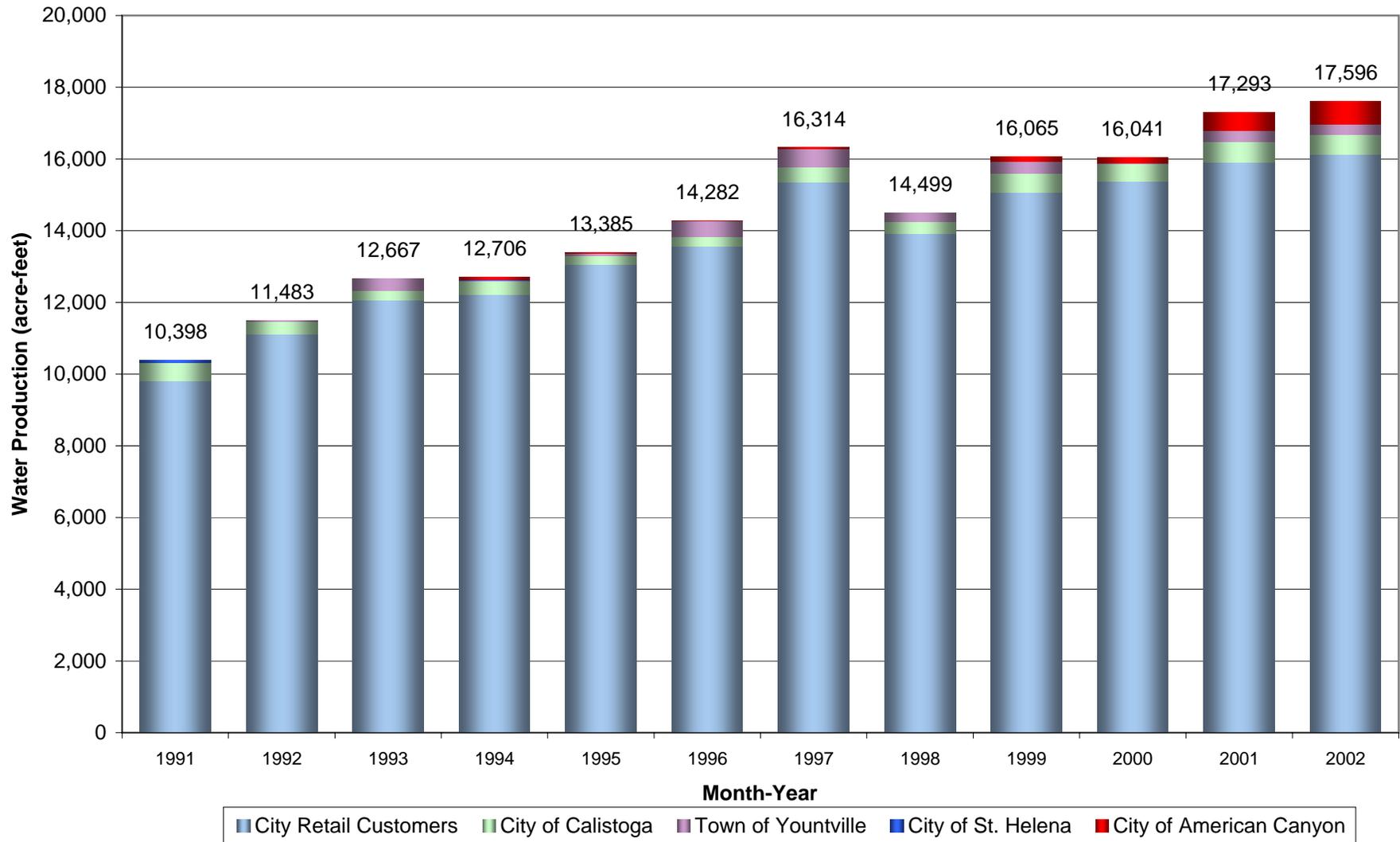


Figure A-3. City of Napa Historical Annual Water Delivery (1991-2002)



City Retail Customers includes all City retail customers, inside and outside the RUL.

Figure A-4. City of Napa Historical Annual City Customer Water Sales (1991-2002)

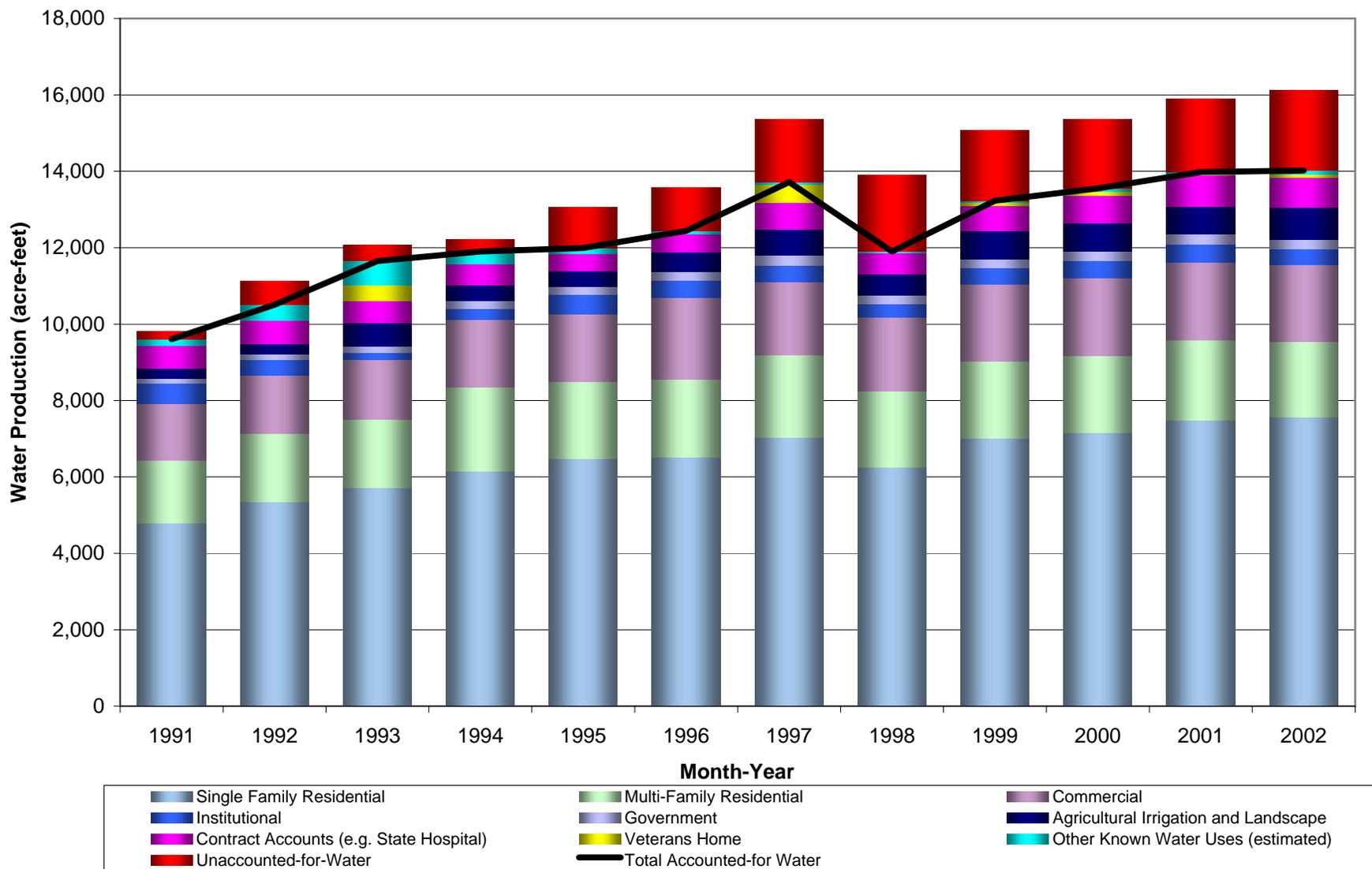


Figure A-5. City of Napa Historical and Projected Water Consumption (1990 - 2050)

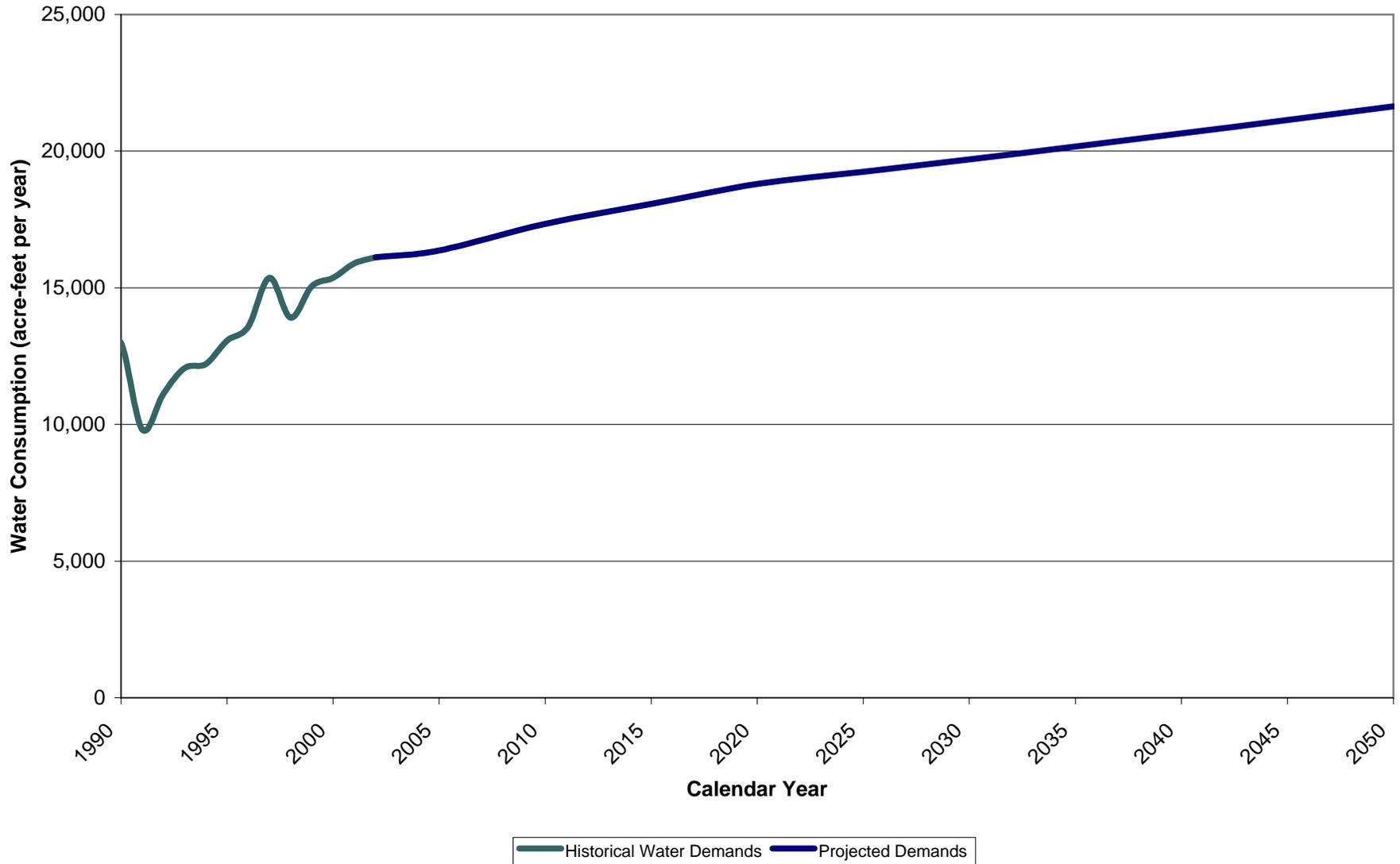
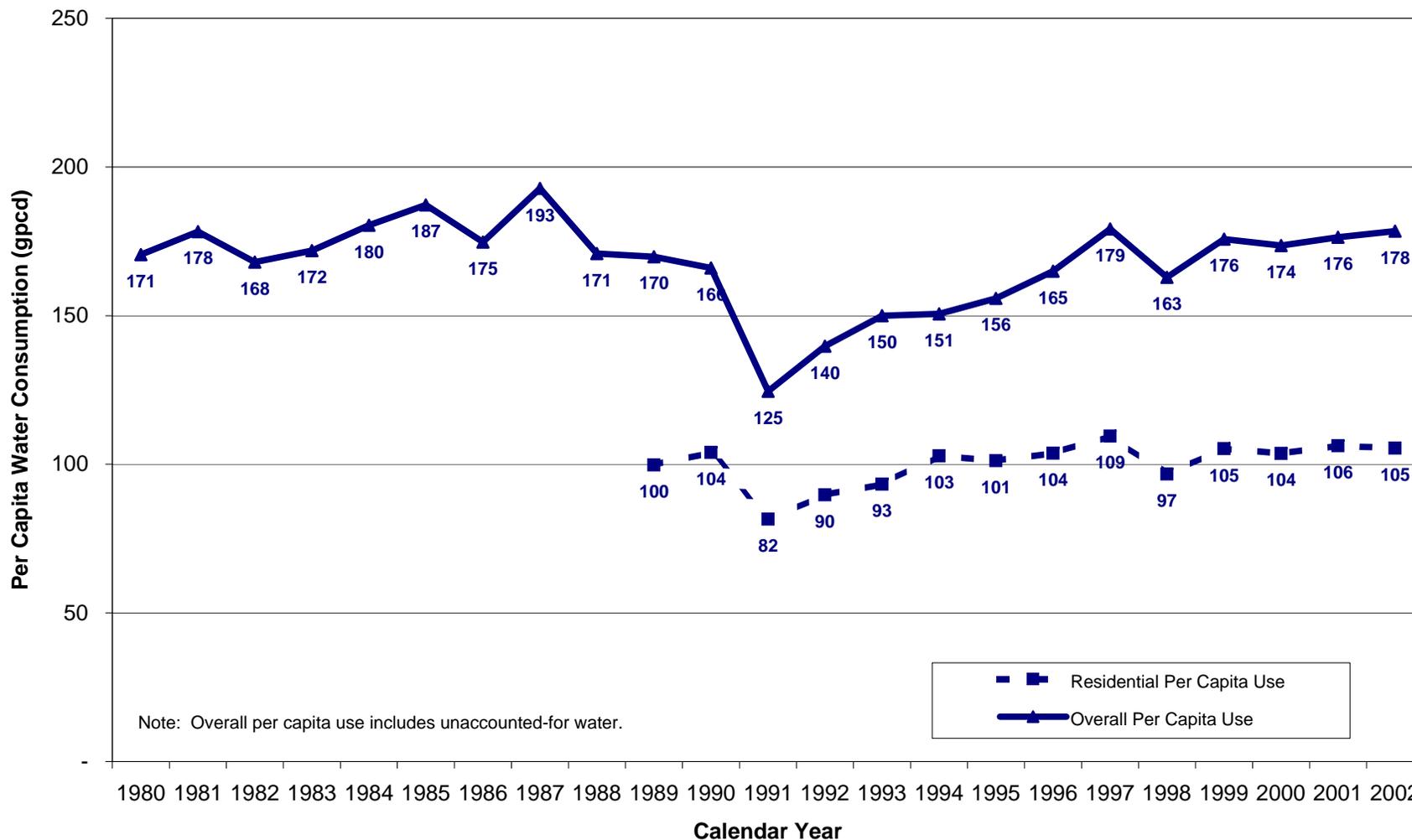


Figure A-6. City of Napa Historical Per Capita Water Use (1980-2002)



APPENDIX B

City of American Canyon Municipal and Industrial Demands

APPENDIX B. CITY OF AMERICAN CANYON MUNICIPAL AND INDUSTRIAL DEMANDS

INTRODUCTION

To update projected water demands, the following data were analyzed:

- Historical Annual Production by Source
- Historical Monthly Production By Source
- Historical and Projected Total Annual Water Consumption
- Historical Per Capita Water Demand

HISTORICAL ANNUAL PRODUCTION BY SOURCE

The total annual production by source is shown in Figure B-1 for the years 1991 through 2002.

American Canyon receives water from the North Bay Aqueduct (treated at the American Canyon Water Treatment Plant on Lynch Road), treated water from the City of Vallejo, and treated water from the City of Napa.

HISTORICAL MONTHLY PRODUCTION BY SOURCE

Water use in the City of American Canyon rises in summer months to meet landscape irrigation and other exterior water demands, and declines in winter months, as shown on Figure B-2. Water supply and distribution facilities must be planned with sufficient capacity to meet the high demands occurring in summer months.

HISTORICAL ANNUAL WATER USE BY LAND-USE TYPE

Historical water demand by land-use type has not been tracked by the City of American Canyon. However, unit water demands were estimated in the 2003 American Canyon Water Master Plan, and were used to estimate future water demands in the following section.

HISTORICAL AND PROJECTED TOTAL ANNUAL WATER CONSUMPTION

The projected water demands at buildout of the adopted General Plan are based on land use and estimated water use by land use type, as shown on Tables B-1 and B-2.

Table B-1 estimates future water demands based on projected land use information provided to WYA by City staff and water use factors provided in the 2003 Water Master Plan. However, the 2003 Water Master Plan also independently estimates the City's buildout water demand. A comparison of these water demand projections is shown in Table B-2. It is not clear why the land use acreages in these two cases are different. Officially, the current General Plan has designated

6,300 afa as the buildout water demand. Therefore, for the purposes of this analysis, the current General Plan projected demand of 6,300 afa will be used for the buildout condition.

The City is assumed to have reached total buildout by 2015; however, it is anticipated that growth would continue at some nominal rate, either through increased densification of housing or through expansion of the General Plan area. Therefore, the projected demand for the Year 2015 has been projected to the Year 2050 at a rate of 0.5 percent per year to account for this nominal post-buildout growth. The historical and projected growth in demand is shown in Figure B-3.

HISTORICAL PER CAPITA WATER DEMAND

Historical per capita water demand for the City of American Canyon's water service area is shown in Figure B-4. As this figure shows, per capita water use remained fairly stable at approximately 150 gpcd until 1987, when it jumped to the low 200's. In 1991 the demand dropped again to near 150 gpcd and has been rising slightly ever since. Current per capita water demand is approximately 220 gpm.

The per capita demands for each year from 1980 to 2002 are presented in Table B-3.

The average over the entire period is 172 gallons per capita per day (gpcd). The average over the 8-year pre-drought period is 152 gpcd. The per capita water demand for the drought and immediate post-drought years was 171 gpcd, with a low of 147 gpcd in 1991. Per capita demand has been rising since the early 1990's, and has met or exceeded that experienced in the predrought years.

Table B-1. Projected Water Demands

Category	Land Use Type													Total Demand
	SFR	Mobile	MFR	Group Care	Comm	Rest.	Lodging	Office	Ware-houses	Industrial	Elem. School	Gov't Office	Recreation	
Units	DU	DU	DU	Beds	KSF	Seats	rooms	KSF	KSF	KSF	Enroll.	Emp.	acres	—
Existing (2000)														
Land Use Units	4,021	719	44	190	318	880	0	460	1,824	725	895	22	37	
Unit Water Demand, gpd/unit	335	210	210	100	155	25	40	155	155	155	15	25	1,500	
Customer Demand (mgd)	1.35	0.15	0.01	0.02	0.05	0.02	0	0.07	0.28	0.11	0.01	0.0	0.06	2.13
2006														
Land Use Units	5234	719	461	190	729	960	250	1,431	3,378	4,628	1,395	68	349	
Unit Water Demand, gpd/unit	335	210	210	100	155	25	40	155	155	155	15	25	1,500	
Customer Demand (mgd)	1.75	0.15	0.10	0.02	0.11	0.02	0.01	0.22	0.52	0.72	0.02	0.0	0.52	4.18
Buildout (2015)														
Land Use Units	5343	719	668	190	902	787	665	3,217	5,348	7,434	2,445	70	922	
Unit Water Demand, gpd/unit	335	210	210	100	155	25	40	155	155	155	15	25	1,500	
Customer Demand (mgd)	1.79	0.15	0.14	0.02	0.14	0.02	0.03	0.50	0.83	1.15	0.04	0.0	1.38	6.19

Source: 2003 City of American Canyon Water Master Plan, HydroScience Engineers, Inc. February 2003

Notes:

- SFR = Single Family Residential
- MFR = Multi-Family Residential
- Comm = Commercial
- Rest. = Restaurants
- KSF = Thousand Square Feet

Table B-2. Comparison of Land Use Data Calculations

Demand Period	Draft Water Master Plan	Table B-1	Difference
Present (2000), mgd	2.18	2.13	0.05
2006, mgd	4.18	4.18	0.00
Buildout (2015), mgd	5.56	6.19	0.63

Table B-3. Historical Per Capita Water Demand Factors

Year	Annual Water Production for City Use ^(a) , mgd	Estimated Population Served ^(b)	Total Water Demand Factor, gpcd
1980	0.87	5,708	152
1981	0.91	5,908	154
1982	0.86	6,108	141
1983	0.87	6,307	137
1984	0.97	6,507	149
1985	1.01	6,707	151
1986	1.02	6,907	148
1987	1.33	7,107	187
Pre-Drought Average (1980-1987)			152
1988	1.40	7,306	192
1989	1.51	7,506	201
1990	1.55	7,706	201
1991	1.22	7,976	152
1992	1.26	8,247	153
1993	1.25	8,517	147
1994	1.35	8,741	154
1995	1.47	8,689	170
1996	1.52	8,849	172
Drought and Post-Drought Average (1988-1996)			171
1997	1.61	8,960	180
1998	1.57	9,056	174
1999	1.82	9,128	199
2000	1.95	9,375	208
2001	2.18	10,093	216
2002	2.48	11,280	220
Recent Years Average (1997-2002)			199

^(a) Draft Water Master Plan Update, February 2003, HydroScience Engineers, Inc.

^(b) 1980, 1990, and 1993 through 2002 from City of American Canyon Planning Dept. Other years are straight-line interpolation.

Figure B-1. City of American Canyon Historical Annual Water Production

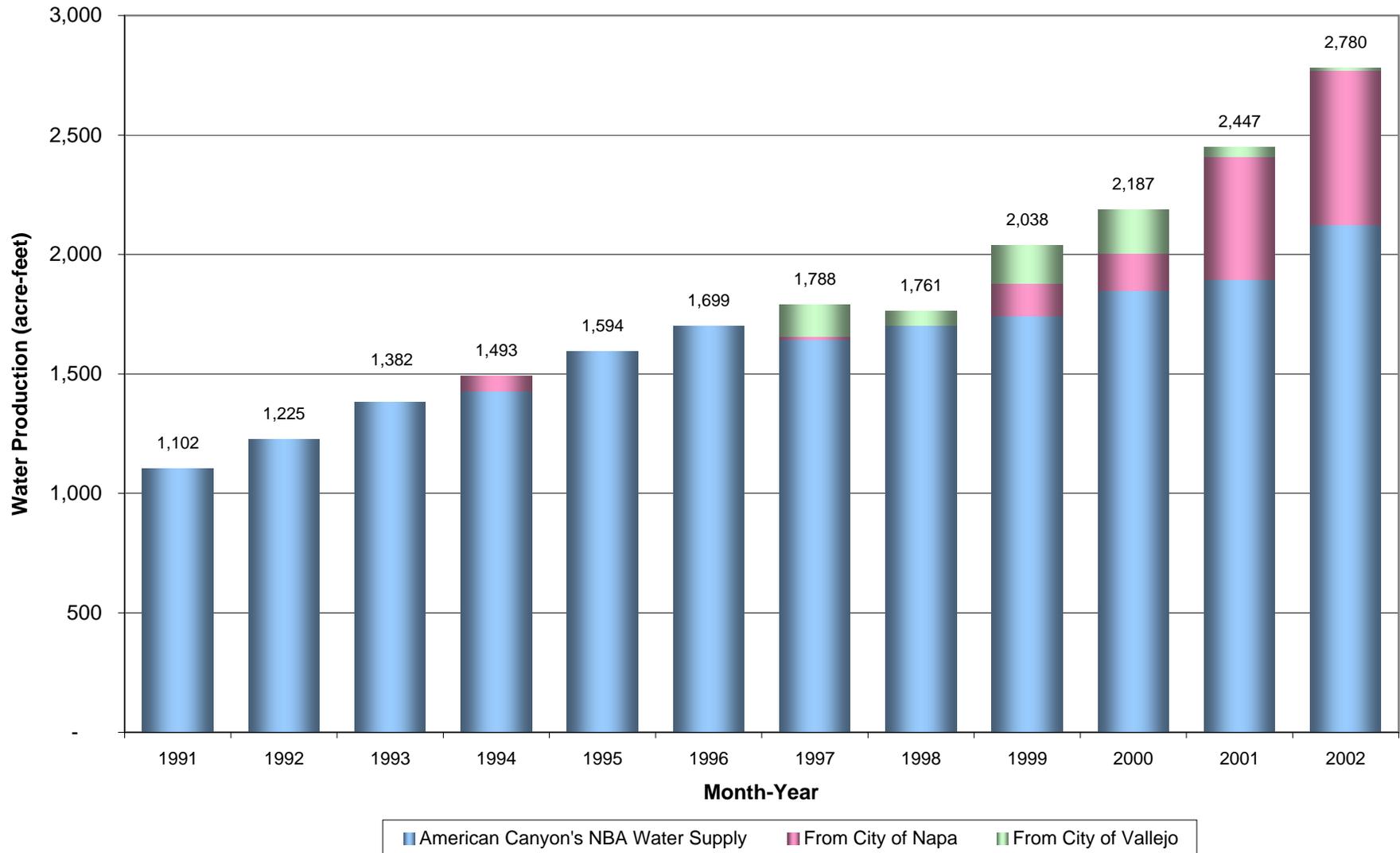


Figure B-2. City of American Canyon Historical Monthly Water Production (1991 - 2002)

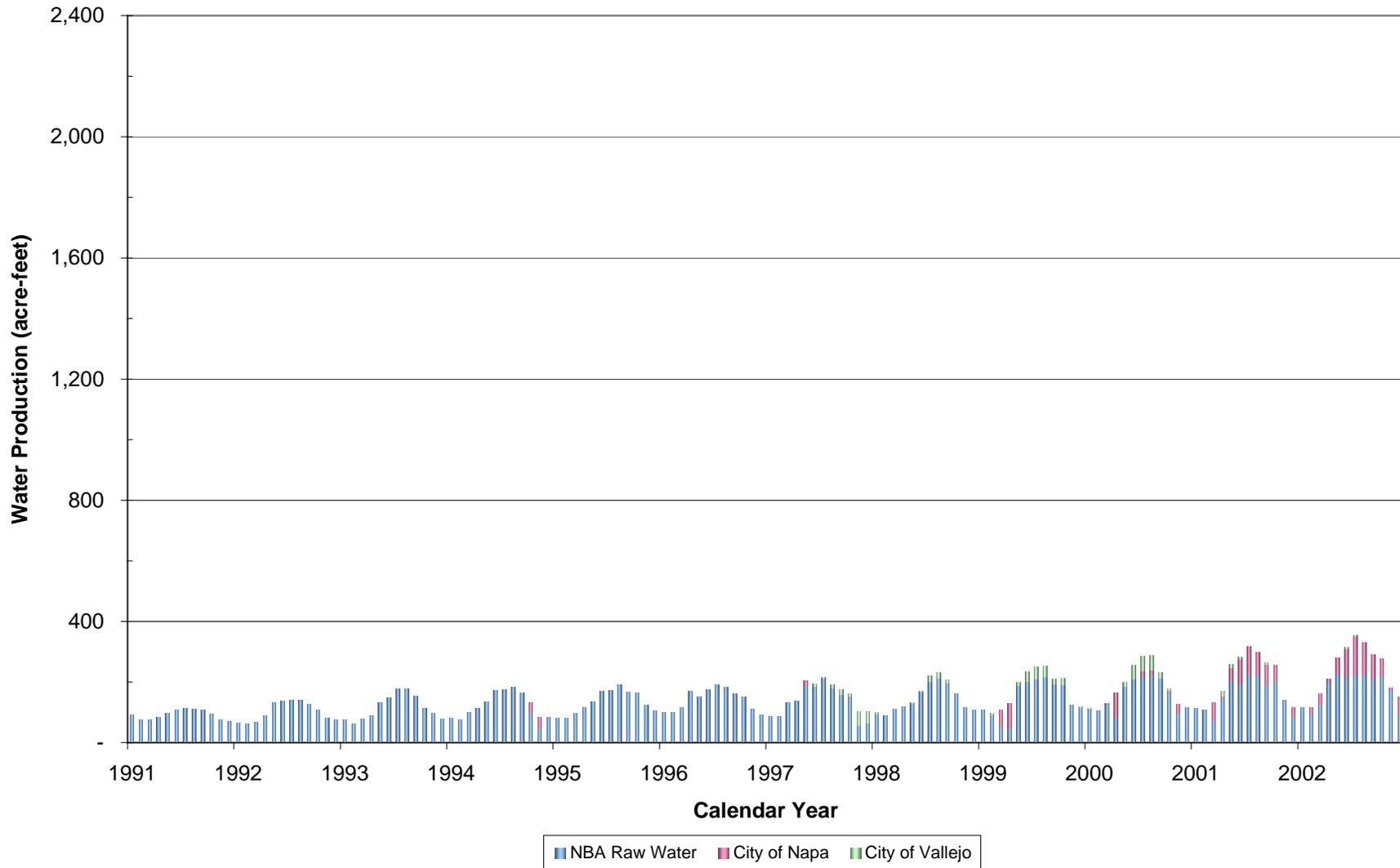


Figure B-3. City of American Canyon Historical and Projected Water Consumption (1990 - 2050)

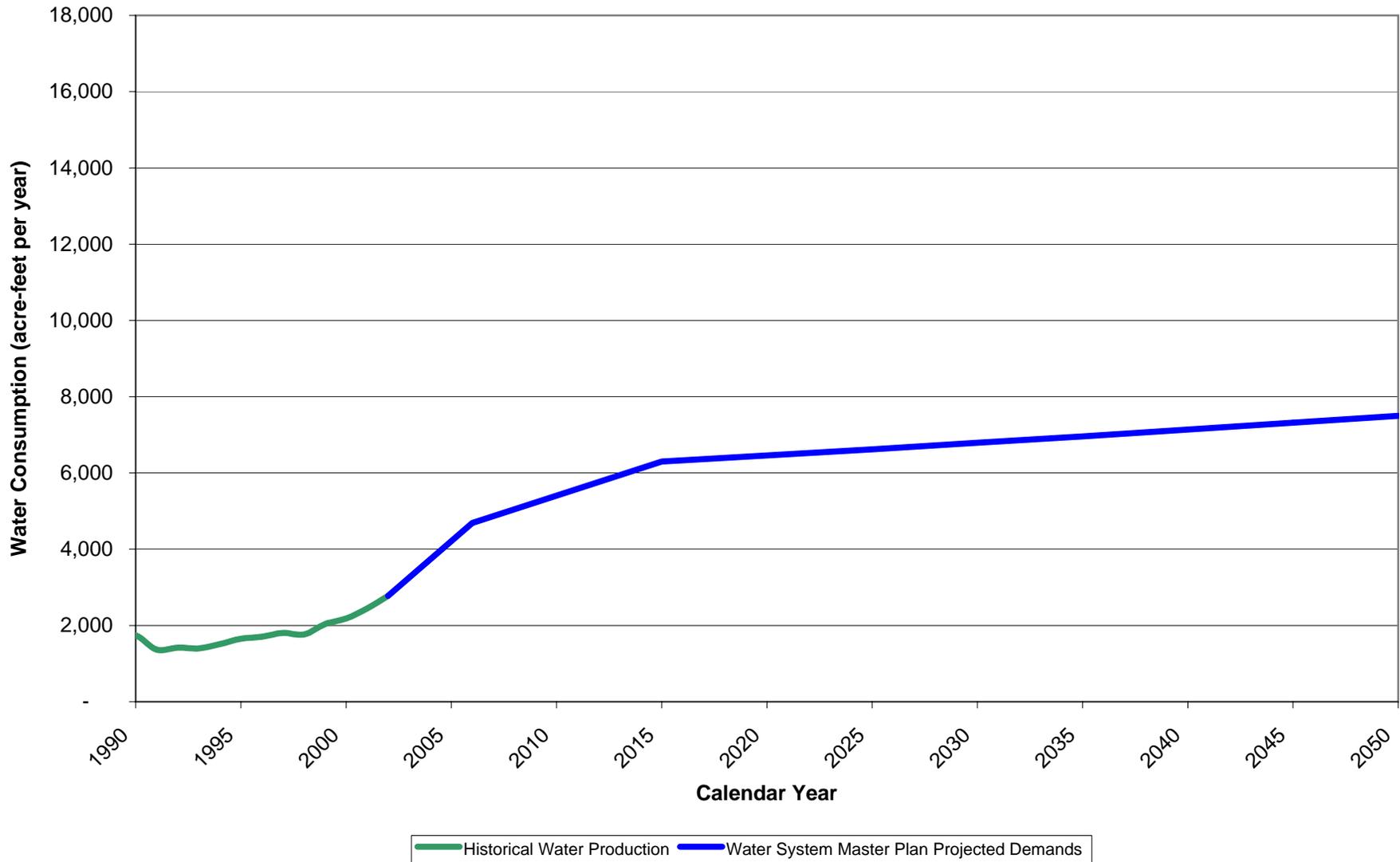
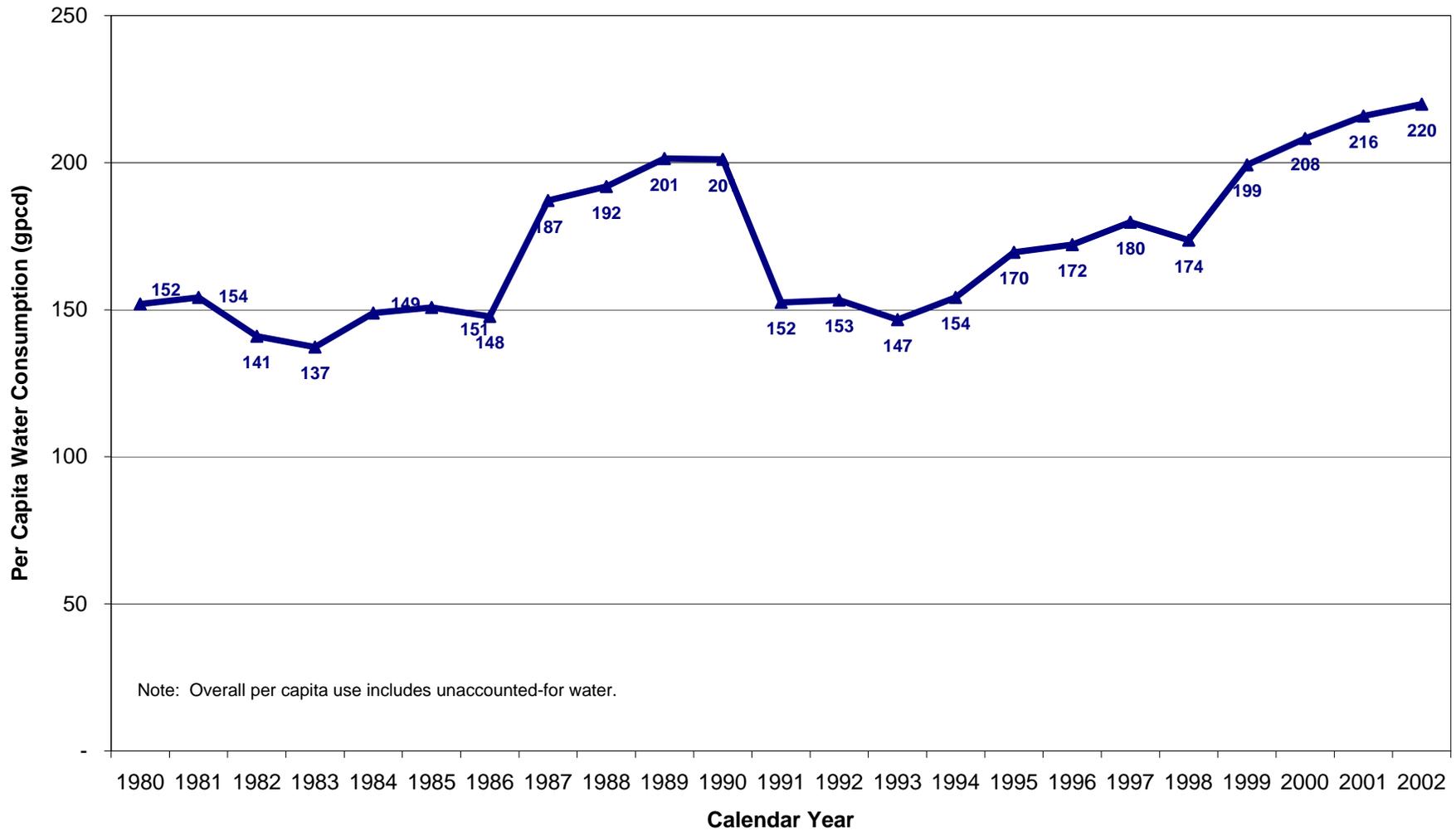


Figure B-4. City of American Canyon Historical Per Capita Water Use (1980-2002)



APPENDIX C

Town of Yountville Municipal and Industrial Demands

APPENDIX C. TOWN OF YOUNTVILLE MUNICIPAL AND INDUSTRIAL DEMANDS

INTRODUCTION

To update the Town of Yountville's projected water demands, the following data were analyzed:

- Historical Annual Production by Source
- Historical Monthly Production By Source
- Historical Annual Water Use by Land-Use Type
- Historical and Projected Total Annual Water Consumption
- Historical Per Capita Water Demand

HISTORICAL ANNUAL PRODUCTION BY SOURCE

The total annual production by source is shown on Figure C-1 for the years 1981 through 2002.

Yountville receives North Bay Aqueduct (NBA) water, which is treated at the City of Napa's Jameson Canyon water treatment plant and delivered to Yountville through the Conn transmission main, and water treated at the Rector water treatment plant (State of California facility), and delivered to Yountville through the Rector transmission main.

HISTORICAL MONTHLY PRODUCTION BY SOURCE

Water use in Yountville rises in summer months to meet landscape irrigation and other exterior water demands, and declines in winter months, as shown on Figure C-2. Water supply and distribution facilities must be planned with sufficient capacity to meet the higher demands that occur during summer months.

HISTORICAL ANNUAL WATER USE BY LAND-USE TYPE

Water deliveries to Yountville's retail customers and other major users are shown on Figure C-3. Yountville does not have any industrial water demand.

An estimation of Yountville's water use by customer based on data provided to WYA by Yountville is shown in Table C-1 and Figure C-3. The unaccounted-for water was calculated by subtracting the Total Consumed, shown in Figure C-3, from the Total Purchased.

The unaccounted-for water ranges from 3 percent to 5 percent of the Total Water Purchased.

HISTORICAL AND PROJECTED TOTAL ANNUAL WATER CONSUMPTION

The projected water demands for buildout based on land use are shown in Table C-2 and on Figure C-4.

Yountville's projected water demands were estimated based on historical water use, land use and population projections, and were modified to reflect implementation of a water conservation and demand management plan. The unit demands prepared using the two methods were compared and found to be in close agreement. The unit demands calculated based on land use were selected, since these more accurately reflect the water demands of visitors and tourists.

The existing and buildout water demands of Yountville were determined by multiplying the unit water demands by the number of existing and planned land use units. It is believed by Yountville staff that, for the 2000 through 2003 period, the 2003 land use data provide the most accurate representation of the numbers of land use units. Therefore, the existing water demands were based on land use in 2003. The buildout demands depend on the ultimate land use. Two possible build-out scenarios (BOS), which were provided by Yountville planning staff, were used to project water demands:

1. BOS1, known development projects, plus full development of the remaining lots and maximum allowed in-fill density.
2. BOS2, full development of remaining lots at less than maximum densities and average allowed in-fill density.

Yountville is assumed to have reached total buildout by 2010; due to growth restrictions, it is not anticipated that growth would continue beyond buildout. The historical and projected growth in demand is shown in Figure C-5.

HISTORICAL PER CAPITA WATER DEMAND

Historical per capita water demand for Yountville's water service area is shown on Figure C-6. As this figure shows, per capita water use has trended slightly upward throughout the period of record, with occasional reduced demand. The per capita demands for each year from 1981 to 2002 are presented in Table C-3.

The average over the entire period is 211 gallons per capita per day (gpcd). The average over the 7-year pre-drought period is 207 gpcd. The per capita water demand for the drought and immediate post-drought years was 203 gpcd, with a low of 178 gpcd in 1996. Per capita demand has been rising since the early 1980's. Per capita water demands have steadily increased, suggesting that more emphasis needs to be placed on conservation activities.

Table C-1. Profile of Water Use for the Town of Yountville, afa

Land Use Category	FY 2000	FY 2001	FY 2002	FY 2003 ^(b)
Residential				
Single Family Residential	63,165	62,558	62,020	60,781
SFR outside of Town	6,960	6,822	7,444	7,698
Condo/Townhouse	6,200	6,295	7,782	6,611
Condo/Landscape	16,314	12,126	12,708	9,478
Multi-Family Residential	4,818	5,127	5,545	5,754
Mobile Home Parks	10,482	16,394	20,842	15,322
Commercial				
Commercial/retail	8,974	10,135	8,138	6,662
Restaurant/Bar	10,372	14,216	10,598	8,628
Hotel/Inns	18,283	22,557	20,224	18,340
Institutional				
Adventist Home	6,559	5,272	5,962	4,137
Church	1,586	1,664	2,182	1,794
School	3,645	2,487	3,009	2,544
Municipal				
Public Facilities	1,300	1,238	1,335	998
Public Landscape	5,607	3,115	3,591	2,471
Total, kgal	164,269	170,009	172,997	151,217
Total, acre-feet	504	522	531	464

^(a) Based on metered water sales data provided by Town staff.

^(b) The low recorded water demands for the year 2003 are believed to be caused by faulty meters and do not represent decreased water demands. Therefore, the data from FY 2003 were not used to calculate the Recommended Updated Unit Demands shown in Table 2-4.

Table C-2. Projected Demand at Buildout of the General Plan Based on Land Use

Land Use Category	Unit Type	Unit Demand, Kgal/year	Estimated for 2003 ^(a)		BOS1 ^(b)		BOS2 ^(c)	
			No. of units	Demand, kgal/year	No. of units	Demand, kgal/year	No. of units	Demand, kgal/year
Residential								
Single Family Residential	Units	114	549	62,851	708	81,053	672	76,932
SFR outside of Town	Units	202	35	7,075	35	7,075	35	7,075
Condo/Townhouse	Units	39	175	6,877	175	6,877	175	6,877
Condo/Landscape ^(d)	Acres	762	18	13,716	10	7,620	10	7,620
Multi- Family Residential	Units	63	82	5,163	155	9,760	120	7,556
Mobile Home Parks	Units	50	319	15,906	319	15,906	319	15,906
Commercial								
Commercial/retail	SF	0.07	126,951	9,082	165,574	11,846	157,069	11,237
Restaurant/Bar	Seats	13	907	11,729	907	11,729	907	11,729
Hotel/Inns	Rooms	59	345	20,355	465	27,435	427	25,193
Institutional								
Adventist Home	Persons	66	90	5,931	90	5,931	90	5,931
Church	total	604	3	1,811	3	1,811	3	1,811
School	Students	16	166	2,581	166	2,581	166	2,581
Municipal								
Public Facilities	total	1,291	1	1,291	1	1,291	1	1,291
Public Landscape	Acres	513	8	4,104	20	10,261	20	10,261
Subtotal, kgal/year				168,472		201,174		191,999
Subtotal, af/year				517		617		589
Estimated System Losses, af/yr ^(e)				52		62		59
Total Demand, af/yr				569		679		648

- (a) Demand projected using existing land use data for 2003, multiplied by the unit water demands recommended in Table 2-4.
- (b) BOS1: Buildout Scenario 1 — full development of the remaining lots and allowed in-fill, based on known development projects.
- (c) BOS2: Buildout Scenario 2 — full development of remaining lots at less than maximum densities and average allowed in-fill.
- (d) Landscape irrigation of Vista Condominiums, representing approximately 8 acres, was removed from the Town potable water system in FY 2004.
- (e) Estimated using an assumed loss rate of 10 percent.

Table C-3. Historical Per Capita Water Demand Factors

Year	Total Demand, gpd ^(a)	Estimated Population served ^(b)	Total Per Capita water Demand, gpcd	Total Demand for Residential Use, gpd	Residential per Capita Water Demand, gpcd
1981	293,823	1,485	198	No Data	No Data
1982	288,497	1,521	190	No Data	No Data
1983	284,274	1,558	182	No Data	No Data
1984	346,477	1,594	217	No Data	No Data
1985	347,182	1,631	213	No Data	No Data
1986	364,607	1,668	219	No Data	No Data
1987	395,467	1,704	232	No Data	No Data
Pre-Drought Average (1981-1987)			207		
1988	368,919	1,741	212	No Data	No Data
1989	405,242	1,777	228	No Data	No Data
1990	327,926	1,836	179	No Data	No Data
1991	380,258	1,860	204	No Data	No Data
1992	373,589	1,884	198	No Data	No Data
1993	387,511	1,909	203	No Data	No Data
1994	446,182	1,933	231	285,405	148
1995	375,489	1,957	192	311,608	159
1996	352,371	1,981	178	294,266	149
Drought and Post-Drought Average (1988-1996)			203		152
1997	510,926	2,005	255	300,545	150
1998	425,907	2,030	210	270,934	133
1999	455,285	2,054	222	292,504	142
2000	464,592	2,078	223	297,542	143
2001	491,011	2,083	236	318,655	153
2002	468,426	2,087	224	338,192	162
Recent Years Average (1997-2002)			228		147

^(a) From Town of Yountville

^(b) California Department of Finance – Total population minus Group Quarters for years 1990 through 2002. Linear interpolation for earlier years from 1980 Census data.

Figure C-1. Town of Yountville Historical Annual Water Purchases by Source (1981 - 2002)

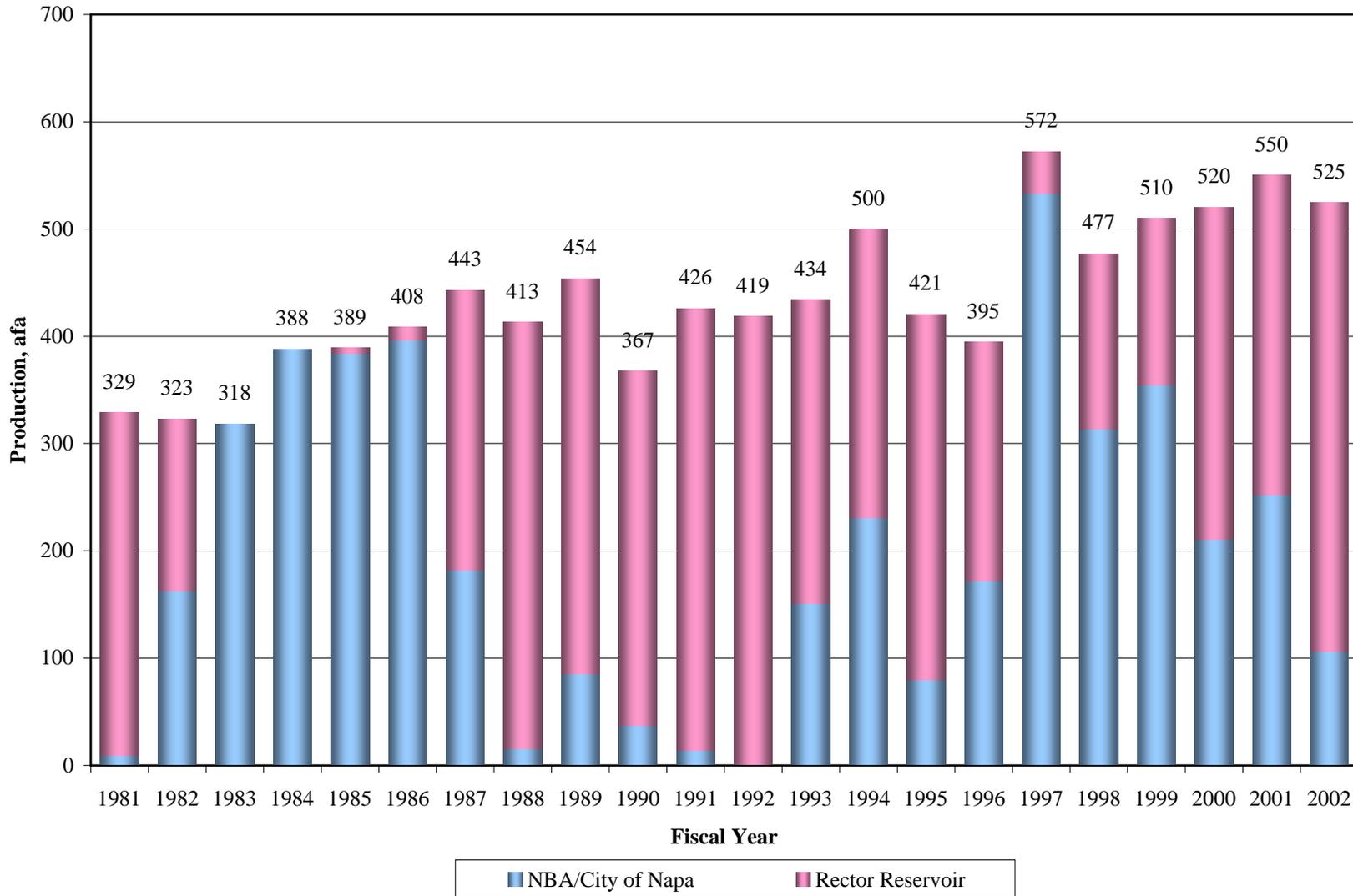


Figure C-2. Town of Yountville Historical Monthly Water Purchases (1991 - 2002)

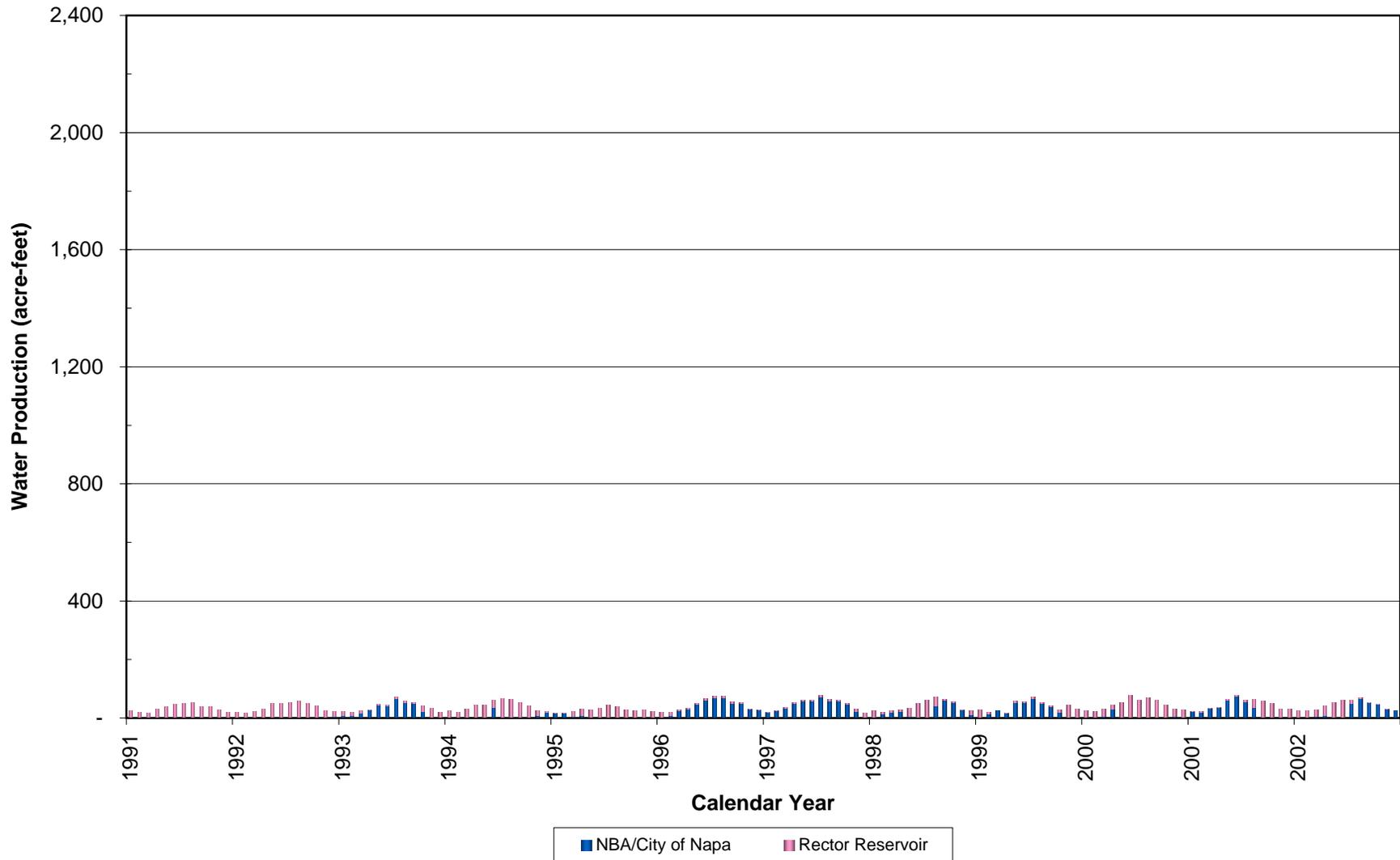


Figure C-3. Town of Yountville Historical Water Consumption (FY 2000-2002)

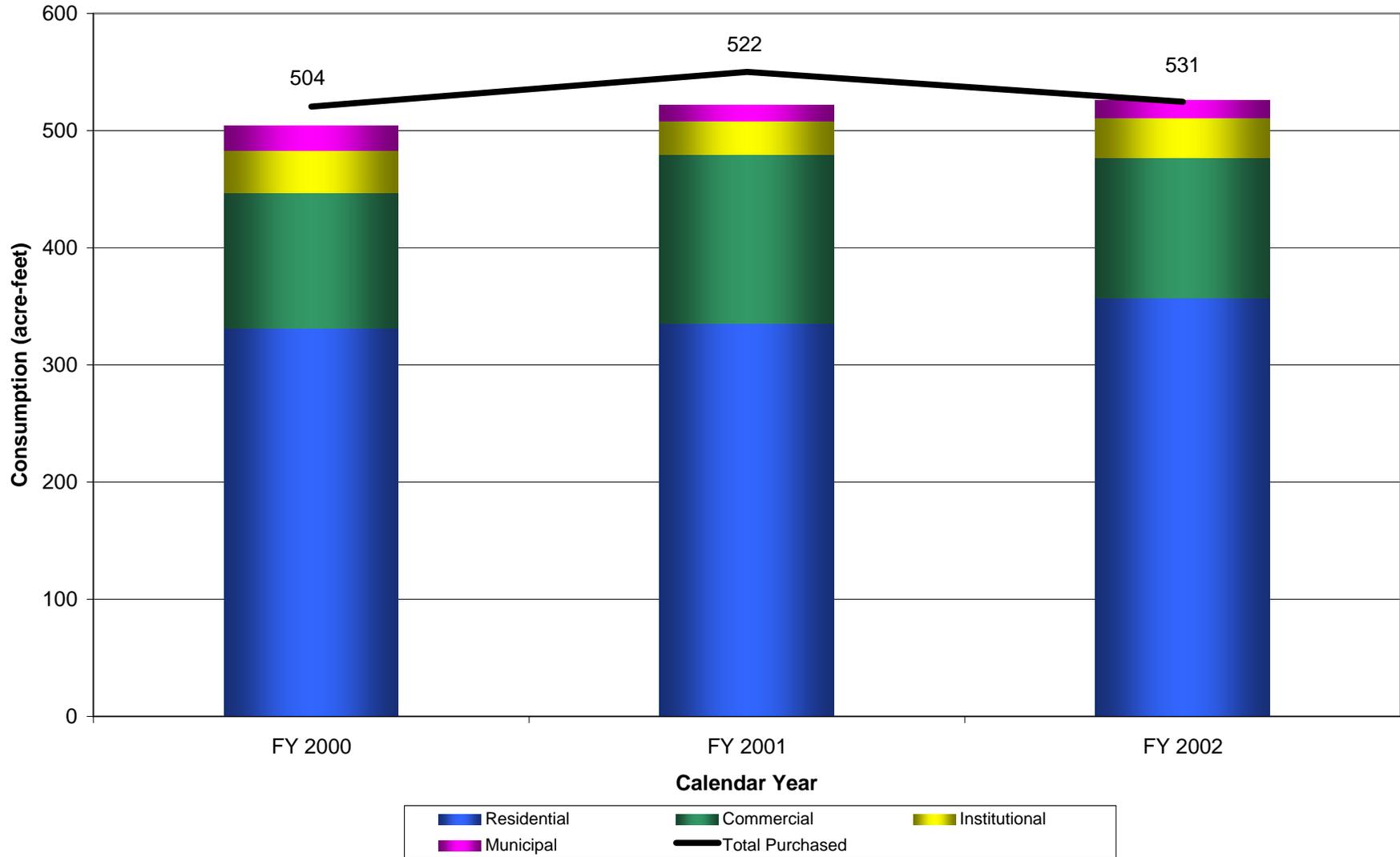


Figure C-4. Town of Yountville Projected Water Consumption Based on Land Use

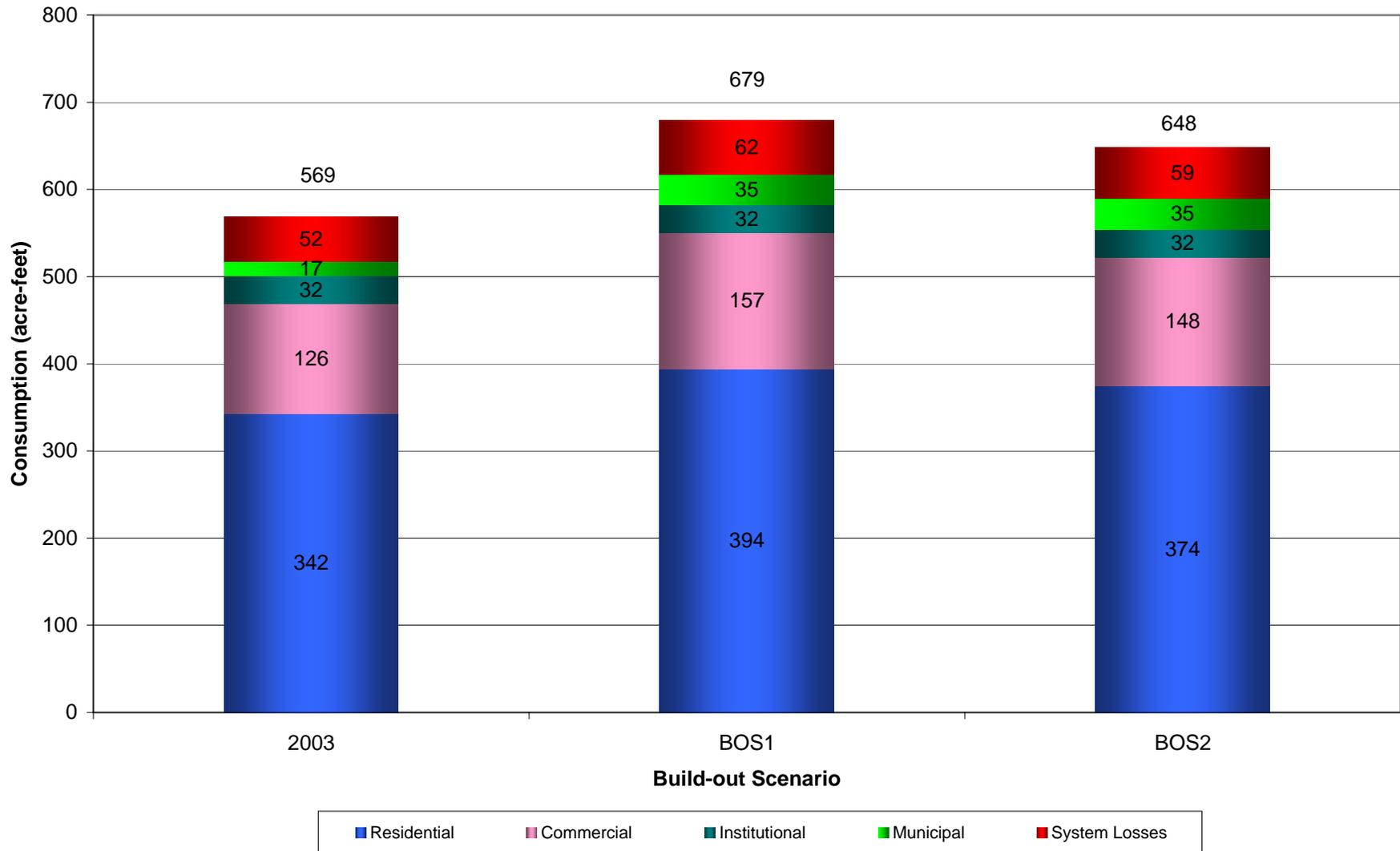


Figure C-5. Town of Yountville Historical and Projected Water Consumption (1990 - 2050)

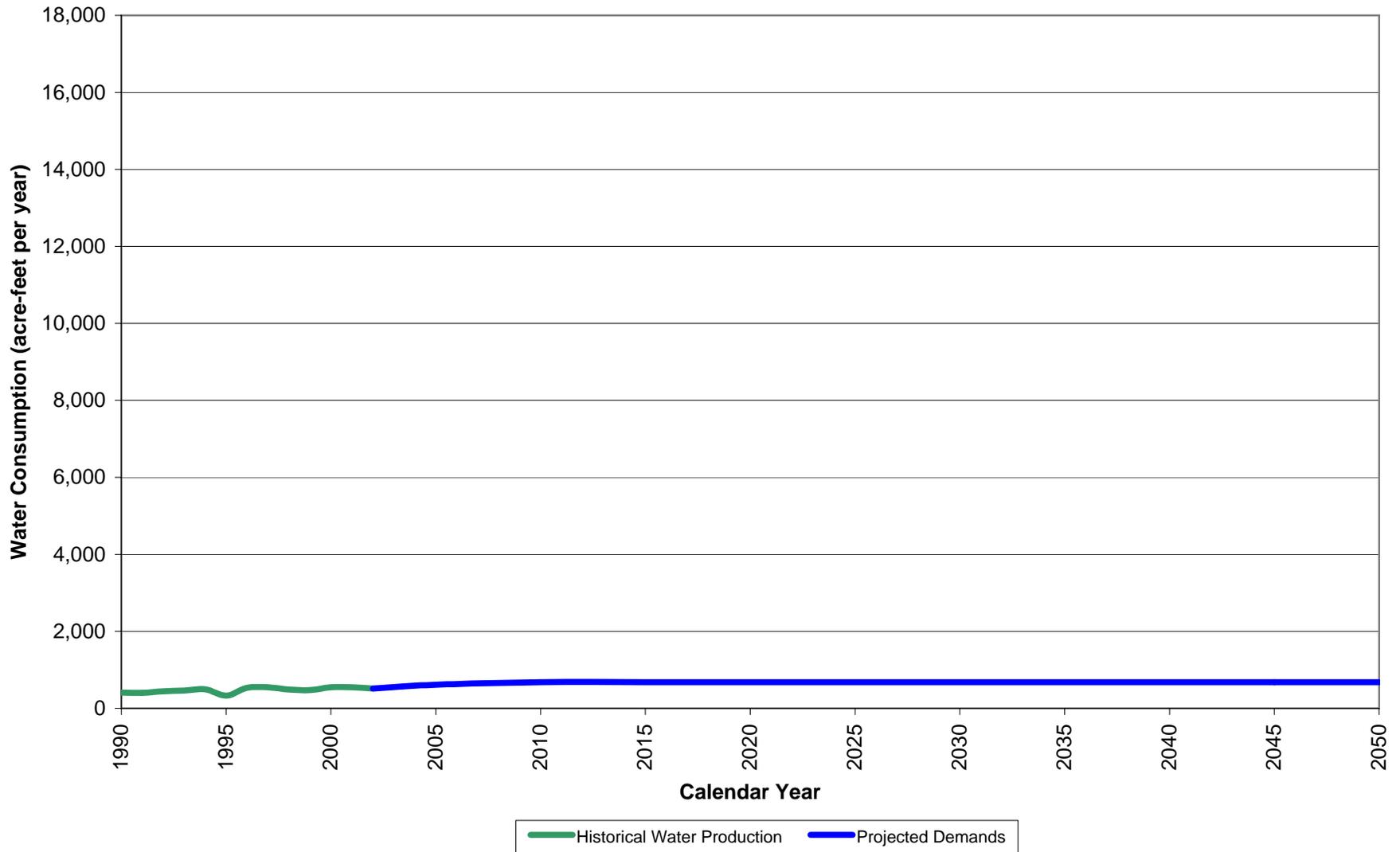
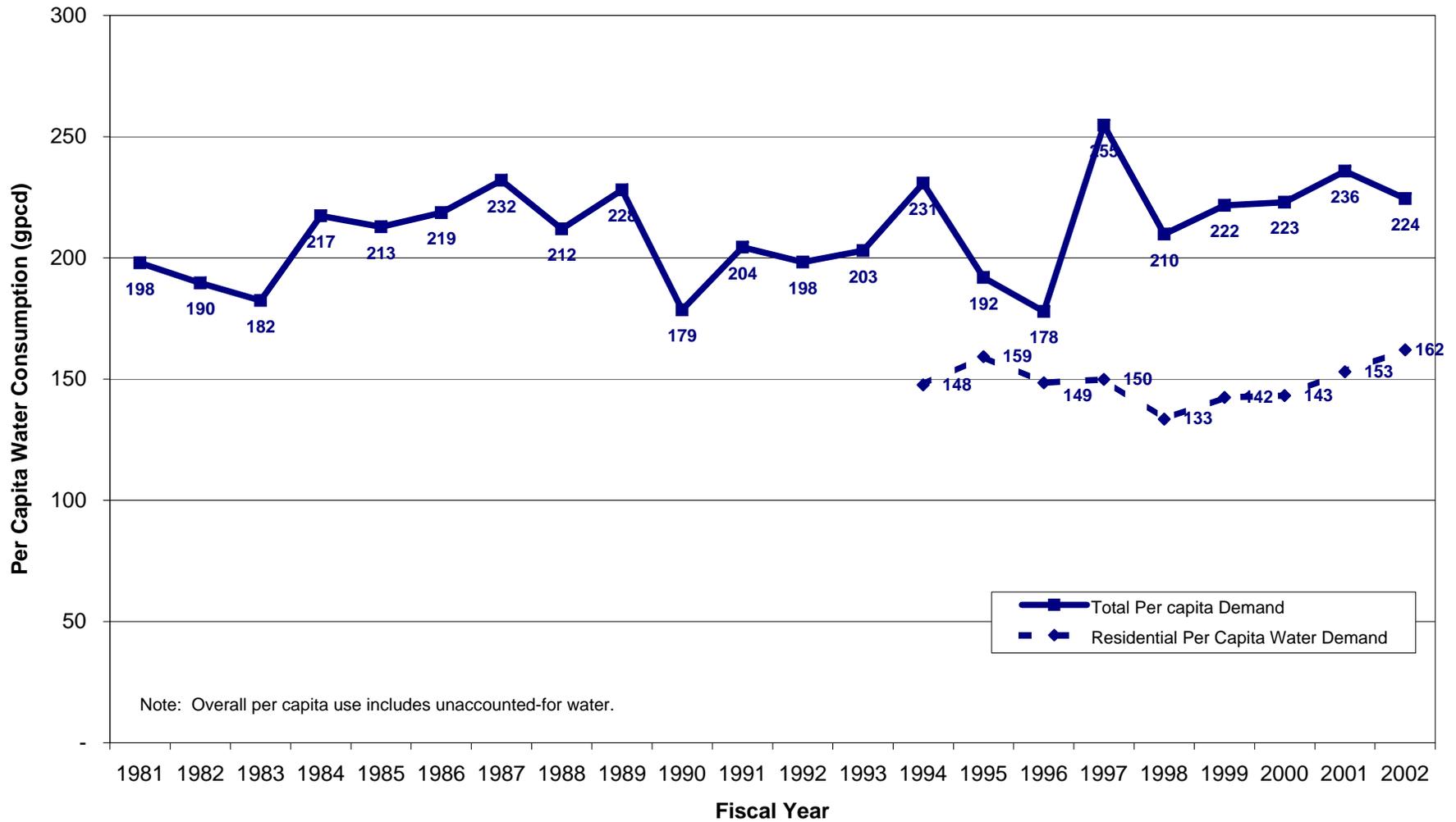


Figure C-6. Town of Yountville Historical Per Capita Water Use (1980-2002)



APPENDIX D

City of St. Helena Municipal and Industrial Demands

APPENDIX D. CITY OF ST. HELENA MUNICIPAL AND INDUSTRIAL DEMANDS

INTRODUCTION

To update the City of St. Helena's projected water demands, the following data were analyzed:

- Historical Annual Production by Source
- Historical Monthly Production By Source
- Historical Annual Water Use by Land-Use Type
- Historical and Projected Total Annual Water Consumption
- Historical Per Capita Water Demand

Much of the information contained in this appendix was developed as part of the City of St. Helena's 2003 Urban Water Management Plan, prepared by West Yost & Associates.

HISTORICAL ANNUAL PRODUCTION BY SOURCE

The City of St. Helena's total annual production by source is shown on Figure D-1 for the years 1990 through 2002.

St. Helena receives water primarily from Bell Canyon Reservoir (treated at the Louis Stralla Water Treatment Plant), with supplemental water supplied by groundwater (Stonebridge Well) and the Lower Reservoir (irrigation and other non-potable uses). Emergency potable water has been supplied by the City of Napa.

HISTORICAL MONTHLY PRODUCTION BY SOURCE

Water use in the City of St. Helena rises in summer months to meet landscape irrigation and other exterior water demands, and declines in winter months, as shown on Figure D-2. Water supply and distribution facilities must be planned with sufficient capacity to meet the higher demands occurring in summer months.

HISTORICAL ANNUAL WATER USE BY LAND-USE TYPE

An estimation of the water deliveries to the City's retail customers both inside and outside City limits are shown in Table D-1 and on Figure D-3.

The unaccounted-for water was calculated by subtracting the Total Consumed from the Total Produced.

The unaccounted-for water ranges from 1 percent to 16 percent of the total water produced, with one aberrant data point in 2000 showing a negative amount of unaccounted-for water.

HISTORICAL AND PROJECTED TOTAL ANNUAL WATER CONSUMPTION

Projected land uses were not available at the time of this analysis.

The historical and projected water consumption based on per capita water demands is shown in Figure D-4. St. Helena is anticipated to reach buildout of its maximum carrying capacity based on General Plan land uses around Year 2050.

HISTORICAL PER CAPITA WATER DEMAND

Historical per capita water demand for St. Helena's entire water service area is shown in Figure D-5. As this figure shows, per capita water use trended slightly downward from 1988 through 1991. Since then, per capita demand has been slowly increasing.

The per capita demands for each year from 1988 to 2002 are presented in Table D-2 including residential and overall per capita water demands for the populations inside and outside City limits. Water demands outside City limits are substantially greater than inside City limits due to the higher volumes of water used for commercial/winery activities, and the lower number of residents per acre. Per capita demand has been rising since the early 1990's.

As is evident from Table D-2 and Figure D-5, the drought response actions implemented by the City of St. Helena reduced the per capita demand slightly during the drought years and immediately following. Per capita water demands, however, have steadily increased, as customers may not be as conscious of conservation activities.

To project future City of St. Helena water demands, per capita demand factors of 228 gpcd and 413 gpcd were used for inside City customers and outside City customers respectively (these per capita demand factors were developed in St. Helena's 2003 Urban Water Management Plan). This per capita demand factor reflects a normal supply year (full-service delivery), and thus does not include demand management that would be implemented by the City of St. Helena during a drought. Projected water demand based on per capita water use and projected population for St. Helena is shown in Table D-3. Water demand, including a 6 percent factor to account for distribution system losses, is projected to increase to 2,179 afa by the year 2020, and to 2,458 by the year 2050.

Table D-1. Profile of Water Use for the City of St. Helena and Vicinity, afa

Water Service Categories	Year											
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Residential Inside City	689.1	787.7	783.3	733.4	734.5	765.6	831.1	744.1	848	925.2	1010.5	1007.9
Residential Outside City	146.5	165.3	178.6	151.5	142.3	142.8	167.1	138.9	168.5	190.1	179.5	179.4
Commercial Inside City	135.1	159.9	149.5	153.2	141.7	162.4	208.2	186.2	222.3	231.6	242.9	231.5
Commercial Outside City	15.3	21.9	39.4	40.7	46.3	53.7	52.3	53.6	65.9	92.8	59.8	63.3
Industrial Inside City	90.7	100.7	110.9	110.2	167.5	130.9	151.9	158.9	177.3	134.1	104.1	128.4
Industrial Outside City	97.2	97.1	103.4	92.1	113.0	133.8	145.6	174.8	131.8	88.8	102.9	90.6
Institutional Inside City	86.9	92.8	108.2	106.3	76.5	79.1	93.6	100.4	98.6	230.6	203.3	164.5
Institutional Outside City	0.4	0.3	0.5	0.6	0.4	0	0	0	0	0	0	0
Landscape Meters--Inside and Outside City	45.3	40	6.8	7.9	61.1	72.3	81.1	56.2	81.2	79.5	94.7	90
Total Inside City	1,001.8	1,141.1	1,151.9	1,103.1	1,120.2	1,138	1,284.8	1,189.6	1,346.2	1,521.5	1,560.8	1,532.3
Total Outside City	259.4	284.6	321.9	284.9	302	330.3	365	367.3	366.2	371.7	342.2	333.3
Landscape Meters--Inside and Outside City	45.3	40	6.8	7.9	61.1	72.3	81.1	56.2	81.2	79.5	94.7	90
Total Consumed	1,306.5	1,465.7	1,480.6	1,395.9	1,483.3	1,540.6	1,730.9	1,613.1	1,793.6	1,972.7	1,997.7	1,955.6
Total Produced	1,430.2	1,735.9	1,633.8	1,465.3	1,500.9	1,706.3	1,779.0	1,647.4	1,856.9	1,896.8	2,114.3	2,290.5
Unaccounted-for water, acre-feet	124	270	153	69	18	166	48	34	63	-76	117	335
Unaccounted-for water, % of Production	9%	16%	9%	5%	1%	10%	3%	2%	3%	-4%	6%	15%

Table D-2. City of St. Helena Historical Per Capita Water Demand Factors

Year	Inside City				Outside City			
	Total Demand, afa	Population	Residential per capita water demand, gpcd	Overall per capita water demand, gpcd	Total Demand, afa	Population	Residential per capita water demand, gpcd	Overall per capita water demand, gpcd
1988	1,290	4,972	144	232	360	720	279	446
1989	1,113	4,981	136	199	331	720	249	410
1990	1,032	4,990	112	185	294	720	201	365
1991	1,002	5,100	121	175	259	720	182	322
1992	1,141	5,200	135	196	285	720	205	353
1993	1,152	5,300	132	194	322	720	221	399
1994	1,103	5,400	121	182	285	720	188	353
1995	1,120	5,500	119	182	302	720	176	374
1996	1,138	5,560	123	183	330	720	177	410
Drought and Post-Drought Average (1988-1996)			127	192	—	—	209	381
1997	1,285	5,620	132	204	365	720	207	453
1998	1,190	5,680	117	187	367	720	172	455
1999	1,346	5,740	132	209	366	720	209	454
2000	1,522	5,800	142	234	372	720	236	461
2001	1,561	5,860	154	238	342	720	223	424
2002	1,532	6,000	150	228	333	720	222	413
Recent Years Average (1997-2002)			138	217	—	—	211	443

Table D-3. Present and Projected Water Demand Based on Per Capita Projection Method^(a)

Year	Inside City			Outside City			Both	Overall
	Population ^(b)	Per Capita Water Demand, gpcd	Projected Water Demand, afa	Population ^(a)	Per Capita Water Demand, gpcd	Projected Water Demand, afa	Landscape Irrigation	Projected Water Demand, afa
2000	5,800	228	1,481	720	413	335	90	1,906
2005	6,100	228	1,555	720	413	335	90	1,980
2010	6,200	228	1,580	720	413	335	90	2,005
2015	6,300	228	1,606	720	413	335	90	2,031
2020	6,400	228	1,631	720	413	335	90	2,056
2030	6,727	228	1,718	720	413	335	90	2,143
2040	7,070	228	1,805	720	413	335	90	2,230
2050	7,433	228	1,900	720	413	335	90	2,327

^(a) Does not include unaccounted-for water system losses, estimated to be 6 percent.

^(b) Source: St Helena Urban Water Management Plan, West Yost & Associates, May 2003 for 2000-2020, Population growth was projected at 0.5 percent per year through 2050. The General Plan estimated maximum carrying capacity is 7,450 persons, based on General Plan land uses.

Figure D-1. City of St. Helena Historical Annual Water Production (1990-2002)

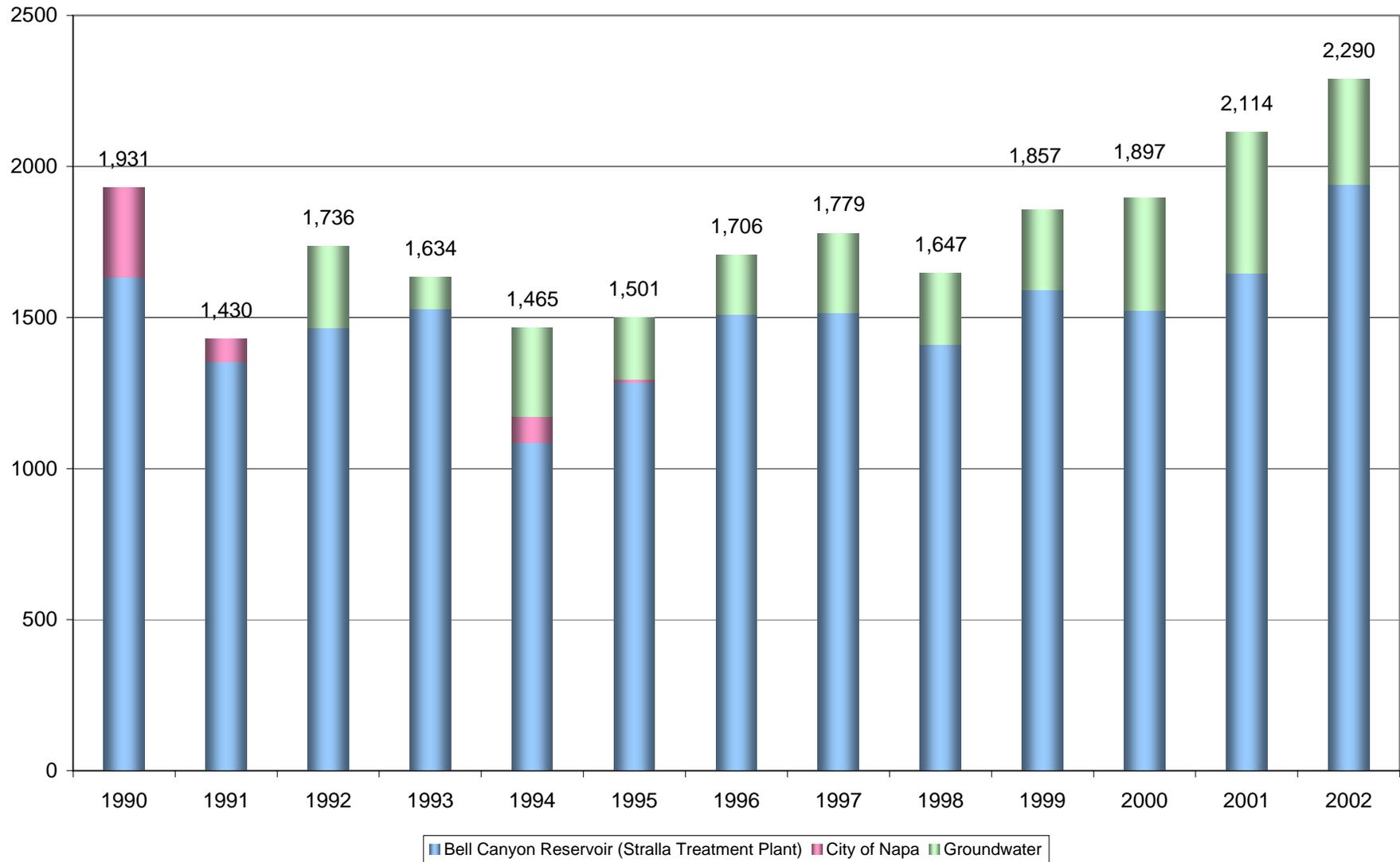


Figure D-2. City of St. Helena Historical Monthly Water Production (1990 - 2002)

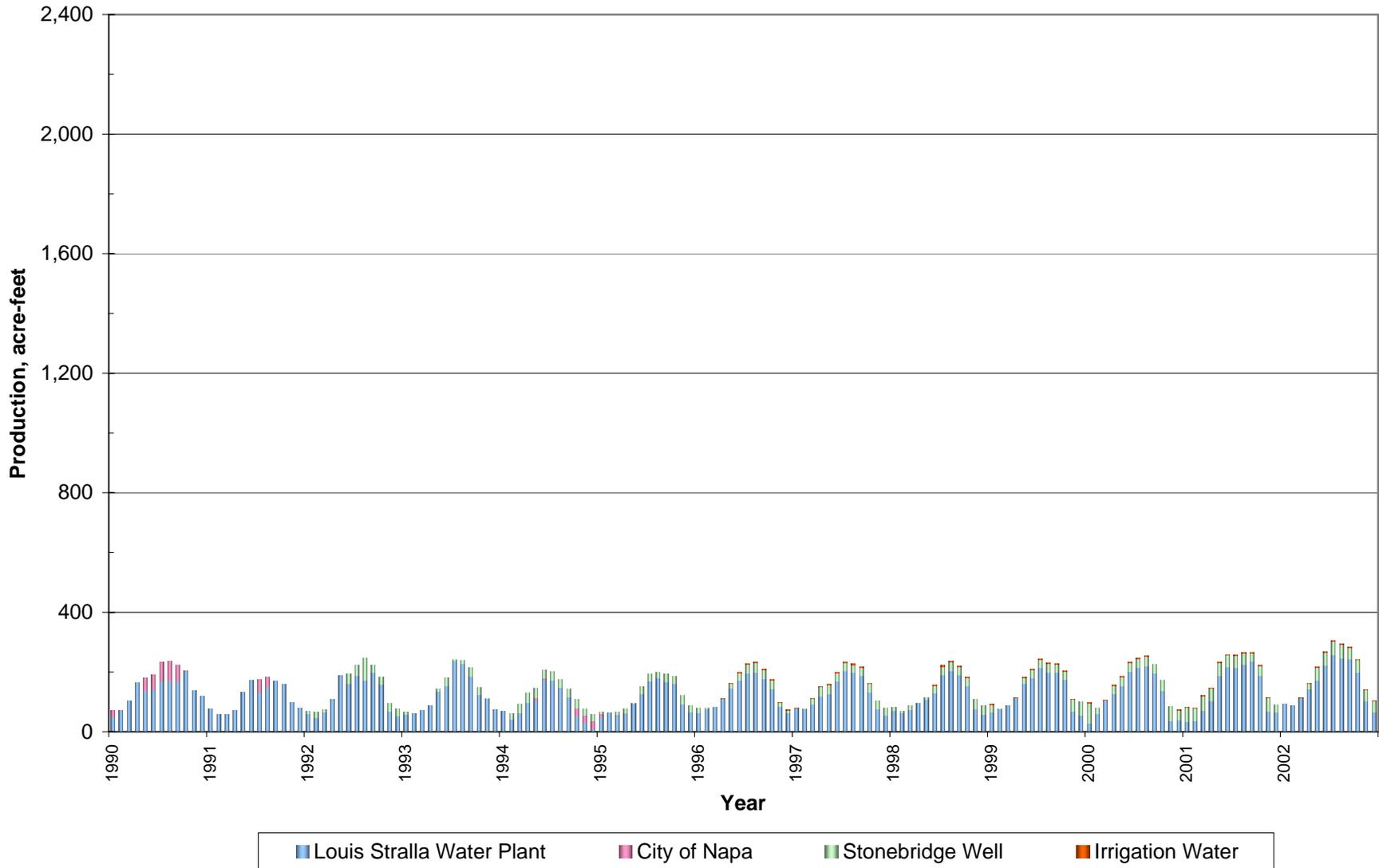


Figure D-3. City of St. Helena Historical Water Consumption (1988-2002)

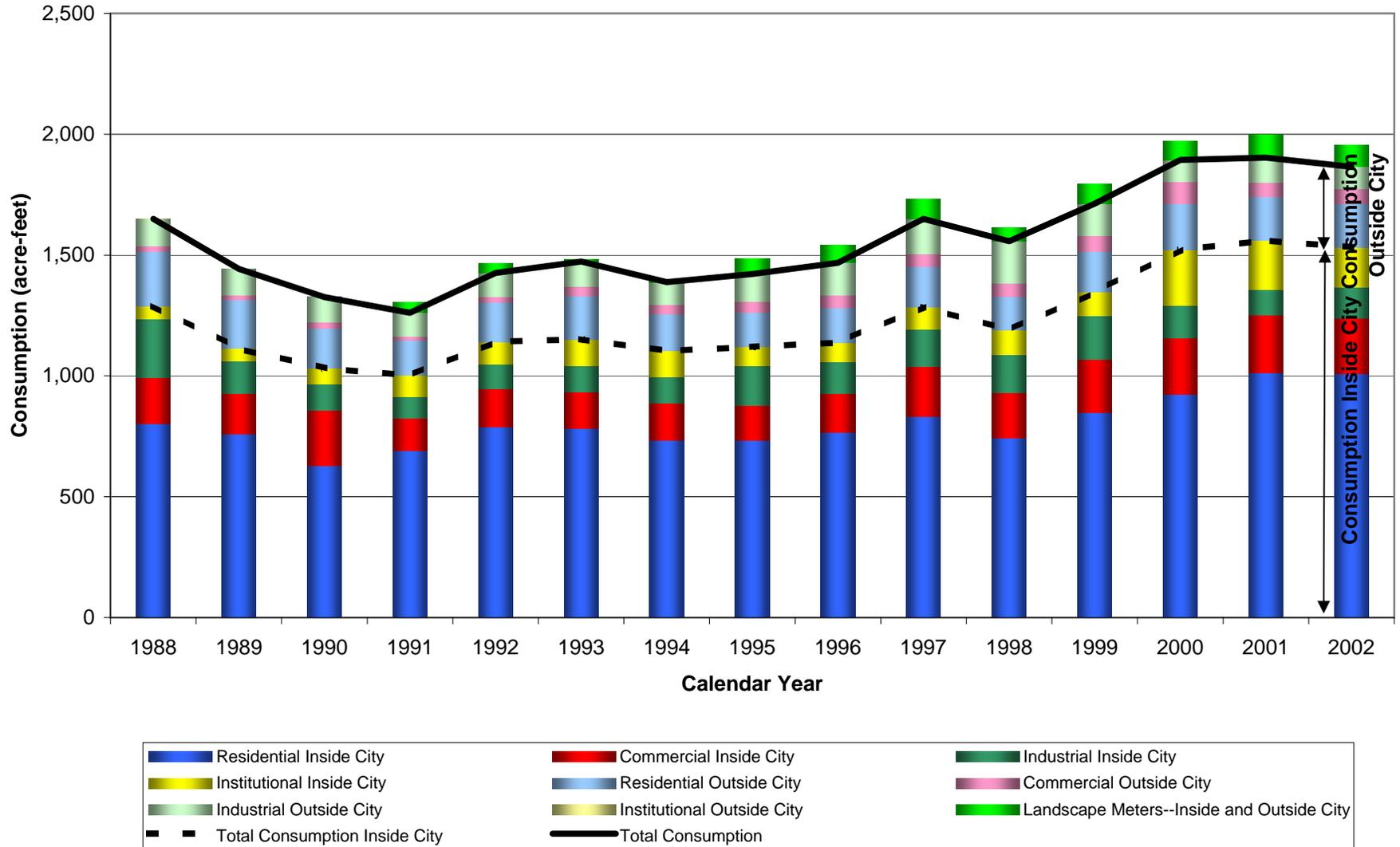


Figure D-4. City of St. Helena Historical and Projected Water Consumption (1990 - 2050)

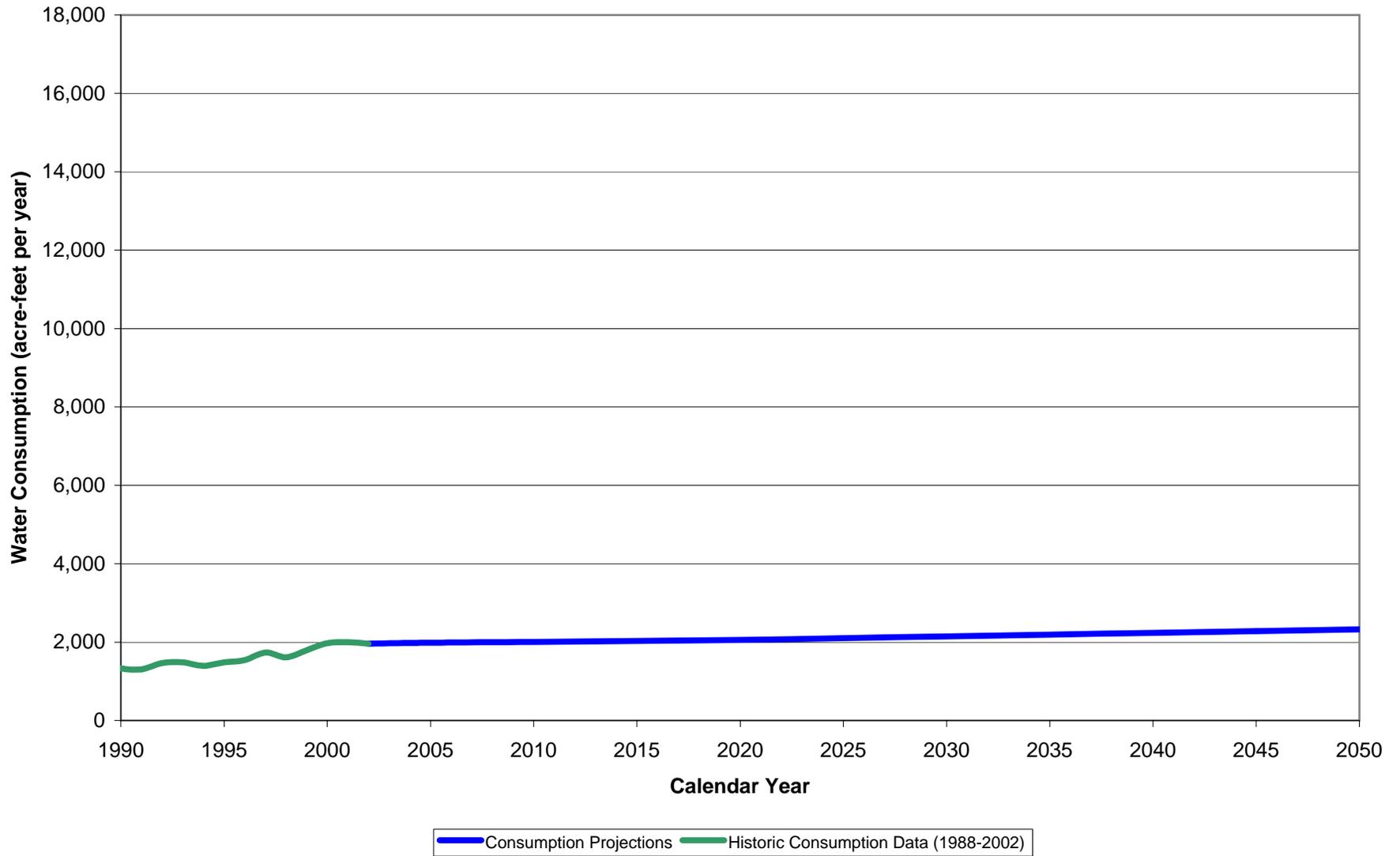
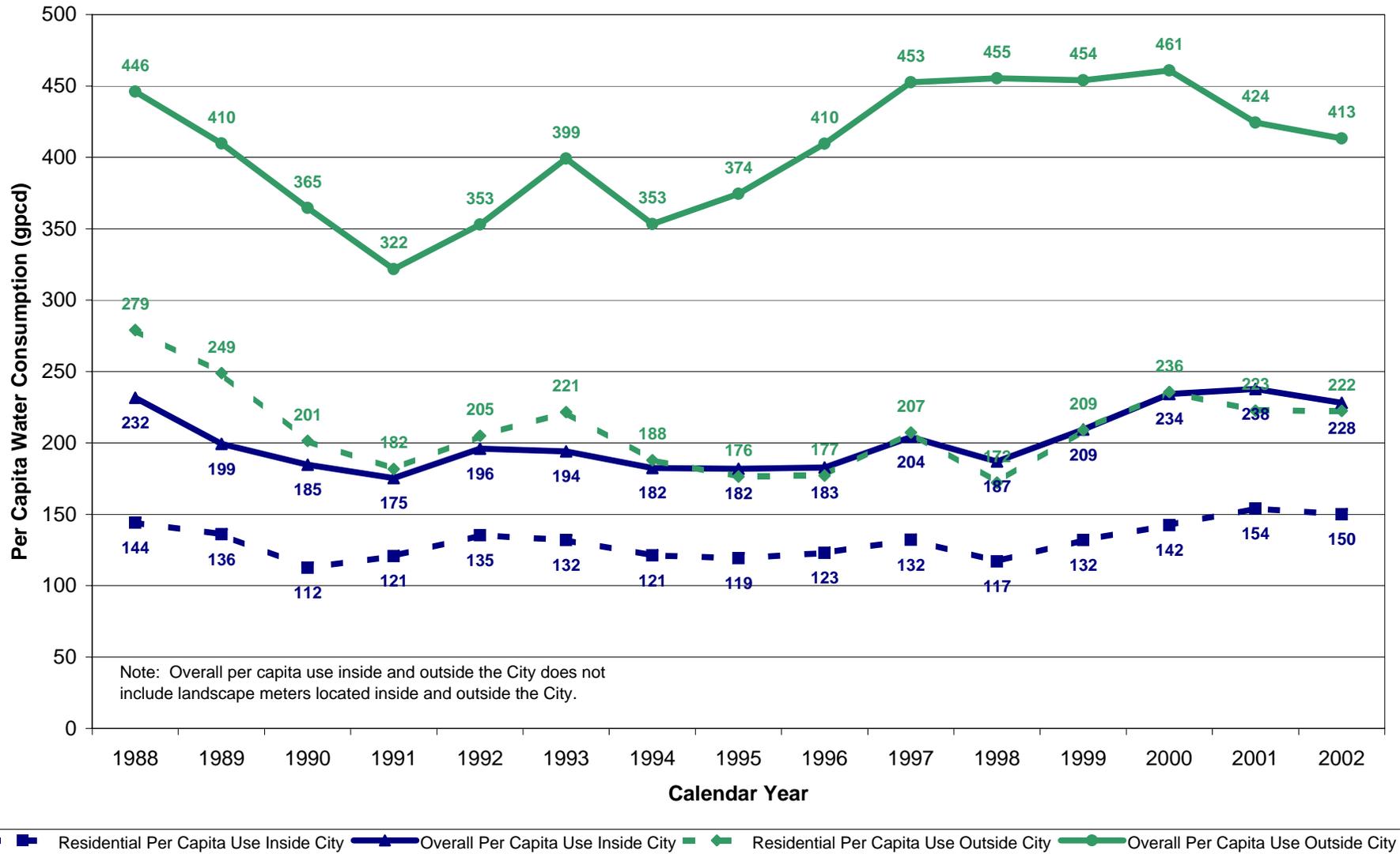


Figure D-5. City of St. Helena Historical Per Capita Water Use (1988-2002)



APPENDIX E

City of Calistoga Municipal and Industrial Demands

APPENDIX E. CITY OF CALISTOGA MUNICIPAL AND INDUSTRIAL DEMANDS

INTRODUCTION

To update the City of Calistoga's projected water demands, the following data were analyzed:

- Historical Annual Production by Source
- Historical Monthly Production By Source
- Historical Annual Water Use by Land-Use Type
- Historical and Projected Total Annual Water Consumption
- Historical Per Capita Water Demand

Much of the data for this appendix was derived from the Water Facilities Plan by Summit Engineering, dated August 2000.

HISTORICAL ANNUAL PRODUCTION BY SOURCE

The total annual production by source is shown on Figure E-1 for the years 1991 through 2002.

Calistoga uses local surface water captured in Kimball Reservoir (treated at the City of Calistoga's Kimball Water Treatment Plant) and imported surface water from the State Water Project wheeled through the North Bay Aqueduct (treated at the City of Napa's Jameson Canyon Water Treatment Plant). The City of Calistoga also had a groundwater supply, but has now discontinued the use of the Fiege Canyon Wells due to elevated water temperatures and taste and odor issues.

HISTORICAL MONTHLY PRODUCTION BY SOURCE

Water use in Calistoga rises in summer months to meet landscape irrigation and other exterior water demands, and declines in winter months, as shown on Figure E-2. Water supply and distribution facilities must be planned with sufficient capacity to meet the higher demands occurring in summer months.

HISTORICAL ANNUAL WATER USE BY LAND-USE TYPE

An estimation of the City retail customer use is shown in Table E-1 and Figure E-3. The unaccounted-for water was calculated by subtracting the Total Water Sales from the Total Water Produced. The unaccounted-for water ranges from 5 percent to 20 percent of the water produced. The percent of unaccounted-for water has been decreasing in recent years.

HISTORICAL AND PROJECTED TOTAL ANNUAL WATER CONSUMPTION

The projected water demands for buildout conditions (2038) based on land use are shown in Table E-2.

Although the projected demands based on land-use are commonly assumed to be more accurate than projected demands based on population and per capita water demands, the demands projected in Table E-2 are probably high, because of the large quantity of commercial demand assumed to be present at buildout. For the total demand calculated in Table E-2 to materialize, commercial properties would have to grow at a rate disproportionate to the residential growth rate. The City of Calistoga has regulated commercial growth to maintain the present ratio of residential to commercial property. The projected demands used in this 2050 Study are based on the per capita water demands, discussed below.

It is significant to point out that the City is assumed to have reached total buildout by 2038. Beyond buildout, population growth was projected at a nominal rate of 0.25 percent per year to account for possible densification of residential areas, or slight changes to the General Plan boundaries. The historical and projected growth in demand is shown in Figure E-4.

HISTORICAL PER CAPITA WATER DEMAND

Historical per capita water demand and population for Calistoga's entire water service area is shown in Figure E-5. As this figure shows, per capita water use was very high in the early 1970's with a sharp decline during the drought of the mid 1970's as water use was severely restricted. Water use then generally rose, reaching a maximum in 1988. Water demands decreased as the drought of the late 1980's and early 1990's worsened. Continued emphasis on water conservation practices has caused a continued decrease in the per capita water demand since 1988.

The per capita demands for each year from 1970 to 2002 are presented in Table E-3. The average over the entire period is 168 gallons per capita per day (gpcd). The average over the 8-year predrought period (1980 to 1987) is 144 gpcd. The per capita water demand for the drought and immediate post-drought years was 176 gpcd. Per capita demand has continued to fall since the early 1990's with the average per capita water demands in recent years averaging 160 gpcd. As is evident from Table E-3 and Figure E-5, continued efforts on the part of Calistoga to reduce potable water demands by effective demand control measures have been effective.

To project water demands, a per capita demand factor of 169 gpcd was used. This per capita demand factor reflects a normal supply year (full-service delivery), and thus does not include demand management that would be implemented by the City of Calistoga during a drought. Projected water demand based on per capita water use and projected population for Calistoga is shown in Table E-4. Water demand is projected to increase to approximately 1,517 af by the year 2040, and to 1,563 af by the year 2050.

Table E-1. Profile of Water Use for the City of Calistoga and Vicinity

Water Service Categories	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Single Family Residential	320	311	316	350	357	354	405	408	409	411	415	427
Multi-Family Residential	101	101	103	106	123	111	87	84	119	125	141	120
Commercial	180	199	208	211	210	226	227	222	230	231	216	227
Industrial	91	95	90	73	89	81	81	85	89	84	72	67
Sales Outside City	—	—	—	—	4	5	6	4	—	—	—	—
Total Water Sales	692	706	717	740	783	777	806	803	846	851	844	842
Total Produced	847	874	848	928	844	876	920	860	904	909	888	915
Unaccounted-for Water	155	168	131	188	61	99	114	57	57.38	58	44	73
Percent	18%	19%	15%	20%	7%	11%	12%	7%	6%	6%	5%	8%

Source: City of Calistoga: Water Facilities Plan dated August 2000 with revised data by City of Calistoga July/August 2003.

Table E-2. Projected Water Demands Based on Land-Use

Water Service Categories	Unit	Water Factor, gpd/unit	Existing ^(a)			Buildout		
			Total Units	Demand Allocation		Total Units	Demand Allocation	
				gallons per day	acre-feet annually		gallons per day	acre-feet annually
Single Family Residential	DU	236	1,063	250,868	281	2,043	482,148	540
Mobile Homes	DU	208	553	115,024	129	698	145,184	163
Multi-Family Residential	DU	630	121	76,230	85	352	221,760	248
Commercial	acres	8,145	22	179,190	201	157	1,278,765	1,432
Industrial								
Bottling Companies	acres	18,886	4	75,544	85	8	151,088	169
Other Industrial	acres	35	3	105	0	11	385	0
Campgrounds/Public Buildings	acres	240	77	18,480	21	156	37,440	42
Total Water Sales				715,441	801		2,316,770	2,595
Unaccounted-For Water (8%)				62,212	70		201,458	225
Total Water Demand				777,653	871		2,518,228	2,820

^(a) 1999 data from Water Facilities Plan, Summit Engineering, August 2000.

Table E-3. Historical Per Capita Water Demand Factors

Year	Total Produced, afa	Population	Per Capita Water Use (Total Produced), gpcd	Per Capita Water Use (Residential), gpcd
1980	597	3,879	137	No Data
1981	518	3,854	120	No Data
1982	542	3,973	122	No Data
1983	644	4,022	143	No Data
1984	709	4,049	156	No Data
1985	742	4,066	163	No Data
1986	774	4,218	164	No Data
1987	869	4,340	179	No Data
Pre-Drought Average (1980-1987)			144	No Data
1988	977	4,374	199	No Data
1989	912	4,386	186	No Data
1990	930	4,468	186	No Data
1991	847	4,480	169	101
1992	874	4,500	173	98
1993	848	4,550	166	98
1994	928	4,640	179	106
1995	844	4,660	162	110
1996	876	4,710	166	105
Drought and Post-Drought Average (1988-1996)			176	103
1997	920	4,760	173	116
1998	860	4,840	159	115
1999	904	4,920	164	96
2000	909	5,190	156	92
2001	888	5,190	153	96
2002	915	5,190	157	94
Recent Years Average (1997-2002)			160	101

Table E-4. Present and Projected Water Demand Based on Per Capita Projection Method^(a)

Year	Population ^(b)	Projected Water Demands, afa
2005	5,550	1,051
2010	5,935	1,124
2020	6,786	1,285
2030	7,760	1,469
2040	8,065 ^(c)	1,525
2050	8,269	1,563

^(a) Based on a per capita water demand factor of 169 gpcd per Water Facilities Plan, Summit Engineering August 2000.

^(b) Population growth estimated at the regulated limit of 1.35 percent per year per Draft 2003 General Plan.

^(c) Buildout population, according to Draft 2003 General Plan, is 8,025 in year 2038.

Figure E-1. City of Calistoga Historical Annual Water Production 1991-2002

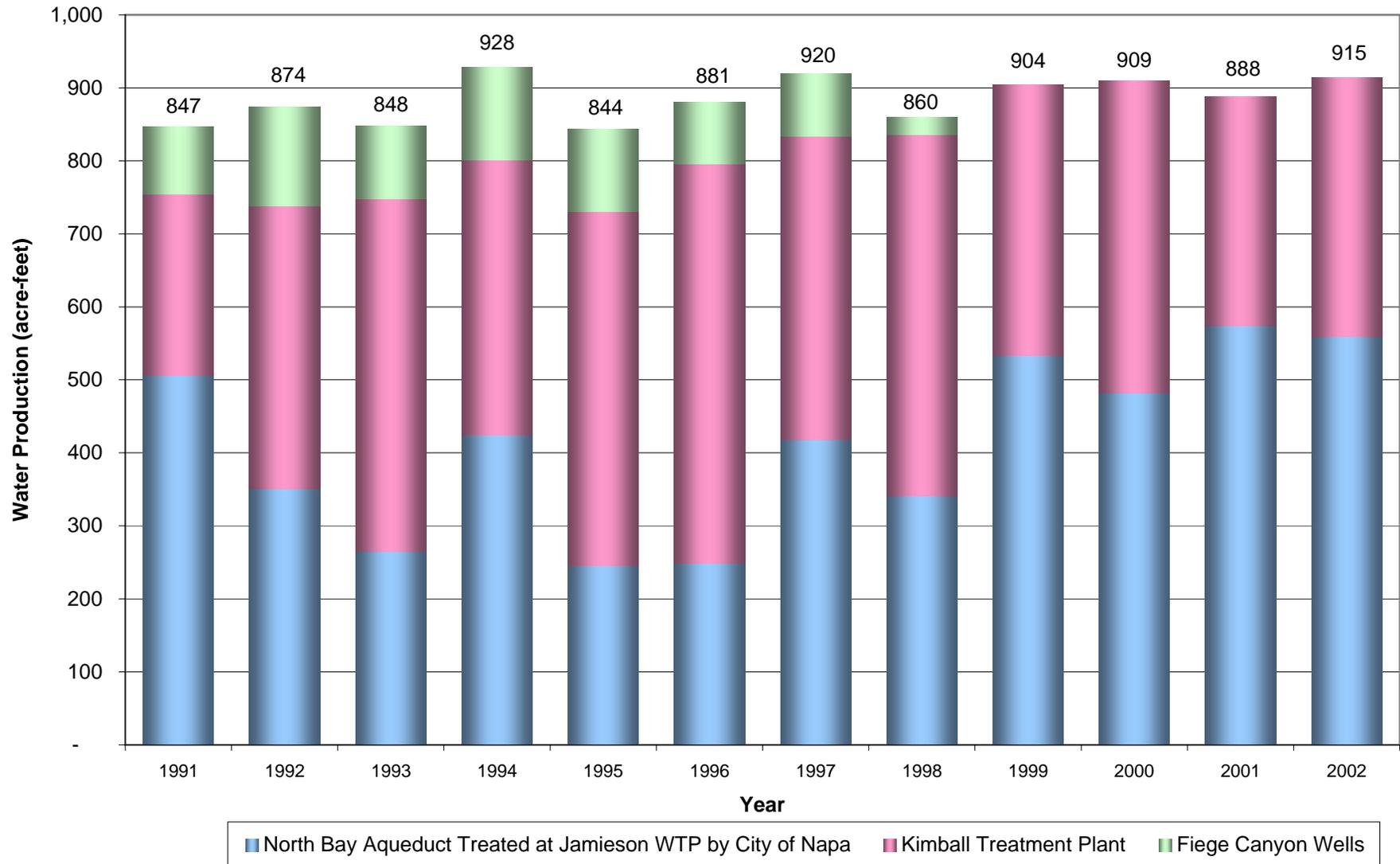


Figure E-2. City of Calistoga Historical Monthly Water Production (1991 - 2002)

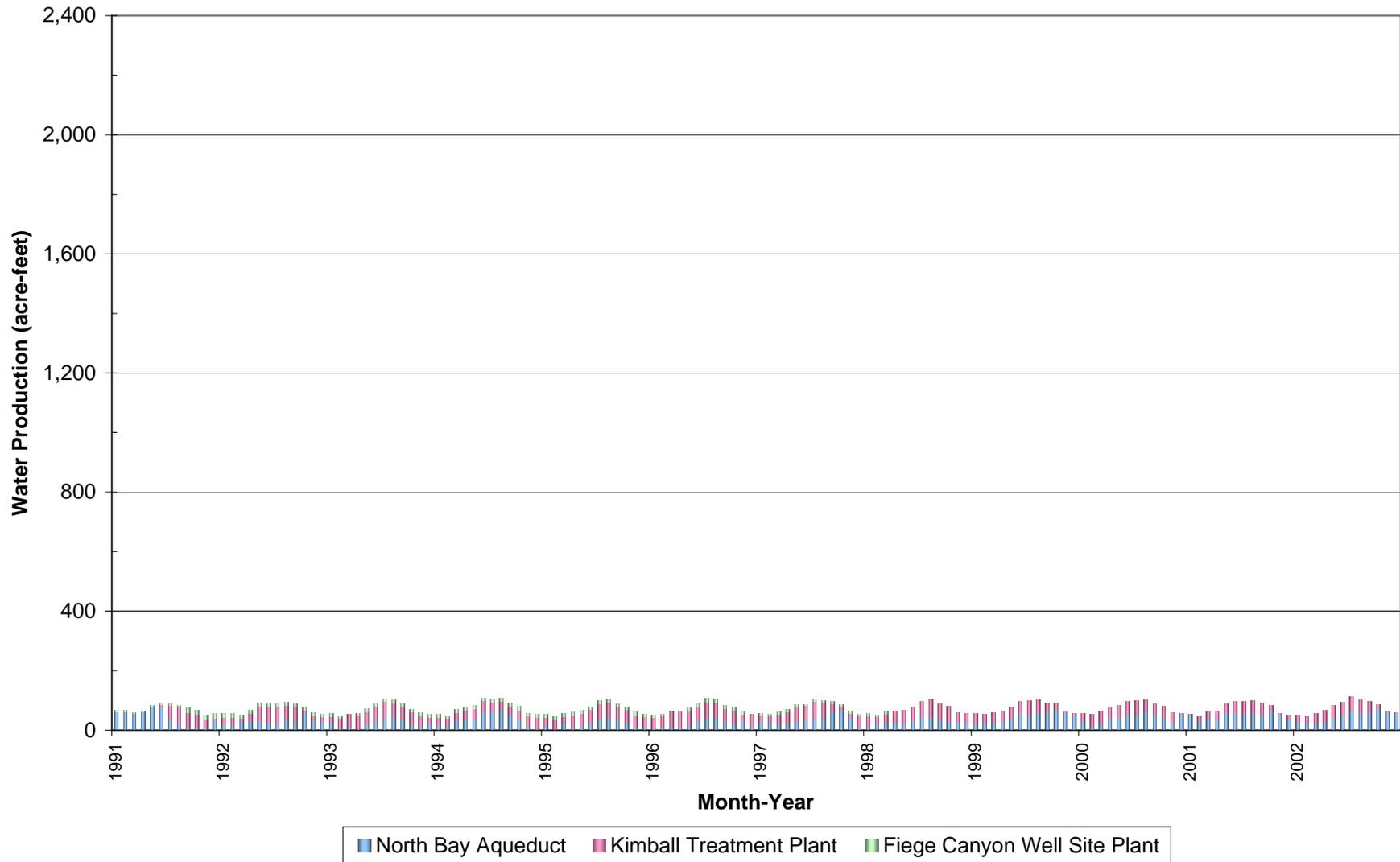


Figure E-3. Calistoga Historical Water Consumption (1991-2002)

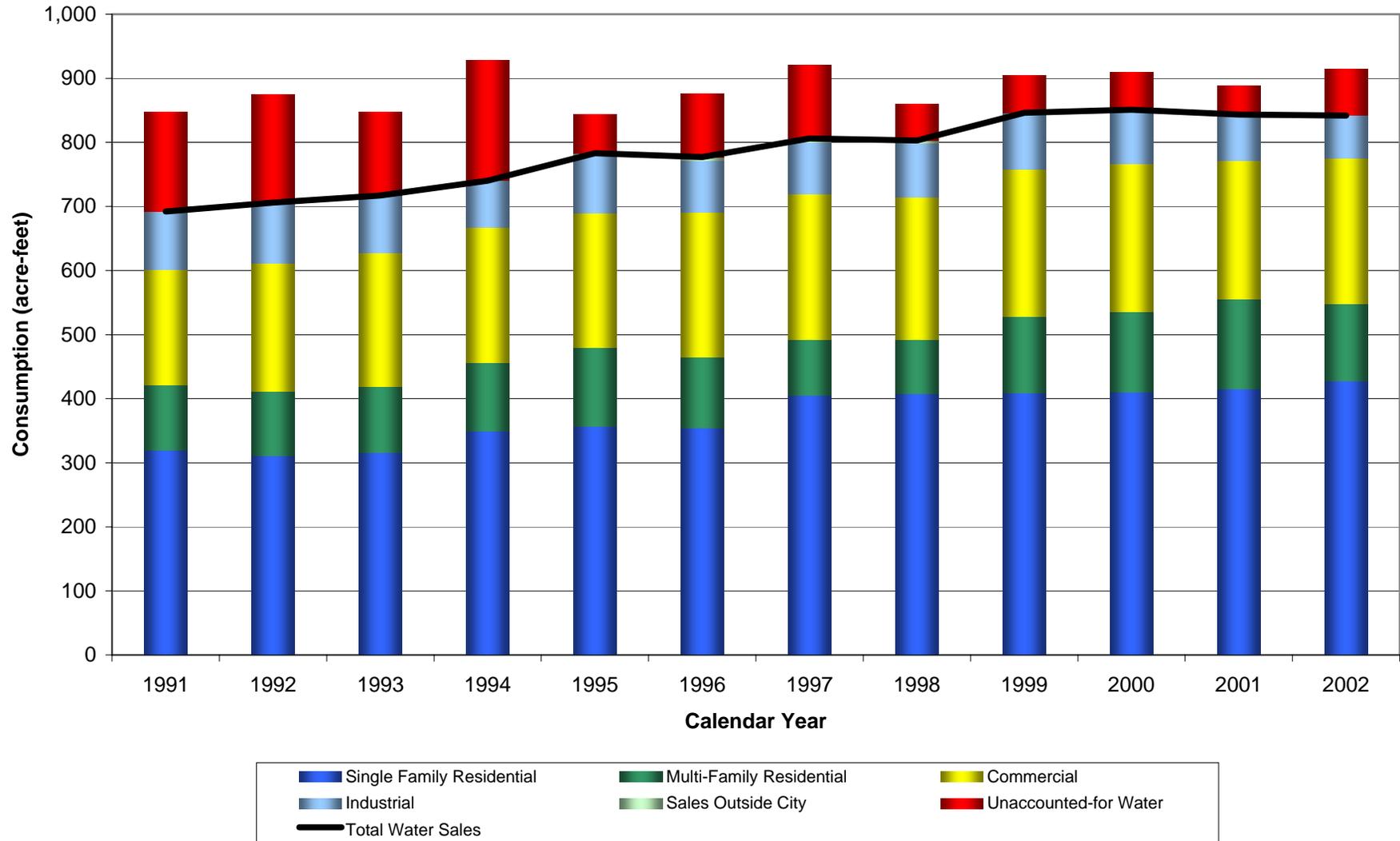


Figure E-4. Calistoga Historical and Projected Water Consumption (1990 - 2050)

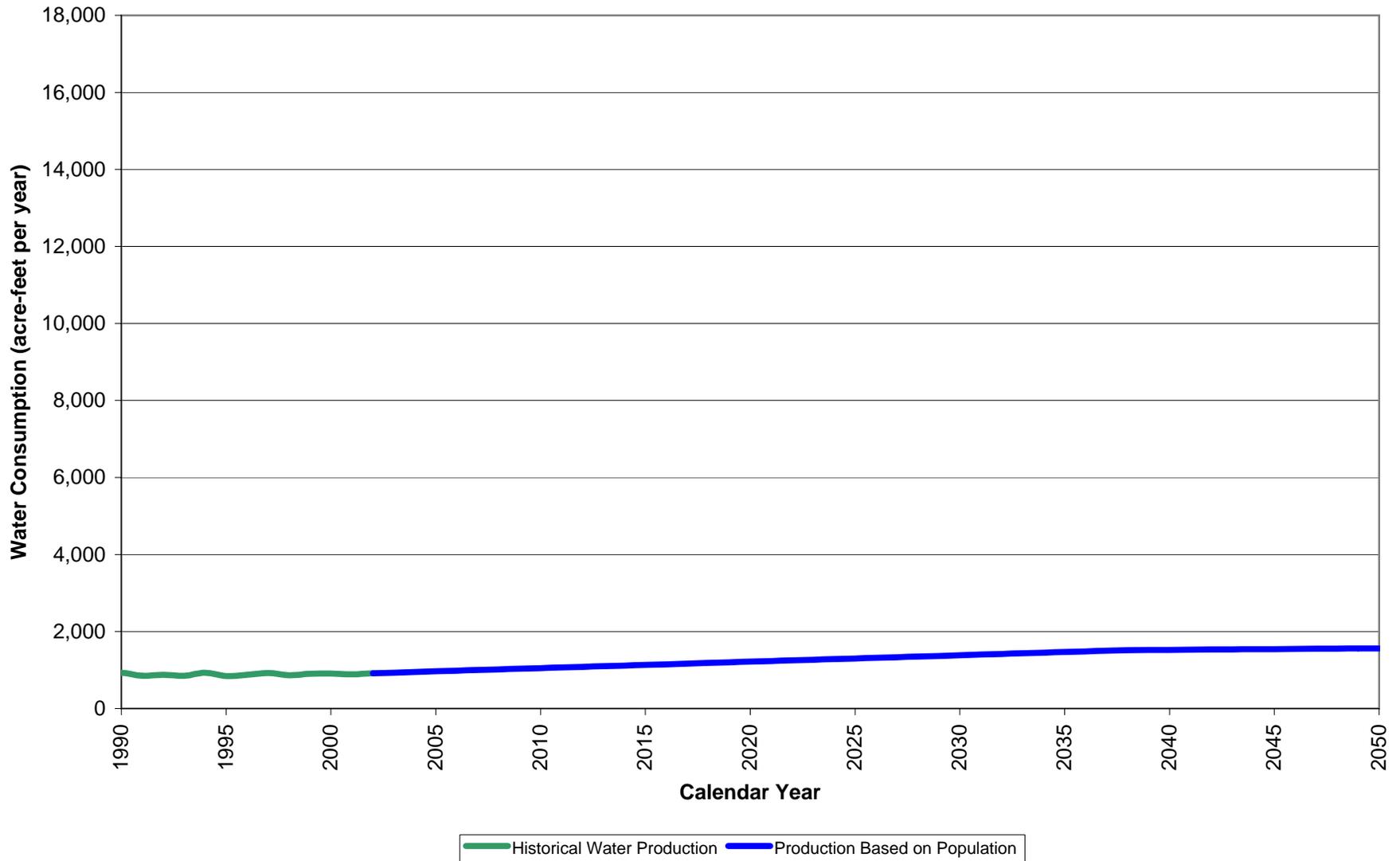


Figure E-5. Calistoga Historical Per Capita Water Use (1970-2002)

